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Policies and Procedures for Infusion Therapy: Older Adult is a companion product to the Infusion Therapy Standards of Practice (the Standards), 8th edition. Evidence-based guidance for clinical practice has been derived directly from the Standards, including associated references, glossary of terms, abbreviations, and acronyms. Policies and Procedures for Infusion Therapy: Older Adult is intended to reflect current knowledge and practices of the clinical specialty of infusion therapy. Because clinical practice continuously evolves based on ongoing research, clinicians should make an independent assessment of the appropriateness and applicability of a policy or procedures in any specific instance. Applicable federal and state laws and regulations should also be considered, as well as the standard of care in a particular jurisdiction, as these may take precedence. INS is not responsible for injury to persons or property, or other harm, arising from exercising guidelines outlined in this publication.

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Organization of Infusion and Vascular Access Services

Policy
Infusion therapy requires interprofessional collaboration among all clinicians that prescribe, dispense, and administer a wide variety of solutions, medications, nutrition, and blood components, as well as management and purchasing personnel.

The scope of services provided by the infusion team/vascular access team (VAT) is structured to meet patient and organizational needs for safe delivery/administration of quality infusion therapy.

Infusion and vascular access services provided in the community follow regulations applicable in each country.

Key Points
- Organizational Needs Assessment
  - Identify the deficits, challenges, clinical outcomes, and costs with delivery of infusion/vascular access within the organization.
    - The failure mode and effects analysis (FMEA) is commonly applied to evaluate current patient care delivery and workflow processes toward the goal of risk reduction.
    - Lean Thinking and Six Sigma are process improvement methods used to identify inefficiencies, variables, process defects, and waste.
    - Assess the needs of the organization to determine the appropriate hours of service to meet patient needs.
- Financial Assessment
  - Master the processes required for financial management of the infusion team/VAT or service within the health care system in each jurisdiction.
    - Know the budgetary process for the infusion team/VAT, the operational costs, and the sources of operational revenue.
    - Establish the infusion team/VAT as a revenue and cost center in acute care hospitals, allowing the team to track and analyze services provided and document financial contributions to the organization, showing revenue to offset costs.
Team Development and Composition

» Leadership: Identify the most appropriate clinician to organize and lead the team.
- As a result of considerable time spent with patients in all venues of care, knowledge of infusion therapies and technology, and patient education activities, nurses specializing in this practice are best suited to fill this role.
- The leadership position may also be held by a physician, respiratory therapist, radiographic technologist, or pharmacist. Ensure that the team’s role is comprehensive, including all aspects of infusion therapy and vascular access device (VAD) management, in addition to VAD insertion.
- Consider a lead clinician who is also responsible for clinical governance, staff development, and quality improvement (QI) activities related to intravenous (IV) solution infusions.

» Composition: Assign the most knowledgeable clinicians to employ a proactive approach for assessing patient needs and selecting the most appropriate VAD, using skillful insertion techniques, managing infusion methods and vascular access care, and evaluating clinical outcomes.
- Organize a team of clinicians dedicated exclusively to infusion and vascular access practices to provide the optimum method for infusion delivery.
- Encourage and support members of the team to obtain and maintain an internationally recognized board certification.

» Identification: Choose a name for this designated team of clinicians that reflects the services provided while allowing for expansion in the scope of service. A wide variety of names are used synonymously including, but not limited to, IV team, infusion team, VAT, and vascular resource team.

» Services Rendered and Operational Plan: Outline services and availability.
- Comprehensive infusion and vascular access services: Available on a 24-hour basis, 7 days/week, insert peripheral intravenous catheters (PIVCs), peripherally inserted central catheters (PICCs) and other central vascular access devices (CVADs); assess each patient daily for VAD necessity; and manage all VAD dressing changes.
Comprehensive teams administer specific types of medications (eg, antineoplastics) to inpatients and outpatients and provide support services to specialty departments (eg, emergency, critical care) on an as-needed basis.

Practice Expansion Options:
- Consider expanding the services of the infusion team/VAT to include placement of all types of CVADs, use of appropriate technologies, and insertion of arterial catheters as needed in each facility. Collaborate with members of other disciplines as needed to accomplish the required steps for this expansion.
- Meet urgent and emergent venipuncture needs in the emergency department (ED) through the use of a team dedicated to inserting all short PIVCs and phlebotomy for blood sampling, known as a difficult intravenous access (DIVA) team or ED vascular access specialist team. These teams are staffed by trained technicians or nurses and employ additional skills to use near-infrared light or ultrasound as needed for venipuncture.

Interprofessional Collaboration
- Initiate and/or participate in interprofessional safety programs to reduce the number, risk, and costs of adverse events related to infusion/vascular access, including:
  - Involvement with antibiotic stewardship programs.
  - Analysis of IV-associated medication errors.
  - Systemic adverse drug reactions (eg, red man’s syndrome) and VAD-associated complications (eg, infiltration, extravasation).
  - Collaboration with acute pain teams to reduce lapses in analgesia.
  - Collaboration with multiple disciplines and departments to reduce errors related to dose error reduction systems (DERS) in electronic infusion pumps.
  - Coordination of product evaluation, QI, staff development, and standardized evidence-based practices (EBPs), within and between health care organizations.
Competency and Competency Assessment

Policy
To provide for patient safety and public protection, the clinician meets licensing requirements and core competencies according to their specific profession.

Due to its invasive, high-risk nature, the clinician with responsibility for the safe delivery of infusion therapy and VAD insertion and/or management demonstrates competency with this role.

Initial competency is assessed and documented before the task or skill is performed without supervision.

Ongoing competency assessment and documentation is a continuous process driven by patient and organizational outcomes.

Invasive procedures (eg, venipuncture, catheter insertion) will not be performed on human volunteers for training purposes.

Key Points
- Responsibility for Competency
  » Individuals must accept responsibility for developing and maintaining clinical competency with infusion therapy and vascular access practices as defined by the clinician’s legal scope of practice and the requirements of the specific clinical practice venue and/or patient population.
- Newly Graduated Clinicians
  » Provide education and skills development opportunities for newly graduated clinicians (eg, nurse residency programs) early in their employment to close the gap between preparation and practice and to improve their confidence.
    - Recognize that each clinician has many variations in prelicensure education, experiences, and previous methods for assessing individual competence. The type and amount of support and feedback and the functionality of co-workers influences the transition to practice.
    - There are significant preparation–practice gaps in knowledge and skills for infusion therapy and vascular access insertion and management for medical and nursing professions. Although
regulatory organizations may require competence with certain procedures (eg, CVAD insertion), there are no consistent guidelines for how to provide training and measure its outcomes.

- **Experienced Clinicians**
  - Experienced clinicians will undergo regular education, skills development, and competency assessment.
    - Length of clinical experience and passive recurrent performance are not surrogates for clinical knowledge and procedural competence for experienced clinicians.
    - Experienced clinicians may not recognize their need for reconstruction of knowledge and skills to correct inaccuracies and improve techniques.

- **Contracted Clinicians**
  - Use a consistent process to manage and monitor outcomes produced by contracted consultants (eg, VAD insertion).
    - Performance expectations for competency for all contracted clinicians include documentation of licensure, competency, and compliance with the organization’s requirements for staff qualifications, personnel practices, and clinical policies and procedures.
    - When contractors are acquiring initial competency of a new skill, the organization’s management should be knowledgeable of the status of these contractors; that these contracted clinicians are adequately supervised while obtaining competency; and that final documentation of competency is provided to the organization.

- **Identify Infusion and Vascular Access Competency Requirements**
  - Collaborate with staff development personnel to identify infusion and vascular access knowledge, skills, and attitudes that require competency assessment, including technical and non-technical skills. Use standards, guidelines, and published evidence to create the competency assessment process.
    - Incorporate adult learning principles and practices by using appropriate teaching methods for adults as learners, their motivations and characteristics as learners, and methods to overcome obstacles to adult learning.
    - Identify the services provided by the infusion team/VAT vs those provided by other clinicians and identify the competencies associated with each role. Some skills may apply to all (eg, monitoring outcome data, use of information technology,
interprofessional teamwork), whereas some will be very specific for the team members (e.g., use of vascular visualization technology, insertion of midline catheters and CVADs, accessing implanted ports, catheter clearance procedures). Some professionals may use the term entrustable professional activities for specific tasks, indicating the learner has reached the point of being trusted to perform the skill without supervision.

- Employ a systems-based approach to infusion and vascular access competencies centered on standardized policies and procedures applied across the entire organization (e.g., hospital, ambulatory infusion centers, and radiology and emergency services).
- Consider implementing assessment methods to identify the clinical skills specific to individual nursing units or a specialty. This method is reported to produce greater clinician satisfaction, improve confidence, and increase independence.
- Consider implementing skills fairs for learning needs assessment and to identify additional interventions for competency development. Skills fairs may be better designed for systemwide core competencies.

- Competency Assessment
  - Employ a variety of perspectives to assess competency including self-assessment, peer-assisted learning, and assessment by others such as an instructor or preceptor.
  - Designate qualified instructors and assessors to develop and implement all phases of the competency assessment process for infusion and vascular access competencies in an unbiased, objective manner. Instructors and assessors should understand and apply the principles of adults as learners, choose appropriate teaching strategies, use appropriate evaluation tools and processes, and provide positive feedback and suggestions for improvement. Instructors and assessors should have documented competency with the skill being assessed.
  - Manage competency assessment and validation in 2 phases, initial and ongoing competency.
    - Perform initial competency assessment when:
      - Orienting newly hired clinicians, both new graduates and clinicians re-entering the workforce.
      - An experienced clinician moves into a position requiring infusion/vascular access skills.
• Practice expansion occurs (eg, insertion of CVADs, administration of hazardous drugs).
• Introducing new policies, practices, and products.
  - Perform ongoing or continuing competency assessment and validation as directed by regulatory and accreditation requirements and organizational safety and quality indicators.
• Follow regulatory and accreditation standards to create a competency assessment plan. Periodic competency assessment is required by accreditation organizations, but the frequency of ongoing assessments is defined by the organization.
• Identify the interventions, actions, and skills requiring ongoing assessment by using clinical outcome data; safety and quality indicators such as adverse events, serious safety events, and sentinel events; changing patient populations served; and patient satisfaction data.
• Identify practice gaps through a learning needs assessment.
• Build alliances with all stakeholders (eg, staff or management) to increase their interest and participation in the needs assessment process.
• Address ongoing competency for low-frequency, high-risk skills by using realistic simulation to practice these skills on a frequent basis.

» Use learner-centered, experiential methods to assess competency for psychomotor skills development in 4 consecutive phases, including knowledge acquisition, observation, simulation, and clinical performance. Choose the most appropriate teaching and evaluation strategies for each phase.
  - Use a skills checklist, a global rating scale or both to assess and document performance in an objective, measurable manner. The tool should reflect real clinical practice and be tested for reliability and validity in the planning process.
  - Plan interprofessional education for competency assessment programs as appropriate, due to the need for a high level of interprofessional collaboration with infusion and vascular access practices.

• Education and Training Methodology
  » Incorporate adult learning principles and practices by using appropriate teaching methods for adults as learners, their motivations and characteristics as learners, and methods to overcome obstacles to adult learning.
Employ a blended learning approach by combining a variety of methods to deliver education and training. This will improve learning outcomes, maximize use of resources, and allow flexibility.

- For knowledge acquisition and critical thinking skills, choose instructor-led delivery or electronic-based delivery of content. Electronic delivery allows for synchronous delivery at a scheduled time for all learners or asynchronous delivery, which allows the learners to access the content at a time and place that is convenient for their schedule. Assigned reading, self-directed study, large and small group discussions, and lectures are additional teaching strategies for knowledge acquisition.

- For psychomotor skill acquisition, employ simulation-based experiences.

- For patient assessment skills, use web-based, multimedia technology for simulation of scenarios or standardized patients.

Use simulation method(s) most suitable to develop and refine technical and non-technical skills using high-fidelity methods (ie, those with greatest degree of realism possible). Simulation on anatomical models is learner-centered with a greater number of learning actions taken (eg, checking available printed guidelines, repetitive skill performance) and a higher level of learner engagement.

- Do not perform invasive procedures (eg, venipuncture, catheter insertion) on human volunteers for training purposes. Learning a skill is not complete until it has been successfully performed on patients under supervision.
  - Use of human volunteers is a form of simulation and does not replace supervised performance on patients.
  - The risk of performing invasive procedures on human volunteers outweighs the benefits. The human volunteer will be exposed to physical health risk for infection, thrombosis, and vessel/tissue damage, plus emotional stress.

- Practice noninvasive steps of a skill on human volunteers including tourniquet application and removal, vein palpation, and vascular visualization using electronic devices, such as near infrared light and ultrasound, because these steps do not involve skin puncture. Invasive procedures require use of anatomical models, task trainers, or virtual reality to allow for repetitive practice.
Measure competency by performance and not by a time or a predetermined number of procedures. There is no established number of procedures performed that will ensure competency for any skill.

- Enhance cultural competency by incorporating respect for all racial, ethnic, and linguistic groups as well as geographical, religious/spiritual, biological, and sociological characteristics into infusion and vascular access practices. Identify and address the needs of diverse patient populations and validate clinician competency to meet those needs.

- Evaluate the competency assessment program based on learner satisfaction, degree of knowledge acquisition, behavioral changes, changes in patient indicators, and the program’s return on investment.

- Competency Accentuated Through Professional Development

  - Empower clinicians for lifelong professional growth and development by incorporating multiple methods into the competency framework. Options include:
    - Acknowledging participation in continuing professional education
    - Achieving and maintaining board certification (eg, CRNI®) from a national certifying body (eg, Infusion Nurses Certification Corporation [INCC])
    - Serving as faculty at seminars and conferences
    - Conducting clinical research
    - Publishing in a scholarly journal
    - Completion of an accredited academic study program in a related field
Product Evaluation, Integrity, and Defect Reporting

Policy

Clinician end users are involved in the evaluation of VAD and/or infusion products, equipment, and technologies, including clinical application, performance, infection/complication prevention, safety, efficacy, acceptability, reliability, and cost.

Clinician end users attain and maintain knowledge related to developments and technologies relating to VADs, infusion products, and equipment to meet evidence-based standards.

Infusion equipment and supplies are inspected for product integrity and function before, during, and after use; product(s) are visually inspected for damage before use; packaging is clean, dry, and intact; product expiration date is verified.

Expired/defective products are removed from patient use and labeled as such; the problem is reported to the appropriate department within the organization, to the manufacturer, and/or to authoritative reporting organizations as required.

Lot numbers, serial numbers, manufacturer, and other information used for tracking potential product defects are maintained by the organization.

Key Points

- Select VAD and infusion-related products/equipment for evaluation based upon factors including, but not limited to, organizational quality indicators, internally and externally reported incident/occurrence/adverse event reports, availability of new/safer products, current/new evidence, and emerging technology.
  - Include an interprofessional group of direct and indirect clinician end users (eg, staff with human factors training, nurses, infection preventionists, physicians, biomedical engineers, information technologists, pharmacists, and patient representatives) in the product evaluation process.
  - Establish clear goals of what is to be measured and evaluated during the process of product evaluation (eg, enhance continuity of care, reduce a complication, improve clinician compliance, save
time, and standardize use) and define in advance the minimum parameters that must be met for evaluation to be considered successful.

» Evaluate the intended organizational use of the product (e.g., reduction of infection, occlusion, or thrombosis) against the manufacturers’ directions for use and indications for the product.

» Develop data collection tools for analysis and ongoing monitoring.

» Provide education and training for use of the product/equipment selected for evaluation; consider support/involvement by the manufacturer in product education.

- Report problems associated with use of any product; remove from use and follow organizational policies and procedures for reporting.

  » Monitor for product recalls and hazard alerts.

  » When a product defect is identified before use, retain the product, product overwrap or packaging, and other identifying information (such as model number, lot number, serial number, expiration date, and unique device identification when available) for further analysis and reporting.

  » Use a structured and objective approach when investigating problems associated with medical devices, which may include issues such as device malfunction and user error; identify the need for additional clinician education.

  » Develop an organizational environment conducive to reporting.

  » Report adverse events or serious adverse events (e.g., sentinel events), or the risk thereof (i.e., close calls) associated with VADs and/or infusion products/equipment and the administration of drugs and biologics, to the appropriate department(s) within the organization (e.g., risk management, QI) and authoritative reporting organizations as required.
Informed Consent

Policy

Informed consent is obtained for all infusion/vascular access-related procedures and treatments in accordance with local/national laws, rules and regulations, and organizational policy.

The clinician performing the invasive procedure (eg, CVAD insertion) facilitates the process and ensures informed consent is obtained.

The patient or surrogate has the right to accept or refuse treatment.

Informed consent is required for human subject participation in research in accordance with local/national laws, rules and regulations, and organizational policy.

Key Points

- Obtaining informed consent is an educational process involving the patient in shared decision-making.
  - The process begins with dialogue between the patient/surrogate and the provider or qualified clinician performing the procedure; however, other clinicians have a significant role in the complete process.
  - The process concludes with the patient/surrogate signing a consent document or providing verbal consent according to organizational policy (eg, via phone conversation). Organizational policy should outline a process for identifying surrogate decision-makers.
  - Continued confirmation of informed consent may be necessary for ongoing treatments (eg, hemodialysis or antineoplastic administration).

- Before informed consent can be obtained, it is necessary to assess the older adult’s mental status. Mental status can be impaired for many reasons. If impaired memory or confusion is due to a reversible condition, it is important to address the underlying condition. If pain is affecting the older adult’s ability to think clearly, appropriate management strategies must be in place prior to obtaining informed consent.

- If necessary, a family member or power of attorney may need to be involved in the consent process.

- The clinician must be knowledgeable about advance directives and health care proxies that may be in existence.
Follow requirements for obtaining informed consent from the patient/surrogate, as regulations vary across jurisdictions. Differences include documentation, the professional performing the consent process, procedures/treatments requiring informed consent, and variations in the legal approach to evaluation of informed consent.

» Recognize that there could be condition-based exceptions to requirements for informed consent (eg, emergency/life-threatening situations/patient incapacitation without surrogate decision-maker) and adhere to the organizational policy for managing these situations.

Ensure that the process for informed consent includes these required elements:

» Consent is voluntarily given and is free from coercion or persuasion.

» The patient/surrogate is capable of comprehending relevant information, appreciates the situation and its consequences, and is able to make choices.

» The patient/surrogate has received the necessary information to understand the procedure/treatment, its purpose, risks, potential benefits, alternative procedures/treatments, common complications, and potentially serious or irreversible risks.

» Formal interpreter services are used to ensure understanding.

» The decision is authorized by the patient/surrogate and documented on the signed form as appropriate.

Define circumstances (eg, emergent and time-sensitive situations) when exemption from obtaining informed consent is allowed. Document details of information provided, method of discussion (eg, telephone), to whom it was given, and the patient or surrogate response in the patient’s health record.

Recognize that photographs and/or videotaping of patients may or may not require informed consent.

» In the United States, unless the photograph is for treatment purposes, payment for services, or health care operations, written informed consent is required under Health Insurance Portability and Accountability Act (HIPAA) rules when the patient is identifiable by inclusion of the patient’s face or other identifiable features such as jewelry, tattoos, or other anatomically notable scars or lesions. This consent includes how the images will be obtained, managed, stored, and shared.
A photograph that does not identify the patient would not require informed consent under HIPAA rules; however, health care facilities may have policies that go beyond these rules (eg, social media policies).

Unidentifiable photographs have benefits for educational purposes; however, there are challenges with adequate security for storage and use and other legal issues such as copyright ownership.

- Choose appropriate methods to deliver the information, including verbal and paper-based written information, videos, or computer-based materials.
- Validate the patient’s/surrogate’s comprehension of the information by asking the patient/surrogate to recount or “teach-back” the proposed treatment or procedure. Clarify and/or reinforce information as needed.
- For research-informed consent, provide explanations and a consent document that begins with a clear, concise, and accurate representation of the research purpose(s). Use extended dialogue and simplified consent documents with a clear layout and text styling to improve the patient’s ability to understand the information. In addition to the standard components of informed consent, the research-informed consent document includes additional components such as:
  - The anticipated length of participation in the research.
  - Identification of procedures that are experimental.
  - Management processes for confidential patient information and their identity.
  - Compensation for participation, if any.
  - Risks and benefits of participation.
  - Availability of medical treatments if injury occurs.

**Assessment**

- Recognize cultural differences that may affect the process of informed consent. The foundation of informed consent is self-determination, which may not fit with cultures where medical treatment choices are a family decision rather than an individual decision.
- Assess patients with age-, trauma-, or disease-related alterations in cognitive capacity for their ability to consent by using tools to evaluate cognitive status or asking probing questions to evaluate language comprehension, memory, and ability to reason. When the patient does not have the necessary cognitive capacity, obtain informed consent from a surrogate.
- Evaluate patient for sensory deficits such as vision or hearing problems.
- Assess for literacy issues, such as inability to read or low reading level, prior to obtaining consent.
- Provide a qualified medical interpreter for those who cannot read their primary language.
- Provide appropriate resources for patients/surrogates who have vision or hearing limitations.

**Patient Education**

- Facilitate the informed consent process by choosing learning methods most appropriate for the patient’s age, relational abilities, and level of health literacy.
  - Provide educational materials and the consent document at a reading level between the fourth and sixth grades and in the patient’s primary language.
  - Provide information at the most appropriate time, considering the effect of anxiety, pain, and other therapeutic interventions on the patient’s comprehension.
  - Allow sufficient opportunity for the patient/surrogate to ask questions and receive answers. Pausing periodically allows the patient time to process the information given and can enhance comprehension.
  - When the patient/surrogate expresses confusion or has further questions, collaborate with the provider about the need for more dialogue.

**Documentation**

- Document in the patient’s health record:
  - Completion of the informed consent process, including organizational written consent form, if applicable
  - Patient/surrogate education and response
Latex Sensitivity or Allergy

Policy

Exposure to latex in the environment is minimized.

Latex-free personal protective equipment (PPE), patient care equipment, and other supplies are provided to latex-sensitive or latex-allergic clinicians and patients and are used during patient care.

A careful and thorough assessment of every patient is performed, not just patients at risk for a latex allergy.

Latex-containing products are removed from the patient care setting to reduce the exposure to latex.

Key Points

- Identify patients at increased risk for or with known latex allergy/sensitivity.
  - Patients with myelomeningocele; an important risk factor for these patients is having more than 5 surgeries.
  - Patients with allergy to tropical fruits (eg, avocado, banana, chestnut, kiwi) have a high cross-reactivity to latex, as such fruits contain proteins with allergenic similarities to latex.
- Identify health care providers with latex allergy/sensitivity; exposure to latex gloves is the most common cause of latex allergy/sensitivity.
- Minimize exposure to latex for those at risk or with known latex allergy/sensitivity as frequent exposure to latex remains the primary cause of sensitization.
  - Review the label on medical devices, equipment, and supplies prior to use for the presence of latex, which is a component of product labeling required by the US Food and Drug Administration (FDA).
  - Recognize that latex products are ubiquitous and that prevention of contact with latex is challenging; examples of items within homes include balloons; refer to available lists of products that contain latex.
  - Access medication vials with latex stoppers only once; most multidose vials no longer contain latex; the Centers for Disease Control and Prevention (CDC) provides a list of vaccines indicating presence or absence of latex in the packaging (eg, syringe/vial).
- Recognize potential exposure routes to latex including direct skin contact, airborne exposure (ie, largely reduced with powder-free gloves), and food/medicine contamination (eg, medical devices, vials). Use nonpowdered, nonlatex gloves; a change to non-powdered latex and synthetic gloves has resulted in dramatic reduction in sensitization.
- Ensure LATEX ALLERGY is noted on patient’s identification band.

**Patient Education**

» Instruct patients/clinicians with latex allergy to wear a medical alert bracelet/necklace, inform all health care providers and caregivers about latex allergies, carry an epinephrine auto-injector and ensure patient/caregivers are competent to use it.

» Provide patient education regarding how to avoid latex exposure from common items such as dishwashing gloves, hot water bottles, balloons, rubber bands, erasers, and swim goggles.

**Assessment**

- Assess patient for a latex sensitivity or allergy, history of asthma, environmental allergens, medications, and food allergies.

- Distinguish between the signs and symptoms associated with latex sensitivity vs latex allergy:
  
  » Latex sensitivity/allergic contact dermatitis: Type IV immunologic reaction/delayed T-cell mediated reaction to chemicals used in latex manufacturing; begins with an acute eczema-like skin rash, vesicles, and pruritus, erythema, or hives. With continued exposure to latex, sensitivity can become latex allergy.

  » Latex allergy: Type I Immunoglobulin E (IgE)-mediated hypersensitivity reactions occur within minutes of exposure to latex; reactions range from mild (eg, urticaria, rhinoconjunctivitis) to severe (eg, bronchospasm, hypotension, anaphylaxis).

**Documentation**

- Document in the patient’s health record:
  
  » Positive screen for latex sensitivity or allergy
Adverse and Serious Adverse Events

Policy

Adverse events, serious adverse events (eg, sentinel events) or close calls associated with infusion therapy and/or VADs are documented and reported within the health care organization and to the appropriate regulatory body when required.

The science of safety, which includes human errors and system failures, along with reporting of adverse events and serious adverse events, is defined in organizational policies, procedures, and/or practice guidelines.

Key Points

- Definitions
  » An adverse event is defined as any unintended or untoward event that occurs with a patient receiving medical treatment that is related to a medication, product, equipment, or procedure.
  » An adverse event is serious when the patient outcome is death, disability, is life-threatening, requires initial or prolonged hospitalization, or requires intervention to prevent permanent damage.

- As an individual ages in years, the chance of developing various disease processes increases, leading to exposure to more drugs for treatment or intervention. The more drugs the older adult is exposed to, the greater the risk for allergic reaction as well as adverse drug interactions.

- Reporting
  » Report adverse events, serious adverse events, or the risk thereof (ie, close calls or "good catches") associated with VADs and/or infusion products/devices and the administration of drugs, biologics, and/or infusates to the appropriate individuals and organizations:
    - Provider and other essential health care team members as appropriate.
    - Organization’s designated management personnel.
    - Appropriate organizational department(s) (eg, risk management, QI).
    - Appropriate advisory organizations (eg, Institute for Safe Medication Practices [ISMP]).
- Appropriate regulatory organization (eg, FDA, Health Protection Branch of the Canada Department of National Health and Welfare [HPB], Federal Institute for Drugs and Medical Devices [BfArM], Medicines and Healthcare products Regulatory Agency [MHRA], Swissmedic).
- Appropriate accreditation organization (eg, The Joint Commission, Joint Commission International).
- Drug and/or device manufacturer (when possible, retain defective device and return to manufacturer as part of the product incident report).

- Investigation
  » Investigate serious adverse events immediately to ensure prompt action and improve safety. The process includes a root cause analysis (RCA) or other systematic investigation and analysis to improve quality and safety. Organizations must have a process to determine which serious events require an RCA.
  » Describe and analyze the event and contributing factors to discern the cause(s) of the event.
  » Implement specific strategies and/or actions for improvement that protects patients. An interprofessional approach to patient safety is comprehensive and focuses on systems issues, procedures, human resources, peer and/or clinical review, products/equipment, processes, and training gaps.
  » Actively participate in the development, implementation, and evaluation of the improvement plan.
  » Consider using an RCA or other systematic investigation or analysis for complex and/or recurrent problems and for close calls.
  » Include patients in adverse event review when appropriate.

- Organizational Processes
  » Establish a strong just culture that continuously strengthens safety and creates an environment that raises the level of transparency, promotes shared learning, encourages reporting, empowers the clinician to identify and implement appropriate actions to prevent adverse events and close calls, and promotes quality patient outcomes.
  » Use standardized tools to identify, document, and track adverse events in accordance with organization policy. Use documents and tools developed by legal and risk management personnel, providing objective and specific facts about the adverse event.
» Improve safety within the organization through a prevention-focused approach by:
  - Developing a culture of safety, shared learning, and high reliability.
  - Focusing on correction of the system(s) and processes rather than blaming the clinician.
  - Examining at-risk behaviors and coaching individuals to make safe behavioral choices according to the precepts of a just culture.
  - Advocating for teamwork interventions, including training and education (eg, focus on communication and leadership); work redesign (eg, change interactions such as interprofessional rounds or local team “huddles”); and use of structured tools and protocols (eg, handoff communication tools and checklists).
  - Standardizing and simplifying the reporting processes throughout the organization as practicable.
  - Using a systematic method to guide safety initiatives such as Healthcare Failure Mode and Effect Analysis (HFMEA).

- Education and Disclosure
  » Educate the patient and caregivers about signs and symptoms of complications, reactions, or any untoward event that could be an adverse event and on how to contact the appropriate clinician for timely management and documentation.
  » Ensure responsible disclosure of errors to patients; promote interprofessional collaboration in planning and discussing information with the team responsible for disclosing information about the adverse event to the patient, caregiver, or surrogate.

Assessment
  - It is important when assessing the older adult to obtain a comprehensive medication history and any past experiences with reactions or sensitivities, including over-the-counter medications, herbal remedies, and culturally-based preparations.

Documentation
  - Document adverse events in the patient’s health record and incident report system as defined in organizational policy.
2. Infection Prevention and Safety Compliance

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Hand Hygiene

Policy

Hand hygiene is performed routinely during patient care activities.

Artificial fingernails and extenders are not worn; artificial or false nails have been associated with higher levels of infectious agents, especially Gram-negative bacilli and yeasts, than natural nails.

Nails are kept clean and nail length is kept short.

Nail polish should be avoided; if organizational policy permits, nail polish should not be chipped as chipped nail polish may support the growth of microorganisms.

Key Points

- Hand hygiene is a routine infection prevention practice that decreases the potential risk of microbial contamination and cross contamination.
- Methods
  - Use an alcohol-based hand rub (ABHR), containing at least 60% ethanol or 70% isopropyl alcohol, routinely for hand hygiene unless the hands are visibly soiled, or if the patient is suspected of having, or there is an outbreak, of a spore-forming pathogen or norovirus gastroenteritis.
    - Unless hands are visibly soiled, an ABHR is preferred over soap and water in most clinical situations, due to evidence of better compliance, as compared to soap and water. Hand rubs are generally less irritating to hands and are effective in the absence of a sink.
    - Perform hand hygiene using an ABHR for at least 20 seconds.
  - Use either a non antimicrobial or antimicrobial soap and water for hand hygiene and wash hands for at least 20 seconds:
    - When the hands are visibly contaminated with blood and or other body fluids.
    - After providing care or having contact with patients suspected or confirmed of being infected with norovirus/rotavirus gastroenteritis or a spore-forming pathogen during an outbreak (eg, Clostridioides difficile).
Organizational Plan

» Ensure that supplies necessary for adherence to hand hygiene are readily accessible in all areas where patient care is being delivered.

» Implement organizational strategies to improve hand hygiene compliance.
  - Use a systematic, multistep approach.
  - Implement multimodal strategies including performance feedback to improve hand hygiene compliance and to reduce infection and colonization rates.
  - Involve the clinician with the evaluation of hand hygiene products to assess for product feel, fragrance, and skin irritation. Provide alternatives for clinicians who have sensitivity to a particular product. Other products for skin care such as gloves, lotions, and moisturizers should be assessed for compatibility with hand antisepsis products.
  - Provide the clinician with education on hand hygiene, monitor hand hygiene performance, and provide feedback regarding hand hygiene performance.

Patient Education

» Educate the patient/caregivers on when and how to perform hand hygiene, and to ask the clinician to perform hand hygiene before having direct contact with the patient if it was not observed.

» When teaching hand hygiene for infusion self-care to the older adult, it is important to take into consideration the patient’s physical ability to stand in front of a sink, any need for ambulation assistive devices such as a cane or walker, skin sensitivity to waterless products, and any cognitive impairments affecting the ability to follow the correct sequencing of steps.

Procedure

» Perform hand hygiene:
  » Before and after having direct contact with the patient.
  » After contact with body fluids or excretions, mucous membranes, and wound dressings.
  » After touching the patient’s surroundings.
  » Before donning gloves.
  » After removing gloves.
» Before, during, as required, and after all clinical procedures requiring Aseptic Non Touch Technique (ANTT), including:
  - Insertion and removal of indwelling invasive medical devices including all vascular access devices (VADs).
  - Ongoing management and manipulation of indwelling medical devices.
  - Infusion administration.
» Before/after eating and after using a restroom.
» Before moving from work on a soiled body site to a clean body site on the same patient.
Standard Precautions

Policy

Standard Precautions are used during all infusion and vascular access procedures, and in all clinical settings that potentially expose the clinician to blood and body fluids, secretions, excretions (except sweat), nonintact skin, and mucous membranes and may contain transmissible infectious agents.

Personal protective equipment (PPE) is selected and worn based on the nature of the patient interaction and potential for exposure to blood, body fluids, or infectious agents, and based upon Transmission-Based Precautions in effect at the time of the patient encounter for specific communicable diseases and for patients who may be immunocompromised.

Surfaces that are in close proximity to the patient and frequently touched surfaces in the patient care environment are cleaned and disinfected more frequently than other surfaces.

Spills of blood or other potentially infectious materials are promptly cleaned and decontaminated.

Durable medical equipment ([DME] eg, electronic infusion pumps, vascular visualization devices) is cleaned and disinfected before and after each patient use with disinfectants that have microcidal activity against pathogens likely to contaminate the equipment and in accordance with manufacturers’ directions for use for cleaning and disinfecting.

Key Points

- The primary role of the immune system is to protect the organism against pathogens. But age-associated alterations to immunity increase the immunocompromised patient’s susceptibility to infectious disease. Using Standard Precautions with all patient care decreases risk.

- Standard Precautions are based on the assumption that every person is potentially infected or colonized with an organism that could be transmitted and that all blood/body fluids, secretions, excretions (except sweat), nonintact skin, and mucous membranes may contain transmissible agents.
- Hand hygiene is a major component of Standard Precautions.
  » Ensure access to hand hygiene facilities and appropriate hand
  antiseptic cleansers (liquid soap and water and ABHR).
  » Perform hand hygiene immediately in between each step of
  removing PPE if the hands become contaminated, immediately
  after removing all PPE, and before leaving the patient’s environment
  (refer to Chapter 2, Hand Hygiene for complete list).
- Ensure that sufficient and appropriate PPE is available and readily
  accessible at the point of care; when wearing any type of PPE, remove
  at the end of the procedure, before leaving the patient care space.

Procedures
- Wear gloves that fit appropriately and extend to cover the wrist of an
  isolation gown (if worn) when there is potential contact with blood (eg,
  during phlebotomy, venipuncture), body fluids, mucous membranes,
  nonintact skin, or contaminated equipment.
  » Change gloves during patient care when torn, when heavily
    contaminated, or if moving from a contaminated body site to a
    clean body site within the same patient.
  » Do not reuse gloves or use for more than 1 patient. Gloves are
    single-use.
  » Gloves should not be considered as a substitute for hand hygiene.
- Wear a single-use disposable gown or apron to protect skin and
  clothing during procedures or activities in which contact with blood
  or body fluids is anticipated.
  » Do not wear the same gown/apron when caring for more than
    1 patient.
- Wear eye protection, which may include goggles with a face mask, or
  face shield alone, to prevent the potential splash or spray of blood,
  respiratory secretions, or other body fluids from the mouth, nose,
  and eyes.
- Clean and disinfect DME (eg, intravenous [IV] poles, flow-control
  devices, vascular visualization devices) using an appropriate
  disinfectant (eg, Environmental Protection Agency [EPA]-registered
  disinfectant) before and after each use.
  » Develop organizational procedures based upon manufacturers’
    instructions for cleaning and disinfection.
  » Maintain separation between clean and soiled equipment to
    prevent cross contamination.
Education

- Use a multimodal approach to Standard Precaution education and training.

- Educate the clinician to implement respiratory hygiene/cough etiquette by covering the mouth/nose with a tissue when coughing, promptly disposing of used tissues, and performing hand hygiene; educate the clinician to stay home when ill.

- Educate the patient and caregiver to implement respiratory hygiene/cough etiquette by placing a face mask on the coughing person, if tolerated and appropriate, or covering the mouth/nose with a tissue when coughing, promptly disposing of used tissues, and performing hand hygiene; educate visitors/family about need for other PPE when near the patient.
Aseptic Non Touch Technique (ANTT®)

Policy

Aseptic Non Touch Technique (ANTT®) is applied to all infusion-related procedures, including vascular and other infusion access device insertion and management, and administration of infusion medications and solutions, as a critical aspect of infection prevention.

Clinicians and patients/caregivers who administer infusions and manage vascular access and other infusion devices are educated in ANTT.

Key Points

- Definitions
  - **Aseptic Technique:** A set of infection prevention actions aimed at protecting patients from infection during invasive clinical procedures and management of indwelling medical devices; notably, it is a generic term that is variously defined, interpreted and used interchangeably with other practice terms, such as clean, sterile, and non-touch technique.

  - **Aseptic Non Touch Technique (ANTT®):** A specific and comprehensively defined type of aseptic technique with a unique theory-practice framework based on an original concept of Key-Part and Key-Site Protection; achieved by integrating Standard Precautions, such as hand hygiene and PPE with appropriate aseptic field management, non-touch technique, and sterilized supplies. It is designed for all invasive clinical procedures and management of invasive medical devices. In the context of infusion therapy, this includes VAD placement and management and infusion administration.

  - **Standard-ANTT:** A combination of Standard Precautions and an approach of protecting Key-Parts and Key-Sites individually, using non-touch technique and Micro Critical Aseptic Fields within a General Aseptic Field. Used for clinical procedures where achieving asepsis and protecting Key-Parts and Key-Sites is straightforward and short in duration, such as VAD flushing and locking, administration set preparation and change, IV medication administration, and simple wound care. In the event of Key-Parts or Key-Sites requiring direct touch, sterile gloves must be used.

  - **Surgical-ANTT:** A combination of Standard Precautions, and an approach of protecting Key-Sites and Key-Parts collectively using
a sterile drape(s) and barrier precautions. Used for clinically invasive procedures where achieving asepsis and protecting Key-Parts and Key-Sites are difficult and/or procedures are long in duration, such as surgery and central vascular access device (CVAD) insertion.

» The 5 practice terms for using ANTT:
- **Key-Site**: Any portal of entry into the patient (eg, VAD site, injection site, open wound).
- **Key-Part**: A part of the procedure equipment that, if contaminated, is likely to contaminate the patient (eg, syringe tip, male luer end/spike of administration set, injection needle).
- **General Aseptic Field**: A decontaminated and disinfected procedure tray or single-use procedure kit/barrier. Used to promote, but not ensure, asepsis.
- **Critical Aseptic Field**: A sterile drape/barrier. Used to ensure asepsis; all procedure equipment is placed upon the drape and managed collectively.
- **Micro Critical Aseptic Field**: A small protective sterile surface/housing (eg, sterile caps, covers, and the inside of recently opened sterile equipment packaging) that protect Key-Parts individually.

**Procedure**
- Standardize the use of aseptic technique with the international standard approach of ANTT for all invasive clinical procedures.
- Education and Competency
  » Document the clinical competency of ANTT as a core competency for all clinicians. This encompasses all aspects of infusion therapy, including but not limited to, preparation and administration of infusion solutions and medications, and insertion and management of VADs and other infusion devices.
  - Recognize that clinicians are ultimately responsible for ensuring the safe and consistent application of the components of ANTT for every clinical intervention requiring aseptic technique.
  - Ensure standardized practice through incorporation of ANTT within the organization that includes ANTT education, initial/ongoing competency assessment, and monitoring of practice standards through audit.
  - Use multimodal standardized resources for clinician education and training.
- Employ ANTT through Key-Part and Key-Site Protection, routine integration of Standard Precautions, and appropriate use of aseptic
fields and non-touch technique. Hand hygiene is a fundamental component of ANTT.

- Select either Standard-ANTT or Surgical-ANTT for the procedure, as determined by organizational policy or clinician risk assessment, using the defined ANTT risk assessment. The decision is guided as follows:
  » For this procedure, is the clinician able to protect all Key-Parts individually?
  » If yes, then Standard-ANTT is used. If no, then select Surgical-ANTT.
    - The clinician considers several practice variables, including:
      • The number and size of Key-Parts and Key-Sites.
      • The invasiveness of the procedure.
      • The duration of the procedure.
      • The environment within which the procedure will take place.
      • The level of PPE required.
  » Use Standard-ANTT for simple procedures of short duration, involving few and small Key-Parts (easily and readily protected by Micro Critical Aseptic Fields and non-touch technique). Examples include infusion of medications, venipuncture, and short peripheral intravenous catheter (PIVC) placement; if gloves are indicated, nonsterile gloves are typically worn; if Key-Parts or Key-Sites require direct touch, sterile gloves are worn.
  » Use Surgical-ANTT for longer, complex procedures, involving multiple or large Key-Parts (eg, CVAD insertion, CVAD exchange), while employing barrier precautions and appropriate use of PPE.
    - For Surgical-ANTT, sterile gloves are worn; however, still employ a non-touch technique of Key-Parts whenever practical to do so.
- Ensure the aseptic state of Key-Parts and Key-Sites by appropriate device disinfection and skin antisepsis.
- Maintain asepsis during VAD dwell time by the use and management of sterile dressings and appropriate securement devices, applied and maintained using ANTT.
- Ensure effective management of the patient care setting prior to clinical procedures, including purposeful decontamination to help reduce the transmission of pathogenic microorganisms.
  » Perform appropriate decontamination and disinfection (before, during, and after clinical intervention) of DME used with an ANTT procedure (eg, ultrasound, electronic infusion pump).
Transmission-Based Precautions

Policy

Transmission-Based Precautions, including Airborne Precautions, Droplet Precautions, and/or Contact Precautions are implemented when strategies, in addition to Standard Precautions, are required to reduce the risk for transmission of infectious agents.

Airborne Precautions are implemented to prevent the transmission of infectious agents that remain infectious when suspended in the air over long distances.

Droplet Precautions are implemented to prevent transmission of pathogens spread through close respiratory or mucous membrane contact with respiratory secretions.

Contact Precautions are implemented to prevent the transmission of infectious agents, which are spread by direct or indirect contact with the patient or the environment, including when there are excessive bodily discharges, such as wound drainage.

Transmission-Based Precautions are adapted and modified to deal with infectious disease crises, such as pandemics, under the direction of organizations including the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO).

Key Points

- As human beings reach older average and maximal ages, the emergence of many diseases associated with aging becomes more apparent. The incidence of infections increases with age. Although the exact cause of aging is unknown, it is recognized that changes of the immune system play an important role in the aging process and in the increase of age-related infections. At the whole organism level, many studies have documented changes in endocrine and neural function; cardiovascular, muscle, and skeletal health; as well as regulation of glucose metabolism. These diverse physiological changes also affect the immune system.
- The clinical consequences of decreased immune response with aging seem clear and are primarily an increased incidence and severity of infections.
- Maintain Transmission-Based Precautions until it is determined that the cause of the symptoms is not due to an infectious agent or the duration of the recommended isolation precautions has been met.
• Establish and maintain a Respiratory Protection Program.
• Notify accepting facilities and transporting agencies about suspected infections and the need for Transmission-Based Precautions when patients are transferred.
• Implement strategies to deal with crises, such as pandemics, by reducing health care facility risk (eg, limit visitors, cancel elective procedures), isolating symptomatic patients, and protecting clinicians (eg, barriers at triage; limit number of staff caring for patient; ensure availability of PPE where most needed, eg, N95 respirators in the presence of aerosol-generating procedures; and adoption of technology, eg, wireless probes, electrocardiogram [ECG] technology to minimize the need for radiological confirmation of device tip location).
  » Understand that care decisions in a crisis are necessarily constrained by specific conditions under a crisis such as a pandemic.
  » Implementation of crisis standards of care is done within the health care organization and in collaboration with health care professionals, policy makers, and the community.

Patient Education
• Provide information and instruction to patients, caregivers, and family/visitors regarding Transmission-Based Precautions enacted; instruction should include:
  » Correct use of PPE donning and doffing.
  » How to avoid self-contamination and/or contamination of the environment.
  » How to perform hand hygiene.
  » Respiratory etiquette (eg, use of tissues or mask).
  » What to expect when clinicians enter/exit patient’s room.

Procedure
• Select and use PPE for Transmission-Based Precautions based on the nature of the patient interaction and potential for exposure to blood, body fluids, or infectious agents, and isolation precaution guidelines in effect at the time of the patient encounter for specific communicable diseases.
• Observe Droplet Precautions, in addition to Standard Precautions, when there is potential contact with respiratory secretions and sprays of blood or body fluids; wear a face mask, eye protection, and fluid
repellent gown, when there is potential contact with respiratory secretions and sprays of blood or body fluids.

- Perform hand hygiene before donning PPE, immediately in between each step of removing PPE if the hands become contaminated, immediately after removing all PPE, and before leaving the patient’s environment (refer to Chapter 2, Hand Hygiene for complete list).

- Wear a fit-tested, certified, N95-or-higher respirator and observe Airborne Precautions, in addition to Standard Precautions, if an infection spread by airborne route is suspected or confirmed, or when microbial agents become airborne transmissible, during unexpected aerosol-generating procedures (eg, intubation) to prevent the potential exposure to infectious agents.
  
  » Perform fit-testing prior to initial respirator use and repeat if there are significant changes to facial structures and at least annually thereafter.
  
  » Perform a seal check every time the respirator is worn and adjust as needed.
Hazardous Drugs and Waste

Policy
Organizational policies, procedures and/or practice guidelines address safe handling of hazardous drugs, appropriate use of PPE, exposure risk reduction, and safe handling of waste, including spills, in accordance with local/national laws, rules, and regulations.

Safe handling practices are required during preparation, administration, and disposal of all hazardous drugs.

All hazardous waste is discarded in appropriate containers and disposed of according to regulations in each jurisdiction.

Key Points
- Recognize that no safe levels of exposure to hazardous drugs have been determined, thus driving the need for a comprehensive hazardous drug control program. Exposure may occur at all points, including receipt of drug shipments, compounding and all steps in preparation, administration in all venues of care (eg, home, ambulatory clinic), and during patient care activities, spills, transportation, and waste disposal.
- Recognize that hazardous drugs are not limited to oncology settings, as there are infusion drugs from other categories classified as hazardous. Certain antineoplastic drugs are administered for many autoimmune conditions in multiple clinical settings. Clinicians in all settings who administer hazardous drugs should be provided appropriate PPE and engineering controls to reduce exposure.

Resources
- Learn the applicable guidelines for handling hazardous drugs in the jurisdiction and if those guidelines are voluntary or mandatory compliance.
- Identify hazardous drugs used in the health care setting and revise as needed. The National Institute for Occupational Safety and Health (NIOSH) provides a list of antineoplastic, nonantineoplastic, other drugs categories, and biologic agents that meet the definition of hazardous drugs. The most recent list should be used, as this list is updated periodically based on new drug information. Health care organizations in the United States are required to review this list annually and to review new drugs and agents as their use begins.
» Additional resources used to evaluate the hazard potential of a drug include safety data sheets (SDSs), drug package inserts and special health warnings from drug manufacturers, professional groups’ and organizations’ evidence-based recommendations, and online resources including:
  - Drugbank (http://drugbank.ca).
  - National Toxicology Program (https://ntp.niehs.nih.gov).

- Organizational Engineering Controls
  » Use appropriate engineering controls within the organization during receipt and unpacking, storage, sterile compounding (eg, containment primary engineering control [C-PEC]), and containment supplemental devices, such as closed system transfer devices (CSTDs).
  » Ensure all containers of hazardous drugs are labeled or marked with the drug identity and the appropriate hazard warning.

- Education
  » Provide appropriate training and document competency for all personnel who handle hazardous drugs at any stage.
  » Education and training alone are not sufficient to reduce health care personnel exposure and must be combined with other administrative and engineering controls.
  » Training should be based on the individual’s job description and be provided before handling any hazardous drugs.
  » At a minimum, this training should include the list of hazardous drugs and their associated risk, review of all policies and procedures, appropriate use of PPE and other equipment or devices, management of known or suspected exposure, spill management, and proper disposal.

- Preparation of Hazardous Drugs
  » Apply the appropriate processes for all personnel preparing sterile hazardous drugs within a C-PEC including hand hygiene, PPE use, decontamination, and disinfection. C-PECs are located in an area that has negative pressure to an adjacent ante area, are designed
for high-efficiency particulate air (HEPA)-filtered air flow, and have exhaust vented to the outside.

- Administration of Hazardous Drugs
  - Use protective devices and techniques for administration of all hazardous drugs including use of CSTDs and inserting the IV administration set spike into the container and priming while inside the C-PEC and before adding the hazardous drug. If this step must be done outside the C-PEC, attach the unprimed set to the primary solution infusion and backprime to move the air into the secondary solution container.

- Spill Prevention of Hazardous Drugs
  - Avoid spills of hazardous drugs through appropriate handling of all drug containers, administration sets, and other supplies used. Inadvertent punctures of solution bags, inadequate connections between the solution container and the administration set, loose connections along the administration set, and improper use of CSTDs are common causes of spills. Immediately contain, deactivate, and decontaminate the surface, followed by cleaning the spill using appropriate PPE.
    - Ensure that a spill kit is available where hazardous drugs are prepared and administered and follow directions for use in the event of a hazardous drug leak or spill. Cleaning processes for hard surfaces, carpet, and the C-PEC will vary.
    - Report such spills as an occurrence according to organizational procedures.
    - Large spills should be handled by health care workers who are trained in hazardous waste handling.
    - After any exposure to hazardous drugs, perform thorough hand washing with soap and water, as alcoholic hand gel is not sufficient to remove the drug from skin.
    - Do not transport parenteral hazardous drugs in a pneumatic tube system.
    - Spill kits should be easily accessible for anyone transporting hazardous drugs.

- Exposure Control Measures Preconception and Postconception
  - Allow clinicians who are actively trying to conceive, are pregnant, or are breastfeeding to refrain from exposure to hazardous drugs and waste. Guidelines from some countries suggest that avoidance of handling chemotherapy drugs is needed only for those trying to conceive and during the first trimester of pregnancy.
\begin{itemize}
    \item Contamination Testing
        \begin{itemize}
            \item Participate in environmental wipe sampling to identify surface residue of hazardous drugs in the areas where compounding, preparation, and administration are conducted. Identify and contain the cause of contamination and deactivate, decontaminate, and improve engineering controls to reduce contamination.
        \end{itemize}
    \end{itemize}

\section*{Procedures}
\begin{itemize}
    \item Personal Protective Equipment
        \begin{itemize}
            \item Use appropriate PPE during all stages of handling hazardous drugs including receipt and storage, compounding and preparation, administration, spill control, and waste disposal. Ensure appropriate steps are used to don and doff PPE. Appropriate PPE varies depending upon the activity being performed and the risk of splashing including:
                \begin{itemize}
                    \item Use of head/hair and shoe covers.
                    \item Face and eye protective covers such as goggles and shields.
                    \item Fit-tested N95 respirator or powered air-purifying respirator if drug inhalation is possible. Filtration designed for gases or vapors may be required for certain situations (eg, unpacking hazardous drugs on arrival, cleaning large spills). Surgical masks do not provide respiratory protection and N95 respirators may not protect against direct liquid splashes.
                    \item Disposable gowns shown to resist permeability with solid front, long sleeves, tight cuffs, and back closure. Remove and discard gown when it is contaminated, before leaving the area where the hazardous drug is handled, and after handling all hazardous drugs. Gowns are single-use only.
                    \item Two pairs of powder-free gloves that have been tested for hazardous drug use, removed, and discarded after each use or after 30 minutes of wear. Wear 1 pair under the gown cuff and 1 pair over the cuff.
                \end{itemize}
        \end{itemize}
    \item Hazardous Waste Disposal
        \begin{itemize}
            \item Safely dispose of hazardous waste and materials used in the preparation and administration of hazardous drugs.
                \begin{itemize}
                    \item WHO identifies cytotoxic waste as 1 of the 7 categories of hospital waste. Segregation of types and source of waste, while necessary for proper disposal, may not be performed in some countries.
                \end{itemize}
        \end{itemize}
\end{itemize}
- Color-coded waste containers are used to separate the source of waste. Do not place hazardous drug waste in containers used for other types of medical waste because medical waste disposal is handled differently from hazardous waste.
- Place contaminated materials including empty ampoules/vials/syringes/solution containers, and administration sets, gloves, and gowns into sealable, leakproof bags. Needles and other sharps are placed in a puncture-proof container. All containers are clearly labeled for hazardous waste.
- Refer to organizational policy and procedure for disposal of unused hazardous drug if infusion is interrupted.

### Excretion Management

» Handle patient body fluids safely for at least 48 hours after receiving a hazardous drug and instruct the patient/caregiver/surrogate in safe handling. Employ these practices for the known excretion time, as some hazardous drugs (e.g., cyclophosphamide) may be present in urine for longer than 48 hours.
- Close toilet lid or cover with a plastic-backed pad and flush twice after use, especially with toilets that have low volume for flushing.
- Wear 2 pairs of powder-free, chemotherapy-tested gloves and a gown shown to resist permeability when handling patient emesis or excretions. Wear a face shield if splashing is anticipated.
- Use disposable linens and leakproof pads to contain contaminated body fluids if possible. Washable linens should be placed in a leakproof bag and handled as contaminated.

### Exposure Event Management

» Immediately apply appropriate measures for exposure to hazardous drugs. Participate in a program of medical surveillance if handling hazardous drugs is a regular part of the job assignment.
- Immediately following skin exposure, remove contaminated clothing and wash skin with soap and water.
- For eye exposure, flush the eye with saline or water for at least 15 minutes and obtain emergency treatment.
- For inhalation, move away from the area and obtain emergency treatment if symptoms are severe.
- Report employee exposure to the organization’s occupational health and safety department. Follow organizational policy for reporting patient exposure.
Medical Waste and Sharps Safety

Policy

Safe handling and disposal of regulated medical waste, which includes sharps, are based on laws, rules, and regulations established in each jurisdiction (eg, countries, states, provinces) and defined in organizational policies, procedures and/or practice guidelines.

Contaminated sharps are discarded in a nonpermeable, puncture-resistant, tamperproof, biohazard container that is easily accessible and located in the immediate area where sharps are used.

Regulated medical waste is discarded in an appropriate container and disposed of according to local, state, and federal laws and regulations.

Safety-engineered devices that isolate or remove the bloodborne pathogens hazard are available in the workplace and when used, are consistently activated and used in accordance with manufacturers’ directions for use.

Risk reduction for clinician exposure to potentially infectious materials and for needlestick injuries is included in an organization’s quality improvement (QI) program.

Key Points

- Identify, report, and document exposure to potentially infectious materials or injury from sharps; follow organizational protocol for postexposure follow-up.
- Monitor and analyze data for trends and implement appropriate QI activities.
- Consider use of a checklist as a guideline for handling medical waste.
- Educate clinicians in safe practices relative to handling of sharps, medical waste disposal, and use of safety-engineered devices; the risk of needlestick injury is reduced when education is combined with implementation of sharps safety products.
  - Address the importance of reporting needlestick injuries and exposure to bloodborne pathogens; needlestick injuries are prevalent and underreported in a number of countries.
  - Involve clinician end users in evaluation of safety engineered devices.
> Medical waste may include liquid or semiliquid blood or other potentially infectious materials, contaminated items that would release blood or other potentially infectious materials in a liquid or semiliquid state, if compressed, or items that are caked with dried blood or other potentially infectious materials and are capable of releasing these materials during handling.

**Patient Education**
- Teach the patient and/or caregiver when and how to dispose of sharps that may be used during the course of self-care.

**Procedure**
- Reduce the risk of needlestick injury associated with parenteral injections, VADs, and blood sampling procedures.
  - Use safety-engineered devices to prevent needlestick injury.
  - Consider the use of passive safety-engineered devices.
  - Do not recap, break, or bend sharps; discard directly into sharps container.
  - Activate built-in safety controls during use, and discard as a single unit after use.
  - Dispose of sharps in a sharps container that is closable, puncture resistant, leakproof, appropriately labeled or color-coded, and large enough to accommodate disposal of the entire blood collection assembly (ie, holder and needle).
  - Consider additional or enhanced security measures where a higher risk of tampering is possible.
- Reduce the risk of potentially infectious exposure when managing medical waste.
  - Don gloves and other PPE as appropriate before handling medical waste.
  - Place medical waste in appropriate bag with corresponding label as outlined in organizational policies.
  - Transport the medical waste to the designated area for temporary collection or storage.
  - Restrict access of medical waste storage areas to authorized personnel.
3. Preparing for Vascular Access Device Placement

Key Definitions ................................................................. 50

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Key Definitions

Peripheral intravenous catheters (PIVCs): are inserted into and reside in veins of the periphery that includes all extremities, the external jugular vein, and scalp veins in neonates. PIVCs are inserted into superficial veins located just under the skin in the superficial tissue as well as deep veins located under the muscle tissue.

Types of PIVCs:

1. **Short peripheral intravenous catheter (short PIVC):** an over-the-needle catheter with a hollow metal stylet (needle) positioned inside the catheter; generally inserted in superficial veins.

2. **Long peripheral intravenous catheter (long PIVC):** inserted in either superficial or deep peripheral veins; offers an option when a short PIVC is not long enough to adequately cannulate the available vein. A long PIVC can be inserted via traditional over-the-needle technique or with more advanced procedures, such as Seldinger and accelerated Seldinger techniques.

3. **Midline catheter:** inserted into a peripheral vein of the upper arm via the basilic, cephalic, or brachial vein with the terminal tip located at the level of the axilla in children and adults; for neonates, in addition to arm veins, midline catheters may be inserted via a scalp vein with the distal tip located in the jugular vein above the clavicle or in the lower extremity with the distal tip located below the inguinal crease.
Central Vascular Access Device (CVAD): a catheter that is inserted into a peripheral or large vein of the chest or groin with the tip advanced to a central position, either the superior or inferior vena cava.

Types of CVADs:

1. Peripherally Inserted Central Catheter (PICC): inserted through veins of the upper extremity or neck in adults and children; for infants, may be inserted through veins of the scalp or lower extremity; catheter tip is located in the superior or inferior vena cava, preferably at its junction with the right atrium, regardless of insertion site.

2. Implanted Vascular Access Port: a catheter inserted into a vein, attached to a reservoir located under the skin.

3. Nontunneled Central Vascular Access Device: a type of CVAD for short-term use that is inserted directly through the skin, usually via the axillary-subclavian, internal jugular, or femoral vein.

4. Tunneled, Cuffed Catheter: a CVAD with a segment of the catheter lying in a subcutaneous tunnel with the presence of a cuff into which the subcutaneous tissue grows to offer security for the catheter; indicates that the skin exit site and vein entry site are separated by the subcutaneous tunnel.
Vascular Access Device Planning

Policy

Infusion therapy is initiated based on the patient’s diagnosis, review of alternative routes of therapy, and consideration of the risks versus the benefits of various treatment modalities.

The appropriate type of vascular access device (VAD), peripheral or central, is selected to accommodate the patient’s vascular access needs, based on the prescribed therapy or treatment regimen, including anticipated duration of therapy, vascular characteristics, patient’s age, comorbidities, history of infusion therapy, preference for VAD type and location, and ability and resources available to care for the device.

Selection of the most appropriate VAD occurs at the earliest opportunity and is a collaborative process among the health care team, the patient, and the patient’s caregiver(s).

The least invasive VAD with the smallest outer diameter and fewest number of lumens needed for the prescribed therapy is selected.

Vessel health and preservation are prioritized when planning vascular access.

Key Points

- Plan of Care for Older Adults
  - A plan of care must address the unique needs of the patient both as an individual and as an older adult.
    - The plan of care should be documented clearly, detailing short- and long-term infusion care goals and objectives, including any identified problems or concerns, recommendations, and time frame for goal achievement.
    - Ensure that the plan of care takes into consideration the unique needs of the older adult, including any impaired cardiac, hepatic, or renal functioning, which may lead to poor tissue perfusion and impaired drug metabolism and excretion.
- VAD Decision Elements
  - The interprofessional team must evaluate the following elements when determining VAD type:
    - Method of administration (eg, continuous or intermittent infusion or manual injection [ie, IV push])
- Infusion rate
- Number of infusion therapies (single vs multiple)
- Anticipated duration of therapy:
  - (<4 days): Insert a PIVC when all the above elements indicate peripherally compatible therapy.
  - (5-14 days): Insert a midline catheter in adult patients when all the above elements indicate peripherally compatible therapy. A long PIVC may remain appropriate if patient’s vasculature, patient’s preference, and local health care outcomes support this practice.
  - (>15 days): Consider insertion of a PICC. Midline catheters or PIVCs may remain appropriate when all the above elements indicate peripherally compatible therapy and if patient’s vasculature, patient preference, and local health care outcomes support this practice.
- pH and Osmolarity
  - Peripheral parenteral therapy should ideally be isotonic and of physiological pH. When this is not achievable, peripheral intravenous (IV) infusion of pH extremes and osmolarity should be avoided to reduce vascular endothelial damage.
  - Identify medications that should and should not be given through peripheral veins.
  - In clinical practice, many parameters, including administration site, number of infusion therapies, vein selected, related venous blood flow, infusion volume, infusion time, and planned duration of therapy contribute to vessel damage. There is no well-defined and generally recognized pH or osmolarity limit.

  » Do not insert a PIVC or midline catheter as a central line-associated bloodstream infection (CLABSI) prevention strategy.

  » If a patient presents with an implanted vascular access port, it should be accessed as the preferred IV route, rather than inserting an additional VAD, unless contraindicated (eg, existing complication with the device).
Assessment

Utilize the considerations outlined in Table 3.1. *Vascular Access Device Planning by Catheter Type* when determining the most appropriate VAD to support the patient’s therapeutic needs.

**TABLE 3.1. VASCULAR ACCESS DEVICE PLANNING BY CATHETER TYPE**

<table>
<thead>
<tr>
<th>Catheter Type</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| **Short PIVC** | Evaluate the infusate characteristics in conjunction with limited duration of infusion therapy and availability of peripheral vascular access sites.  
Avoid use for continuous infusion of medication with irritant or vesicant properties.  
For time-critical infusions of lifesaving therapies, such as vasopressors, begin the infusion through a PIVC until a CVAD can be safely inserted. Insert CVAD as soon as possible and within 24 to 48 hours.  
Do not use a short PIVC when the vein lies deep in subcutaneous tissue or for veins classified as deep veins (lying underneath muscle), thus restricting the proportion of catheter that will be located within the vein. At least two-thirds of the PIVC should reside within the vessel to reduce the risk of PIVC failure.  
Use a 22- to 26-gauge catheter for older adults, and patients with limited venous options to minimize insertion-related trauma.  
Consider large-gauge catheters when rapid fluid replacement is a necessity.  
Use steel-winged devices only for single-dose administration. Do not leave the device in situ. |
| **Long PIVC** | Choose a long PIVC when all aspects of a short PIVC are met, but the vessel is difficult to palpate or visualize with the naked eye; ultrasound guidance/near infrared technology is recommended. Evaluate depth of vessel when choosing a long PIVC to ensure two-thirds of catheter lies within vein. |
| **Midline Catheter** | Assess infusate characteristics and planned duration of infusion therapy for tolerability by peripheral veins.  
Use in adult patients for medications and solutions such as antimicrobials, fluid replacement, and analgesics with characteristics that are well-tolerated by peripheral veins.  
Assess the clinical benefit of using a midline catheter that inhibits bacterial attachment and biofilm formation.  
Avoid the use in patients with a history of thrombosis, hypercoagulability, decreased venous flow to the extremities, or end-stage renal disease requiring vein preservation. |
### Catheter Type

<table>
<thead>
<tr>
<th>Midline Catheter</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increase catheter site surveillance when administering intermittent infusions of known irritants and vesicants due to increased risk of phlebitis or extravasation.</td>
</tr>
<tr>
<td></td>
<td>Evaluate the risk and benefit of intermittently infusing vesicant medication for more than 6 days.</td>
</tr>
</tbody>
</table>

### CVAD

- (PICC, Implanted Vascular Access Port, Nontunneled CVAD, Tunneled CVAD)
- Select a CVAD to administer any type of infusion therapy in which the benefit outweighs the risk.

To minimize unnecessary CVAD insertion, use an evidence-based list of indications for CVAD use including but not limited to:

- Clinical instability of the patient and/or complexity of infusion regimen (multiple infusates).
- Episodic chemotherapy treatment where insufficient peripheral venous access is anticipated.
- Prescribed continuous infusion therapy not appropriate for peripheral infusion (e.g., vesicant, PN, electrolytes, and other medications).
- Invasive hemodynamic monitoring.
- Long-term intermittent infusion therapy (e.g., any medication including anti-infectives in patients with a known or suspected infection or IV therapy for chronic diseases).
- History of failed or difficult peripheral IV access when use of ultrasound guidance has failed.

Recognize risks associated with CVADs, including venous thrombosis and an increased risk for CLABSI.

- Balance the treatment benefit against the risk of venous thrombosis and infection for patients who have cancer, or are chronically ill, when choosing a PICC.
- Choose a catheter appropriate to the patients’ vasculature and therapy requirements.
- Consider use of an antithrombogenic PICC to reduce thrombosis risk.
- Use a CVAD with the least number of lumens to reduce the risk of thrombosis, infection, and occlusion.

Do not use a PICC as an infection prevention strategy.
<table>
<thead>
<tr>
<th>Catheter Type</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| CVAD (PICC, Implanted Vascular Access Port, Nontunneled CVAD, Tunneled CVAD) | Collaborate with the health care team to consider the use of anti-infective CVADs, as they have shown a decrease in colonization and/or CABSI in some settings. Consider use in the following circumstances:  
  • Expected dwell of more than 5 days  
  • CABSI rate remains high even after employing other preventive strategies.  
  • For patients with enhanced risk of infection (ie, neutropenic, transplant, burn, or chronically ill patients)  
  • Emergency insertions  
  • For patients at risk of developing CABSI, do not use anti-infective CVADs in those with allergies to the anti-infective substances, such as chlorhexidine, silver sulfadiazine, rifampin, or minocycline. |
|                               | Plan proactively for an arteriovenous fistula or an arteriovenous graft for patients with CKD as a permanent access for dialysis; this includes restriction of device insertion that might compromise future fistula sites.  
  • PICC placement before or after hemodialysis initiation is associated with failure to transition to a working fistula; before PICC placement, consult with the nephrology team when available.  
  • Avoid PICCs in patients with CKD. |
|                               | Consider use of an implanted vascular access port in patients who require infrequent/intermittent vascular access, as they have a lower rate of infection compared to tunneled and nontunneled CVADs.  
  • Contraindications to implanted vascular access ports include: severe uncorrectable coagulopathy, uncontrolled sepsis or positive blood culture, and burns, trauma, or neoplasm of the chest that preclude chest wall placement; alternative sites where anterior chest wall is not feasible include the femoral vein or a trapezius approach.  
  • Insertion of implanted vascular access ports in the upper arm may be an alternative site for patients in whom chest ports cannot be implanted.  
  • Advantages include low risk of complication during treatment, and patient benefits include minimal care and management and improved body image. |
|                               | Consider a tunneled cuffed CVAD for patients who are anticipated to require continuous long-term infusion therapy (eg, antineoplastic therapy, PN). |
|                               | Consider the need for a power-injectable CVAD and know the pressure limits and other limitations (eg, maximum number of power injections) of the device including all attached or add-on devices (eg, implanted port access needle, extension set, needleless connector), to avoid catheter rupture. |
### Catheter Type | Considerations
---|---
Arterial Catheter | Insert a peripheral arterial or pulmonary arterial catheter for short-term use for hemodynamic monitoring, obtaining blood samples, and analyzing blood gas in critically ill patients.

Consider use of a 20-gauge catheter for radial arterial access in adults; 1 large study demonstrated a low rate of complications using a 20-gauge vs an 18-gauge catheter.

**Abbreviations:** CABS, catheter-associated bloodstream infection; CKD, chronic kidney disease; CLABS, central line-associated bloodstream infection; CVAD, central vascular access device; IV, intravenous; PICC, peripherally inserted central catheter; PIVC, peripheral intravenous catheter; PN, parenteral nutrition.

### Patient Education
- Teach the patient and caregiver(s)
  - Rationale for VAD
  - Types of VADs appropriate for required infusion therapy
  - Advantages and disadvantages of VAD types
  - Care and management requirements
  - Potential risks/complications and how and to whom to report them
Site Selection

Policy

The most appropriate vein and insertion site is selected to best accommodate the VAD required for the prescribed infusion therapy.

Vessel health and preservation are prioritized during site selection.

The type and duration of infusion therapy, patient preference, and the patient’s physiologic condition (eg, age, diagnosis, comorbidities) and vascular condition (eg, history of vascular access attempts, vessel and skin health at site of insertion and proximal) are assessed when preparing for site selection and VAD insertion.

Selection of the most appropriate vein and insertion site occurs in collaboration with the patient/caregiver and the health care team based on the projected treatment plan.

Key Points

- Utilize vascular visualization technologies during site assessment.
  - PIVCs: Use vascular visualization technologies to identify and select the most appropriate vein for insertion.
  - PICCs: Use ultrasound to identify and assess vasculature including size, depth, and trajectory of vessels; anatomy to avoid such as arteries and nerves; optimal site for PICC insertion; and to increase first-time insertion success.
  - Nontunneled CVADs: Use ultrasound for vein identification, assessment, and insertion in all sites to decrease risks of cannulation failure, arterial puncture, hematoma, pneumothorax, and hemothorax.
  - Arterial Access: Use ultrasound to identify, assess and insert arterial catheters to increase first-attempt success and reduce insertion-related complications, such as hematoma.

- Special considerations
  - The following sites must not be used or are used only with caution due to increased risk of nerve damage:
    - Cephalic vein at the radial wrist
    - Volar (inner) aspect of the wrist
    - Antecubital fossa (at/above)
Avoid the following PIVC insertion areas due to increased risk of failure, injury, or exacerbation of complications:
- Flexion
- Pain on palpation
- Compromised skin and sites distal to these areas, such as areas with open wounds
- Extremities with an infection
- Area of planned procedure(s)
- Veins that are compromised (eg, previous cannulation, bruised, reddened/streaked, infiltrated, sclerosed, corded, or engorged)
- Visible veins of the chest, breast, abdomen, or other locations on the trunk of the body
- Veins of the lower extremities unless needed for an emergent insertion, due to risk of tissue damage, thrombophlebitis, and ulceration; remove as soon as possible.

Paralysis or hemiparesis: When feasible, avoid venipuncture on an extremity with paralysis or hemiparesis (eg, traumatic injury, cerebrovascular accident) due to alteration in normal blood flow and decreased sensation that would prevent reporting pain associated with nerve injury and other complications.

Lymphedema: Consider restricting venipuncture to the contralateral upper extremities in patients with lymphedema, and those at increased risk for lymphedema (eg, axillary surgical dissection or radiation therapy) based on the risk of decreased perfusion, impaired immune function, and increased risk of infection due to compromised axillary drainage.
- Consider early referral to an infusion nurse/vascular access specialist.
- If emergent vascular access is needed, choose the most readily accessible vein for access in either upper extremity, then establish a plan for ongoing vascular access.

Chronic kidney disease (CKD): Avoid placing PICCs in patients with CKD due to the risks of central vein stenosis and occlusion, as well as resultant venous depletion preventing future fistula construction. PICC insertion before or after hemodialysis initiation is associated with failure to transition to a working fistula.
- Avoid placing a nontunneled CVAD via the subclavian vein for patients with CKD.
For patients with renal dysfunction, who have an arteriovenous fistula or graft (AVF/AVG):

- Restrict venipuncture for PIVC insertion to the dorsum of the hand whenever possible and avoid the cephalic vein, regardless of arm dominance, in patients with an actual or planned dialysis fistula or graft.
- Avoid the use of forearm and upper arm veins for peripheral catheter insertion. A collaborative discussion with the patient and the provider is needed to discuss the benefits and risks of using a vein in an affected extremity.

Assessment

Utilize the considerations outlined in Table 3.2. *Vascular Access Device Site Selection by Catheter Type* when determining the most appropriate VAD site to support the patient’s therapeutic needs.

### TABLE 3.2. VASCULAR ACCESS DEVICE SITE SELECTION BY CATHETER TYPE

<table>
<thead>
<tr>
<th>Catheter Type</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short PIVC</td>
<td>Select veins on the dorsal and ventral surfaces of the upper extremities, including the metacarpal, cephalic, basilic, and median veins.</td>
</tr>
<tr>
<td></td>
<td>Inserting in a forearm vessel may:</td>
</tr>
<tr>
<td></td>
<td>• Prolong the dwell time</td>
</tr>
<tr>
<td></td>
<td>• Increase the likelihood of the PIVC lasting the full length of the prescribed therapy</td>
</tr>
<tr>
<td></td>
<td>• Decrease pain during dwell time</td>
</tr>
<tr>
<td></td>
<td>• Promote self-care</td>
</tr>
<tr>
<td></td>
<td>• Prevent accidental removal and occlusions</td>
</tr>
<tr>
<td></td>
<td>Consider hand veins only for short-term therapy that is planned for &lt; 24 hours. Insertion in areas of flexion, such as the hand, is associated with higher rates of failure over time.</td>
</tr>
<tr>
<td></td>
<td>The external jugular vein may be considered in patients in acute care settings and in emergency situations when other veins cannot be accessed.</td>
</tr>
<tr>
<td></td>
<td>• An alternative vascular access site should be arranged as soon as possible.</td>
</tr>
<tr>
<td>Long PIVC</td>
<td>Consider veins found on the dorsal and ventral surfaces of the upper extremities, including the cephalic, basilic, and median veins.</td>
</tr>
<tr>
<td></td>
<td>Insertion should be in the forearm without crossing into the antecubital fossa.</td>
</tr>
</tbody>
</table>
### Preparing for Vascular Access Device Placement

<table>
<thead>
<tr>
<th>Catheter Type</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Midline Catheter</strong></td>
<td>Select an upper arm site using the basilic, cephalic, and brachial veins.</td>
</tr>
<tr>
<td><strong>PICC</strong></td>
<td>Select the basilic, brachial, or cephalic vein above the antecubital fossa that is most appropriate for PICC insertion.</td>
</tr>
<tr>
<td></td>
<td>• The basilic vein is preferable.</td>
</tr>
<tr>
<td></td>
<td>• Ensure a catheter-to-vessel ratio of &lt; 45%.</td>
</tr>
<tr>
<td></td>
<td>Avoid insertion in these areas:</td>
</tr>
<tr>
<td></td>
<td>• Sites with pain on palpation</td>
</tr>
<tr>
<td></td>
<td>• Areas with wounds</td>
</tr>
<tr>
<td></td>
<td>• Veins that are compromised due to previous cannulation, injury, bruising, sclerosing, cording or engorgement</td>
</tr>
<tr>
<td><strong>Nontunneled CVAD</strong></td>
<td>Weigh the risks vs benefits when selecting a site for nontunneled CVADs. Considerations include patient physiology, vascular history, infusion needs, and emergent nature of insertion.</td>
</tr>
<tr>
<td></td>
<td>Jugular insertion site considerations:</td>
</tr>
<tr>
<td></td>
<td>• Less mechanical complications on insertion</td>
</tr>
<tr>
<td></td>
<td>• Improved securement with low internal jugular approach</td>
</tr>
<tr>
<td></td>
<td>• Risk of thrombosis and infection are increased with longer dwell times</td>
</tr>
<tr>
<td></td>
<td>Femoral insertion site considerations:</td>
</tr>
<tr>
<td></td>
<td>• Higher risk of infection</td>
</tr>
<tr>
<td></td>
<td>• Easy access with use of ultrasound in emergent/short-term situations</td>
</tr>
<tr>
<td></td>
<td>Axillo-subclavian insertion site considerations:</td>
</tr>
<tr>
<td></td>
<td>• Lower risks of infection and of symptomatic DVT</td>
</tr>
<tr>
<td></td>
<td>• Increased mechanical complications on insertion may occur (eg, pneumothorax if inserted medially).</td>
</tr>
<tr>
<td></td>
<td>• Increased risk of DVT and stenosis with long-term use of the subclavian site.</td>
</tr>
</tbody>
</table>

**Abbreviations:** CVAD, central vascular access device; DVT, deep vein thrombosis; PICC, peripherally inserted central catheter; PIVC, peripheral intravenous catheter.

### Patient Education
- Teach the patient and caregiver(s)
  - Rationale for VAD site selection process
  - Importance of continuance of activities of daily living with VAD placement as appropriate
  - Limitations on activities of daily living with VAD placement
Vascular Visualization

Policy

Vascular visualization technology is employed to increase insertion success of the most appropriate, least invasive VAD, minimizing the need to escalate to an unnecessary, more invasive device and to reduce insertion-related complications.

Use visualization technology to aid in vessel identification and selection and for patients with difficult intravenous access (DIVA).

Vascular visualization equipment is cleaned and disinfected after each patient use with disinfectants that have antimicrobial activity against pathogens likely to contaminate the equipment and in accordance with manufacturers’ directions for cleaning and disinfecting.

Key Points

- Near Infrared (nIR) Light Technology
  » Use to aid in locating viable superficial peripheral venous sites and decreasing procedure time for PIVC insertion.
  » Using during peripheral site assessment helps clinicians make more informed decisions about vein selection.
  » The use has been associated with enhanced first-time insertion success.

- Visible Light Devices
  » Consider the use of visible light devices that provide transillumination of the peripheral veins.
    - Visible light devices aid in locating superficial veins, but usefulness may be limited in adults or older children due to the thickness of subcutaneous tissue and size of the arm circumference.
    - Use only cold light sources in devices designed for vascular visualization due to risk for thermal burns.

- Ultrasound
  » Use ultrasound for PIVC, midline catheter and CVAD insertion.
    - Short PIVC: Use ultrasound in patients with DIVA.
    - Long PIVC: Insertion with ultrasound may reduce failure due to an increased ratio of catheter within the vessel.
- CVAD: Use real-time ultrasound guidance and a systematic approach to improve insertion success rates, reduce number of needle punctures, and decrease insertion complication rates.

**Assessment**

- Assess the patient’s medical history for conditions that may affect the peripheral vasculature and increase the need for visualization technology to assist in locating appropriate venous insertion sites.
- Evaluate factors that increase difficulty with locating veins by observation and palpation (known as landmark techniques) that include, but are not limited to:
  - Disease processes that result in structural vessel changes (eg, diabetes mellitus, hypertension)
  - History of frequent venipuncture and/or lengthy courses of infusion therapy
  - Variations in skin between patient populations, such as darker skin tones and excessive hair on the skin
  - Skin alterations, such as the presence of scars or tattoos
  - Patient’s age
  - Obesity
  - Fluid volume deficit

**Education**

**Clinician:**

- Education for all clinicians who utilize vascular visualization technologies will be provided and competency validated prior to use on patients.
- Assess clinician competency in the use of vascular visualization technology for insertion of VADs.
  - Knowledge includes but is not limited to:
    - Assessment of vessels and surrounding tissues
    - Vessel size, depth, location
    - Potential complications
    - Adherence to Aseptic Non Touch Technique (ANTT) during insertion procedure
- Document clinician competency according to organizational protocols.
Patient:

- Provide education to patient and caregiver regarding the use of vascular visualization technologies and potential benefits.

Documentation

- Document in the patient’s health record:
  - Use of visualization technology
  - Identification of the insertion site by anatomical descriptors, laterality, landmarks, or appropriately marked drawings
  - Patient’s response to the procedure
Vascular Access Site Preparation and Skin Antisepsis

Policy
Skin antisepsis is performed prior to VAD placement.
The intended VAD insertion site is visibly clean prior to application of an antiseptic solution; if visibly soiled, cleanse the intended site with soap and water prior to application of antiseptic solution(s).
Perform skin antisepsis at the VAD site as part of routine site care.

Key Points
- Infection Prevention
  » The clinician understands that site preparation and antisepsis is essential to preventing insertion-related infection during catheter insertion through migration of microbes down the catheter tract.
  » The clinician understands risk factors of catheter-associated bloodstream infection (CABSI) includes inadequate skin antisepsis prior to VAD insertion.
  » Use a single-use applicator containing antiseptic solution, not a multiple use product (eg, bottle of antiseptic solution).
  » Remove excess hair at the insertion site if needed to facilitate application of VAD dressings; use single-patient-use scissors or disposable-head surgical clippers; do not shave as this may increase the risk for infection.
  » Perform skin antisepsis using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution.
    - If there is a contraindication to chlorhexidine solution, an iodophor (eg, povidone-iodine) or 70% alcohol may also be used.
    - Aqueous chlorhexidine may be considered if there is a contraindication to alcohol-based chlorhexidine.
  » Antiseptic preparations can cause stinging and irritation, adding to the older adult’s discomfort. Too much alcohol can dry already compromised skin. An older adult will be less likely to cooperate with venipuncture procedures if she or he experiences pain at this early stage. Although antiseptic agents should be applied with friction, be aware that irritated skin may become more damaged, causing further distress and discomfort to the older adult.
Assessment
- Evaluate patient history of any allergy or sensitivity to skin antiseptics.
- Evaluate the need to remove excess hair at insertion and dressing site. Discuss with patient prior to procedure.
- Assess condition of skin at intended insertion and dressing site to ensure skin is healthy and intact.

Patient Education
- Provide education and rationale to patient and caregiver regarding the use of skin antiseptic prior to VAD insertion and during routine site care.

Procedure
1. Perform hand hygiene. Don nonsterile gloves.
2. Wash insertion site with soap and water if visibly soiled. Clip excess hair as necessary.
3. Cleanse insertion site with antiseptic solution according to manufacturers’ instructions.
   A. Chlorhexidine solution (preferred): apply using a back-and-forth motion for at least 30 seconds.
   B. Povidone-iodine: apply using applicator and allow to remain on the skin for 1.5 to 2 minutes or longer to completely dry for adequate antisepsis. The use of concentric circles or a back-and-forth motion for this skin preparation has not been studied.
4. Allow antiseptic solution to dry completely. Follow manufacturers’ directions for use to determine appropriate product application and dry times.
   A. Always allow product to naturally dry without wiping, fanning, or blowing on skin.
5. Do not touch or palpate the insertion site after skin antisepsis.
   A. If repalpation of the vein is required after skin antisepsis, use sterile gloves for palpation and insertion and adhere to the principles of Surgical-ANTT to prevent recontamination of the insertion site.
Documentation

- Document in the patient’s health record:
  » Type of antiseptic solution used for skin preparation prior to VAD insertion and/or VAD site care
  » Removal of excess hair at VAD site and product used
  » Condition of skin prior to application of antiseptic solution and/or hair removal
Pain Management for Venipuncture and Vascular Access Procedures

Policy

Appropriate strategies are implemented to reduce pain associated with phlebotomy and VAD-related procedures (eg, insertion, implanted vascular access port access) based upon assessment of patient’s condition, developmental level, and engagement of patients and families to determine preferences.

Key Points

- Clinicians may fail to recognize the benefits of pain management for venipuncture and vascular access procedures. Assess for barriers which may influence underuse of pain management strategies such as underestimation of procedural pain, lack of knowledge, time, lack of orders, and cost.
  - Educate clinicians about pain management strategies and techniques for vascular access procedures.
  - Ensure pain management products and supplies are readily available for use in clinical areas throughout the organization.
- Use local anesthetic agents to reduce pain in older adults.
  - Vapocoolant spray used prior to skin antisepsis and before IV cannulation is associated with decreased pain during the procedure; some studies are inconsistent in clinical findings
  - Topical transdermal agents
  - Jet injection of pressure-accelerated lidocaine (needle-free method)
  - Intradermal lidocaine (to be avoided in pregnancy) or bacteriostatic 0.9% sodium chloride
    - Rare allergic reactions can occur with lidocaine and bacteriostatic saline (benzyl alcohol); assess for past use/reactions and monitor for an allergic response.
    - Because there is less supportive underlying tissue in older adults, care must be taken not to nick and damage the vein or inadvertently administer the anesthetic intravascularly.
- Use behavioral interventions such as distraction, relaxation, breathing exercises.
- Improve the patient experience of PIVC insertion.
  - Incorporate pain management strategies as a standard practice.
  - Engage patient in decision-making for vascular access.
  - Employ interventions to increase first-time success.
- Recognize that some patients may have a significant fear of needles and that pain management strategies may reduce fear.
  - Employ techniques that reduce fear whenever possible, which may include distraction (eg, watching television, conversation during procedure), keeping the needle/catheter out of site, and use of analgesic/anesthetic agents.

**Assessment**
- Patient tolerance to pain and patient preferences related to pain management
- Patient anxiety about the procedure
- Allergic reactions, tissue damage

**Patient Education**
- Provide patient/caregiver information on the selected local anesthetic agent, including benefits, management, and potential complications, as well as how and to whom to report them.

**Procedure**

**Supplies**
- Transdermal (topical) anesthetic cream or patch
  - Transparent semipermeable membrane (TSM) dressing
  - Antiseptic solutions
  - Gauze pads
  - Gloves
- Lidocaine hydrochloride 1% solution or bacteriostatic 0.9% sodium chloride
  - Antiseptic solution
  - Gauze pads
  - Gloves
  - 1-mL (tuberculin) syringe
Jet injector with CO₂ cartridge
- Lidocaine
- Antiseptic solution
- Gauze pads
- Gloves

**Preprocedure Preparation**
1. Obtain and review provider’s order or standard protocol.
2. Verify patient’s identity using 2 independent identifiers, according to organizational policy (eg, name and date of birth).
3. Assess for any history of hypersensitivity or allergy to local anesthetics.
4. Check medication for expiration or beyond-use dates; inspect syringe for leaks, cracks, particulate matter, and clarity of medication.
5. Compare medication label against order, for accuracy.
6. Perform hand hygiene.
7. Don gloves.

**Transdermal (Topical) Anesthetic Cream**
1. Apply recommended amount of transdermal anesthetic cream to intended venipuncture site or implanted port needle insertion site.
2. Cover anesthetic cream with TSM dressing.
3. Remove dressing material after recommended application time, and cleanse skin of remaining transdermal cream.
4. Proceed with device insertion procedure.
5. Assess for response and any reactions to topical anesthetic cream.

**Anesthetic Dermal Patch**
1. Apply anesthetic dermal patch to intended venipuncture site or implanted port needle insertion site.
2. Leave on skin for the recommended application time.
3. Remove patch.
4. Proceed with device insertion procedure.
5. Assess for response and any reactions to anesthetic dermal patch.
**Intradermal Anesthetic**

May be used with peripheral venipuncture and percutaneous CVAD insertion.

1. Cleanse skin of intended venipuncture site with antiseptic solution and allow to dry.
2. Draw 0.3 mL of injectable anesthetic into 1-mL (tuberculin) syringe.
3. With needle bevel up, gently insert needle intradermally lateral to intended venipuncture site.
4. Aspirate to confirm no blood return.
5. Inject 0.1 to 0.3 mL anesthetic to form wheal at intended access site.
6. Remove needle and discard syringe in appropriate sharps container.
7. Proceed with device insertion.
8. Assess for response and any reactions to intradermal anesthetic.

**Jet Injection of Pressure-accelerated Lidocaine**

1. Fill the jet injector with lidocaine 1% solution (buffered or nonbuffered) according to manufacturers’ instructions.
2. Cleanse skin of intended venipuncture site with antiseptic solution and allow to dry.
3. Prepare the injector for activation according to manufacturers’ instructions.
4. Administer jet injection immediately beside the intended venipuncture site; do not inject directly over the vessel. Follow manufacturers’ instructions regarding positioning and administration procedure.
5. Proceed with device insertion once medication has taken effect.
6. Assess for response and any reactions to intradermal anesthetic.

**Documentation**

- Document in the patient’s health record:
  - Local anesthetic used
  - Date, time of administration
  - Patient education
  - Patient response to effectiveness of local anesthetic and VAD procedure
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Policy Statements

Note: Please refer to these policy statements for all applicable insertion procedures described in this chapter.

- Clinical Competency and Organizational Protocols
  - Insertion and removal of vascular access devices (VADs) are performed by providers/clinicians within the boundaries of their identified scope of practice, based on their licensure, upon documented competency, and in accordance with organizational policies, procedures, and/or practice guidelines.
  - Establish indications and protocols for VAD selection and insertion in organizational policies, procedures, and/or practice guidelines and according to manufacturers’ directions for use.
  - Ensure patient safety through clinician competency in the use of infusion equipment, including knowledge of appropriate indications, contraindications, and manufacturers’ directions for use.

- All VADs
  - Use a new, sterile VAD for each catheterization attempt, including use of introducers.
  - Do not alter VADs outside manufacturers’ directions for use.
  - Secure VADs to prevent complications associated with VAD motion at the insertion site and unintentional loss of access.
  - Use VAD securement methods that do not interfere with the ability to routinely assess and monitor the access site or impede vascular circulation or delivery of the prescribed therapy.

- Peripheral Intravenous Catheters (PIVCs)
  - Restrict PIVC insertion attempts to no more than 2 attempts per clinician. Multiple unsuccessful attempts cause pain to the patient, delay treatment, limit future vascular access, increase cost, and increase the risk for complications. After 2 unsuccessful attempts, escalate to a clinician with a higher skill level and/or consider alternative routes of medication administration.

- Central Vascular Access Devices (CVADs)
  - Implement the central line bundle when placing CVADs, which includes the following interventions: hand hygiene, skin antisepsis using alcohol-based chlorhexidine, and maximal sterile barrier precautions. Preference for upper body insertion site to reduce risk of infection.
A checklist is completed by a trained observer to ensure that all steps have been completed without contamination. The observer is trained in how to observe and assist with the procedure and may be an unlicensed person without insertion skills.

Ensure proper placement of the CVAD tip, within the lower one-third of the superior vena cava (SVC) or cavoatrial junction (CAJ).
- For lower body insertion sites, the CVAD tip should be positioned in the inferior vena cava (IVC) above the level of the diaphragm.
- Before use of the CVAD for infusion, if required, the inserter should properly reposition the CVAD and obtain a confirmation of correct location.

Determine tip location of a CVAD radiographically or by other imaging technologies prior to initiation of infusion therapy or when clinical signs and symptoms suggest tip malposition.

Document the original tip location in the patient’s health record and make available to other organizations involved with the patient’s care.

**VAD Equipment**

- Establish the use and maintenance of infusion equipment in organizational policies, procedures, and/or practice guidelines.
- Clean and disinfect infusion equipment after each patient use with disinfectants that have antimicrobial activity against pathogens likely to contaminate the equipment and in accordance with manufacturers’ directions for cleaning and disinfecting.
Key Definitions

VAD Securement

**Adhesive securement device (ASD):** an adhesive-backed device that adheres to the skin with a mechanism to hold the VAD in place; a separate dressing is placed over the ASD. Both the dressing and ASD must be removed and replaced at specific intervals during the VAD dwell time.

**Integrated securement device (ISD):** a device that combines a dressing with securement functions; includes transparent, semipermeable window and a bordered fabric collar with built-in securement technology.

**Subcutaneous anchor securement system (SASS):** a securement device that anchors the VAD in place via flexible feet/posts that are placed just beneath the skin; these act to stabilize the catheter right at the point of insertion. A separate dressing is placed over the SASS. The SASS does not need to be changed at regular intervals when the dressing is changed; it can remain in place if there are no associated complications.

**Tissue adhesive (TA):** a medical-grade cyanoacrylate glue that can seal the insertion site and temporarily bond the catheter to the skin at the point of insertion and under the catheter hub. TA should be reapplied at each dressing change.

VAD Insertion Techniques

**Seldinger technique:** a multistep process that employs the use of a dilator to facilitate catheter advancement into a central location over a guidewire.

**Modified Seldinger technique (MST):** a multistep process that employs the use of a micropuncture needle and a dilator/introducer combination to insert a catheter for vascular access.

**Accelerated Seldinger technique (AST):** a process that employs a preassembled device that combines the needle, guidewire, and catheter in a single unit. This process reduces the number of individual pieces required, potentially decreasing the risk of insertion-related complications.
Short Peripheral Intravenous Catheter Insertion

Key Points

- Implementation of a PIVC insertion bundle should be considered for improving insertion success and reducing complications.
- Early referral to an infusion/vascular access specialist is warranted if patient assessment yields no visible or palpable veins.
- Use visualization technology to aid in peripheral vein identification and selection for patients with difficult intravenous access (DIVA).

  » Assess the patient’s medical history for conditions that may affect the peripheral vasculature and increase the need for visualization technology to assist in locating appropriate venous or arterial insertion sites. Factors that increase difficulty with locating veins by observation and palpation (known as landmark techniques) include, but are not limited to:

    - Disease processes that result in structural vessel changes (eg, diabetes mellitus, hypertension).
    - History of frequent venipuncture and/or lengthy courses of infusion therapy.
    - Variations in skin between patient populations, such as darker skin tones and excessive hair on the skin.
    - Skin alterations, such as the presence of scars or tattoos.
    - Patient’s age.
    - Obesity.
    - Fluid volume deficit.

- PIVCs must be removed immediately in the following situations:

  » If nerve damage is suspected, such as when the patient reports severe pain on insertion (ie, electrical shock-like pain) or paresthesias (eg, numbness or tingling) related to the insertion; promptly notify the provider.

  » If an artery is inadvertently accessed, remove the catheter, and apply pressure to the peripheral site until hemostasis is achieved. Assess circulatory status and if impaired, notify the provider promptly.
Joint Stabilization

- Joint stabilization devices, such as an arm board or splint, are used to facilitate infusion delivery, maintain device functionality, and minimize infusion therapy complications; they are not considered restraints.
  - Avoid use if possible due to restricted movement of the stabilized body part.
  - Maintain a functional position by padding the device as needed to support the area of flexion (eg, hand, arm, elbow, foot) to maintain a functional position.
  - Apply in a manner that permits visual inspection and assessment of the vascular access site and vascular pathway and does not exert pressure that will cause circulatory constriction, pressure injury, or nerve damage in the area of flexion or under the device.
  - Use when a PIVC is placed in the antecubital fossa. This site is not recommended, but if a PIVC is present, the joint is stabilized.
  - Remove periodically for assessment of circulatory status, range of motion and function, and skin integrity.

- Caution is recommended when applying the joint stabilization device to the older adult’s hand or wrist area when there is evidence of arthritic joint changes. While positioning the hand or wrist in a functional position is necessary, extra padding under taping surfaces may be required to prevent joint stiffness and resulting discomfort.

- Follow organizational policy regarding required frequency of assessment and joint stabilization device removal. The older adult must be checked frequently, and the joint stabilization device removed at regular intervals to allow full range of motion and circulation assessment. Reinforcement of patient teaching should be continued to prevent accidental dislodgement and self-injury.

- Collaborative efforts should be made with the interprofessional team members to develop a plan of care to prevent patient attempts to remove the VAD while preventing the use of restraints. Use the least restrictive restraining device as necessary.

- A soft restraint may be required for older adults who might accidentally dislodge a VAD. The restraint should not be applied so tightly that the patient’s circulation, infusate flow, or securement of the catheter is compromised. Careful assessment and documentation are required when using any type of joint stabilization device.
Vascular Access Device Placement

- **Vascular Access Site Preparation and Skin Antisepsis**
  - Adhere to principles of Standard-Aseptic Non Touch Technique (Standard-ANTT) based upon the assessment of the complexity of the PIVC insertion. Use Standard-ANTT for simple PIVC insertion.
  - Don a new pair of disposable, nonsterile gloves in preparation for PIVC insertion; do not touch/palpate the insertion site after skin antisepsis.
  - If repalpation of the vein is required after skin antisepsis, use sterile gloves for palpation and insertion and adhere to the principles of Surgical-ANTT to prevent recontamination of the insertion site. Contamination of nonsterile gloves is well documented.
  - Refer to Chapter 3, *Vascular Access Site Preparation and Skin Antisepsis* for complete procedure.
  - Antiseptic preparations can cause stinging and irritation, adding to the older adult’s discomfort. Too much alcohol can dry already compromised skin. An older adult will be less likely to cooperate with venipuncture procedures if she or he experiences pain at this early stage. Although antiseptic agents should be applied with friction, be aware that irritated skin may become more damaged, causing further distress and discomfort to the older adult.

- **Tourniquet Use**
  - Use single-patient-use, latex-free tourniquets.
  - Wrap the area where the tourniquet will be placed with a washcloth or apply the tourniquet over a piece of clothing to reduce the discomfort, pressure, or “pinching” sensation. The tourniquet should lie flat against the skin or over clothing for additional comfort.
  - Older adults who are disoriented may become more confused during tourniquet application. Calm reinforcement and reassurance should alleviate the older adult’s anxiety during the procedure.
  - Due to friability of aging skin, the length of time and amount of tension applied to the tourniquet should be limited to avoid inadvertent bruising and skin tears. Venous distention may take longer and tapping the area over the vein and intended venipuncture site may cause accidental bruising.
  - Do not apply a tourniquet for more than 2 to 3 minutes. Remove tourniquet immediately after assessment.
  - If the tourniquet is too tight or in place for an extended period of time, the vein may become overdistended and/or damaged during venipuncture.
» Limit the length of time and amount of tension applied to the tourniquet in immunocompromised patients to avoid inadvertent bruising and skin tears. Venous distention may take longer and tapping the area over the vein and intended venipuncture site may cause accidental bruising. If the tourniquet is too tight or in place for an extended period, the vein may become overdistended and become damaged during venipuncture.

» Do not apply a tourniquet on an extremity with an arteriovenous fistula (AVF).

» Release the tourniquet as soon as possible after the insertion of the PIVC and positive confirmation of blood return.

» Use an appropriate method to promote vascular distention when inserting a short PIVC, including:
  - Use of gravity or impeding venous flow with the use of a blood pressure cuff or tourniquet (while maintaining arterial circulation).
  - If a blood pressure cuff is used to promote venous distension, inflate to just below diastolic pressure. An arterial pulse should be easily palpable distal to the tourniquet location.

Procedure

I. Preprocedure Assessment

- Review Patient’s Health Record:
  » Note documented allergies (e.g., antiseptic solution, anesthetic, adhesives, etc).
  » Patient age and physical condition
  » Assess the characteristics of the prescribed infusion therapy and the anticipated length of therapy to determine if a short PIVC is the most appropriate VAD.

- Select Insertion Site:
  » Assess the condition of the skin and previous sites of venipunctures and/or infusion complications (e.g., phlebitis, infiltration) and avoid these areas for short PIVC insertion.
  » Discuss arm preference with the patient and the recommendation for use of the nondominant arm to decrease accidental removal (refer to Chapter 3, Site Selection).
  » Assess the number and location of peripheral veins that are easily seen and palpated (refer to Chapter 3, Site Selection).
II. Patient Education

- Prior to procedure, teach patient and caregiver:
  - The purpose of the short PIVC insertion procedure, including risks and benefits.
  - What to expect during the procedure.
  - Signs and symptoms of common complications.
  - How and to whom to report complications.

III. Preprocedure Preparation

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review the provider’s order for infusion therapy and PIVC placement.
4. Obtain informed consent according to organizational policy or patient assent.
5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
6. Prepare for insertion, collect necessary insertion supplies, and set up sterile field.

- Supplies
  - Gloves, nonsterile (sterile gloves are needed if site is palpated after skin antisepsis)
  - Short PIVC with safety mechanism
  - Vein visualization device (as appropriate)
  - Single-use clippers or scissors for hair removal, if indicated
  - Local anesthetic, as indicated
  - Securement device or product
  - Short extension set, if not permanently attached to the catheter
  - Needleless connector
  - Preservative-free 0.9% sodium chloride prefilled syringe(s) or primed administration set
Intravenous (IV) start kit (preferred) or the following:
- Single-use tourniquet
- Antiseptic solution
- Sterile alcohol-free skin barrier product
- Transparent semipermeable membrane (TSM) dressing (preferred)
- Sterile gauze and sterile tape for dressing, if indicated
- Label

IV. Insertion Procedure
1. Place patient in sitting or recumbent position, as appropriate.
2. Explanations should be reinforced with each step of the procedure, so the older adult is aware of what to expect. Calmly explain the procedure as it occurs to enhance patient cooperation and compliance. It may be helpful to have another caregiver or family member present to reassure the older adult about the intent and expected outcome of the procedure.
3. Place tourniquet to promote venous distention.
4. Assess vasculature of the upper extremity and identify potential sites that are easily seen and/or palpated.
5. If no venous sites are visible or easily palpatated, use technology to improve insertion success:
   A. For visible light devices, use only cold light sources designed for vascular visualization to reduce risk for thermal burns. Darken the room to remove ambient light levels when using these devices; ensure adequate light to observe blood return from the catheter.
   B. For near infrared light devices, follow the manufacturers’ directions for use to identify bifurcating veins, tortuosity of veins, and palpable but nonvisible veins.
   C. For ultrasound-guided insertion, assessment of vessel depth is critical since selection of the appropriate length catheter will prevent inadvertent infiltration. Follow the manufacturers’ directions for use of ultrasound equipment (refer to Chapter 4, Ultrasound-Guided Long Peripheral Intravenous Catheter Placement).
6. Remove tourniquet.
7. Perform hand hygiene, don clean gloves.
8. Prepare insertion site:
   A. If visibly soiled, cleanse with antiseptic soap and water.
   B. Remove excess hair, if necessary, by clipping.

10. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, *Vascular Access Site Preparation and Skin Antisepsis*).
   A. Use an iodophor (e.g., povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.
   B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

11. Prepare equipment.
   A. Flush add-on devices with preservative-free 0.9% sodium chloride to remove air from devices.

12. Reapply a tourniquet above the intended venipuncture site or use alternative methods to promote venous distention.

13. Use vein visualization technology as needed.

14. If vein palpation is necessary after application of skin antiseptic, apply sterile gloves.

15. Stabilize the selected vein below the intended venipuncture site by stretching the skin taut with the nondominant hand.
   A. In the older adult, stabilization of the vein can be difficult due to changes in underlying tissue structures. The vein wall may be difficult to penetrate because of aging processes as well as other factors.

16. Perform venipuncture and advance catheter according to device-specific manufacturers’ directions for use. Observe blood in the catheter and/or flash chamber of the short PIVC that is the color and consistency of venous whole blood.

17. Release the tourniquet.

18. Activate the needle safety mechanism according to manufacturers’ directions for use.

19. Attach needleless connector or other appropriate add-on device primed with preservative-free 0.9% sodium chloride and flush PIVC or attach primed administration set.

20. Observe the site for signs of swelling, or if patient complains of discomfort or pain. Remove the catheter if signs are present.

21. Apply securement device or product to catheter (refer to Chapter 4, *Key Definitions*). If not available, use only sterile tape.
22. Apply a TSM dressing over the insertion site; omit this step if integrated securement device/dressing is used.

23. For added securement, curl the extension set to the side and tape to the arm. Do not “wrap” the tape around the extremity.

24. Discard used supplies in the appropriate receptacles.

25. Remove gloves and perform hand hygiene.

26. Label dressing with:
   A. Insertion date and time.
   B. Gauge and length of device.
   C. Initials of inserter.

**Documentation**

- Document in the patient’s health record:
  » Use of vascular visualization technology
  » Date and time of insertion, number of attempts, device functionality, anesthetic used, inserter name/identification
  » Identification of the insertion site by anatomical descriptors, laterality, landmarks, or appropriately marked drawings
  » Dressing and securement type
  » Catheter gauge and length
  » Patient response to the procedure
  » Patient education
Short Peripheral Intravenous Catheter Insertion via the External Jugular Vein

Key Points

- A PIVC via the external jugular (EJ) vein should be considered a short-term placement due to the risk for dislodgement from neck motion, the risk for air embolism due to placement site, and increased risk for infection due to difficulty maintaining an intact dressing on this site. Collaborate with the health care team to develop a plan for ongoing vascular access.

- A PIVC via the EJ vein should not be used in the presence of:
  - Traumatic injury or surgery involving the superficial or deep structures of the neck.
  - Skin infection/cellulitis, phlebitis, hematoma, infiltration, or known occlusion of the EJ vein.

- A PIVC via the EJ vein is used cautiously in patients with altered mental status due to the risk of air embolus if the catheter becomes dislodged after insertion.

- Caution should be used in patients with known coagulopathies, as the vessels of the neck are not easily compressible if abnormal bleeding occurs.

- Place the patient in a 10° to 15° Trendelenburg position to prevent complications when inserting the catheter. No more than 2 insertion attempts on 1 side should be performed.

- PIVC placement via the EJ vein is appropriate for isotonic solution and medication administration.

- Ultrasound equipment may be used to assess for vessel size and patency but should not be needed to guide catheter insertion since the EJ vein is a very superficial vein.

- Antiseptic preparations can cause stinging and irritation, adding to the older adult’s discomfort. Too much alcohol can dry already compromised skin. An older adult will be less likely to cooperate with venipuncture procedures if she or he experiences pain at this early stage. Although antiseptic agents should be applied with friction, be aware that irritated skin may become more damaged, causing further distress and discomfort to the older adult.
PIVCs must be removed immediately in the following situations:

» If nerve damage is suspected, such as when the patient reports severe pain on insertion (ie, electrical shock-like pain) or paresthesias (eg, numbness or tingling) related to the insertion; promptly notify the provider.

» If an artery is inadvertently accessed, remove the catheter, and apply pressure to the peripheral site until hemostasis is achieved. Assess circulatory status and if impaired, notify the provider promptly.

Procedure

I. Preprocedure Assessment

- Review Patient’s Health Record:
  » Note documented allergies (eg, antiseptic solution, anesthetic, adhesives, etc).
  » Patient age and physical condition
  » Assess the characteristics of the prescribed infusion therapy to determine if a short PIVC in EJ vein is appropriate.

- Select EJ Insertion Site:
  » Assess the condition of the skin.
  » Assess both sides of the neck for the most visible EJ vein.
  » Assess ability to keep patient’s hair or beard away from the EJ PIVC insertion site. Hair may need to be clipped for patients with beards.

II. Patient Education

- Prior to procedure, teach patient and caregiver:
  » The purpose of short PIVC insertion, procedure, including risks and benefits.
  » Signs and symptoms of common complications.
  » How and to whom to report complications.
  » Rationale for use of ultrasound.

III. Preprocedure Preparation

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).

2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review provider’s order for insertion of the PIVC via the EJ vein.
4. Obtain informed consent according to organizational policy or patient assent.
5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
6. Prepare for insertion, collect necessary insertion supplies, and set up sterile field.
   • Supplies
     » Gloves, nonsterile (sterile gloves are needed for site palpation after skin antisepsis)
     » PIVC with safety mechanism
     » Vein visualization device, if needed
     » Single-use clippers or scissors for hair removal, if indicated
     » Local anesthetic, as indicated
     » Securement device or product
     » Short extension set, if not permanently attached to the catheter
     » Needleless connector
     » Preservative-free 0.9% sodium chloride prefilled syringe(s) or primed administration set
     » IV start kit (preferred) or the following:
       - Antiseptic solution
       - TSM dressing (preferred)
       - Sterile gauze and sterile tape for dressing, if indicated
       - Label
     » For ultrasound:
       - Disinfected ultrasound probe (refer to Chapter 3, Vascular Visualization)
       - Sterile water-based ultrasound gel
       - Sterile ultrasound probe cover
       - Portable ultrasound machine

IV. Insertion Procedure
1. Place patient in a supine position for vessel assessment.
2. Explanations should be reinforced with each step of the procedure, so the older adult is aware of what to expect. Calmly explain the procedure as it occurs to enhance patient cooperation and
compliance. It may be helpful to have another caregiver or family member present to reassure the older adult about the intent and expected outcome of the procedure.

3. Assess vasculature using ultrasound.
   A. Ensure ultrasound probe has been disinfected prior to patient use according to manufacturers’ instructions and organizational policy.
   B. Perform hand hygiene.
   C. Don clean gloves.
   D. Apply liberal amount of ultrasound gel to the patient’s neck.

4. Apply probe to the skin: visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site.
   A. Apply light downward pressure with ultrasound probe. When compressed, arteries are pulsatile; healthy veins should compress easily. Nerves can appear as echogenic bundles adjacent to veins and arteries, and caution should be used to avoid nerve stimulation.
   B. Assess EJ vein for vessel size, path, round shape, and compressibility.
   C. Assess for adequacy of vessel size comparative to proposed outer catheter diameter to promote hemodilution and preserve vessel health.

5. Remove gloves and discard.

6. Perform hand hygiene, don clean gloves.

7. Prepare insertion site:
   A. If visibly soiled, cleanse with antiseptic soap and water.
   B. Remove excess hair, if necessary, by clipping.


9. Place patient in 10° to 15° Trendelenburg position for catheter insertion.

10. Turn the patient’s head gently to the opposite side to expose the EJ vein.
    A. Turning the head too far will flatten and obscure the vein.

11. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, Vascular Access Site Preparation and Skin Antisepsis).
A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.

B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

12. Prepare equipment.
   A. Flush add-on devices with preservative-free 0.9% sodium chloride to remove air from devices.

13. If vein palpation is necessary after application of skin antiseptic, don sterile gloves.

14. Place thumb distal to the insertion site, pulling the skin upward to stabilize the vein.

15. Perform venipuncture and advance catheter according to device-specific manufacturers’ directions for use. Observe blood in the catheter and/or flash chamber of PIVC that is the color and consistency of whole blood.

16. Activate the safety mechanism according to manufacturers’ directions for use.

17. Attach needleless connector or other appropriate add-on device primed with preservative-free 0.9% sodium chloride and flush PIVC or attach primed administration set.

18. Observe the site for signs of swelling, or if patient complains of discomfort or pain, and remove the catheter if present.

19. Apply securement device or product to catheter (refer to Chapter 4, Key Definitions). If not available, use only sterile tape.

20. Apply a TSM dressing over the insertion site; omit this step if integrated securement device/dressing is used.

21. Discard used supplies in the appropriate receptacles.

22. Remove gloves and perform hand hygiene.

23. Label dressing with:
   A. Insertion date and time.
   B. Gauge and length of device.
   C. Initials of inserter.

24. Perform probe disinfection according to organizational policy and manufacturers’ instructions.
Documentation

- Document in the patient’s health record:
  - Use of vascular visualization technology
  - Date and time of insertion, number of attempts, functionality of device, anesthetic used, inserter name/identification
  - Identification of the insertion site by anatomical descriptors, laterality, landmarks, or appropriately marked drawings
  - Catheter gauge and length
  - Dressing and securement type
  - Patient response to the procedure
  - Patient education
Ultrasound-Guided Long Peripheral Intravenous Catheter Insertion

Key Points

- Implementation of a PIVC insertion bundle should be considered for improving insertion success and reducing complications.

- Assess the patient’s medical history for conditions that may affect the peripheral vasculature and increase the need for vein visualization technology to assist in locating appropriate venous or arterial insertion sites. Factors that increase difficulty with locating veins by observation and palpation (known as landmark techniques) include, but are not limited to:
  - Disease processes that result in structural vessel changes (eg, diabetes mellitus, hypertension).
  - History of frequent venipuncture and/or lengthy courses of infusion therapy.
  - Variations in skin between patient populations, such as darker skin tones and excessive hair on the skin.
  - Skin alterations, such as the presence of scars or tattoos.
  - Patient’s age.
  - Obesity.
  - Fluid volume deficit.

- PIVCs must be removed immediately in the following situations:
  - If nerve damage is suspected, such as when the patient reports severe pain on insertion (ie, electric shock-like pain) or paresthesias (eg, numbness or tingling) related to the insertion; promptly notify the provider.
  - If an artery is inadvertently accessed, remove the catheter and apply pressure to the peripheral site until hemostasis is achieved. Assess circulatory status and if impaired, notify the provider promptly.

- Joint Stabilization
  - Joint stabilization devices, such as an arm board or splint, are used to facilitate infusion delivery, maintain device functionality, and minimize infusion therapy complications; they are not considered restraints.
    - Avoid use if possible due to restricted movement of the stabilized body part.
- Maintain a functional position by padding the device as needed to support the area of flexion (eg, hand, arm, elbow, foot).
- Apply in a manner that permits visual inspection and assessment of the vascular access site and vascular pathway and does not exert pressure that will cause circulatory constriction, pressure injury, or nerve damage in the area of flexion or under the device.
- Use when a PIVC is placed in the antecubital fossa. This site is not recommended, but if a PIVC is present, the joint is stabilized.
- Remove periodically for assessment of circulatory status, range of motion and function, and skin integrity.

» Caution is recommended when applying the joint stabilization device to the older adult's hand or wrist area when there is evidence of arthritic joint changes. While positioning the hand or wrist in a functional position is necessary, extra padding under taping surfaces may be required to prevent joint stiffness and resulting discomfort.

» Follow organizational policy regarding required frequency of assessment and joint stabilization device removal. The older adult must be checked frequently, and the joint stabilization device removed at regular intervals to allow full range of motion and circulation assessment. Reinforcement of patient teaching should be continued to prevent accidental dislodgement and self-injury.

» Collaborative efforts should be made with the interprofessional team members to develop a plan of care to prevent patient attempts to remove the VAD while preventing the use of restraints. Use the least restrictive restraining device as necessary.

» A soft restraint may be required for older adults who might accidentally dislodge a VAD. The restraint should not be applied so tightly that the patient’s circulation, infusate flow, or securement of the catheter is compromised. Careful assessment and documentation are required when using any type of joint stabilization device.

- Vascular Access Site Preparation and Skin Antisepsis

» Adhere to principles of Standard-ANTT based upon the assessment of the complexity of the PIVC insertion. Use Standard-ANTT for simple PIVC insertion.
- Don a new pair of disposable, nonsterile gloves in preparation for PIVC insertion; do not touch/palpate the insertion site after skin antisepsis.
If repalpation of the vein is required after skin antisepsis, use sterile gloves for palpation and insertion and adhere to the principles of Surgical-ANTT to prevent recontamination of the insertion site. Contamination of nonsterile gloves is well documented.

» Refer to Chapter 3, *Vascular Access Site Preparation and Skin Antisepsis* for complete procedure.

» Antiseptic preparations can cause stinging and irritation, adding to the older adult’s discomfort. Too much alcohol can dry already compromised skin. An older adult will be less likely to cooperate with venipuncture procedures if she or he experiences pain at this early stage. Although antiseptic agents should be applied with friction, be aware that irritated skin may become more damaged, causing further distress and discomfort to the older adult.

**Tourniquet Use**

» Use single-patient-use, latex-free tourniquets.

» Wrap the area where the tourniquet will be placed with a washcloth or apply the tourniquet over a piece of clothing to reduce the discomfort, pressure, or “pinching” sensation. The tourniquet should lie flat against the skin or over clothing for additional comfort.

» Do not apply a tourniquet for more than 2 to 3 minutes. Remove tourniquet immediately after assessment.

» Older adults who are disoriented may become more confused during tourniquet application. Calm reinforcement and reassurance should alleviate the older adult’s anxiety during the procedure.

» Due to friability of aging skin, the length of time and amount of tension applied to the tourniquet should be limited to avoid inadvertent bruising and skin tears. Venous distention may take longer and tapping the area over the vein and intended venipuncture site may cause accidental bruising.

» If the tourniquet is too tight or in place for an extended period the vein may become overdistended and/or damaged during venipuncture.

» Do not apply a tourniquet on an extremity with an AVF.

» Release the tourniquet as soon as possible after the insertion of the PIVC and positive confirmation of blood return.
Use an appropriate method to promote vascular distention when inserting a PIVC, including:

- Use of gravity or impeding venous flow with the use of a blood pressure cuff or tourniquet (while maintaining arterial circulation).
- If a blood pressure cuff is used to promote venous distension, inflate to just below diastolic pressure. An arterial pulse should be easily palpable distal to the tourniquet location.

### Ultrasound Use

- Ultrasound-guided PIVC insertion is an important clinical adjunct for patients with DIVA (refer to Chapter 3, *Vascular Visualization*).
- Measure the catheter-to-vessel ratio prior to insertion of an upper extremity VAD; ensure a catheter-to-vessel ratio of < 45%.
- Assess the anatomy prior to insertion when using ultrasound to identify vascular anomalies (eg, occlusion or thrombosis) and to assess vessel diameter.
  - Select the most appropriate vessel to cannulate based on vessel size, shape, depth, flow, and patency; identification of potential structures to avoid (eg, nerves, arteries) within the vicinity of insertion; respiratory variation; catheter-to-vein ratio; and operator experience.
- Minimize damage to surrounding structures; identify vessels in the short (transverse) axis and proceed with insertion, or, alternatively, if the long (longitudinal) axis for needle insertion is preferred for adult patients redirect the probe to this plane upon completion of initial assessment.
- Use a sterile, single-use gel packet and a sterile sheath over the probe and disinfect before and after each use to reduce the risk for ultrasound probe contamination and subsequent risk for infection; refer to manufacturers’ directions for use.

## Procedure

### I. Preprocedure Assessment

- **Review Patient’s Health Record:**
  - Note documented allergies (eg, antiseptic solution, anesthetic, adhesives, etc).
  - Patient age and physical condition
  - Assess the characteristics of the prescribed infusion therapy and the anticipated length of therapy to determine if a long PIVC is the most appropriate VAD.
Select Insertion Site:

» Assess the condition of the skin and previous sites of venipunctures and/or infusion complications (e.g., phlebitis, infiltration) and avoid these areas for PIVC insertion.

» Discuss arm preference with the patient and the recommendation for use of the nondominant arm to decrease accidental removal (refer to Chapter 3, Site Selection).

Assess Vasculature With Ultrasound Device:

» Ensure ultrasound probe has been disinfected prior to patient use according to manufacturers’ instructions and organizational policy.

» Perform hand hygiene.

» Don clean gloves.

» Apply liberal amount of ultrasound gel to the patient’s arm.

» Apply probe to the skin: visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site.

  - Apply light downward pressure with ultrasound probe. When compressed, arteries are pulsatile; healthy veins should compress easily. Nerves can appear as echogenic bundles adjacent to veins and arteries, and caution should be used to avoid nerve stimulation.

  - Assess veins for vessel size, path, round shape, and compressibility without a tourniquet.

  - Assess depth of intended vessel for venipuncture.

  - Assess for adequacy of vessel size compared to proposed outer catheter diameter to promote hemodilution and preserve vessel health.

  - Avoid selecting smaller vessels to prevent phlebitis and thrombosis.

  - Remove gloves and discard.

» Longitudinal or transverse views can be used when placing vascular catheters with ultrasound. Surrounding structures will not be visible in the longitudinal view.

» Assessment of vessel depth is critical, because selection of the appropriate length catheter will prevent inadvertent infiltration.

  - Vessels > 0.5 cm deep have an increased risk for inadvertent infiltration as the result of the use of short catheters; choose catheters long enough to ensure at least two-thirds of the catheter length will reside in the vein after insertion.
- Power injection of ultrasound-guided VADs can result in extravasation if sufficient catheter length does not dwell in the vessel.
- Vessels > 1.5 cm below the surface of the skin should be avoided, and an alternative vascular access plan should be developed.

II. Patient Education

- Prior to procedure, teach patient and caregiver:
  - The purpose of long PIVC insertion, procedure, including risks and benefits.
  - Signs and symptoms of common complications.
  - How and to whom to report complications.
  - Rationale for use of ultrasound.

III. Preprocedure Preparation

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review provider’s order for infusion therapy.
4. Obtain informed consent according to organizational policy or patient assent.
5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow it to dry completely.
6. Prepare for insertion, collect necessary insertion supplies, and set up sterile field.

- Supplies
  - Gloves, nonsterile (sterile gloves are needed for site palpation after skin antisepsis)
  - PIVC with safety mechanism
  - Single-use clippers or scissors for hair removal, if indicated
  - Local anesthetic, as indicated
  - Securement device or product
  - Short extension set, if not permanently attached to the catheter
  - Needleless connector
  - Preservative-free 0.9% sodium chloride prefilled syringe(s) or primed administration set
IV. Insertion Procedure

1. Position patient for comfort and equipment for visualization of the vasculature.

2. Explanations should be reinforced with each step of the procedure, so the older adult is aware of what to expect. Calmly explain the procedure as it occurs in order to enhance patient cooperation and compliance. It may be helpful to have another caregiver or family member present to reassure the older adult as to intent and expected outcome of the procedure.

3. Apply a bead of sterile ultrasound gel to the probe and cover with sterile probe cover; avoid contamination of the probe cover that will be in contact with the patient’s skin.

4. Perform hand hygiene and don clean gloves.

5. Prepare the insertion site:
   A. If visibly soiled, cleanse with antiseptic soap and water.
   B. Remove excess hair, if necessary, by clipping.


7. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, Vascular Access Site Preparation and Skin Antisepsis).
A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.

B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

8. Apply tourniquet.

9. Apply a small amount of sterile ultrasound gel to the prepped area.

10. Relocate the intended vein with the ultrasound probe, verifying it is nonpulsatile.

11. Place the tip of the catheter on the skin at a distance from the probe that will intersect the vein within the plane of the scan field as the catheter is advanced to the intended vein’s depth. Pierce the skin using a shallow enough angle to allow for successful threading of the catheter into the vessel. Move the ultrasound probe toward the catheter to identify the catheter tip. Move the ultrasound probe and the needle in the same direction, keeping the needle tip in view on the screen as the catheter approaches the vein. Observe for dimpling of the tissue and vessel wall as the needle tip approaches and enters the lumen of the intended vessel. Make sure to keep the gel and probe away from the sterile catheter.

   A. The tip of the catheter stylet will appear as an echogenic white dot on the screen.

12. Align the path of the needle to enter the centermost superficial area of the vein wall and observe the needle tip entering the lumen of the vein. The needle tip should remain in view at all times. If the inserter is unable to visualize the tip of the needle, the probe, not the needle, should be moved to reestablish visibility. Otherwise, inadvertent nerve or arterial puncture could occur.

13. Confirm slow venous blood return the color and consistency of whole blood.

   A. If blood return is pulsatile, immediately abort the procedure by removing the needle and tourniquet and applying pressure to the area for 10 minutes or until hemostasis is achieved.

14. Place the ultrasound probe on the sterile field.

15. Decrease the angle of the catheter and advance the catheter into the vein.


17. Retract the catheter stylet while applying pressure to the vein proximal to the tip of the catheter, using caution not to contaminate the insertion site.
18. Attach needleless connector or other appropriate add-on device primed with preservative-free 0.9% sodium chloride.

19. Retrieve probe from the sterile field and position over the catheter tip in the longitudinal view.

20. Flush the catheter while viewing the catheter in the longitudinal view on ultrasound to ensure the catheter is properly seated in the vein and that inadvertent infiltration has not occurred during insertion.

21. Apply securement device or product to catheter (refer to Chapter 4, Key Definitions). If not available, use only sterile tape.

22. Confirm blood return, lack of resistance to flush, and absence of swelling or tenderness at site.

23. Catheters placed in the antecubital space or within another area of flexion require joint stabilization to prevent infiltration/extravasation.

24. Apply a TSM dressing over the insertion site; omit this step if integrated securement device/dressing is used.

25. For added securement, curl the extension set to the side and tape to the arm. Do not “wrap” the tape around the extremity.

26. Discard used supplies in the appropriate receptacles.

27. Remove gloves and perform hand hygiene.

28. Label dressing with:
   A. Insertion date and time.
   B. Gauge and length of device.
   C. Initials of inserter.

29. Perform probe disinfection according to organizational policy and manufacturers’ instructions.

**Documentation**

- Document in the patient’s health record:
  - Use of ultrasound guidance for PIVC insertion
  - Date and time of insertion, number of attempts, functionality of device, anesthetic used, inserter name/identification
  - Identification of the insertion site by anatomical descriptors, laterality, landmarks, or appropriately marked drawings
  - Catheter gauge and length
  - Dressing and securement type
  - Patient response to the procedure
  - Patient education
Ultrasound-Guided Midline Catheter Insertion

Key Points

- Use the safest available insertion technique, including the Seldinger technique, modified Seldinger technique (MST), or accelerated Seldinger technique (AST), to reduce the risk for insertion-related complications such as air embolism, guidewire loss, embolism, inadvertent arterial cannulation, and bleeding (refer to Chapter 4, Key Definitions).
- Use a maximal sterile barrier with insertion using Seldinger technique/MST.
- Consider a partial barrier with insertion using AST.
- Ensure appropriate midline catheter length for selected vessel and for proper tip location. In adult patients, tip location should be at level of axilla.
- Consider measuring arm circumference at insertion to establish a baseline and monitor arm circumference on a regular basis due to risk of catheter-associated deep vein thrombosis (CA-DVT).
- Antiseptic preparations can cause stinging and irritation, adding to the older adult’s discomfort. Too much alcohol can dry already compromised skin. An older adult will be less likely to cooperate with venipuncture procedures if she or he experiences pain at this early stage. Although antiseptic agents should be applied with friction, be aware that irritated skin may become more damaged, causing further distress and discomfort to the older adult.

Procedure

I. Preprocedure Assessment

- Collaborate with the prescribing provider for any relative contraindication to placement before placing a midline catheter.
- Assess for history of allergies to analgesics, adhesives, or antimicrobial solutions.
- Select sites in the upper arm, using the basilic, cephalic, and brachial veins, with the basilic vein preferred.
- Avoid insertion in areas with pain on palpation, areas of open wounds, areas on an extremity with an infection, veins that are compromised.
(eg, bruised, infiltrated, phlebitic, sclerosed, corded, or engorged), and areas of planned procedures.

- Discuss arm preference with the patient and the recommendation for use of the nondominant arm to decrease chances of accidental removal.

- Ultrasound use
  » Longitudinal or transverse views can be used when placing vascular catheters with ultrasound. Surrounding structures will not be visible in the longitudinal view. The needle tip should remain in view at all times. If the inserter is unable to visualize the tip of the needle, the probe, not the needle, should be moved to reestablish visibility. Otherwise, inadvertent nerve or arterial puncture could occur.
  » Visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site. When compressed, arteries are pulsatile. Healthy veins should compress easily when light, downward pressure is applied to the ultrasound probe. Nerves can appear as echogenic bundles adjacent to veins and arteries, and caution should be used to avoid nerve stimulation.
  » Assess veins for vessel size, path, round shape, and compressibility without a tourniquet.
  » Assess depth of the intended vessel for venipuncture.
  » Assess for adequacy of vessel size compared to proposed outer catheter diameter (catheter-to-vein ratio of < 45%) to promote hemodilution and preserve vessel health.

II. Patient Education

- Prior to procedure, teach patient and caregiver:
  » The purpose of midline catheter, procedure, including risks and benefits.
  » Signs and symptoms of common complications.
  » How and to whom to report complications.
  » Rationale for use of ultrasound.

III. Preprocedure Preparation

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review provider’s order for insertion of midline catheter.
4. Obtain informed consent according to organizational policy or patient assent.
5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
6. Prepare for insertion, collect necessary insertion supplies, and set up sterile field.
   - Supplies
     » Insertion kit for Modified Seldinger procedure:
       - Midline catheter
       - Safety microintroducer needle
       - Introducer/dilator appropriate to the catheter size
       - Guidewire
       - Safety scalpel
       - Single-use tourniquet
     » Insertion tray:
       - Maximal barrier supplies
         • Head covering
         • Mask
         • Sterile gloves (2 pairs)
         • Sterile gown
         • Underarm sterile drape
         • Large sheet sterile drape with fenestration
       - Antiseptic solution
       - Sterile gauze
       - Disposable tape measure
       - Disposable skin marker
     » Local anesthetic, as needed, according to protocol or as ordered
       - 3-mL syringe and small-gauge needle for subcutaneous anesthetic administration
     » Securement device or product
     » Extension set (needed for some catheters)
     » Needleless connector(s) for each lumen
     » Prefilled syringe preservative-free 0.9% sodium chloride flushes for each lumen
» Prefilled syringe of heparin lock solution 10 units per mL or as indicated by organizational policy or prescriber order
» TSM dressing: antimicrobial sponge or antimicrobial gel dressing, if used
» Skin protectant solution
» For ultrasound:
  - Disinfected ultrasound probe (refer to Chapter 3, Vascular Visualization)
  - Sterile ultrasound gel
  - Sterile ultrasound probe cover
  - Ultrasound machine
» Clean gloves
» For the Seldinger technique, add components for the procedure not included in the insertion kit.
» For AST, follow manufacturers’ instructions.

IV. Insertion Procedure

1. Perform hand hygiene.
2. Position patient supine, as appropriate, related to insertion site.
3. Explanations should be reinforced with each step of the procedure, so the older adult is aware of what to expect. Calmly explain the procedure as it occurs to enhance patient cooperation and compliance. It may be helpful to have another caregiver or family member present to reassure the older adult about the intent and expected outcome of the procedure.
   A. Ensure ultrasound probe has been disinfected prior to patient use according to manufacturers’ instructions and organizational policy.
   B. Perform hand hygiene.
   C. Don clean gloves.
   D. Apply liberal amount of ultrasound gel to the patient’s arm.
5. Apply probe to the skin: visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site.
   A. Apply light downward pressure with ultrasound probe. When compressed, arteries are pulsatile; healthy veins should compress easily. Nerves can appear as echogenic bundles adjacent to veins and arteries, and caution should be used to avoid nerve stimulation.
B. Assess veins for vessel size, path, round shape, and compressibility without a tourniquet.
C. Assess depth of intended vessel for venipuncture.
D. Assess for adequacy of vessel size compared to the proposed outer catheter diameter to promote hemodilution and preserve vessel health.
E. Avoid selecting smaller vessels to prevent phlebitis and thrombosis.
F. Mark the level of the proposed insertion site with a single-use disposable skin marker on the outer aspect of the arm to avoid leaving ink under the dressing and to allow for appropriate skin cleansing.
G. Remove the ultrasound gel from the patient’s skin.

6. Measure arm circumference to establish a baseline measurement.
8. Remove gloves and discard.
10. Don head covering and mask.
11. Open the insertion tray and midline catheter kit to create a sterile field and add additional items as needed to the field, using sterile technique.
12. Don sterile gown and 2 pairs of sterile gloves.
13. Prime any needed extension set(s) and catheter with 0.9% sodium chloride.
14. If the catheter has a stylet wire, withdraw just past the desired length, bending the stylet wire over the catheter hub before trimming the catheter to the premeasured length. Use caution never to cut the stylet wire.
15. If the catheter must be trimmed, use a guillotine or scalpel to achieve a blunt cut. Do not use scissors.
16. Place sterile drape under the extremity of the intended insertion site.
17. Prep the skin in the entire area where the dressing will cover. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, *Vascular Access Site Preparation and Skin Antisepsis*).
   A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.
8. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

18. Apply a tourniquet proximal to the insertion site.
19. Remove outer set of gloves after prepping the skin and applying the tourniquet.
20. Cover the ultrasound with sterile probe cover and secure.
21. Apply sterile ultrasound gel to skin over the proposed insertion site.
22. Relocate the intended vein with the ultrasound probe, verifying that it is nonpulsatile and compressible.
23. Inject local anesthetic subcutaneously at the insertion site, if needed. Before injection, aspirate for absence of blood return.
24. Apply covered probe to skin, visualize the vessel, and insert the microintroducer needle through the skin and into the vein using a 45° angle. Place the tip of the microintroducer needle on the skin at a distance from the probe that will intersect the vein within the plane of the scan field as the catheter is advanced to the intended vein’s depth. Move the ultrasound probe toward the needle to identify the needle tip. Move the ultrasound probe and the needle in the same direction, keeping the needle tip in view on the screen as the catheter approaches the vein. Observe for dimpling of the tissue and vessel wall as the needle tip approaches and enters the lumen of the intended vessel. Make sure to keep the gel and probe away from the sterile catheter.
   A. The tip of the microintroducer needle will appear as an echogenic white dot on the screen.
25. Align the path of the needle to enter the centermost superficial area of the vein wall and observe the needle tip entering the lumen of the vein.
26. Confirm slow venous blood return the color and consistency of whole blood.
   A. If blood return is pulsatile, immediately abort the procedure by removing the needle and tourniquet and applying pressure to the area for 10 minutes or until hemostasis is achieved.
27. Observe for blood return in microintroducer needle hub and visualize the needle tip in the center of the vein on ultrasound before proceeding.
28. Put the ultrasound probe down on sterile field.
29. Reduce the angle of the microintroducer needle and stabilize the microintroducer needle.
30. Insert the floppy-tipped guidewire into the microintroducer needle, threading into the vein. The guidewire should never be inserted into a position beyond the level of the axilla.

31. Carefully remove the microintroducer needle from the vein and skin, pulling it back over the guidewire.
   A. Do not allow the guidewire to move outward through the microintroducer needle because of the risk of severing the guidewire.

32. Secure the guidewire with your nondominant hand to prevent migration in or out of the vein.

33. Make a skin nick, if needed.
   A. Using a scalpel, hold the blade with the blunt side against the wire.
   B. Make a small nick at the insertion site on the side of the guidewire to facilitate insertion of the peel-away dilator/introducer into the skin.

34. Advance the peel-away dilator/introducer over the guidewire through the skin completely into the vein using a twisting motion.

35. Remove the guidewire.

36. Release the tourniquet, using caution not to break sterile technique.

37. Slowly remove the dilator leaving the peel-away introducer sheath in the vein.

38. Slowly advance the catheter through the introducer sheath.

39. Continue to advance the catheter slowly to the measured length.

40. Attach sterile 0.9% sodium chloride-filled syringe, and aspirate for blood return the color and consistency of whole blood from catheter and flush to determine patency.

41. Break the wings and slowly peel away the introducer sheath as it is withdrawn, taking care to allow the catheter to remain in its terminal tip location.

42. Connect the primed extension set(s) to the catheter hub, if needed.

43. Apply a needleless connector to each lumen.

44. Clean excess blood from the insertion site using chlorhexidine solution or dry gauze.

45. Place securement device or product (separate or integrated) and sterile dressing.
   A. Apply sterile alcohol-free skin barrier product (if used) around the perimeter of the intended dressing site. Do not apply barrier film/
product directly under chlorhexidine-impregnated sponge or gel patch as the solution will block its action at the puncture site. Apply TSM once barrier product is completely dry.

B. Apply securement device or product according to manufacturers’ instructions (refer to Chapter, 4 Key Definitions).

C. Apply sterile gauze and TSM dressing to oozing sites unless a hemostatic agent is used to absorb serosanguinous drainage. Change gauze and TSM dressing in 24 hours.

46. Flush and lock the midline catheter according to organizational policy.

47. Label dressing with date performed or date to be changed and initials of inserter.

48. Discard used supplies in appropriate receptacles.

49. Remove personal protective equipment (PPE) and perform hand hygiene.

50. Perform probe disinfection according to organizational policy and manufacturers’ instructions.

Documentation

- Document in the patient’s health record:
  - Use of ultrasound device
  - Date/time of insertion, number of attempts, catheter functionality, local anesthetic, inserter name and identification
  - Insertion site: vessel and size
  - Catheter length, size, and number of lumens
  - Length of any external catheter
  - Dressing and securement device or product used
  - Arm circumference measurements relative to insertion site
  - Patient response to the procedure and pain management
  - Patient education
Central Vascular Access Device Tip Location

Key Points

- Position the tip of a CVAD in the lower third of the SVC at or near the CAJ.
  - Upper body insertion sites:
    - Respiratory variation, arm movement, and changes in body position will cause the CVAD tip to move above or below the CAJ, indicating excursion into the upper right atrium.
    - Tip location deeper in the right atrium near the tricuspid valve or in the right ventricle is associated with cardiac arrhythmias.
  - Lower body insertion sites:
    - The CVAD tip should be positioned in the IVC above the level of the diaphragm.
- Avoid placing tip of the CVAD outside the SVC or IVC (e.g., innominate, brachiocephalic, subclavian, external, or common iliac veins), as this is associated with higher rates of complications. In rare circumstances including anatomical or pathophysiological changes, these less-than-ideal tip positions might be clinically indicated.
- Immediately post-CVAD insertion, and prior to initiating infusion therapy, a clinician with documented competency must verify the CVAD tip position by using electrocardiogram (ECG) or assessing the postprocedure chest radiograph.
  - Confirmation of tip location by postprocedure chest radiograph remains acceptable practice and is required in the absence of technology used during the procedure.
    - This method is less accurate because the CAJ cannot be seen on the radiograph and requires identification of tip location by measurement from the carina, trachea-bronchial angle, or thoracic vertebral bodies.
    - Patient repositioning or movement results in distal or proximal migration of the catheter tip by as much as 2 cm depending on the movement.
    - Recognize that radiographic or ECG tip location technology does not differentiate between venous and arterial placement. If arterial placement is suspected, use other methods to confirm or refute arterial placement. Re-evaluate CVAD tip position if there are signs and symptoms of malposition.
Assessment

- Preinsertion CVAD Length Assessment
  » Determine the desired catheter length for insertion by anthropometric measurement including, but not limited to, external measurement from the planned insertion site to the third intercostal space, use of formulas to calculate length based on body surface area, or measurement from preprocedure chest radiographs.

- CVAD Tip Location Assessment Upon Transfer From External Health Care Facility
  » Assess the catheter tip position when a patient is transferred from an external health care facility; if all the following criteria are met, it is appropriate to use the catheter without additional tip confirmation:
    - Documentation exists confirming catheter tip position at the CAJ on insertion.
    - Ability to aspirate blood and flush the catheter without resistance.
    - External catheter length remains the same as documented upon insertion.
    - Confirm catheter tip placement with a chest radiograph when any of these criteria are not met.

Patient Education

- Prior to procedure, teach patient and caregiver:
  » The significance of correct CVAD tip position.
  » The importance of maintaining correct CVAD tip position and purpose of catheter securement.
  » Signs and symptoms of tip malposition (refer to Chapter 6, Central Vascular Access Device Malposition).
  » How and to whom to report complications.

Procedure

- Use methods for identifying CVAD tip location during the insertion procedure (i.e., “real-time”) due to greater accuracy, more rapid initiation of infusion therapy, and reduced costs.
  » Use ECG methods with either a metal guidewire or a column of normal saline inside the catheter lumen and observe the ECG tracing to place the CVAD tip at the CAJ. Follow manufacturers’ directions for use with other ECG-based technology using a changing light pattern to detect tip location.
» Assess patient for known history of cardiac dysrhythmias and the presence of a P wave on ECG (if available) before planning to use ECG technology for placement. Contraindications to the use of ECG technology include patients with an abnormal ECG rhythm with an absence or alteration in the P wave (eg, presence of pacemakers, extreme tachycardia). Recent prospective observational studies have demonstrated safety and efficiency of using ECG to confirm catheter tip position in patients with atrial fibrillation.

» Consider the use of ultrasound for CVAD tip location. The clinical applicability of this is currently limited by the small sample sizes used to demonstrate its efficacy as a reliable and safe method to replace chest radiographs in all ages, and its usefulness is limited by the knowledge, skill, and experience of the operator.

- The addition of agitated saline to enhance transthoracic echocardiography has been shown to be effective in detecting catheter tip position in the lower third of the SVC, as well as detecting catheter malposition through delayed opacification and reduced echogenicity.

» Avoid fluoroscopy except where CVAD placement is difficult or has failed at the bedside, as it requires exposure to ionizing radiation.

» Postprocedure radiograph imaging is not necessary if alternative tip location technology confirms proper tip placement.

Documentation

- Document in the patient’s health record:
  » Date/time of insertion
  » CVAD tip location
  » Copy of the ECG tracing, chest radiograph note, or other appropriate report
  » Length of catheter external to the CVAD insertion site
Ultrasound-Guided Peripherally Inserted Central Catheter Insertion Using Modified Seldinger Technique

Key Points

- Recognize risks associated with peripherally inserted central catheters (PICCs), including increased incidence of venous thrombosis and rates of central line-associated bloodstream infection (CLABSI), similar to other nontunneled CVADs.

- Use ultrasound for vein identification, assessment, and insertion to decrease risks of cannulation failure, arterial puncture, hematoma, pneumothorax, and hemothorax.

- Ultrasound guidance is associated with improved insertion success rate, reduced number of needle punctures, and decreased risk of insertion complication rates when used to place CVADs.

- Power injection of PICCs can result in catheter malposition. Verification of proper tip placement should be reestablished after power injection.

- Relative contraindications to PICC placement include upper extremity edema; limited mobility; vascular implants (eg, AVF); prolonged bleeding time; history of unresolved deep vein thrombosis (DVT) or SVC filter; end-stage renal disease requiring vein preservation; and the right arm of children after procedures treating specific congenital cardiac defects that may have decreased blood flow to the subclavian artery.

- PICC placement with an SVC filter should only be attempted using fluoroscopy.

- For any catheter placed above the level of the heart where the gradient of intrathoracic pressure can lead to an influx of air, use air emboli precautions by taking steps to cover the open access to the vasculature when inserting needles, introducers, dilators, or catheters.

- Antiseptic preparations can cause stinging and irritation, adding to the older adult’s discomfort. Too much alcohol can dry already compromised skin. An older adult will be less likely to cooperate with venipuncture procedures if she or he experiences pain at this early stage. Although antiseptic agents should be applied with friction, be aware that irritated skin may become more damaged, causing further distress and discomfort to the older adult.
- PICCs may be the preferred CVAD in patients with coagulopathy disorders or those receiving anticoagulants, as direct pressure can be applied to control bleeding, and in patients with respiratory diagnoses or intracranial bleeding when the Trendelenburg position is difficult or contraindicated.

**Procedure**

**I. Preprocedure Assessment**

- Collaborate with the prescribing provider for any relative contraindication to placement before placing a PICC.
- Assess for history of allergies to analgesics, adhesives, or antimicrobial solutions.
- Select sites in the upper arm, using the basilic (preferred), cephalic, and brachial veins.
- Avoid insertion in areas with pain on palpation, areas of open wounds, areas on an extremity with an infection, veins that are compromised (eg, bruised, infiltrated, phlebitic, sclerosed, corded, or engorged), and areas of planned procedures.
- Discuss arm preference with the patient and the recommendation for use of the nondominant arm to decrease chances of accidental removal.

- **Ultrasound use**
  - Longitudinal or transverse views can be used when placing vascular catheters with ultrasound. Surrounding structures will not be visible in the longitudinal view. The needle tip should remain in view at all times. If the inserter is unable to visualize the tip of the needle, the probe, not the needle, should be moved to reestablish visibility. Otherwise, inadvertent nerve or arterial puncture could occur.
  - Visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site. When compressed, arteries are pulsatile. Healthy veins should compress easily when light, downward pressure is applied to the ultrasound probe. Nerves can appear as echogenic bundles adjacent to veins and arteries, and caution should be used to avoid nerve stimulation.
  - Assess veins for vessel size, path, round shape, and compressibility without a tourniquet.
  - Assess depth of the intended vessel for venipuncture.
Assess for adequacy of vessel size compared to proposed outer catheter diameter (catheter-to-vein ratio of < 45%) to promote hemodilution and preserve vessel health.

II. Patient Education

- Prior to procedure, teach patient and caregiver:
  - The purpose of PICC, procedure, including risks and benefits.
  - What to expect with the procedure and purpose for ultrasound and other technology used.
  - Signs and symptoms of common complications.
  - How and to whom to report complications.

III. Preprocedure Preparation

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review provider’s order for insertion of PICC.
4. Obtain informed consent per organizational policy or patient assent.
5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
6. Prepare for insertion, collect necessary insertion supplies, and set up sterile field.

- Supplies
  - Insertion kit for Modified Seldinger procedure:
    - PICC
    - Safety microintroducer needle
    - Introducer/dilator appropriate to the catheter size
    - Guidewire
    - Stylet
    - Safety scalpel
    - Single-use tourniquet
» Insertion tray:
   - Maximal barrier supplies
     • Head covering
     • Mask
     • Sterile gloves (2 pairs)
     • Sterile gown
     • Underarm sterile drape
     • Large, full-body sheet sterile drape with fenestration
   - Antiseptic solution
   - Sterile gauze
   - Disposable tape measure
   - Disposable skin marker
» Local anesthetic, as needed per protocol, or as ordered
   - 3-mL syringe and small-gauge needle for subcutaneous anesthetic administration
» Securement device or product
» Needleless connector(s) for each lumen
» Prefilled syringe preservative-free 0.9% sodium chloride flushes for each lumen
» Prefilled syringe of heparin lock solution 10 units per mL or as indicated by organizational policy or provider order.
» TSM dressing; antimicrobial sponge or antimicrobial gel dressing if used
» Skin protectant solution
» For ultrasound:
   - Disinfected ultrasound probe (refer to Chapter 3, Vascular Visualization)
   - Sterile ultrasound gel
   - Sterile ultrasound probe cover
   - Ultrasound machine
» Disinfectant wipes
» Clean gloves
» Tip-locating device
IV. Insertion Procedure

1. Perform hand hygiene.
2. Position patient supine, as appropriate, related to insertion site.
3. Explanations should be reinforced with each step of the procedure so the older adult is aware of what to expect. Calmly explain the procedure as it occurs to enhance patient cooperation and compliance. It may be helpful to have another caregiver or family member present to reassure the older adult about the intent and expected outcome of the procedure.
   A. Ensure ultrasound probe has been disinfected prior to patient use according to manufacturers’ instructions and organizational policy.
   B. Perform hand hygiene.
   C. Don clean gloves.
   D. Apply liberal amount of ultrasound gel to the patient’s arm.
5. Apply probe to the skin: visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site.
   A. Apply light downward pressure with ultrasound probe. When compressed, arteries are pulsatile; healthy veins should compress easily. Nerves can appear as echogenic bundles adjacent to veins and arteries, and caution should be used to avoid nerve stimulation.
   B. Assess veins for vessel size, path, round shape, and compressibility without a tourniquet.
   C. Assess depth of intended vessel for venipuncture.
   D. Assess for adequacy of vessel size compared to the proposed outer catheter diameter to promote hemodilution and preserve vessel health.
   E. Avoid selecting smaller vessels to prevent phlebitis and thrombosis.
   F. Mark the level of the proposed insertion site with a single-use disposable skin marker on the outer aspect of the arm to avoid leaving ink under the dressing and to allow for appropriate skin cleansing.
   G. Remove the ultrasound gel from the patient’s skin.
6. To approximate the desired terminal tip location at the lower one-third of the SVC at the level of the CAJ, measure from the proposed insertion site to the clavicular head on the right side and then down to the bottom of the third intercostal space on the right. Viewing previous
chest radiographs can help determine the distance from the clavicle to the level of the CAJ. Add length as needed to facilitate use of chosen securement device or product.

7. Measure arm circumference to establish a baseline measurement.
9. Remove gloves and discard.
10. Prepare for insertion, collecting necessary insertion supplies and setting up a sterile field.
11. Perform hand hygiene.
12. Don head covering and mask.
13. Perform hand hygiene.
14. Open the insertion tray and PICC kit to create a sterile field and include items in the field using sterile technique as needed.
15. Don sterile gown and 2 pairs of sterile gloves.
16. Prime any needed extension set(s) and catheter with 0.9% sodium chloride.
17. Use stylet wires according to manufacturers’ directions for use.
   A. Never cut a wire of any kind.
   B. If the catheter has a manufacturer-installed stylet wire, withdraw just past the desired length, bending the stylet wire over the catheter hub or locking in place before trimming the catheter to the premeasured length.
   C. If the stylet wire is provided in the kit but not already installed inside the PICC, follow directions for loading the stylet wire into the catheter lumen.
   D. Stylet wires provide stiffness for ease of catheter insertion. The stylet wire should not extend beyond the catheter tip.
18. If the catheter must be trimmed, use a guillotine or scalpel to achieve a blunt cut. Do not use scissors.
19. Place sterile drape under the extremity of the intended insertion site.
20. Prep the skin in the entire area where the dressing will cover. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, Vascular Access Site Preparation and Skin Antisepsis).
   A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.
8. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

21. Apply a tourniquet proximal to the insertion site.

22. Remove outer set of gloves after prepping the skin and applying the tourniquet.

23. Place large, sterile sheet drape with insertion site fenestration over the entire patient; best practice is to cover the patient’s face with the large, sterile drape. If the patient cannot tolerate having his or her face covered, the drape can be tented, and the patient can wear a mask or turn the head away from the insertion site.

24. Cover the ultrasound with sterile probe cover and secure.

25. Apply sterile ultrasound gel to skin over the proposed insertion site.

26. Relocate the intended vein with the ultrasound probe, verifying it is nonpulsatile and compressible.

27. Inject local anesthetic subcutaneously at the insertion site, if needed. Before injection, aspirate for absence of blood return.

28. Apply covered probe to skin, visualize the vessel, and insert the microintroducer needle through the skin and into the vein using a 45° angle. Place the tip of the access needle on the skin at a distance from the probe that will intersect the vein within the plane of the scan field as the catheter is advanced to the intended vein’s depth. Move the ultrasound probe toward the catheter to identify the catheter tip. Move the ultrasound probe and the needle in the same direction, keeping the needle tip in view on the screen as the catheter approaches the vein. Observe for dimpling of the tissue and vessel wall as the needle tip approaches and enters the lumen of the intended vessel. Make sure to keep the gel and probe away from the sterile catheter.

A. The tip of the microintroducer needle will appear as an echogenic white dot on the screen.

29. Align the path of the needle to enter the centermost superficial area of the vein wall and observe the needle tip entering the lumen of the vein.

30. Confirm slow venous blood return the color and consistency of whole blood.

A. If blood return is pulsatile, immediately abort the procedure by removing the needle and tourniquet and applying pressure to the area for 10 minutes or until hemostasis is achieved.

31. Observe for blood return in microintroducer needle hub and visualize the needle tip in the center of the vein on ultrasound before proceeding.
32. Put the ultrasound probe down on sterile field.
33. Reduce the angle of the microintroducer needle and stabilize the microintroducer needle.
34. Insert the floppy-tipped guidewire into the microintroducer needle, threading into the vein. The guidewire should never be inserted into a position beyond the level of the axilla without fluoroscopy guidance.
35. Carefully remove the microintroducer needle by removing it from the vein and skin and pulling it back over the guidewire.
   A. Do not allow the guidewire to move outward through the microintroducer needle due to risk of severing the guidewire.
36. Secure the guidewire with your nondominant hand to prevent migration in or out of the vein.
37. Make a skin nick, if needed.
   A. Using a scalpel, hold the blade with the blunt side against the wire.
   B. Make a small nick at the insertion site on the side of the guidewire to facilitate insertion of the peel-away dilator/introducer into the skin.
38. Advance the peel-away dilator/introducer over the guidewire through the skin completely into the vein using a twisting motion.
39. Remove the guidewire.
40. Release the tourniquet, using caution not to break sterile technique.
41. Slowly remove the dilator, leaving the peel-away introducer sheath in the vein.
42. Slowly advance the catheter through the introducer sheath.
43. Continue to advance the catheter slowly to the predetermined measurement.
   A. If using a tip-locating device, follow the manufacturers’ directions for use to determine proper tip placement, using air emboli precautions.
   B. If tip-location technology is not being used, withdraw the stylet wire from the catheter lumen, using air emboli precautions.
44. Attach sterile 0.9% sodium chloride-filled syringe, and aspirate for blood return the color and consistency of whole blood from catheter and flush to determine patency.
45. Break the wings and slowly peel away the introducer sheath as it is withdrawn, taking care to allow the catheter to remain in its terminal tip location.
46. Connect the primed extension sets.
47. Apply a needleless connector to each lumen.
48. Clean excess blood from the insertion site using chlorhexidine solution or dry gauze.
49. Place securement device or product (separate or integrated) and sterile dressing.
   A. Apply sterile alcohol-free skin barrier product (if used) around the perimeter of the intended dressing site. Do not apply barrier film/product directly under chlorhexidine-impregnated sponge or gel patch as the solution will block its action at the puncture site. Apply TSM once barrier product is completely dry.
   B. Apply securement device or product according to manufacturers’ instructions (refer to Chapter 4, *Key Definitions*).
   C. Apply sterile gauze and TSM dressing to oozing sites unless a hemostatic agent is used to absorb serosanguinous drainage. Change gauze and TSM dressing in 24 hours.
50. Flush and lock the PICC according to organizational policy.
51. Label dressing with date performed or date to be changed and clinician’s initials.
52. Discard used supplies in appropriate receptacles.
53. Remove PPE and perform hand hygiene.
54. Perform probe disinfection according to organizational policy and manufacturers’ instructions.
55. Obtain a chest radiograph to determine tip placement if not using a tip-locating device and follow organizational policy for activating the catheter for use.
   A. If tip termination is below the lower one-third of the SVC at the level of the CAJ, the catheter may be withdrawn after insertion to attain proper tip location using a sterile dressing change procedure.
   B. If tip termination is above the lower one-third of the SVC at the level of the CAJ, the catheter should never be advanced after the initial insertion procedure has been completed.
Documentation

- Document in the patient’s health record:
  - Use of ultrasound device
  - Date/time of insertion, number of attempts, functionality of catheter, local anesthetic, inserter name/identification
  - Insertion site: vessel and size
  - Catheter length, size, and number of lumens
  - Length of any external catheter
  - Terminal tip location and method used
  - Dressing and securement device or product used
  - Arm circumference measurements relative to insertion site
  - Patient response to the procedure and pain management
  - Patient education
Ultrasound-Guided Nontunneled Central Vascular Access Device Insertion Using Modified Seldinger Technique

Key Points

- Use ultrasound for vein identification, assessment, and insertion in all sites to decrease risks of cannulation failure, arterial puncture, hematoma, pneumothorax, and hemothorax.
- Ultrasound guidance is associated with improved insertion success rate, reduced number of needle punctures, and decreased risk of insertion complication rates when used to place CVADs.
- Insertion technique
  - MST is advantageous as it offers the ability to access vessels with a small-gauge needle, which can cause less trauma to the vein and improve access success. In the event of inadvertent arterial puncture, the opening in the artery is smaller, and bleeding can be more easily controlled.
  - A disadvantage of the MST is the open lumen of the dilator/introducer while inserting the catheter can result in air embolus.
- Carotid or femoral artery puncture, nerve injury, hematoma, air embolism, pneumothorax, and hemothorax are unique and potentially life-threatening complications associated with CVAD insertion that require the inserter to be trained to manage potential insertion complications.
- Site-Specific Points
  - Axillary vein insertion can increase the risk of pneumothorax secondary to the close proximity of the pleura to the needle insertion site. Damage to the brachial plexus is a risk of axillary vein insertion.
  - Femoral vein insertion sites present a higher risk of infection and should be avoided when possible since catheter securement and occlusive dressing adherence can be difficult to maintain. Femoral insertion does not require Trendelenburg positioning.
  - Subclavian vein: Ultrasound evaluation of the infraclavicular subclavian vein is difficult secondary to the overlying clavicle.
Moving outward to the axillary vein makes ultrasound more useful. Pinch-off syndrome, in which the catheter gets trapped between the clavicle and the first rib, can be a risk for subclavian insertions. Catheter occlusion and fracture can result. Phrenic nerve injury and brachial plexus injury are risks associated with subclavian insertions.

- Internal jugular (IJ) vein sites may be difficult to secure secondary to head movement, and carotid artery puncture is also a risk because of the close proximity of the artery and the vein in the neck.

- EJ veins are more tortuous than the IJ veins, making catheter threading more difficult, and vessel superficiality may create difficulty with catheter securement.

- Recognize risks associated with CVADs, including increased incidence of venous thrombosis and rates of CLABSI.

- Relative contraindications to CVAD placement depending on the choice of insertion site include prolonged bleeding time, history of unresolved deep vein thrombosis of the IJ, EJ, axillary, femoral, or subclavian vein on the ipsilateral side, or SVC filter, IVC filter, or inability to tolerate Trendelenburg positioning.

- IJ, EJ, axillary, and subclavian vein CVAD placement in patients with an SVC filter should only be attempted using fluoroscopy.

- Use air emboli precautions by taking steps to cover the open access to the vasculature when inserting needles, introducers, dilators, or catheters for any catheter placed above the level of the heart where the gradient of intrathoracic pressure can lead to an influx of air.

- Verify the CVAD tip position by using ECG or chest radiograph verification to determine the terminal tip location. Femoral CVADs require an abdominal radiograph to determine tip location if ECG is not used.

- Use ultrasound to assess for and identify the “sliding lung sign” to perform point-of-care assessment for pneumothorax prior to obtaining a chest radiograph for IJ, EJ, subclavian, and axillary vein insertions (documented competency is required for this assessment). If the sliding lung assessment creates suspicion for pneumothorax, immediately contact the provider to request a STAT chest radiograph.

- Antiseptic preparations can cause stinging and irritation, adding to the older adult’s discomfort. Too much alcohol can dry already compromised skin. An older adult will be less likely to cooperate with venipuncture procedures if she or he experiences pain at this early stage. Although antiseptic agents should be applied with friction, be
aware that irritated skin may become more damaged, causing further distress and discomfort to the older adult.

Procedure

I. Preprocedure Assessment

- Collaborate with the provider for any relative contraindication to placement before placing CVAD.
- Assess for history of allergies to analgesics, adhesives, or antimicrobial solutions.
- Perform insertion into the right IJ vein (when possible) since this route provides a more direct path to the SVC.
- Avoid insertion in areas with pain on palpation, areas of open wounds, and veins that are compromised (eg, bruised, infiltrated, phlebitic, sclerosed, corded, or engorged), and areas of planned procedures.
- Ultrasound use
  - Longitudinal or transverse views can be used when placing vascular catheters with ultrasound. Surrounding structures will not be visible in the longitudinal view. The needle tip should remain in view at all times. If the inserter is unable to visualize the tip of the needle, the probe, not the needle, should be moved to reestablish visibility. Otherwise, inadvertent nerve or arterial puncture can occur.
  - Visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site. When compressed, arteries are pulsatile. Healthy veins should compress easily when light downward pressure is applied to the ultrasound probe. Nerves can appear as echogenic bundles adjacent to veins and arteries, and caution should be used to avoid nerve stimulation.
  - Assess the proposed vein for vessel size, path, round shape, depth, and compressibility.
  - Assess for adequacy of vessel size compared to proposed outer catheter diameter (catheter-to-vein ratio of < 45%) to promote hemodilution and preserve vessel health.
  - Avoid selecting smaller vessels to reduce the risk of phlebitis and thrombosis.
II. Patient Education

- Prior to procedure, teach patient and caregiver:
  » The purpose of CVAD, procedure, including risks and benefits.
  » What to expect with the procedure and purpose for ultrasound and other technology used.
  » Signs and symptoms of common complications.
  » How and to whom to report complications.

III. Preprocedure Preparation

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review provider’s order for insertion of CVAD.
4. Obtain informed consent per organizational policy or patient assent.
5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
6. Prepare for insertion, collect necessary insertion supplies, and set up sterile field.

- Supplies
  » Insertion kit for Modified Seldinger procedure should include:
    - CVAD kit that includes the appropriate-length catheter
    - Safety microintroducer needle
    - Introducer/dilator appropriate to the catheter size
    - Guidewire
    - Safety scalpel
  » Insertion tray should include:
    - Maximal barrier supplies
      • Head covering
      • Mask
      • Sterile gloves (2 pairs)
      • Sterile gown
      • Large, full-body sheet sterile drape with fenestration
- Antiseptic solution
- Sterile gauze
- Disposable tape measure
- Disposable skin marker
- Local anesthetic as needed per protocol, or as ordered
  - 3-mL syringe and small-gauge needle for subcutaneous anesthetic administration
- Securement device or product
- Needleless connector(s) for each lumen
- Preservative-free 0.9% sodium chloride flushes for each lumen
- Prefilled syringe of heparin lock solution 10 units per mL or as indicated by organizational policy or provider’s order
- TSM dressing; antimicrobial sponge or antimicrobial gel dressing, if used
- Skin protectant solution
- For ultrasound:
  - Disinfected ultrasound probe (refer to Chapter 3, Vascular Visualization)
  - Sterile ultrasound gel
  - Sterile ultrasound probe cover
  - Ultrasound machine
- Disinfectant wipes
- Clean gloves

**IV. Insertion Procedure**
1. Perform hand hygiene, don clean gloves.
2. Place patient in supine position for vessel assessment.
3. Reinforce explanations with each step of the procedure, so the older adult is aware of what to expect. Calmly explain the procedure as it occurs to enhance patient cooperation and compliance. It may be helpful to have another caregiver or family member present to reassure the older adult about the intent and expected outcome of the procedure.
4. Assess vasculature using ultrasound:
   A. Ensure ultrasound probe has been disinfected prior to patient use according to manufacturers’ instructions and organizational policy.
B. Apply liberal amount of ultrasound gel to the patient’s neck, chest, or groin.

C. Apply probe to the skin: visualize and note the location of the proposed vein and any surrounding nerves or arteries.

D. Assess the proposed vein for vessel size, path, round shape, depth, and compressibility.

E. Avoid selecting smaller vessels to prevent thrombosis.

F. Remove the ultrasound gel from the patient’s skin.

5. To approximate the desired terminal tip location at the lower one-third of the SVC at the level of the CAJ, measure from the proposed insertion site down to the bottom of the third intercostal space on the right. Viewing previous chest radiographs can help to determine the distance from the clavicle to the level of the CAJ. Add length as needed to facilitate use of chosen securement device or product.

A. If using the femoral vein, measure from the groin to the level just above diaphragm.

6. Remove gloves and discard.

7. Perform hand hygiene.

8. Don head covering and mask.


10. Open the insertion tray and CVAD kit to create a sterile field, and include additional items in the field, using sterile technique as needed.

11. Don sterile gown and 2 pairs of sterile gloves.

12. Prime any needed extension set(s) and catheter with 0.9% sodium chloride.

13. If the catheter must be trimmed, use a guillotine or scalpel to achieve a blunt cut. Do not use scissors. IJ, EJ, femoral, subclavian, and axillary CVADs generally have manufactured tips (eg, rounded, formed, separate lumen exit sites) and are not usually trimmed.

14. Prep the skin in the entire area where the dressing will cover. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, Vascular Access site Preparation and Skin Antisepsis).

A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.

B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.
15. Remove outer set of gloves after prepping the skin.

16. Place large, sterile sheet drape with insertion site fenestration over the entire patient; best practice is to cover the patient’s face with the large, sterile drape. If the patient cannot tolerate having his or her face covered, the drape can be tented, and the patient can wear a mask or turn the head away from the insertion site.

17. Have an assistant place the patient in Trendelenburg position if using the vessels above the level of the heart.

18. Cover the ultrasound with sterile probe cover and secure.

19. Apply sterile ultrasound gel to skin over the proposed insertion site.

20. Relocate the intended vein with the ultrasound probe, verifying it is nonpulsatile and compressible.

21. Inject local anesthetic subcutaneously at the insertion site, if needed. Before injection, aspirate for absence of blood return.

22. Apply covered probe to skin, visualize the vessel, and insert the microintroducer needle through the skin and into the vein using a 45° angle. Place the tip of the access needle on the skin at a distance from the probe that will intersect the vein within the plane of the scan field as the catheter is advanced to the intended vein’s depth. Move the ultrasound probe toward the catheter to identify the catheter tip. Move the ultrasound probe and the needle in the same direction, keeping the needle tip in view on the screen as the catheter approaches the vein. Observe for dimpling of the tissue and vessel wall as the needle tip approaches and enters the lumen of the intended vessel. Make sure to keep the gel and probe away from the sterile catheter.

A. The tip of the microintroducer needle will appear as an echogenic white dot on the screen.

B. Note that respiratory variation may cause the IJ and EJ vessel shape and size to change.

23. Align the path of the needle to enter the centermost superficial area of the vein wall and observe the needle tip entering the lumen of the vein.

24. Confirm slow venous blood return the color and consistency of whole blood.

A. If blood return is pulsatile, immediately abort the procedure by removing the microintroducer needle and applying pressure to the area for 10 minutes or until hemostasis is achieved.
25. Observe for venous blood return in microintroducer needle hub, immediately cover the needle hub with gloved thumb to prevent entrance of air and visualize the needle tip in the center of the vein on ultrasound before proceeding.

26. Put the ultrasound probe down on sterile field.

27. Reduce the angle of the microintroducer and stabilize it.

28. Insert the floppy-tipped guidewire into the microintroducer needle, threading into the vein.

29. Carefully remove the microintroducer needle by removing it from the vein and skin and pulling it back over the guidewire.
   A. Do not allow the guidewire to move outward through the microintroducer needle due to risk of severing the guidewire.
   B. Secure the guidewire with your nondominant hand to prevent migration in or out of the vein.

30. Use the longitudinal view to confirm the guidewire’s position in the vein on ultrasound.

31. Make a skin nick, if needed.
   A. Using a scalpel, hold the blade with the blunt side against the wire.
   B. Make a small nick at the insertion site on the side of the guidewire to facilitate insertion of the peel-away dilator/introducer into the skin.

32. Advance the peel-away dilator/introducer over the guidewire through the skin completely into the vein using a twisting motion.

33. Remove the guidewire.

34. Place your thumb over the opening in the dilator/introducer to prevent air influx.

35. If possible, have the patient exhale, or remove the guidewire during exhalation cycle if the patient is ventilated.

36. If arterial puncture is suspected after the dilator/introducer has been placed, do not remove the dilator/introducer, and request immediate assistance from the provider and vascular surgery.

37. Slowly remove the dilator leaving the peel-away introducer sheath in the vein.

38. Place your thumb over the opening in the introducer to prevent air influx.

39. Slowly advance the catheter through the introducer sheath.

40. Continue to advance the catheter slowly to the predetermined length.
41. Withdraw any stylet wire from the catheter lumen, using air emboli precautions.

42. Attach sterile 0.9% sodium chloride-filled syringe and aspirate for blood return the color and consistency of whole blood from each catheter lumen, and flush to determine patency. Central venous pressure monitoring or arterial blood gas collection can be used to determine venous placement if needed.

43. Break the wings and slowly peel away the introducer sheath as it is withdrawn, taking care to allow the catheter to remain in its terminal tip location.

44. Connect the primed extension set(s) to the catheter hub, if needed.

45. Apply a needleless connector to each lumen.

46. Clean excess blood from the insertion site using chlorhexidine solution or dry gauze.

47. Place securement device or product (separate or integrated) and sterile dressing.
   A. Apply sterile alcohol-free skin barrier product (if used) around the perimeter of the intended dressing site. Do not apply barrier film/product directly under chlorhexidine-impregnated sponge or gel patch as the solution will block its action at the puncture site. Apply TSM once barrier product is completely dry.
   B. Apply securement device or product according to manufacturers’ instructions (refer to Chapter 4, Key Definitions).
   C. Apply sterile gauze and TSM dressing to oozing sites unless a hemostatic agent is used to absorb serosanguinous drainage. Change gauze and TSM dressing in 24 hours.

48. Flush and lock the CVAD per organizational policy.

49. Label dressing with date performed or date to be changed and clinician’s initials.

50. Discard used supplies in appropriate receptacles.

51. Remove PPE and perform hand hygiene.

52. Perform probe disinfection according to organizational policy and manufacturers’ instructions.

53. Obtain a chest radiograph to determine tip placement if not using a tip-locating device and follow organizational policy for activating the catheter for use.
A. If tip termination is below the lower one-third of the SVC at the level of the CAJ, the catheter may be withdrawn after insertion to attain proper tip location using a sterile dressing change procedure.

B. If tip termination is above the lower one-third of the SVC at the level of the CAJ, the catheter should never be advanced after the initial insertion procedure has been completed.

**Documentation**

- Document in the patient’s health record:
  - Use of ultrasound
  - Date/time of insertion, number of attempts, functionality of catheter, local anesthetic, if used, inserter name/identification
  - Insertion site: vessel and size
  - Catheter length, size, and number of lumens
  - Length of any external catheter
  - Terminal tip location and method used
  - Dressing and securement device or product used
  - Patient response to procedure and pain management
  - Patient education
Ultrasound-Guided Nontunneled Central Vascular Access Device Insertion Using Seldinger Technique

Key Points

- Use ultrasound for vein identification, assessment, and insertion to decrease risks of cannulation failure, arterial puncture, hematoma, pneumothorax, and hemothorax.
- Ultrasound guidance is associated with improvement in insertion success rates, reduced number of needle punctures, and decreased insertion complication rates when it is used to place CVADs.
- Insertion technique
  » Seldinger technique is advantageous for CVAD placement since the catheter is passed over a leading wire that guides it into the vena cava. This process can increase success for tortuous vessels. Several devices are available (eg, Raulerson syringe, valved introducer sheath) that may decrease the risk of venous air embolus during the insertion procedure.
  » Disadvantages of the Seldinger technique include the risk for vessel or pleura damage or puncture with the leading wire. Seldinger technique also requires a larger-gauge needle for vessel access that can be problematic if inadvertent arterial puncture occurs.
- Site-Specific Points
  » Axillary vein insertion can increase the risk of pneumothorax secondary to the close proximity of the pleura to the needle insertion site. Damage to the brachial plexus is a risk of axillary vein insertion.
  » Femoral vein insertion sites present a higher risk of infection and should be avoided when possible since catheter securement and occlusive dressing adherence can be difficult to maintain. Femoral insertion does not require Trendelenburg positioning.
  » Subclavian vein: Ultrasound evaluation of the infraclavicular subclavian vein is difficult secondary to the overlying clavicle. Moving outward to the axillary vein makes the use of ultrasound more useful. Pinch-off syndrome, in which the catheter gets trapped between the clavicle and the first rib, can be a risk for subclavian insertions. Catheter occlusion and fracture can result. Phrenic nerve injury and brachial plexus injury are risks associated with subclavian insertions.
» IJ vein sites may be difficult to secure secondary to head movement, and carotid artery puncture is also a risk because of the close proximity of the artery and the vein in the neck.

» EJ veins are more tortuous than the IJ veins, making catheter threading more difficult, and vessel superficiality may create difficulty with catheter securement.

» Recognize risks associated with CVADs, including increased incidence of venous thrombosis and rates of CLABSI.

» Relative contraindications to CVAD placement depending on the choice of insertion site include prolonged bleeding time, history of unresolved deep vein thrombosis of the IJ, EJ, axillary, femoral, or subclavian vein on the ipsilateral side, or SVC filter, IVC filter, or inability to tolerate Trendelenburg positioning.

» IJ, EJ, axillary, and subclavian CVAD placement in patients with an SVC filter should only be attempted using fluoroscopy.

- Use air emboli precautions by taking steps to cover the open access to the vasculature when inserting needles, introducers, dilators, or catheters for any catheter placed above the level of the heart where in which the gradient of intrathoracic pressure can lead to an influx of air.

- Verify the CVAD tip position by using ECG or chest radiograph verification to determine the terminal tip location. Femoral CVADs require an abdominal radiograph to determine tip location if ECG is not used.

- Use ultrasound to assess for and identify the “sliding lung sign” to perform point-of-care assessment for pneumothorax prior to obtaining a chest radiograph for IJ, EJ, subclavian, and axillary vein insertions (documented competency is required for this assessment). If the sliding lung assessment creates suspicion for pneumothorax, immediately contact the provider to request a STAT chest radiograph.

- Antiseptic preparations can cause stinging and irritation, adding to the older adult’s discomfort. Too much alcohol can dry already compromised skin. An older adult will be less likely to cooperate with venipuncture procedures if she or he experiences pain at this early stage. Although antiseptic agents should be applied with friction, be aware that irritated skin may become more damaged, causing further distress and discomfort to the older adult.
Procedure

I. Preprocedure Assessment

- Collaborate with the provider for any relative contraindication to placement before placing CVAD.
- Assess for history of allergies to analgesics, adhesives, or antimicrobial solutions.
- Perform insertion into the right IJ vein (when possible) since this route provides a more direct path to the SVC.
- Avoid insertion in areas with pain on palpation, areas of open wounds, and veins that are compromised (e.g., bruised, infiltrated, phlebitic, sclerosed, corded, or engorged), and areas of planned procedures.
- Ultrasound use
  - Longitudinal or transverse views can be used when placing vascular catheters with ultrasound. Surrounding structures will not be visible in the longitudinal view. The needle tip should remain in view at all times. If the inserter is unable to visualize the tip of the needle, the probe, not the needle, should be moved to reestablish visibility. Otherwise, inadvertent nerve or arterial puncture can occur.
  - Visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site. When compressed, arteries are pulsatile. Healthy veins should compress easily when light downward pressure is applied to the ultrasound probe. Nerves can appear as echogenic bundles adjacent to veins and arteries, and caution should be used to avoid nerve stimulation.
  - Assess the proposed vein for vessel size, path, round shape, depth, and compressibility.
  - Assess for adequacy of vessel size compared to proposed outer catheter diameter (catheter-to-vein ratio of < 45%) to promote hemodilution and preserve vessel health.
  - Avoid selecting smaller vessels to reduce the risk of phlebitis and thrombosis.

II. Patient Education

- Prior to procedure, teach patient and caregiver:
  - The purpose of CVAD, procedure, including risks and benefits.
  - What to expect with the procedure and purpose for ultrasound and other technology used.
  - Signs and symptoms of common complications.
  - How and to whom to report complications.
III. Preprocedure Preparation

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).

2. Verify patient’s identity using 2 independent identifiers, according to organizational policy (eg, name and date of birth).

3. Obtain and review provider’s order for insertion of CVAD.

4. Obtain informed consent per organizational policy or patient assent.

5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.

6. Prepare for insertion, collect necessary insertion supplies, and set up sterile field.

- Supplies
  - Insertion kit for Seldinger procedure should include:
    - CVAD kit that includes the appropriate-length catheter
    - Safety introducer needle
    - Dilator appropriate to the catheter size
    - J-tip guidewire
    - Safety scalpel
  - Insertion tray should include:
    - Maximal barrier supplies
      - Head covering
      - Mask
      - Sterile gloves (2 pairs)
      - Sterile gown
      - Large full-body sheet sterile drape with fenestration
    - Antiseptic solution
    - Sterile gauze
    - Disposable tape measure
    - Disposable skin marker
  - Local anesthetic as needed per protocol, or as ordered
    - 3-mL syringe and small-gauge needle for subcutaneous anesthetic administration
  - Securement device or product
» Needleless connector(s) for each lumen
» Preservative-free 0.9% sodium chloride flushes for each lumen
» Prefilled syringe of heparin lock solution 10 units per mL or as indicated by organizational policy or provider’s order
» TSM dressing; antimicrobial sponge or antimicrobial gel dressing, if used
» Skin protectant solution
» For ultrasound:
  - Disinfected ultrasound probe (refer to Chapter 3, Vascular Visualization)
  - Sterile ultrasound gel
  - Sterile ultrasound probe cover
  - Ultrasound machine
» Disinfectant wipes
» Clean gloves

IV. Insertion Procedure
1. Perform hand hygiene, don clean gloves.
2. Place patient in supine position for vessel assessment.
3. Explanations should be reinforced with each step of the procedure, so the older adult is aware of what to expect. Calmly explain the procedure as it occurs to enhance patient cooperation and compliance. It may be helpful to have another caregiver or family member present to reassure the older adult about the intent and expected outcome of the procedure.
4. Assess vasculature using ultrasound:
   A. Ensure ultrasound probe has been disinfected prior to patient use according to manufacturers’ instructions and organizational policy.
   B. Apply liberal amount of ultrasound gel to the patient’s neck, chest, or groin.
   C. Apply probe to the skin: visualize and note the location of the proposed vein and any surrounding nerves or arteries.
   D. Assess the proposed vein for vessel size, path, round shape, depth, and compressibility.
   E. Avoid selecting smaller vessels to prevent thrombosis.
   F. Remove the ultrasound gel from the patient’s skin.
5. To approximate the desired terminal tip location at the lower one-third of the SVC at the level of the CAJ, measure from the proposed insertion site down to the bottom of the third intercostal space on the right. Viewing previous chest radiographs can help to determine the distance from the clavicle to the level of the CAJ. Add length as needed to facilitate use of chosen securement device or product.
   A. If using the femoral vein, measure from the groin to the level just above diaphragm.

6. Remove gloves and discard.

7. Perform hand hygiene.

8. Don head covering and mask.


10. Open the insertion tray and CVAD kit to create a sterile field, and include additional items in the field, using sterile technique as needed.

11. Don sterile gown and 2 pairs of sterile gloves.

12. Prime any needed extension set(s) and catheter with 0.9% sodium chloride.

13. If the catheter must be trimmed, use a guillotine or scalpel to achieve a blunt cut. Do not use scissors. IJ, EJ, femoral, subclavian, and axillary CVADs generally have manufactured tips (eg, rounded, formed, separate lumen exit sites) and are not usually trimmed.

14. Prep the skin in the entire area where the dressing will cover. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturer’s directions for use; allow to dry completely (refer to Chapter 3, Vascular Access Site Preparation and Skin Antisepsis).
   A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.
   B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

15. Remove outer set of gloves after prepping the skin.

16. Place large, sterile sheet drape with insertion site fenestration over the entire patient; best practice is to cover the patient’s face with the large, sterile drape. If the patient cannot tolerate having his or her face covered, the drape can be tented, and the patient can wear a mask or turn the head away from the insertion site.

17. Have an assistant place the patient in Trendelenburg position if using the vessels above the level of the heart.
18. Cover the ultrasound with sterile probe cover and secure.
19. Apply sterile ultrasound gel to skin over the proposed insertion site.
20. Relocate the intended vein with the ultrasound probe, verifying it is nonpulsatile and compressible.
21. Inject local anesthetic subcutaneously at the insertion site, if needed. Before injection, aspirate for absence of blood return.
22. Apply covered probe to skin, visualize the vessel, and insert the introducer needle through the skin and into the vein at a 45° angle. Place the tip of the access needle on the skin at a distance from the probe that will intersect the vein within the plane of the scan field as the catheter is advanced to the intended vein's depth. Move the ultrasound probe toward the catheter to identify the catheter tip. Move the ultrasound probe and the needle in the same direction, keeping the needle tip in view on the screen as the catheter approaches the vein. Observe for dimpling of the tissue and vessel wall as the needle tip approaches and enters the lumen of the intended vessel. Make sure to keep the gel and probe away from the sterile catheter.
   A. The tip of the introducer needle will appear as an echogenic white dot on the screen.
   B. Note that respiratory variation may cause the IJ and EJ vessel shape and size to change.
23. Align the path of the needle to enter the centermost superficial area of the vein wall and observe the needle tip entering the lumen of the vein.
24. Confirm slow venous blood return the color and consistency of whole blood.
   A. If blood return is pulsatile, immediately abort the procedure by removing the introducer needle and applying pressure to the area for 10 minutes or until hemostasis is achieved.
25. Observe for venous blood return in introducer needle hub, immediately cover the needle hub with gloved thumb to prevent entrance of air and visualize the needle tip in the center of the vein on ultrasound before proceeding.
26. Put the ultrasound probe down on sterile field.
27. Reduce the angle of the introducer and stabilize it.
28. Insert the J-tip guidewire into needle, threading it into the vein to the predetermined measurement.
29. Carefully remove the needle by withdrawing it from the vein and skin and pulling it back over the guidewire. Follow manufacturers’ directions for use of Raulerson syringe or valved dilator to reduce risk of air embolus.
   A. Do not allow the guidewire to move outward through the introducer needle due to risk of severing the guidewire.
   B. Secure the guidewire with your nondominant hand to prevent migration in or out of the vein.
30. Use the longitudinal view to confirm the guidewire’s position in the vein on ultrasound.
31. Make a skin nick, if needed.
   A. Using a scalpel, hold the blade with the blunt side against the wire.
   B. Make a small nick at the insertion site on the side of the guidewire to facilitate insertion of the vessel dilator into the skin.
32. Advance the dilator over the guidewire through the skin using a twisting motion. The dilator is intended to dilate the subcutaneous tissue.
   A. If arterial puncture is suspected after the dilator has been placed, do not remove the dilator, and request immediate assistance from the provider and vascular surgery.
33. Remove the dilator, leaving the guidewire in place.
34. Hold the guidewire, and carefully thread the catheter over the guidewire into the skin until the wire comes out the distal catheter lumen. Maintain control of the guidewire at all times. Observe air emboli precautions by clamping any additional lumens for the insertion procedure.
35. Secure the wire as it protrudes from the lumen, while advancing the catheter through the skin and vein to its measured length.
36. Slowly remove the guidewire once the catheter is in place. Immediately place gloved thumb over the catheter hub to prevent air influx.
37. If possible, have the patient exhale or remove the guidewire during exhalation cycle if the patient is ventilated.
38. Attach sterile 0.9% sodium chloride-filled syringe, and aspirate for blood return the color and consistency of whole blood from each catheter lumen and flush to determine patency. Central venous pressure monitoring or arterial blood gas collection can be used to determine venous placement if needed.
39. Connect the primed extension set(s) to the catheter hub, if needed.
40. Apply a needleless connector to each lumen.
41. Clean excess blood from the insertion site using chlorhexidine solution or dry gauze.
42. Place securement device or product (separate or integrated) and sterile dressing.
   A. Apply sterile alcohol-free skin barrier product (if used) around the perimeter of the intended dressing site. Do not apply barrier film/product directly under chlorhexidine-impregnated sponge or gel patch as the solution will block its action at the puncture site. Apply TSM once barrier product is completely dry.
   B. Apply securement device or product according to manufacturers’ instructions (refer to Chapter 4, Key Definitions).
   C. Apply sterile gauze and TSM dressing to oozing sites unless a hemostatic agent is used to absorb serosanguinous drainage. Change gauze and TSM dressing in 24 hours.
43. Flush and lock the CVAD per organizational policy.
44. Label dressing with date performed or date to be changed and clinician’s initials.
45. Discard used supplies in appropriate receptacles.
46. Remove PPE and perform hand hygiene.
47. Perform probe disinfection according to organizational policy and manufacturers’ instructions.
48. Obtain a chest radiograph to determine tip placement if not using a tip-locating device and follow organizational policy for activating the catheter for use.
   A. If tip termination is below the lower one-third of the SVC at the level of the CAJ, the catheter may be withdrawn after insertion to attain proper tip location using a sterile dressing change procedure.
   B. If tip termination is above the lower one-third of the SVC at the level of the CAJ, the catheter should never be advanced after the initial insertion procedure has been completed.

**Documentation**
- Document in the patient’s health record:
  - Use of ultrasound
  - Date/time of insertion, number of attempts, functionality of catheter, local anesthetic, if used, inserter name/identification
  - Insertion site: vessel and size
» Catheter length, size, and number of lumens
» Length of any external catheter
» Terminal tip location and method used
» Dressing and securement device or product used
» Patient response to procedure and pain management
» Patient education
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Administration Set Management

Policy
Administration set changes are performed with adherence to Standard-Aseptic Non Touch Technique (ANTT) at a frequency based upon factors such as patient condition, type, rate, and frequency of solution administered, immediately upon suspected contamination, when the integrity of the product or system has been compromised, and when a new vascular access device (VAD) is placed.

Administration sets with luer-lock design are used to ensure a secure connection, reduce manipulation, and minimize the risk of leaks, disconnections, or misconnections.

Key Points
- Administration set changes can pose a problem for patients who have impaired vision or who are cognitively impaired.
- Administration Set Construction and Composition
  » Use administration sets with integrated add-on devices (eg, filters) to minimize the number of connections, thus reducing the risk of contamination, misuse, and accidental disconnection.
  » Use administration sets with anti–free-flow mechanisms with electronic infusion pumps.
  » Do not use administration sets that have injection ports for high-risk medications delivered via an epidural, intrathecal, or arterial route.
  » Use a primary continuous administration set that contains a back-check valve or use a dedicated pump set with integrated mechanisms to prevent retrograde flow of the secondary medication into the primary solution container.
  » Use an extension set with parallel lumens when multiple administration sets must be connected to the same VAD lumen. Delays in flow rates, leakage from the infusion system, and other unintended therapy interruptions are reduced with these extension sets as compared to a manifold of multiple stopcocks.
  » Use administration sets with composite material recommended for drugs at risk of tubing adsorption, which may affect accuracy of drug delivery (eg, nitroglycerin, diazepam, insulin). Monitor clinical response to medication.
  » Use administration sets with lipid-based infusates, such as injectable lipid emulsions (ILEs), that are free of Di[2-ethylhexyl]phthalate (DEHP).
- **Infection Prevention**
  - Prime and attach administration sets just before use.
  - Adhere to Standard-ANTT when connecting, changing, and accessing administration set injection ports.
  - Avoid disconnecting primary and secondary continuous administration sets whenever possible.
    - If disconnection of a continuous or an intermittent infusion administration set is unavoidable, aseptically attach a new, sterile, compatible covering device to protect male luer ends on administration sets, ensuring correct connection of catheters/administration sets/add-on devices.
    - If the secondary administration set is disconnected from the primary set, the secondary administration set is now considered a primary intermittent administration set and is changed every 24 hours.
  - Attach a new, sterile, compatible covering device to the male luer end of the administration set after each intermittent use. Do not attach the exposed male luer end of the administration set to a port on the same administration set (ie, “looping”).
  - Never use an administration set for more than 1 patient.

- **Safety**
  - Label administration sets.
    - Indicate the date of initiation or date of change based on organizational policies, procedures, and/or practice guidelines.
    - When there are different access sites (ie, intraspinal, intraosseous, subcutaneous) or multiple solution containers connected to a VAD, label the tubing with the route and/or medication/solution near the connection to the solution container and near the patient’s access site.
  - Teach nonclinical staff, patients, and caregivers not to connect or disconnect administration sets to prevent misconnections.
  - Trace all catheters/administration sets/add-on devices between the patient and solution container to the VAD before connecting or reconnecting any infusion/device, at each care transition to a new setting or service, and as part of the handoff process.
  - Minimize risk of strangulation or entanglement related to the use of administration sets.
- Employ preventative strategies such as individual risk assessment, ongoing assessment of need for continuous vs intermittent infusions, increased supervision, or video surveillance, avoiding use of extension sets, coiling excess tubing, and use of accessories to stabilize flexible lines (eg, clear plastic sleeve over administration set).

- **Changing Administration Set and Add-on Devices**
  » Consider use of a new administration set when initiating a new concentration of a continuous intravenous (IV) medication to prevent infusing any of the previous concentration remaining in the tubing at the rate intended for the new concentration. Change administration set immediately if contamination is suspected or product integrity is compromised.
  » Change add-on device(s) with new VAD insertion, with each administration set replacement if integrated tubing design (eg, filter part of administration set), or as defined by the organization, and whenever the integrity of the product is compromised or suspected to be compromised.
  » Change the needleless connector no more frequently than 96-hour intervals or according to the manufacturers’ directions for use. The needleless connector should be changed in the following circumstances:
    - If the needleless connector is removed for any reason
    - If there is residual blood or debris within the needleless connector
    - Prior to drawing a sample for blood culture from the VAD
    - Upon contamination
    - Per organizational policies, procedures, and/or practice guidelines
    - Per the manufacturers’ directions for use
### TABLE 5.1. ADMINISTRATION SET CHANGE FREQUENCY BY ADMINISTRATION TYPE

<table>
<thead>
<tr>
<th>Administration Type</th>
<th>Administration Set</th>
<th>Set Change Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>Primary and secondary sets</td>
<td>No more frequently than every 96 h but at least every 7 d (unless otherwise stated in manufacturers’ directions for use)</td>
</tr>
<tr>
<td>Intermittent</td>
<td>Primary and secondary sets</td>
<td>Every 24 h</td>
</tr>
<tr>
<td>Hemodynamic and arterial pressure monitoring</td>
<td>Continuous</td>
<td>Every 96 h</td>
</tr>
</tbody>
</table>

### TABLE 5.2. ADMINISTRATION SET CHANGE FREQUENCY BY INFUSATE

<table>
<thead>
<tr>
<th>Infusate</th>
<th>Administration Set</th>
<th>Set Change Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood and blood components</td>
<td>Continuous or single unit</td>
<td>At end of 4 h</td>
</tr>
<tr>
<td>Injectable lipid emulsions</td>
<td>Continuous or single dose</td>
<td>Every 12 h or with each new container</td>
</tr>
<tr>
<td>Parenteral nutrition</td>
<td>Continuous with injectable lipid emulsions</td>
<td>Every 24 h</td>
</tr>
<tr>
<td></td>
<td>Continuous without injectable lipid emulsions</td>
<td>Every 24 h</td>
</tr>
<tr>
<td></td>
<td>Cyclic or intermittent delivery</td>
<td>Every 24 h</td>
</tr>
<tr>
<td>Propofol</td>
<td>Continuous or single dose</td>
<td>At least every 6 to 12 h</td>
</tr>
</tbody>
</table>

*Abbreviations: d, days; h, hours.*

**Documentation**

- Document in the patient’s health record:
  - Date and time of administration set change
Maintaining Vascular Access Device Patency: Flushing and Locking

Policy
VADs are flushed and aspirated for a blood return prior to each infusion to assess catheter function and prevent complications.

VADs are flushed after each infusion to clear the infused medication from the catheter lumen, thereby reducing the risk of contact between incompatible medications.

Each VAD lumen is locked after completion of the final flush to decrease the risk of intraluminal occlusion, depending on the solution used, to reduce catheter-associated bloodstream infection (CABSI).

A luer-locking needleless connector is used to connect syringes and/or administration sets to a VAD hub or other injection site to eliminate use of needles and reduce needlestick injuries.

Standardized protocols are established for flushing and locking solutions within each organization.

Key Points
- Infection Prevention
  » Use single-dose vials or prefilled, labeled syringes for all VAD flushing and locking.
  » If multidose vials must be used, dedicate a vial to a single patient. Do not store multidose vials in patient treatment areas and store according to manufacturers’ directions for use; discard if sterility is compromised or questionable.
  » Use commercially available prefilled syringes to reduce the risk of CABSI, save time for syringe preparation, and aid optimal flushing technique and objectives.
  » Do not use IV solution containers (eg, bags or bottles) as a source for obtaining flush solutions.
  » A syringe or needle/cannula should be considered contaminated once it has been used to enter or connect to a patient’s IV solution container or administration set.
  » Disinfect connection surfaces (ie, needleless connectors, injection ports) before flushing and locking procedures.
Assess VAD Function and Patency

» Assess VAD function using a 10-mL syringe or a syringe specifically designed to generate lower injection pressure (ie, 10-mL diameter syringe barrel), taking note of any resistance.

- During the initial flush, slowly aspirate the VAD for free-flowing blood return that is the color and consistency of whole blood, an important component of assessing catheter function prior to administration of medications and solutions.
- Do not forcibly flush any VAD with any syringe size. If resistance is met and/or no blood return noted, take further steps (eg, checking for closed clamps or kinked sets, removing dressing) to locate an external cause of the obstruction. Internal causes may require diagnostic tests, including, but not limited to, a chest radiograph to confirm tip location and mechanical causes (eg, pinch-off syndrome), color duplex ultrasound, or fluoroscopy to identify thrombotic causes.
- After confirming catheter patency, use an appropriately sized syringe for medication dose. Do not transfer the medication to a larger syringe (refer to Chapter 8, Compounding and Preparation of Parenteral Solutions and Medications).

Flush After Medication Administration

» Flush the VAD lumen with preservative-free 0.9% sodium chloride following the administration of an IV push medication at the same rate of injection as the medication. Use an amount of flush solution to adequately clear the medication from the lumen of the administration set and VAD.

Flushing and Locking Volumes

» Use a minimum volume equal to twice the internal volume of the VAD system for VAD flushing.

» Use a volume that is equal to the internal volume of the VAD system plus 20% for VAD locking.

Flush Technique

» Use positive-pressure techniques to minimize blood reflux into the VAD lumen.

- Prevent syringe-induced blood reflux by leaving a small amount (eg, 0.5-1.0 mL) of flush solution in a traditional syringe (ie, not a prefilled syringe) to avoid compression of the plunger rod gasket or by using a prefilled syringe designed to prevent this type of reflux.
- Prevent connection/disconnection reflux by using the appropriate sequence for flushing, clamping, and disconnecting determined by the type of needleless connector being used.
- Use a pulsatile flushing technique. Administering 10 short boluses of 1 mL solution interrupted by brief pauses may be more effective at removing solid deposits (e.g., fibrin, drug precipitate, intraluminal bacteria) compared to continuous low-flow techniques.
- Consider flushing all lumens of a multilumen catheter after obtaining blood samples to reduce the possibility of changing intraluminal pressure causing blood reflux into the other lumens.
- Follow manufacturers’ directions for use regarding clamping the VAD when not in use. Clamping can prevent contamination and exsanguination in the event of inadvertent disconnection of any set or add-on device.

- **Locking Solutions by Catheter Type**
  - Recommendations for locking solutions include:
    - Short and long peripheral intravenous catheters (PIVCs) and midline catheters: lock with preservative-free 0.9% sodium chloride.
    - Central vascular access devices (CVADs): lock with either preservative-free 0.9% sodium chloride or heparin 10 units/mL according to the manufacturers’ directions for use for the VAD and needleless connector.
    - Implanted vascular access ports: flush and lock accessed but noninfusing implanted vascular access ports daily using at least 10 mL of 0.9% sodium chloride (or heparin as prescribed).
  - For implanted vascular access ports that are not accessed, there is insufficient evidence to recommend the optimal frequency, solution, or volume to maintain the patency. Consider extending maintenance flushing/locking to every 3 months with 10 mL of 0.9% sodium chloride and 3 or 5 mL of heparin (100 units/mL).
  - Hemodialysis CVADs: use citrate or heparin lock solution; low-concentration citrate (< 5%) is recommended to reduce the risk of CABS LI and CVAD dysfunction; tissue plasminogen activator (tPA) may be used prophylactically once per week to reduce CVAD occlusion; the choice of locking solution is based upon clinician discretion due to inadequate evidence to demonstrate a difference between solutions.
  - Apheresis CVADs: consider maintaining patency by using high-concentration heparin and sodium citrate.
• Stem cell harvesting via apheresis: heparin-induced thrombocytopenia (HIT) may be a risk in patients with multiple myeloma who require stem cell harvesting for autotransplantation.

- Arterial catheters: use solution containing heparin (eg, 1 unit/mL of heparin) or preservative-free 0.9% sodium chloride as a continuous infusion to maintain patency of arterial catheters used for hemodynamic monitoring.

- Alternative Locking Solutions
  » Change to an alternative locking solution when the heparin lock solution is thought to be the cause of adverse drug reactions from heparin; when heparin-induced thrombocytopenia and thrombosis (HITT) develops; and when there are spurious laboratory studies drawn from the CVAD that has been locked with heparin.

- Antimicrobial Locking Solutions
  » Use antimicrobial locking solutions for therapeutic and prophylactic purposes in patients with long-term CVADs in the following circumstances: patients with a history of multiple CABSIs, high-risk patient populations, and in facilities with unacceptably high rates of CVAD-associated bloodstream infection, despite implementation of other methods of infection prevention.

- The length of time that antimicrobial lock solutions should reside inside the CVAD lumen is inconclusive; up to 12 hours per day may be required, thus limiting use in patients receiving continuous or frequent intermittent infusions.

- Aspirate all antimicrobial locking solutions from the CVAD lumen at the end of the locking period. Do not flush the lock solution into the patient’s bloodstream, as this could increase development of antibiotic resistance and other adverse effects. Gentamicin-resistant bacteria from gentamicin lock solution have been reported to increase CABSII rates.

Assessment
- Determine the type of needleless connector in use prior to flushing or locking the VAD to ensure correct clamping sequence is performed.

- Verify if the current locking solution dwelling in the VAD needs to be aspirated and discarded or if it may be infused as part of the flushing procedure (eg, some hemodialysis VADs and all antimicrobial lock solutions).
Patient Education

- Prior to procedure, teach patient and caregiver:
  » The purpose and importance of VAD flushing and locking.
  » What to expect with the procedure.
  » Inform patient that they may experience a disturbance in taste and odor as the VAD is flushed.
  » Inform patients of potential conflicts with religious beliefs when using heparin derived from animal products (eg, porcine, bovine) and obtain assent. Use preservative-free 0.9% sodium chloride instead of heparin when possible, in this patient population.

Procedures

Flushing

1. Obtain and review provider’s order or standard protocol.
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Gather supplies (if locking procedure is to be performed immediately after flushing, gather sufficient supplies for both procedures):
   » Flushing and Locking:
     - Gloves
     - Antiseptic wipes
     - Preservative-free 0.9% sodium chloride prefilled syringe(s)
     - Lock solution as indicated (eg, preservative-free 0.9% sodium chloride, heparin solution [10 units/mL]), or other solution in a prefilled syringe.
     - 10-mL syringe(s) for aspiration of locking solution, if needed
4. Perform hand hygiene.
5. Don gloves.
6. Disinfect needleless connector.
   A. If using a disinfection cap, remove and discard. Do not reuse this cap.
   B. If using manual disinfection, vigorously scrub with antiseptic wipe using friction and allow to dry completely. Discard antiseptic wipe.
7. Attach syringe of preservative-free 0.9% sodium chloride to needleless connector, while maintaining the sterility of the syringe tip.
8. Open VAD clamp, if present.
9. Slowly inject preservative-free 0.9% sodium chloride into VAD, noting any resistance or sluggishness of flow, and slowly aspirate until brisk blood return is obtained.
   A. ALERT: If an antimicrobial locking solution was used, withdraw solution from the CVAD lumen before flushing, and discard. Flushing the lock solution into the patient’s bloodstream could increase development of antibiotic resistance and other adverse effects.
   B. Inability to flush or absence of a blood return from a CVAD requires further investigation about the cause (eg, mechanical problem, fibrin/thrombosis over VAD tip, extravascular tip location). Refer to Chapter 6, Central Vascular Access Device Malposition and Central Vascular Access Device Occlusion.
   C. Inability to flush or absence of a blood return from a PIVC or midline catheter requires further evaluation for catheter patency; catheter replacement may be indicated.
   D. A pulsatile flushing technique of 10 short boluses of 1 mL interrupted by brief pauses may be effective at removing solid deposits.
   E. Never inject against resistance.
10. Remove syringe and discard.
11. Initiate infusion therapy as prescribed (refer to Chapter 8, Infusion Medication and Solution Administration).
12. Detach syringe and discard.
13. Scrub the needleless connector with a new disinfectant wipe.
14. Attach syringe of preservative-free 0.9% sodium chloride to needleless connector, while maintaining the sterility of the syringe tip.
15. Slowly inject preservative-free 0.9% sodium chloride into VAD and administer the flush at the same rate as the administration rate of the medication left in the VAD lumen.
   A. Note any resistance or sluggishness of flow.
   B. A pulsatile flushing technique of 10 short boluses of 1 mL interrupted by brief pauses may be effective at removing solid deposits.
16. Ensure the correct flow rate if continuous fluids are infusing or proceed with locking the VAD.
Locking

1. VAD locking procedure is generally performed once flushing procedure is completed (see steps 1-16 in flushing procedure above).

2. Gather supplies prior to flushing procedure:
   - Gloves
   - Antiseptic wipes
   - Preservative-free 0.9% sodium chloride prefilled syringe(s)
   - Lock solution as indicated (eg, preservative-free 0.9% sodium chloride, heparin solution [10 units/mL]), or other solution in a prefilled syringe.
   - 10-mL syringe(s) for aspiration of locking solution, if needed

3. Perform hand hygiene.

4. Don gloves.

5. Disinfect needleless connector with antiseptic using friction and a scrubbing motion and allow to dry.

6. Attach syringe with locking solution to needleless connector while maintaining the sterility of the syringe tip.

7. Slowly inject solution into VAD.

8. Follow appropriate clamping sequence to reduce blood reflux based on type of needleless connector used:
   A. Negative displacement – flush, clamp, disconnect
   B. Positive displacement – flush, disconnect, clamp
   C. Neutral and antireflux – no specific sequence required

9. Discard syringe and used supplies in appropriate receptacles.

10. Remove gloves and perform hand hygiene.

Documentation

- Document in the patient’s health record:
  - Date, time of administration
  - Flush/lock solution and volume
  - VAD flushing resistance (eg, sluggish, brisk)
  - Route, specific VAD or lumen used for administration
  - Patient response to the procedure
Vascular Access Device Assessment, Care, and Dressing Changes

Policy
A postinsertion care bundle in conjunction with a culture of safety and quality is implemented to reduce the risk of catheter-related infection during daily care and management.

The entire infusion system, from the VAD insertion site to the solution container, is routinely assessed for system integrity, infusion accuracy, identification of complications, and expiration dates of the infusate, dressing, and administration set.

The necessity of the VAD is assessed daily, discussed with the patient’s health care team, and removed upon unresolved complication and when no longer necessary for treatment.

Adhere to ANTT when providing site care and dressing changes on VADs.

Site care is performed at established intervals, including skin antisepsis and dressing changes, and immediately if the dressing integrity becomes compromised (eg, lifted/detached on any border edge or within transparent portion of dressing; visibly soiled; presence of moisture, drainage, or blood) or compromised skin integrity is present under the dressing.

A sterile dressing combined or integrated with a securement device/method appropriate for patient’s condition. Patient preference is maintained on all peripheral and central VADs to protect the site, provide a microbial barrier, and promote skin health and VAD securement.

VADs are secured to prevent complications associated with VAD motion at the insertion site and unintentional loss of access.

Ensure methods used to secure the VAD do not interfere with the ability to routinely assess and monitor the access site or impede vascular circulation or delivery of the prescribed therapy.

Key Points
- Because of age-related changes especially in the immune system, the older adult is more susceptible to infection. Remote infections may predispose the older adult to catheter-related bloodstream infections (CR-BSI).
Changes in sensorium and cognition may predispose the older adult to accidental manipulations of the VAD and dressing materials.

Urinary incontinence and accidental separation or dislodgement of enteral feeding systems may also affect VAD dressing integrity.

In the older adult, skin care is of the utmost importance.

- Compromised dressing materials must be changed as soon as possible. Antimicrobial cleansing agents are often very drying or irritating to the skin.
- The skin must be inspected with each dressing change for any adverse reaction to antiseptic solutions and adhesives.
- Pressure areas (from catheter hubs or administration sets and add-on devices) should be observed for maceration caused by leakage of bodily fluids or infusates from the catheter-skin junction. Older adults may be at greater risk for catheter-associated skin injury (CASI). These are a medium for bacterial growth, and their presence may necessitate more frequent dressing changes or VAD replacement. Additionally, be aware in the older adult of the increased risk of medical adhesion-related skin injury (MARSII) associated with the use of adhesive-based engineered stabilization devices.

Dressing and Securement Change Frequency

- Transparent semipermeable membrane (TSM) dressings and TSM dressings with an integrated securement device (ISD) should be changed at least every 7 days or immediately if dressing integrity is disrupted (eg, lifted/detached on any border edge or within transparent portion of dressing; visibly soiled; presence of moisture, drainage, or blood) or compromised skin integrity is present under the dressing.
- Sterile gauze dressings should be changed at least every 2 days when inspection of the insertion site is necessary or if dressing integrity disrupted (eg, if damp, loosened or visibly soiled); note that a gauze dressing underneath a TSM dressing is considered a gauze dressing, unless the site is not obscured (eg, to support wings of an implanted VAD noncoring needle).
- Adhesive securement devices (ASDs) must be removed with each dressing change to allow for appropriate skin antisepsis and application of a new ASD.
- Tissue adhesive (TA) should be reapplied at each dressing change.
Subcutaneous anchor securement systems (SASS) designed to remain in place for the life of the VAD do not need to be removed and replaced regularly with each dressing change, however they should be assessed during catheter care and management to ensure integrity.

- **Promote Skin Health and Dressing Adherence**
  - Remove dressing and ASD, maintaining skin integrity and preventing VAD dislodgement (eg, avoiding rapid and/or vertical pulling or insufficient support of skin when removing the dressing). In accordance with ANTT, use sterile gloves if there is a need to touch the insertion site.
  - Remove excess hair at the insertion site if needed to facilitate application of VAD dressings; use single-patient-use scissors or disposable-head surgical clippers; do not shave as this may increase the risk for infection.
  - Perform skin antisepsis at VAD site with each dressing change using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution.
    - Use an iodophor (eg, povidone-iodine) or 70% alcohol if there is a contraindication to chlorhexidine solution.
    - Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

- **Protect Skin Integrity**
  - Assess and protect skin integrity at VAD site with each dressing change.
  - Anticipate potential risk for skin injury (eg, due to age, malnutrition, dehydration, dermatologic conditions, diabetes, radiation therapy, immunosuppression, joint movement, and presence of edema).
  - Use a sterile, alcohol-free skin barrier product, compatible with skin antiseptic agent, to protect at-risk skin and when using an ASD to prevent skin irritation and breakdown; allow to dry prior to dressing application.
  - Do not apply antimicrobial ointment to VAD insertion sites as part of routine catheter site care (exception: hemodialysis catheters).
  - Consider use of a hemostatic agent to control bleeding and reduce need for additional dressing changes.

- **VAD Protection**
  - Do not use rolled bandages, with or without elastic properties, as a primary method of VAD securement, as they do not adequately secure the VAD.
» Keep sharp objects away from the VAD; never use scissors or pins on or near the catheter.

» Protect VAD when patient is showering or bathing by covering the catheter site with a clear plastic wrap or device designed for this purpose. Cover the connections and protect hub connections from water contamination.

» Avoid taking blood pressure measurements or placement of a tourniquet over the site/upper extremity with a peripherally inserted central catheter (PICC) or on an extremity with a peripheral VAD during periods of infusion.

- VAD Dressings
  » Select the type of sterile dressing (TSM or gauze) considering factors such as the type of VAD, risk of bleeding or infection, skin condition, known allergies or sensitivities, patient size, patient preference, cost, sterility, wear time, and ease of use of dressing, with the goal of selecting and applying a dressing that will have minimal dressing disruptions (as multiple dressing changes increase the risk of infection).

  » Use chlorhexidine-impregnated dressings for all patients 18 years and older with CVADs and arterial catheters when all other CABSI prevention strategies have proven ineffective. Use with caution among patients with fragile skin and/or complicated skin pathologies; monitor for erythema and dermatitis at the dressing site.

  » Label the dressing with the date performed or date to be changed, avoiding placement of the label over the insertion/exit site.

  » For tunneled, cuffed CVADs, a dressing may no longer be required when the subcutaneous tunnel is healed. Time to heal is patient specific.

  » Use a dressing change kit to standardize the procedure and improve time efficiency.

Assessment

- Frequency
  » Assess VAD site, entire infusion system, and patient for signs of complications at a frequency dependent on patient factors, such as age, condition, and cognition; type/frequency of infusate. For inpatient facilities:
    - CVADs: assess with each infusion and at least daily.
    - PIVCs: assess at least every 4 hours; every 1 to 2 hours for patients who are critically ill/sedated or have cognitive deficits; and more often for patients receiving infusions of vesicant medications.
**Complications**

- Assess the entire infusion system through visual inspection, from the solution container, progressing down the administration set to the patient and VAD insertion site with each infusion intervention.
- Identify signs of complications (e.g., evidence of dislodgement, redness, tenderness, swelling, infiltration, induration, body temperature elevation, and drainage) by visual inspection and palpation through the dressing and through patient reports about any discomfort (e.g., pain, paresthesia, numbness, or tingling). Refer to Chapter 6, *Vascular Access Device Complications*.
- Remove nontransparent dressing to visually inspect site if patient has local tenderness or other signs of possible local infection; otherwise, use palpation for assessment.
- Measure the external CVAD length at each dressing change or when catheter dislodgement is suspected and compare to the external CVAD length documented at insertion (refer to Chapter 6, *Central Vascular Access Device Malposition*).
- Measure circumference of the extremity and compare to baseline measurement when clinically indicated to assess the presence of edema and possible catheter-associated deep vein thrombosis (CA-DVT) for midline catheters and PICCs (refer to Chapter 6, *Catheter-Associated Deep Vein Thrombosis*).

**Patient Education**

- Prior to procedure, teach patient and caregiver:
  - The purpose and importance of VAD assessment and management procedures.
  - What to expect with VAD assessment and management procedures.
  - Complications signs or symptoms, such as redness, pain, or swelling, and where/how/whom to report them.

**Procedures**

**PIVC Dressing Change**

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).
2. Obtain and review provider’s order or standard protocol.
3. Verify patient’s identity using 2 independent identifiers, according to organizational policy (e.g., name and date of birth).
4. Gather supplies.
   - Gloves, nonsterile (sterile gloves if there is a need to touch the insertion site)
   - Antiseptic solution
   - Securement device or product
   - Skin barrier solution
   - Site dressing
   - Label

5. Perform hand hygiene.

6. Don gloves.

7. Assess insertion site for absence of redness, tenderness, swelling, or drainage. If present, the catheter should be removed.

8. Remove existing dressing beginning at device hub and gently pull the dressing perpendicular to the skin toward the insertion site. Avoid inadvertently dislodging the catheter, as it may be adhered to the dressing. Use an alcohol pad or other adhesive removal solution, if required.

9. Remove securement device or product.

10. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, Vascular Access Site Preparation and Skin Antisepsis).

   A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.

   B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

11. Apply skin barrier solution. Do not apply this solution directly under the chlorhexidine-impregnated sponge or gel component of the dressing.

12. Apply new securement device or product.

13. Apply sterile dressing to insertion site.

14. Discard used supplies in appropriate receptacles.

15. Remove gloves and discard.

16. Perform hand hygiene.

17. Label dressing with date performed.
CVAD or Midline Catheter Dressing Change

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).

2. Obtain and review provider’s order or standard protocol.

3. Verify patient’s identity using 2 independent identifiers, according to organizational policy (eg, name and date of birth).

4. Gather supplies (Note: A CVAD dressing kit is recommended).
   - Mask
   - Gloves, nonsterile
   - Gloves, sterile
   - Antiseptic solution
   - Tape measure, sterile if indicated
   - Securement device or product
   - Skin barrier solution
   - Site dressing
   - Label

5. Perform hand hygiene.

6. Don mask.

7. Assemble supplies on sterile field.

8. Don nonsterile gloves.

9. Assess insertion site for absence of redness, tenderness, swelling, or drainage; palpate site for any local tenderness. If present, contact the provider for a collaborative decision regarding interventions, including potential device removal. Assess the integrity of SASS if used.

10. Remove existing dressing, beginning at device hub, and gently pull the dressing perpendicular to the skin toward the insertion site. Avoid inadvertently dislodging the catheter, as it may be adhered to the dressing.

11. Remove securement device or product (unless SASS is used).

12. Remove gloves.

13. Perform hand hygiene.


15. Identify catheter tip dislodgement by routinely assessing for changes in external catheter length.
16. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, Vascular Access Site Preparation and Skin Antiseptis).
   A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.
   B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.
17. Apply skin barrier solution. Do not apply this solution directly under the chlorhexidine-impregnated sponge or gel component of the dressing.
18. Apply chlorhexidine-impregnated sponge, if used.
19. Apply new securement device or product.
20. Apply sterile dressing to insertion site.
21. Discard used supplies in appropriate receptacles.
22. Remove gloves and discard.
23. Perform hand hygiene.
24. Label dressing with date performed.

Documentation
- Document in the patient’s health record:
  » Site assessment findings
  » Performance of procedure, including type of antiseptic solution and dressing type
  » Measurement of external length of the catheter (if applicable)
  » Patient response to the procedure
  » Patient education
Vascular Access Device Removal

Policy
The clinical need for each VAD is assessed daily for acute inpatient settings. VADs are removed when clinically indicated (eg, unresolved complication, discontinuation of infusion therapy, or when no longer necessary for the plan of care).
VADs are not removed solely on length of dwell time, because there is no known optimal dwell time.

Key Points

Short and Long PIVCs and Midline Catheters
- Tape and other adhesive materials must be removed carefully to avoid skin injury, including tearing and bruising, in the older adult. An adhesive remover can be helpful for the process. A pressure dressing may be necessary with patients who have bleeding dyscrasias or are on anticoagulants.
- Remove PIVCs if no longer included in the plan of care or if not used for > 24 hours.
- Remove PIVCs and midline catheters when clinically indicated, based on findings from site assessment and/or clinical signs and symptoms of systemic complications.
- Notify the health care team of signs and symptoms of suspected CABSII and discuss the need for obtaining cultures (eg, drainage, blood culture, catheter tip) before removing a PIVC.
- In the event of an extravasation, detach all administration sets and aspirate from the catheter hub prior to catheter removal to extract the vesicant medication from the catheter lumen and as much as possible from the subcutaneous tissue.
- Remove catheters labeled “emergent insertion” (or other verbiage) indicating insertion was performed under suboptimal aseptic conditions. Remove and insert a new short PIVC, long PIVC, or midline catheter as soon as possible, within 24 to 48 hours.

Nontunneled CVADs including PICCs
- Use of a standardized tool including factors to be considered for making the decision to remove the CVAD.
Assess and discuss with the health care team the continued need for the CVAD on a daily basis and remove when it is no longer needed for the plan of care. Criteria for justification of continued use of a CVAD include but are not limited to:

- Clinical instability of the patient (e.g., alteration in vital signs, oxygen saturation).
- Prescribed continuous infusion therapy (e.g., parenteral nutrition, fluid and electrolytes, medications, blood, or blood products).
- Hemodynamic monitoring.
- Prescribed intermittent infusion therapy (e.g., any medication including anti-infectives in patients with a known or suspected infection).
- Documented history of difficult peripheral venous access.

Remove CVADs labeled “emergent insertion” (or other verbiage) indicating insertion was performed under suboptimal aseptic conditions within 48 hours. Determine ongoing VAD requirement with patient’s health care team prior to placing new VAD.

Determine the removal or salvage of a CVAD due to suspected or confirmed CABSI on blood culture results, specific cultured organism(s), patient’s current condition, available vascular access sites, effectiveness of antimicrobial therapy, and provider direction.

Do not remove a CVAD in the presence of CA-DVT when the catheter is correctly positioned at the lower third of the superior vena cava (SVC) at or near the cavoatrial junction (CAJ), is functioning properly with a blood return, and has no evidence of any infection. The decision to remove the CVAD should also consider the severity of deep vein thrombosis (DVT)-related symptoms, presence of contraindications for systemic anticoagulation, and the continued need for infusion therapy requiring a CVAD (e.g., vesicants, irritants).

Remove a CVAD with a primary or secondary catheter tip malposition that cannot be repositioned to the lower third of the SVC at or near the CAJ.

Consult with the health care team regarding diagnostic imaging studies and the appropriate medical management prior to removal of a CVAD in the event of infiltration or extravasation.

Air embolism prevention during removal of CVADs

- Place the patient in a supine flat or Trendelenburg position unless contraindicated so that the insertion site is below the level of the heart.
» Instruct the patient to perform a Valsalva maneuver at the appropriate point during catheter withdrawal.

» After removal, apply digital pressure with a sterile dry gauze pad at and just above the insertion site until hemostasis is achieved by using manual compression.

» Apply an air-occlusive dressing to the access site for at least 24 hours to occlude the skin-to-vein tract and to decrease the risk of retrograde air emboli.

» Encourage the patient to remain in a flat or reclining position, if able, for 30 minutes after removal.

- Assess the removed catheter to ensure it is fully intact, after planned or inadvertent CVAD removal. If a retained fragment is suspected, notify the provider immediately. Fracture of a catheter and potential embolization can occur from excessive force during infusion therapy, the force of inadvertent removal, or from adherence to internal structures.

- CVAD Resistance During Removal
  » Never forcibly remove a CVAD if resistance is encountered. Contact the provider to discuss appropriate interventions for successful removal.
  » Catheter pieces retained in the vein should be removed with endovascular techniques to reduce the risk of infection, thrombosis, and migration of the catheter piece.

Assessment

- Assess and report signs and symptoms of CVAD complications and changes in catheter function to provider. Consider the need for alternative vascular access if removal is necessary.

- Assess and report all signs and symptoms to the provider for unplanned or early removal of a CVAD due to a complication. Assess the fluids and medications being given and their impact on patient stability. Begin the infusion therapy through a PIVC when possible or contact the provider for altering the orders for peripheral infusion until a new CVAD is inserted.

- Prior to VAD removal, determine if the patient is on anticoagulants or has any risk for prolonged bleeding, as increased time may be needed for hemostasis to occur.

- Do not remove a CVAD in the presence of CA-DVT when the catheter is correctly positioned at the CAJ, the catheter is functioning correctly with a blood return, there is no evidence of any infection, and there is absence of severe DVT-related symptoms causing pain.
In the presence of an elevated body temperature, assess all obvious sources or causes for this elevation. Do not remove a functioning peripheral catheter or CVAD based solely on temperature elevation in the absence of confirmatory evidence of CABSI. Use clinical judgment regarding the appropriateness of removing the catheter if an infection is evidenced elsewhere or if a noninfectious cause of fever is suspected.

**Patient Education**

- Prior to procedure, teach patient and caregiver:
  - What to expect with VAD removal procedure.
  - Educate patient on Valsalva maneuver for all CVAD removal procedures. Instruct the patient to perform a Valsalva maneuver at the appropriate point during catheter withdrawal.
    - If a Valsalva maneuver is contraindicated, have the patient exhale during the procedure (refer to Chapter 6, *Air Embolism*). When the Valsalva maneuver is contraindicated, use a Trendelenburg, or left lateral decubitus position or have the patient hold their breath as able to take and follow direction.
  - Signs or symptoms of increasing redness, pain, or swelling within the 48 hours after the catheter has been removed, and where/how/whom to report.
  - When to remove and/or change dressing and keeping exit site clean and dry until healed.

**Procedures**

**Short and Long PIVC Removal**

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).
2. Obtain and review provider’s order or standard protocol.
3. Verify patient’s identity using 2 independent identifiers, according to organizational policy (eg, name and date of birth).
4. Gather supplies:
   - Gloves, nonsterile
   - Gauze, sterile
   - Tape
   - Adhesive dressing
5. Perform hand hygiene.
6. Don gloves.
7. Discontinue all infusates and/or clamp extension set.
8. Place patient in sitting or recumbent position.
9. Remove dressing from insertion site.
10. Remove securement method if present; use appropriate solution as indicated to loosen dressing and securement adhesive.
11. Inspect catheter-skin junction.
12. Hold gauze gently to insertion site with nondominant hand. With dominant hand, slowly remove catheter using gentle, even pressure and keeping catheter parallel to skin.
13. Apply pressure to site with gauze until hemostasis is achieved.
14. Apply gauze and tape dressing or an adhesive dressing to PIVC site.
15. Inspect catheter: it is intact, the tip is not jagged, and the length is appropriate for product, to ensure entire catheter is removed.
16. Discard used supplies in appropriate receptacles.
17. Remove gloves and discard.
18. Perform hand hygiene.

**Midline Catheter and Nontunneled CVAD Removal**

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).
2. Obtain and review provider’s order or standard protocol.
3. Verify patient’s identity using 2 independent identifiers, according to organizational policy (eg, name and date of birth).
4. Gather supplies:
   - Personal protective equipment, as indicated
   - Gloves, nonsterile
   - Suture removal set, as needed
   - Gauze, sterile
   - Air-occlusive dressing (eg, petroleum gauze) as needed
5. Perform hand hygiene.
6. Don gloves.
7. Discontinue all infusates and/or clamp extension set.
8. Position patient:
   A. Midline catheter: sitting or recumbent
   B. CVAD: supine flat or Trendelenburg, unless contraindicated so that the insertion site is below the level of the heart.

9. Remove dressing from insertion site.

10. Remove securement method or sutures, if present. Use appropriate solution as indicated to loosen dressing and securement adhesive. If a SASS is in place, follow manufacturers’ directions for removal.

11. Inspect catheter-skin junction.

12. Instruct the patient to perform a Valsalva maneuver during catheter withdrawal.

13. Hold gauze gently to insertion site with nondominant hand. With dominant hand, slowly remove catheter; use gentle, even pressure.
   A. Use extreme caution when removing CVAD to prevent air embolism.
   B. Stop removal procedure if resistance is met.
      i. Redress catheter site with sterile dressing and attempt interventions, such as a warm compress above the exit site, relaxation techniques, and limb elevation.
      ii. Reattempt removal after 15 to 30 minutes.
      iii. Consult with provider if resistance continues.

14. After removal of a CVAD, apply digital pressure until hemostasis is achieved by using manual compression with a sterile, dry gauze pad.

15. Apply an air-occlusive dressing (eg, petroleum gauze) to the access site for at least 24 hours to occlude the skin-to-vein tract and to decrease the risk of retrograde air emboli.

16. Patient should remain in supine position for 30 minutes after CVAD removal.

17. Inspect catheter: it is intact, the tip is not jagged, and the length is appropriate for product, to ensure entire catheter is removed.

18. Leave dressing in place for at least 24 hours. Change dressing every 24 hours until exit site has healed.
Documentation

- Document procedure in the patient’s health record:
  » Date and time of procedure
  » Reason for removal (eg, completion of therapy, complication, accidental patient removal, etc)
  » Length of catheter and integrity of catheter tip at time of removal
  » Patient response to the procedure
  » Patient education
# 6. Vascular Access

Device-Related Complications: Identification and Intervention

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Phlebitis

Policy

The clinician assesses the vascular access site for signs and symptoms of phlebitis; determines the need for and type of intervention; educates the patient and/or caregiver about phlebitis, the intervention, and any follow-up; and assesses patient response to treatment.

The clinician collaborates with the provider about the need for continued or alternative vascular access when the vascular access device (VAD) is removed due to phlebitis.

Key Points

- Use a standardized phlebitis scale definition to rate the grade of phlebitis.
- Older adults can be at particular risk for phlebitis due to alteration in the integumentary system, fluid and electrolyte imbalances, malnutrition, and other preexisting disease processes.
  - Patients are often exposed to multiple parenteral medications and solutions with chemical properties that are inherently irritating.
- Phlebitis can contribute to medication error by delay of therapy administration and fluctuations in therapeutic medication levels secondary to delivery disruption.
- Phlebitis may result from chemical, mechanical, or infectious causes.
  - Chemical causes include:
    - Infusates with dextrose (>10%); extremes of pH
    - Hyperosmolar solutions
    - Known irritating solutions (eg, potassium chloride, promethazine, amiodarone, some antibiotics)
    - Particulate matter
    - Inadequate hemodilution due to excessive catheter to vessel ratio
    - Excessive infusion rate for a short peripheral intravenous catheter (PIVC)
    - Failure to allow antiseptic solution to dry before catheter insertion
  - Mechanical causes result from vein wall irritation, such as:
    - Catheter insertion angle and tip position
    - Multiple manipulations of infusion delivery system
- Large catheter gauge size in small vessel
- Catheter material and diameter
- Failure to secure catheter adequately
- Failure to stabilize the joint, if insertion site in or near a joint must be used

» Infectious causes result from:
- Inadequate hand hygiene and/or failure to use gloves
- Inadequate skin antisepsis before venipuncture
- Failure to adhere to aseptic technique during catheter placement and infusion administration
- Contaminated VAD dressing
- Failure to secure catheter or joint, causing catheter movement and dragging skin organisms into puncture site
- Contamination of the catheter segment or hub lumen during insertion

» The risk for phlebitis is reduced when risk factors are mitigated, including the following:
- Using the smallest-gauge catheter to accommodate the prescribed therapy
- Avoiding catheter placement in areas of flexion
- Adhering to aseptic technique with catheter placement and all infusion access and medication/solution administration
- Allowing the antiseptic to dry thoroughly before inserting catheter
- Securing the catheter to minimize movement at the insertion site
- Using a midline catheter or a central vascular access device (CVAD) for infusates identified as causing phlebitis, depending on length of infusion time and anticipated duration of therapy (refer to Chapter 3, Vascular Access Device Planning).

Patient Education
- Provide the patient and caregiver with instructions about how to recognize signs and symptoms of phlebitis and how and to whom to report.
- Continue to reinforce this education throughout therapy treatment.
Assessment

- Identify signs and symptoms of phlebitis through gentle palpation of site through the dressing, observation of the site, and evaluation of subjective complaints from the patient:
  » Pain/tenderness at site
  » Erythema
  » Warmth
  » Swelling
  » Induration
  » Purulent drainage
  » Palpable venous cord

Interventions

1. Discontinue infusion.
2. Remove catheter.
3. Evaluate potential causes of the phlebitis
   A. Chemical
   B. Mechanical
   C. Infection
4. Notify provider of severe phlebitis (grade 3 or 4).
5. Implement interventions to relieve discomfort associated with phlebitis: limb elevation, application of warm compresses, and analgesics as ordered.
6. Reassess vascular access needs based on evaluation of probable cause of phlebitis.
   A. Insert new PIVC in opposite extremity or
   B. Discuss with patient and health care team consideration for a CVAD if phlebitis is likely due to chemical causes and there is need for ongoing infusion therapy.
7. Observe site for signs of postinfusion phlebitis after removal of all catheters.
   A. Postinfusion phlebitis may appear after removal when no signs and symptoms were present at removal or signs and symptoms could worsen when present at removal.
**Documentation**

- Document in the patient’s health record:
  - Provider notification
  - Interventions taken
  - Patient assessment data
  - Patient condition and response to interventions
  - Patient education

- Complete an Adverse Event Report based on severity of phlebitis in accordance with organizational policy.

- Use a standardized phlebitis scale definition to rate the grade of phlebitis (Tables 6.1 and 6.2).

**TABLE 6.1 PHLEBITIS SCALE**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Clinical Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No symptoms</td>
</tr>
<tr>
<td>1</td>
<td>Erythema at access site with or without pain</td>
</tr>
<tr>
<td>2</td>
<td>Pain at access site with erythema and/or edema</td>
</tr>
<tr>
<td>3</td>
<td>Pain at access site with erythema</td>
</tr>
<tr>
<td></td>
<td>Streak formation</td>
</tr>
<tr>
<td></td>
<td>Palpable venous cord &gt;1 inch in length</td>
</tr>
<tr>
<td>4</td>
<td>Pain at access site with erythema</td>
</tr>
<tr>
<td></td>
<td>Streak formation</td>
</tr>
<tr>
<td></td>
<td>Palpable venous cord &gt;1 inch in length</td>
</tr>
<tr>
<td></td>
<td>Purulent drainage</td>
</tr>
</tbody>
</table>

### TABLE 6.2 VISUAL INFUSION PHLEBITIS SCALE

<table>
<thead>
<tr>
<th>Score</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>IV site appears healthy</td>
</tr>
</tbody>
</table>
| 1     | **One** of the following is evident:  
     | Slight pain near IV site **OR** slight redness near IV site |
| 2     | **Two** of the following are evident:  
     | • Pain at IV site  
     | • Erythema  
     | • Swelling |
| 3     | **All** of the following signs are evident:  
     | • Pain along path of cannula  
     | • Induration |
| 4     | **All** of the following signs are evident and extensive:  
     | • Pain along path of cannula  
     | • Erythema  
     | • Induration  
     | • Palpable venous cord |
| 5     | **All** of the following signs are evident and extensive:  
     | • Pain along path of cannula  
     | • Erythema  
     | • Induration  
     | • Palpable venous cord  
     | • Pyrexia |

*Abbreviation: IV, intravenous.*

Infiltration and Extravasation

Policy

The risk of infiltration and extravasation is reduced through careful selection of the most appropriate VAD and insertion site and through establishment of VAD patency prior to and during infusion therapy.

Peripheral and CVAD sites are regularly assessed for signs and/or symptoms of infiltration and extravasation before and during each intermittent infusion and on regular intervals during continuous infusions.

Appropriate intervention(s) are implemented immediately upon recognition of infiltration/extravasation as determined by the characteristics of the solution or medication escaping from the vein.

Recognize the differences among vesicant, nonvesicant, and irritant solutions and medications. Each organization should reach a consensus on what medication is considered to be a vesicant and irritant based on their internal formularies.

Key Points

- Infiltration and Extravasation in Older Adults
  - Accidental dislodgement of the VAD may go unnoticed due to changes in the older adult’s sensorium, less-elastic tissues, and other conditions. Diminished responses to noxious stimuli may delay verbalized complaints. Older adults tend not to report discomfort and pain as frequently as younger patients. Such patients can be accurately assessed when prompted more frequently.
  - Older adults may feel they are expected to tolerate some level of pain; that expression of discomfort may be considered a weakness; that he or she may be viewed as “difficult”; or that there may be a serious reason for the pain, such as disease progression and imminent death.
  - The perception of cutaneous pain may decrease as a result of diminished receptors in aging skin. The older adult may have a change in peripheral sensations, causing decreased responses to stinging, heat or pain, or recognition of swelling at the venipuncture site resulting in more extensive injury.
  - The body’s capacity to heal can also be decreased due to age and disease processes. Infection is more likely to develop in damaged tissues and in some cases can lead to the need for surgery, loss of the extremity, and even death.
Vein fragility and the high acuity levels of older adult patients can increase the likelihood of infiltration and extravasation, resulting in significant morbidity.

- **Infiltration** is defined as inadvertent administration of a nonvesicant solution or medication into surrounding tissue, whereas **extravasation** is defined as inadvertent infiltration of vesicant solution or medication into surrounding tissue. A vesicant is an agent capable of causing tissue damage when it escapes from the intended vascular pathway into surrounding tissue.

- Infiltration of solutions or medications could lead to impairment of functional capabilities, which could result in diminished capacities for self-care. Infiltration can also contribute to medication error by delay of therapy administration and fluctuations in therapeutic medication levels secondary to delivery disruption.

- Extravasation of vesicant parenteral solution or medication can be devastating. When a vesicant solution or medication extravasates, it can cause formation of blisters, with subsequent sloughing of tissues occurring from tissue necrosis. Extravasation can also contribute to medication error by delay of therapy administration and fluctuations in therapeutic medication levels secondary to delivery disruption.

- Limit the extent of injury through early recognition of signs and symptoms of infiltration/extravasation which may reduce the amount of fluid that escapes into an extravascular space.

- Alarms from electronic infusion pumps are not designed to detect the presence or absence of infiltration/extravasation.

- Vesicant medications include antineoplastic medications, as well as many noncytotoxic medications, and are associated with many forms of tissue damage.
  
  » A large volume of irritant medication could produce local tissue damage.

  » A large volume of any solution (eg, vesicant, nonvesicant, and/or irritant) may cause compartment syndrome, which could lead to amputation and nerve damage that could produce complex regional pain syndrome.

- **Risk factors by category include:**

  » Mechanical factors
    
    - Insertion sites in the hand, antecubital fossa, upper arm, foot, and ankle
    
    - Catheter size
- Ultrasound-guided catheter insertion in deep veins with less than two-thirds catheter residing within the vein
- Increased manipulation of the PIVC at the catheter hub
- Subsequent peripheral catheters after the first insertion
- Peripheral catheters indwelling longer than 24 hours
- Difficult venous access, multiple previous venipunctures, or lengthy history of infusion therapy
- CVAD tip location leading to vessel erosion and extravasation due to lack of adequate CVAD securement and body movements, such as respiratory and cardiac function
- Insertion technique and inserter experience

» Pharmacologic factors
- Medication concentration
- Volume escaping into the tissue
- Hyperosmolarity
- Nonphysiological pH
- Ability of medication to bind DNA, kill replicating cells, and/or cause vascular dilatation
- Excipients, such as alcohol or polyethylene glycol, used in the formulation of some medications
- Length of the injection or infusion time for vesicant medications

» Obstructive factors that limit blood flow and cause overflow of infusing fluids from the puncture site
- Vein thrombosis or stenosis proximal to (located above) the insertion site and tip location
- Lymphedema

» Patient-related factors
- Female gender
- Inability or difficulty with communicating pain, tightness, or other discomfort
- Altered mental status or cognition (eg, agitation, confusion, sedation)
- Age-related changes to vasculature, skin, and subcutaneous tissue
- Diseases that produce changes in vasculature or impaired circulation (eg, diabetes, lymphedema, systemic lupus, Raynaud's disease, peripheral neuropathy, peripheral vascular disease)
Medications that alter pain sensation (eg, narcotics) or suppress the inflammatory response (eg, steroids)

Current infection

Reduce risk by:

» Using appropriate methods for VAD planning, site selection, insertion, stabilization, and VAD dressing
» Avoiding use of winged steel needles for infusion
» Utilizing clinicians with the highest skill level when performing venipuncture in patients with difficult intravenous access (DIVA).
» Assessing all VADs for patency and the absence of signs and symptoms of infiltration and extravasation before each intermittent infusion and on a regular basis for continuous infusions
» Assessing PIVCs frequently as follows: minimally at least every 4 hours; every 1 to 2 hours for patients who are sedated or have cognitive deficits; and more often for patients receiving infusions of vesicant medications
» Careful observation of the insertion site and catheter pathway for changes in color and/or temperature, presence of edema, and leakage from the insertion site
» Comparison of extremity circumference when localized edema is not obvious
» Gentle palpation of site through intact dressing
» Flushing to identify resistance
» Aspiration of blood return
» Listening to patient’s report of any type of pain or discomfort
» Collaboration with pharmacists for appropriate diluent type and volume for each medication
» Collaboration with the provider for appropriate type of VAD

Patient Education

Teach patient and caregiver:

» Information about the risk of vesicant medications and the possible progression of signs and symptoms after the event.
» Treatment interventions, their purpose, and length of treatment.
» Preinfusion: The risks of receiving an infusion prior to administration, emphasizing the signs and symptoms to immediately report; and how/where/whom to report them.
» Postinfusion: The possible progression of the signs and symptoms of infiltration/extravasation; the need to protect the site from sunlight.

» Appropriate actions, if the site worsens after discharge.

» Required follow-up with provider as appropriate.

Assessment

- Identify the nature (ie, vesicant, nonvesicant, or irritant) of antineoplastic and noncytotoxic medications before administration and be prepared to use the correct thermal application and antidote treatment for each medication.

- Assess the extremity and areas proximal and distal to insertion site.

- Identify signs and symptoms of infiltration/extravasation

  » Pain may be the initial symptom and may be sudden and severe when associated with a rapid injection of solutions or medications; may be out of proportion to the injury; may appear with passive stretching of the muscles in the extremity; pain intensity may increase over time.

  » Edema may appear as a raised area under the skin near the peripheral VAD site or as an enlarged and tense extremity due to fluid accumulating in compartments of the extremity.

  » Compare circumference of both extremities.

  » Edema from a CVAD may appear as a raised area on the neck or chest.

  » Changes in color may include blanching from nonvesicant fluids; vesicants can produce redness; however, extravasation into deep tissue may not produce visible color changes.

  » Fluid leakage may occur from the puncture site, subcutaneous tunnel, or port pocket.

  » Blister formation may appear within hours or may be delayed for days with antineoplastic agents. Progression to ulceration may vary from a few days to 1 to 2 weeks, depending on the medication that extravasated.

Interventions

1. Stop infusion immediately when the patient reports pain, burning, stinging and/or tightness, at or around the insertion site, catheter tip, or entire venous pathway; this should not be considered “normal” with any infusion. Further assessment is required to determine appropriate intervention(s).
2. Assess the area distal to the VAD site for capillary refill, sensation, and motor function.

3. Confirm the presence or absence of blood return by aspiration. To enhance blood return, use a slow, gentle technique to pull back syringe plunger rod and/or a small syringe (eg, 3 or 5 mL). The peripheral catheter tip could be inside the vein lumen, yet an additional puncture of the vein wall is allowing fluid leakage. Absence of blood return from a CVAD could be caused for many reasons, and diagnostic studies may be needed.

**Procedures**

**Infiltration from a PIVC or Midline Catheter:**
1. Remove the catheter and apply a dressing. Pressure at the insertion site should not be used, as this will force the solution into contact with more tissue.
2. Elevate the extremity.
3. Apply cold for infiltration of hyperosmolar fluids (> 350 mOsm per liter).
4. Apply warm compresses for isotonic or hypotonic fluids.
5. Perform a neurovascular assessment, including capillary refill, sensation, and movement of distal joints.
6. Outline the area of visible signs with a skin marker to assess changes.
7. Estimate the amount of fluid that escaped from the vein.
8. Notify the provider about alterations in the neurovascular assessment.

**Infiltration from a CVAD, including peripherally inserted central catheters (PICCs):**
1. Evaluate the type of fluid(s) and medication(s) infusing through the CVAD.
2. Stop the infusion.
3. If the fluid and medication can be infused through a peripheral vein, insert a peripheral catheter and initiate infusion(s).
4. Immediately collaborate with the provider for patient management, especially if a peripheral vein cannot tolerate the infusing solution.
5. Diagnostic testing may be needed to identify the extravascular tip location and to plan appropriate removal.
6. Estimate the amount of fluid that escaped from the vein.
Extravasation from a PIVC or Midline Catheter:

1. Stop the infusion immediately.
2. Do not flush the VAD, as this would inject additional medication into the tissue.
3. Disconnect the administration set from the catheter hub, and aspirate from the catheter with a small syringe, although a very small amount of fluid may be retrieved.
4. Remove the PIVC and apply a dressing to achieve hemostasis.
5. Pressure at the insertion site should not be used, as this will force the solution into contact with more tissue.
6. Using a skin marker, outline the area with visible signs of extravasation to allow for assessing changes.
7. Estimate the volume of solution that escaped into the tissue.
8. Elevate the extremity.
9. Photograph the affected area to identify progression or exacerbation of the tissue injury.
10. Notify the provider about the event and activate the established treatment protocol or the prescribed treatment.
11. Use the appropriate thermal application.
   A. Apply dry, cold compresses when the goal is to localize the medication in the tissue and reduce inflammation.
      i. Apply for 20 minutes 4 times a day for 24 to 48 hours unless otherwise prescribed.
      ii. Do not use cold compresses with extravasation of vinca alkaloids and vasopressors and in the presence of vaso-occlusive events (eg, sickle cell anemia). Neutralize the medication with the appropriate antidote.
   B. Apply dry, warm compresses when the goal is to increase local blood flow and disperse the medication through the tissue. Dilute the medication further with the appropriate antidote.
12. Administer the appropriate antidote for the extravasated drug (refer to Table 6.3).
13. Apply a sterile transparent occlusive dressing to the entire area.

Extravasation from a CVAD, including a PICC:

1. Stop the infusion immediately.
2. Check for dislodged catheter, dislodged port access needle, and ruptures or leaks from the external catheter.
3. Aspirate the residual drug, if possible, from the CVAD. For an implanted port needle dislodged from the port reservoir, attempt aspiration from the port pocket.

4. For extravasation into the subcutaneous area surrounding the port pocket or nontunneled CVAD insertion site, the appropriate thermal application and antidote injection should be considered.

5. For extravasation into other intrathoracic extravascular areas, collaborate with the provider about radiographic diagnostic tests and a plan of care, which could involve surgical intervention.

All Infiltration/Extravasation Events:

1. Monitor progression of signs and symptoms and/or response to treatment at periodic intervals, usually determined by venue of care.

2. Photograph the site at periodic intervals, including the date and time, according to organizational policy.

3. Facilitate consultation with other specialists as needed (eg, hand surgeon, rehabilitation with physical or occupational therapy, pain management).

Documentation

- Document in the patient’s health record:
  - Provider notification and referrals to other specialists
  - Interventions taken
  - Patient condition and response to interventions
  - Patient assessment data
    - Details of the type, size, and location of the VAD involved
    - Patency assessment of the VAD before, during, and after the event, including blood return
    - All solution and medications involved, method of administration (eg, injection, rate of infusion), and estimate of amount of solution in the tissue
  - Patient education
  - Follow-up evaluations

- Use a standardized tool that is valid and reliable for assessing and documenting the event. Continue use of the same tool through resolution.

- Use a standardized format to document the initial event and each ongoing assessment to ensure that all factors are considered.

- Complete an Adverse Event Report, according to organizational policy.
<table>
<thead>
<tr>
<th>Extravasated Drug</th>
<th>Dosage of Antidote</th>
<th>Route of Administration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vasopressors such as: Dopamine Dobutamine Norepinephrine Epinephrine Methylene blue Vasopressin Phenylephrine</td>
<td>5 to 10 mg in 10 mL of normal saline</td>
<td>Subcutaneous injection of 0.5 to 1 mL around area of extravasation Clean entire site with antiseptic. Use 25-gauge or smaller needles and change for each injection.</td>
<td>Administer immediately or within 12 hours of the event. Repeated injection may be necessary if hypoperfusion is still present or if vasoconstriction is extending to a greater area. First line antidote for dobutamine, dopamine, epinephrine, norepinephrine, phenylephrine</td>
</tr>
</tbody>
</table>
### ANTIDOTE: TERBUTALINE

<table>
<thead>
<tr>
<th>Extravasated Drug</th>
<th>Dosage of Antidote</th>
<th>Route of Administration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vasopressors such as:</td>
<td>1 mg in 10 mL of normal saline</td>
<td>Subcutaneous injection of 1 mL around area of extravasation</td>
<td>Used when phentolamine is not available.</td>
</tr>
<tr>
<td>Dopamine</td>
<td></td>
<td>Clean entire site with antiseptic.</td>
<td></td>
</tr>
<tr>
<td>Dobutamine</td>
<td></td>
<td>Use 25-gauge or smaller needles and change for each injection.</td>
<td></td>
</tr>
<tr>
<td>Norepinephrine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epinephrine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methylene blue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vasopressin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phenylephrine</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### ANTIDOTE: NITROGLYCERINE OINTMENT

<table>
<thead>
<tr>
<th>Extravasated Drug</th>
<th>Dosage of Antidote</th>
<th>Route of Administration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vasopressors such as:</td>
<td>2% ointment 1 to 2-inch length for adults</td>
<td>Topical application Reapplied every 8 hours if needed</td>
<td>First line antidote for vasopressin and methylene blue</td>
</tr>
<tr>
<td>Dopamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dobutamine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norepinephrine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epinephrine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methylene blue</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vasopressin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phenylephrine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs containing propylene glycol such as:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phenytoin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### ANTIDOTE: HYALURONIDASE

<table>
<thead>
<tr>
<th>Extravasated Drug</th>
<th>Dosage of Antidote</th>
<th>Route of Administration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinca alkaloids such as: Vincristine, Vinblastine, Vindesine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs containing propylene glycol such as: Etomidate, Lorazepam</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epipodophyllotoxins such as: Etoposide, Teniposide</td>
<td>15 units in pediatric patients</td>
<td>Subcutaneous injection</td>
<td>Administer immediately.</td>
</tr>
<tr>
<td>Antibiotics with low pH such as: Vancomycin, Doxycycline, Gentamicin</td>
<td>Up to 1500 units in adults</td>
<td>Clean entire site with antiseptic.</td>
<td>Delay of more than 1 hour decreases effectiveness.</td>
</tr>
<tr>
<td>Hyperosmolar preparations such as: Parenteral nutrition</td>
<td>For cytotoxic agents, 1 to 6 mL or 1 mL for each mL of extravasated drug</td>
<td>Use 25-gauge or smaller needles and change for each injection.</td>
<td></td>
</tr>
<tr>
<td>Electrolytes such as: Calcium salts, Calcium chloride, Calcium gluconate, Sodium bicarbonate, Potassium chloride, Hypertonic sodium chloride</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antibiotics such as: Penicillin, Ampicillin, Nafcillin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-infectives such as: Metronidazole (Flagyl), Pentamidine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other medications with pH extremes: Aminophylline, Mannitol, Acyclovir, Amiodarone, Immune globulin, Pentobarbital, Phenobarbital, Promethazine, Dextrose solutions ≥ 10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contrast agents</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Subcutaneous injection:**

- Clean entire site with antiseptic.
- Use 25-gauge or smaller needles and change for each injection.
- Administer immediately.
- Delay of more than 1 hour decreases effectiveness.
### ANTIDOTE: SODIUM THIOSULFATE

<table>
<thead>
<tr>
<th>Extravasated Drug</th>
<th>Dosage of Antidote</th>
<th>Route of Administration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechlorethamine hydrochloride</td>
<td>10% or 20% solution</td>
<td>Subcutaneous injection 2 mL for each 1 mg of extravasated drug</td>
<td>Administer immediately. Delay of more than 1 hour decreases effectiveness</td>
</tr>
<tr>
<td></td>
<td>Prepare according to manufacturers’ directions for use.</td>
<td>Clean entire site with antiseptic Use 25-gauge or smaller needles and change for each injection.</td>
<td></td>
</tr>
</tbody>
</table>

### ANTIDOTE: DEXRAZOXANE

<table>
<thead>
<tr>
<th>Extravasated Drug</th>
<th>Dosage of Antidote</th>
<th>Route of Administration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthracyclines such as:</td>
<td>Days 1 and 2 = 1000 mg per m², not to exceed 2000 mg Day 3 = 500 mg per m², not to exceed 1000 mg</td>
<td>IV infusion</td>
<td>First dose within 6 hours of extravasation event; subsequent doses given at the same time each day Use a large vein on the opposite extremity if possible or select a vein distal to the extravasated site if the same extremity must be used. Remove cold compresses 15 minutes before infusion begins.</td>
</tr>
<tr>
<td>Daunorubicin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doxorubicin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epirubicin</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: IV, intravenous; mg, milligram; mL, milliliter; m², meter squared.
Nerve Injury

Policy
A VAD is immediately removed upon patient report of paresthesia-type pain during peripheral venipuncture and during catheter dwell time.

During the insertion or dwell of CVADs, the possibility of nerve injury is considered and evaluated whenever the patient complains of respiratory difficulty or unusual presentations of pain or discomfort.

Report signs and/or symptoms of nerve injury promptly to the provider.

Key Points
- Older adults may be unable to articulate the feeling of numbness, tingling, or weakness. Careful assessment of the patient’s range of motion of the extremity is important, especially if the patient reports his or her extremities feel funny, hurt, or feel different.
- Anatomical variations in veins, arteries, and nerves used for PIVC or CVAD insertion are common and can be complex. Nerve injuries are not always preventable. However, it is important to recognize that certain sites may have a greater risk for nerve injury.
- The following venipuncture sites may be associated with greater risk for nerve injury due to the specific nerves as indicated:
  - Cephalic vein at the radial wrist with potential injury to the superficial radial nerve.
  - Volar (inner) aspect of the wrist with potential injury to the median nerve.
  - At/above the antecubital fossa with potential injury to the median and anterior interosseous nerve and the lateral and medial antebrachial nerves.
  - Subclavian and jugular sites with potential injury to nerves of the brachial plexus.
  - Brachial vein during PICC insertion with potential injury to the median nerve.
- Arterial sites with the greatest risk for nerve injury include:
  - Brachial artery with potential injury to the median nerve.
  - Radial artery with potential injury to the median and radial nerve.
  - Axillary artery with potential injury to the brachial plexus.
• Reduce the risk of nerve damage:
  » Use appropriate means to control bleeding at attempted and successful sites to reduce the risk of hematoma that can lead to nerve injury due to compression.
  » Avoid multiple attempts at venipuncture.
  » Use ultrasound guidance to reduce the risk of insertion-related complications when placing short or long PIVCs in patients with DIVA and when placing CVADs and midline catheters.
  » Stop the VAD insertion procedure immediately and carefully remove the VAD if the patient reports symptoms of paresthesia, such as radiating electric pain, tingling, burning, prickly feeling, or numbness; stop the procedure upon the patient’s request and/or when the patient’s actions indicate severe pain.
  » Insert a PIVC or phlebotomy needle at no greater than a 30° angle depending upon vein depth unless using ultrasound guidance; for shallow veins and veins of older adults, use a 5° to 15° angle. Do not use subcutaneous probing techniques or multiple passes of the needle or catheter when performing any puncture procedure.
  » Choose the median cubital vein (first choice) or the cephalic vein for phlebotomy, as these veins are closer to the surface and in an area where nerve damage is least likely; the basilic or median basilic veins are a last choice due to proximity to the median nerve and brachial artery.
  » Minimize the risk of needle movement during phlebotomy procedures while attaching and removing the blood collection tube(s).
  » Avoid the cephalic vein in the first quarter of the forearm (ie, above the wrist) for approximately 8.5 cm above the styloid process of the radius due to risk of superficial radial nerve injury.
  » Remove a PIVC immediately when a patient reports paresthesia-type pain its dwell as fluid accumulating in the tissue can lead to nerve compression injuries. Fluid can originate from infiltrated IV solutions, hematoma, and edema associated with the inflammatory process of phlebitis and thrombophlebitis.
  » Limit the amount of solution that enters the tissue through early recognition of signs and symptoms of infiltration/extravasation.
Assessment

- Identify the presence of primary or secondary medical diagnoses of complex regional pain syndrome, also known as reflex sympathetic dystrophy, as the risk of venipuncture-associated nerve injury may be increased.

- Some patients may be unable to articulate the feeling of numbness, tingling, or weakness. Careful assessment of the patient’s range of motion of the extremity is important, especially if the patient reports his or her extremities feel funny, hurt, or feel different.

- Identify signs and symptoms of nerve injury during VAD placement or during VAD dwell including:
  » “Electric pain”
  » Tingling
  » Burning
  » Prickly feeling
  » Numbness
  » Subclavian/jugular insertion: respiratory difficulty/dyspnea, eye changes (eg, pupil constriction, upper eyelid drooping), right shoulder/neck pain, and/or hiccups due to phrenic nerve damage

Patient Education

- Teach patient and caregiver:
  » Symptoms of paresthesia (eg, radiating electric pain, tingling, burning, prickly feeling, or numbness).
  » To immediately report any symptoms of paresthesia.

Interventions

If the patient reports paresthesia-type pain during peripheral venipuncture:

1. Take immediate action.
   A. Stop the VAD insertion procedure and carefully remove the VAD.

2. Notify provider; recognize that consultation with a medical specialist (eg, hand specialist) may be required.

3. Monitor neurovascular status, and report changes to provider.
   A. Intensification of paresthesia (eg, pain, burning, localized tingling, numbness) may be indicative of advancing nerve damage from development of a neuroma (surgical removal required) or compartment syndrome (nerve compression).
**Documentation**

- Document in the patient’s health record:
  - Provider notification
  - Interventions taken
  - Patient assessment data
  - Patient condition and response to interventions
  - Patient education
- Complete an Adverse Event Report according to organizational policy.
Infection

Key Definitions

Catheter-Associated Bloodstream Infection (CABSI): Given variability in international definitions, outcome reporting, and application of the terms catheter-related bloodstream infection (CR-BSI) and central line-associated bloodstream infection (CLABSI), the INS Standards of Practice Committee is using the terminology catheter-associated bloodstream infection (CABSI) to refer to bloodstream infections (BSIs) originating from either PIVCs and/or CVADs. Both are equally injurious and can occur from 4 possible sources:
1. During catheter insertion through migration of microbes down the catheter tract.
2. Via the catheter hub/lumen during routine administration and manipulation at the hub/lumen.
3. Due to endogenous microorganisms within the bloodstream.
4. From contaminated infusates.

Catheter-Related Bloodstream Infection (CR-BSI): The recognized diagnostic criterion that more accurately confirms the catheter as the source of the infection. It is diagnosed if the same organism is isolated from a blood culture and the tip culture, and the quantity of organisms isolated from the tip is greater than 15 colony forming units (CFUs). Alternatively, differential time to positivity (DTP) requires the same organism to be isolated from a peripheral vein and a catheter lumen blood culture, with growth detected 2 hours sooner (ie, 2 hours less incubation) in the sample drawn from the catheter.

Central Line-Associated Bloodstream Infection (CLABSI): This is most commonly reported as a surveillance term; however, it is not an established diagnostic criterion. CLABSI is a primary BSI in a patient who had a central line within the 48-hour period before the development of the BSI and is not related to an infection at another site. However, since some BSIs are secondary to sources other than the central line (eg, pancreatitis, mucositis) and may not be easily recognized, the CLABSI surveillance definition may overestimate the true incidence of CR-BSI.
Policy

Infection prevention measures are implemented with the goal of preventing infusion- and VAD-related infections.

The patient with a VAD is assessed for signs and/or symptoms of infection and is educated about infection, risks, interventions, and any required follow-up.

A care bundle is implemented in conjunction with a culture of safety and quality to reduce the risk of infection associated with VADs during insertion and during daily care and management.

Key Points

- Health care-associated infections are more prevalent among older adults who tend to be the sickest and most immunocompromised, undergo invasive procedures, and have VADs. Infections due to antibiotic resistance are of great concern in these populations.
- Cognitive and sensory deficiencies can make the older adult less reliable when reporting discomfort in early stages of VAD-related infection development. Confusion, disorientation, delirium, sleepiness, and other aberrations of normal behavior may be early indicators of infection.
- Infection can occur locally at the venipuncture site or may be systemic. Primary infections located distant from the catheter-skin junction may also contribute to VAD-related infections, as well as systemic infections. Patient noncompliance with care and management strategies may contribute to infectious compromise. Reinforcement of patient education, especially being aware of patients with cognitive impairments, is necessary.
- Consider contamination of the infusate (eg, parenteral solution, IV medications, or blood products) as a source of infection. This is a rare event, but an infusate can become contaminated during the manufacturing process (intrinsic contamination) or during its preparation or administration (eg, antibiotics) in the patient care setting (extrinsic contamination).
- Use chlorhexidine-impregnated dressings for older adult patients with CVADs and arterial catheters when all other CABS1 prevention strategies have proven ineffective.
- Consider the use of daily chlorhexidine bathing in patients in the intensive care unit (ICU) with a CVAD in situ as a strategy to reduce CABS1 if other prevention strategies have not been effective.
Risk factors for infection and CR-BSI include:

» Inadequate skin antisepsis before VAD insertion
» Multiple manipulations of VAD hub and infusion delivery system
» Patient age, condition, acuity
» Presence of infection at another anatomical location (ie, urinary, surgical site)
» Education and skill of clinician(s)
» Inadequate VAD insertion technique
» Inadequate care and maintenance practices

Infection is a preventable complication when risk factors are mitigated, including the following:

» Perform hand hygiene before placing and before providing any VAD-associated interventions.
» Use maximal sterile barrier precautions during CVAD insertion and midline catheter insertion.
» Choose the optimal VAD site. The subclavian vein is the preferred site for nontunneled catheters.
» Use chlorhexidine solution for skin antisepsis before VAD insertion and as part of routine site care.
» Use sterile gloves to palpate the site of a PIVC insertion after application of skin antiseptic agent.
» Disinfect needleless connectors before each entry into the VAD lumen.
» Maintain Aseptic Non Touch Technique (ANTT) during all infusion administration and VAD care.
» Change administration set and any add-on devices at recommended intervals.
» Minimize use of add-on devices.
» Remove VAD when no longer needed.
» Use appropriate site-protection devices during showers or bathing.
» Use an antimicrobial catheter to reduce the risk of CABSI in at-risk patients such as those in ICUs.
Patient Education

- Teach patient and caregiver:
  - Teach patients to avoid allowing VAD dressing and attached administration sets to get wet during handwashing or bathing.
  - Teach patients/caregivers who will self-manage the VAD/infusion after discharge hand hygiene, aseptic technique, disinfection of needleless connectors, and site protection during bathing.

Assessment

- Identify signs and symptoms of exit site infection:
  - Tenderness
  - Erythema
  - Induration
  - Purulence within 2 cm of catheter-skin junction
  - Skin breakdown at the VAD insertion site

- Identify signs and symptoms of port-pocket infection:
  - Erythema
  - Dehiscence of surgical incision used for implanted port insertion
  - Necrosis of skin over reservoir of implanted port
  - Tenderness
  - Induration
  - Purulent exudate from needle access site
  - Purulent exudate from subcutaneous pocket containing reservoir

- Identify signs and symptoms of infection in the tract of a subcutaneously tunneled catheter:
  - Erythema
  - Tenderness
  - Induration in tissues overlying catheter and more than 2 cm from catheter exit site

- Identify signs and symptoms of CABS1:
  - Chills
  - Backache
  - Fever
  - Hypothermia
  - Nausea
  - Malaise
» Vomiting
» Headache
» Hypotension

- Do not remove a functioning CVAD solely on suspicion of infection when there is no other confirmatory evidence of catheter-related infection other than an elevated core body temperature.

**Interventions**

1. If signs and symptoms of exit site infection are present:
   A. Obtain culture of purulent exudate.
   B. Notify provider of signs and symptoms.
   C. Assess infusion therapy needs and potential for changing therapy to another route, if possible.
   D. Implement orders as appropriate (eg, antimicrobial therapy), usually including VAD removal.

2. If signs and symptoms of port-pocket or tunnel-tract infection are present:
   A. Notify provider of signs and symptoms.
   B. Anticipate removal of device.

3. If signs and symptoms of CABSI are present:
   A. Notify provider immediately.
   B. Obtain blood cultures from VAD and from a separate peripheral vascular access site, as ordered.
   C. Culture infusate if there is possibility of infusion-related contamination, if appropriate, as ordered.
   D. Initiate parenteral anti-infective therapy as ordered.
   E. If unsuccessful in treating suspected bloodstream infection, VAD may need to be removed.

4. Additional interventions:
   A. Monitor patient, including ongoing assessment of VAD site, vital signs, review of laboratory findings, and response to interventions.
   B. Perform site care and management, if VAD is not removed.
   C. Replace administration sets as follows:
      i. Replace primary and secondary continuous administration sets used to administer solutions other than lipid, blood, or blood products no more frequently than every 96 hours.
ii. Replace administration sets for parenteral nutrition (PN) solutions (total nutrient admixture [TNA] and amino acid/dextrose formulations) at least every 24 hours.

iii. Replace the administration set whenever the peripheral catheter site is changed or when a new CVAD is placed.

iv. Change intermittent administration sets every 24 hours and aseptically attach a new, sterile, compatible covering device to the male luer end of the administration set after each intermittent use. Do not attach the exposed male luer end of the administration set to a port on the same set (“looping”).

**Documentation**

- Document in the patient’s health record:
  - Provider notification
  - Interventions taken
  - Patient assessment data
  - Patient condition and response to interventions
  - Patient education
- Complete an Adverse Event Report according to organizational policy.
Air Embolism

Policy
All infusion connections are of a luer-lock design to ensure a secure connection (eg, IV administration sets, syringes, needleless connectors, extension sets, and any add-on devices).

Air is always purged/removed from any administration device (eg, IV administration sets, syringes, needleless connectors, extension sets, and any add-on devices) prior to connection or initiating an infusion.

Clinicians, patients, and/or caregivers initiating and managing infusion therapy are instructed in air embolism recognition, prevention, and implementation of critical actions in the event an air embolism is suspected.

Key Points
- If a CVAD becomes dislodged or disconnected, the older adult must be assessed for signs of air embolism. Particular attention should be paid to the older adult at risk for inadvertent separation of the tubing from the VAD or removing the device entirely. The older adult may not be able to articulate pain, palpitations or other signs and symptoms associated with air embolism. Even if the patient is aware that something has changed, he or she may not be able to call for help due to preexisting conditions such as stroke, intubation or tracheotomy, or dementia and delirium. Preparing the patient for removal of a CVAD is important but may not be completely understood by the older adult.
- Air embolism is a preventable complication when risk factors are mitigated, including the following actions:
  » During VAD Use and Management:
    - Prime and purge air from all administration sets prior to use.
    - Ensure the VAD is securely clamped when disconnecting/reconnecting a new administration set, needleless connector, or any other add-on device.
    - When possible, position the patient in a flat, supine manner any time the CVAD lumen is opened, (eg, during changes of administration sets, needleless connectors, or any other add-on device). If this position is not possible, a securely closed clamp is the only way to prevent air from entering the lumen.
- Trace all lines between the catheter and the solution container during each assessment, patient transfer and handoff procedure.
- Never use scissors, razors, or other sharp objects near the VAD.
- Use an air-eliminating filter appropriately on administration sets, including when the patient has a right-to-left heart shunting defect.

» During CVAD Placement:
- Implement precautions to prevent air embolism during placement of CVADs and other procedures involving entry into the vascular system, such as catheter exchange and extracorporeal membrane oxygenation.

» During CVAD Removal:
- Place the patient in a supine position during CVAD removal, or Trendelenburg position if tolerated so that the CVAD insertion site is at or below the level of the heart (refer to Chapter 5, Vascular Access Device Removal).
- Instruct the patient to perform a Valsalva maneuver at the appropriate point during catheter withdrawal (if appropriate for patient’s condition).
- After removal of a CVAD, apply digital pressure until hemostasis is achieved by using manual compression with a sterile, dry gauze pad.
- Apply an air-occlusive dressing (eg, petroleum gauze) to the access site for at least 24 hours for the purpose of occluding the skin-to-vein tract and decreasing the risk of retrograde air emboli.
- Encourage the patient to remain in a flat or reclining position, if able, for 30 minutes after removal.

Patient Education
- Teach patient and caregiver:
  » How to prevent an air embolism and critical actions to take if an air embolism is suspected with any type of VAD. Ensure availability of a clamp or hemostat to use in the event of a ruptured or damaged VAD and provide instruction on how/when to use it.
  » Never disconnect or reconnect any IV administration sets or connectors from the catheter hub, unless specifically instructed to do so and evaluated as competent in the procedure
  » Never use scissors, hemostats, or razors near the catheter
Assessment

- Identify signs and symptoms of potential air embolism:
  - Sudden onset of dyspnea
  - Gasping/breathlessness
  - Coughing
  - Chest pain
  - Hypotension
  - Tachyarrhythmias
  - Wheezing
  - Tachypnea
  - Altered mental status
  - Altered speech
  - Changes in facial appearance
  - Numbness
  - Paralysis
  - Presence of a loud continuous churning sound over precordium during auscultation

Interventions

1. Take immediate action:
   A. Locate source of air entry and resolve: close, fold, clamp, or cover the existing catheter, use manual pressure if needed and cover the puncture site with an air-occlusive dressing or pad if the catheter has been removed.
   B. Place the patient on left side in the Trendelenburg position or in the left lateral decubitus position if not contraindicated by other conditions, such as increased intracranial pressure, eye surgery, or severe cardiac or respiratory diseases, to minimize migration of embolus.

2. Initiate code team.
   A. Perform basic life support as needed.

3. Notify provider.

4. Obtain adequate vascular access.

5. Provide 100% oxygen if available and further support actions as needed.

6. Continue to monitor vital signs and observe patient.
Documentation

- Document in the patient’s health record:
  » Provider notification
  » Interventions taken
  » Patient assessment data
  » Patient condition and response to interventions
  » Patient education
- Complete an Adverse Event Report according to organizational policy.
Central Vascular Access Device Occlusion

Policy
CVAD patency is routinely assessed, as defined by the ability to flush all catheter lumens without resistance and the ability to yield a blood return.

Catheter salvage is preferred over catheter removal for management of CVAD occlusion with choice of clearing agents based on a thorough assessment of potential causes of occlusion.

When catheter patency cannot be restored and there is continued need for the device, notify provider. Alternative actions, such as radiographic studies to identify catheter tip location or evaluate catheter flow, may be implemented.

Treat all catheter lumens with partial, withdrawal, or complete occlusion. Do not leave an occluded lumen untreated because another lumen is functional; prolonged fibrin formation is a risk factor for CABS.

Key Points
- Patient positioning is often a factor in the prevention of catheter occlusion, especially if the catheter has been inserted near an area of flexion. The older adult may be forgetful or physically contracted. Clothing may become binding or constrictive as will restraints, making flow rates difficult to maintain. Avoiding VAD use in areas of flexion and practicing judicious use of joint stabilization when necessary can help; however, they do not take the place of frequent assessment of the patient and the infusion delivery system.

- Proper flushing and locking of all types of CVADs is essential since the older adult can have comorbidities related to blood dyscrasias, and the patient’s intravascular volume may be decreased significantly which may potentiate occlusions.

- Reduce the risk for CVAD occlusion through the following interventions:
  - Use proper flushed and locking procedures (refer to Chapter 5, Maintaining Vascular Access Device Patency: Flushing and Locking).
  - Prevent catheter dislodgement through appropriate catheter securement.
Avoid incompatible mixtures of IV solutions and/or medications. Medications with high risk for precipitation may include:
- Alkaline medications: phenytoin, diazepam, ganciclovir, acyclovir, ampicillin, imipenem, and heparin
- Acidic medications: vancomycin and PN solutions; ceftriaxone and calcium gluconate; and mineral precipitate in PN solutions with increased levels of calcium and phosphate.

» Perform pulsatile flushing between infusions with at least 10 mL of preservative-free 0.9% sodium chloride or use separate catheter lumens if available.

» Do not allow solution containers to “run dry.”

» Respond promptly to electronic infusion pump alarms.

» Use appropriate sequence of catheter clamping and final syringe disconnection, based on the type of needleless connector, to reduce reflux of blood into the catheter tip.

» Ensure all clamps are open before initiating infusion.

- Identify risk of lipid residue occlusion when administering TNA, employing preventative strategies (eg, increased flushing) if lipid residue build-up is suspected.

Assessment
- Identify signs of partial or complete catheter occlusion, including:
  » Inability to withdraw blood or sluggish blood return.
  » Sluggish flow; resistance or inability to flush lumen; inability to infuse fluid.
  » Frequent occlusion alarms on electronic infusion pump.
  » Swelling/leaking at infusion site.
  » No reflow or insufficient blood flow in hemodialysis CVADs.

- Assess the infusions, injections, flushing procedures, and other events with the CVAD that led to the occlusion to determine the possible cause.

- Evaluate/identify potential causes of occlusion
  » Mechanical:
    - External: tight suture, catheter clamped, clamp not attached correctly, kinked tubing, filter obstruction
    - Internal: catheter malposition, kinked catheter, pinch-off syndrome
» Nonthrombotic: lipid buildup in patients receiving TNA admixtures, drug precipitate
» Thrombotic: most common, due to fibrin buildup, thrombosis within catheter lumen or surrounding catheter tip (eg, intraluminal occlusion or fibrin sheath/tail)

- Review the patient’s medication record and collaborate with the pharmacist for the appropriate intervention/catheter clearance agent for precipitate/thrombotic occlusions based on the history of catheter performance and problems.
- Assess patient for any contraindications for use of a catheter-clearance agent.

Interventions
1. Rule out mechanical causes of CVAD occlusion before considering use of a precipitate-clearing or thrombolytic agent.
2. Follow single-syringe method or stopcock method for complete occlusions as these are instillation methods that use a negative-pressure approach.
3. Follow direct instillation method for partial occlusion when CVAD can still be flushed, but blood aspiration is not possible, or flow is sluggish.
4. Use a volume of the precipitate-clearing agent in an amount approximating the internal lumen volume of the CVAD.
5. Use a volume of a thrombolytic agent based on the manufacturers’ directions for use.
6. Check the CVAD manufacturers’ directions for use when considering instillation of alcohol solutions such as ethanol, as they may damage catheters made of some types of polyurethane.

Patient Education
- Prior to procedure, teach patient and caregiver:
  » The purpose of the catheter clearance procedure
  » What to expect during the procedure

Procedures

Single-Syringe Method for Complete Occlusions
1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review the provider’s order or standard protocol.
4. Gather supplies:
   - Gloves
   - Antiseptic solution
   - 10-mL syringe with precipitate-clearing or thrombolytic agent
   - 10-mL syringe preservative-free 0.9% sodium chloride
   - Needleless connector
5. Perform hand hygiene.
6. Don gloves.
7. Disinfect needleless connector with antiseptic solution and allow to air-dry.
8. Clamp CVAD, if appropriate.
9. Attach syringe with precipitate-clearing or thrombolytic agent to the needleless connector. Alternatively, remove the needleless connector as it could be a source of infecting organisms and/or thrombus and prepare to attach the syringe directly to the CVAD hub.
10. Unclamp CVAD and, while holding syringe vertically, gently aspirate until plunger reaches approximately 8-mL mark.
11. While maintaining syringe in vertical position, slowly release the plunger and repeat step until solution is pulled into the CVAD. Never apply pressure to plunger. Clamp CVAD.
12. Leave syringe in place and secure. Label syringe “Do not use” with date, time, and initials.
13. Allow solution to dwell in CVAD lumen according to thrombolytic manufacturers’ directions for use; in the case of a precipitate-clearance agent, allow solution to dwell for 20 to 60 minutes.
14. After appropriate dwell time, unclamp CVAD and attempt to aspirate blood.
   A. A free-flowing blood return the color and consistency of whole blood indicates patency.
   B. If patency is reestablished, withdraw a total of 4 to 5 mL of blood, clamp CVAD, and remove and discard syringe into biohazard container.
   C. Repeat procedure once if patency not achieved.
15. Attach 10-mL syringe of preservative-free 0.9% sodium chloride, unclamp CVAD, and flush using positive-pressure method.

16. Resume infusion therapy as ordered or lock catheter as appropriate.

17. Dispose of used supplies in appropriate receptacles.

18. Remove gloves.

19. Perform hand hygiene.

20. Notify provider if unable to achieve patency.

**Stopcock Method for Complete Occlusions**

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).

2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).

3. Obtain and review the provider’s order or standard protocol.

4. Gather supplies:
   - Gloves
   - Antiseptic solution
   - 3-way stopcock
   - 10-mL syringe
   - 10-mL syringe with precipitate-clearing or thrombolytic agent
   - 10-mL syringe preservative-free 0.9% sodium chloride
   - Needleless connector

5. Perform hand hygiene.

6. Don gloves.

7. Disinfect junction of CVAD and needleless connector with antiseptic solution and allow to air-dry.

8. Clamp catheter.

9. Remove needleless connector and aseptically attach stopcock to the CVAD hub; turn off from the patient to the CVAD hub.

10. Attach empty sterile 10-mL syringe to 1 port of stopcock.

11. Attach 10-mL syringe of precipitate-clearing or thrombolytic solution to stopcock port.

12. Open stopcock port connected to empty syringe.

13. Aspirate empty syringe to 8 to 9 mL while maintaining plunger position, then close port, creating negative pressure within catheter lumen.
14. Open stopcock connected to syringe with precipitate-clearing or thrombolytic agent, allowing solution to enter the CVAD lumen.
   A. Procedure steps 13 and 14 may need to be repeated until solution is pulled into the CVAD.

15. Secure device “unit” (stopcock/syringes) to patient and label “Do not use” with date, time, and initials.
   A. May opt to remove stopcock and syringes and replace with sterile needleless connector during dwell time; however, increased manipulation at hub increases risk of contamination should the procedure need to be repeated.

16. Allow solution to dwell according to thrombolytic manufacturers’ directions for use; in the case of a precipitate-clearing agent, allow to dwell for 20 to 60 minutes.

17. Disinfect needleless connector (if used to replace stopcock unit) with antiseptic solution and allow to dry.

18. Aseptically attach 10-mL syringe and attempt to aspirate blood (if previous syringe is left attached to stopcock, another one is not needed).
   A. A free-flowing blood return that is the color and consistency of whole blood indicates patency.
   B. If patency is reestablished, withdraw a total of 4 to 5 mL of blood, clamp CVAD, and remove and discard syringe into biohazard container.
   C. Repeat procedure once if patency not achieved.

19. Attach 10-mL syringe of preservative-free 0.9% sodium chloride, unclamp CVAD, and flush using positive-pressure method.

20. Resume ordered therapy or lock catheter as appropriate.

21. Dispose of used supplies in appropriate receptacles.

22. Remove gloves.

23. Perform hand hygiene.

24. Notify provider if unable to achieve patency.

**Direct Instillation Method for Partial Thrombotic or Nonthrombotic Occlusions**

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).

2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review the provider’s order or standard protocol.

4. Gather supplies:
   - Gloves
   - Antiseptic solution
   - 10-mL syringe with precipitate-clearing or thrombolytic agent
   - 10-mL syringe preservative-free 0.9% sodium chloride
   - Needleless connector

5. Perform hand hygiene.

6. Don gloves.

7. Disinfect needleless connector with antiseptic solution and allow to air-dry.

8. Clamp CVAD, if appropriate.

9. Attach syringe with precipitate-clearing or thrombolytic agent to the needleless connector.
   A. Alternatively, remove the needleless connector, because it could be a source of infecting organisms and/or thrombus, and prepare to attach the syringe directly to the CVAD hub.

10. Unclamp CVAD, if appropriate, and slowly inject precipitate-clearing or thrombolytic agent. Do not force solution into CVAD.

11. Clamp CVAD and leave syringe attached. Label CVAD “Do not use” with date, time, and initials.

12. Allow solution to dwell according to thrombolytic manufacturers’ directions for use; in the case of a precipitate-clearing agent, allow to dwell for 20 to 60 minutes.

13. After appropriate dwell time, unclamp CVAD and attempt to aspirate blood.
   A. A free-flowing blood return that is the color and consistency of whole blood indicates patency.
   B. If patency is reestablished, withdraw a total of 4 to 5 mL of blood, clamp CVAD, and remove and discard syringe into biohazard container.
   C. Repeat procedure once if patency not achieved.

14. Attach 10-mL syringe of preservative-free 0.9% sodium chloride, unclamp CVAD, and flush using positive-pressure method.

15. Resume infusion therapy as ordered or lock catheter as appropriate.

16. Dispose of used supplies in appropriate receptacles.

17. Remove gloves.

18. Perform hand hygiene.

19. Notify provider if unable to achieve patency.
Documentation

- Document in the patient’s health record:
  » Patient and CVAD assessment data
  » Interventions performed and outcome
  » Provider notification
  » Response to interventions

TABLE 6.4. AGENTS FOR CVAD CLEARANCE OF A DRUG PRECIPITATE

<table>
<thead>
<tr>
<th>Drug Precipitate</th>
<th>Clearing Agent</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acidic drug (pH &lt; 6)</td>
<td>Hydrochloric acid (0.1 N)</td>
<td>NA</td>
</tr>
<tr>
<td>Alkaline drug (pH &gt; 7)</td>
<td>Sodium bicarbonate 8.4%</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Sodium hydroxide 0.1 mmol/L</td>
<td></td>
</tr>
<tr>
<td>Injectable lipid emulsion</td>
<td>70% ethanol</td>
<td>Use with caution with polyurethane CVADs, as ethanol may cause catheter damage; check manufacturers’ directions for use.</td>
</tr>
</tbody>
</table>

Abbreviations: CVAD, central vascular access device; L, liter; mmol, millimole; N, normality; NA, not applicable.
Catheter Damage (Embolism, Repair, Exchange)

Policy

Preventative strategies are implemented to maintain catheter integrity and reduce the risk for catheter damage.

Assessment of the patient’s risk-to-benefit ratio is performed prior to undertaking catheter repair or exchange.

Catheter repair is initiated on the order of a provider.

CVAD exchange is initiated on the order of a provider.

Key Points

- Catheter damage includes catheter fracture and embolism and loss of integrity to the external catheter (eg, crack or hole in catheter).
- There are several ways for catheter fracture to occur; it is particularly important to assess the older adult for prevention of this untoward event. The cognitively impaired older adult may manipulate unfamiliar objects in his or her immediate environment, including infusion catheters, devices, and other related equipment. If a catheter becomes inadvertently dislodged, careful inspection must be made to ascertain that the device is intact, according to manufacturers’ configuration and length. The older adult may not be able to adequately describe associated symptoms of catheter fracture or embolization, so careful monitoring by the clinician is necessary. The clinician should pay particular attention to patient education, encouraging patient compliance, and therapy restrictions on daily activities to maintain safety.
- Prevent catheter damage through the following actions:
  » Use a 10-mL barrel syringe to assess VAD patency.
  » Do not forcibly flush a VAD against resistance with any syringe size.
  » Do not use power injection with VADs that are not labeled for this purpose.
  » Do not forcibly remove a VAD against resistance.
  » Protect and secure catheter (cover catheter with clothing and avoid friction of heavy items over external CVADs)
  » Employ clinicians who are competent in VAD insertion procedures.
  » Use ultrasound guidance for CVAD placement.
  » Do not withdraw the catheter or wire from the needle during insertion.
Causes of catheter embolism include pinch-off syndrome, separation of the catheter from an implanted port, and catheter damage during catheter exchange.

» Pinch-off syndrome is a relatively rare but significant and often unrecognized complication. It occurs when the CVAD enters the costoclavicular space medial to the subclavian vein and is positioned outside the lumen of the subclavian vein in the narrow area bounded by the clavicle, first rib, and costoclavicular ligament. Catheter compression causes intermittent or permanent catheter occlusion and, because of the “scissoring” effect of catheter compression between the bones, can result in catheter tearing, transection, and catheter embolism.

» Options to consider for management of a damaged or ruptured catheter include use of a repair procedure (external damage), a catheter exchange procedure, or insertion of a new catheter at a new site.

Patient Education

» Teach patient and caregiver:
  » Never flush or forcibly administer an infusion through any VAD
  » Do not use razors, scissors, or any other type of cutting tool near the VAD

Assessment

» External catheter damage:
  » Inability to aspirate blood
  » Localized pain and/or subcutaneous swelling
  » Pinholes, cuts, and tears to the external portion of the catheter extending from catheter-skin junction to hub of catheter
  » Leaking or wet dressing during infusion or flushing

» Internal catheter damage:
  » Examine VAD catheter tip and length after removal, comparing the removed length to the inserted length for damage and possible fragmentation.

» Catheter/ guidewire embolism signs and symptoms:
  » Inability to aspirate blood return
  » Palpitations, arrhythmias, dyspnea, cough, or thoracic pain that are not associated with the patient’s primary disease or comorbidities
  » May be no symptoms
• Pinch-off syndrome (subclavian vein insertion sites):
  » Difficulty aspirating, resistance to flushing, patient report of pain, possible swelling at the insertion site, and a change in the clinical picture with arm or shoulder movement

Interventions

1. Examine guidewire and catheter tip and length after removal, comparing the removed length to the inserted length for damage and possible fragmentation. If damage is seen or suspected, a chest radiograph or further evaluation may be warranted. Promptly manage catheter or guidewire embolism.
   A. Place patient on left side in Trendelenburg position unless contraindicated (e.g., increased intracranial pressure, eye surgery, or severe cardiac or respiratory disease); minimize movement of patient and involved limb; reassure patient; call immediately for emergency medical assistance.
   B. Pressing the limb over the target vein may decrease the chance of migration of the fracture; consider immediate application of a tourniquet above site when catheter or guidewire embolization is observed.
   C. Notify health care team; percutaneous interventional/surgical procedures are likely required for fragment/catheter removal to prevent further complications.

2. If external catheter damage is seen or suspected, immediately seal catheter proximal to damaged portion of the catheter.
   A. Seal catheter by closing an existing clamp, adding a clamp, covering the damaged area with an adhesive dressing material or folding the external segment and securing.
   B. Label the catheter “Do not use” while awaiting decision for repair.
   C. If no device-specific repair kit is available, contact provider to collaborate regarding other alternatives, such as catheter exchange or insertion of a new catheter.

3. If internal catheter damage is seen or suspected, contact provider; a chest radiograph or further evaluation is warranted.
Procedure

Catheter Repair

1. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
2. Obtain provider’s order to repair damaged catheter, if appropriate.
   A. An assessment of risks versus benefits of catheter repair should be discussed.
   B. Factors in decision making include, but are not limited to, patient’s immune status, duration for remaining infusion therapy, or external catheter length.
   C. When catheter damage under the skin is suspected or external catheter repair is not appropriate, catheter removal and replacement using an exchange procedure or insertion at a new site are appropriate options.
3. Obtain sterile repair kit from the manufacturer specific to individual type and size of CVAD.
4. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
5. Gather supplies:
   - Personal protective equipment
   - Clamp
   - Repair kit supplied by manufacturer, specific to CVAD
   - Sterile drape if not included in repair kit.
   - Antiseptic solution
6. Maintain Surgical-ANTT during the repair and observe Standard Precautions throughout the procedure.
7. Perform hand hygiene.
8. Don mask and sterile gloves.
9. Disinfect external portion of catheter with antiseptic solution, allow to air-dry, and position external catheter on a sterile drape.
10. Reduce risk of venous air embolism during procedure:
    A. Place the patient in a supine position with the head flat if patient can tolerate this position.
    B. Clamp external catheter proximal to the patient.
11. Complete repair according to manufacturers’ directions for use.
12. Apply new sterile dressing, if applicable.
13. Reassess catheter tip location after repair.

**Documentation**
- Document in the patient’s health record:
  - Provider notification
  - Interventions taken
  - Patient assessment data
  - Patient condition and response to interventions
  - Patient education
- Complete an Adverse Event Report according to organizational policy.
Catheter-Associated Deep Vein Thrombosis

Policy
The clinician identifies risk factors, implements preventative strategies, assesses the patient for sign/symptoms of suspected catheter-associated deep vein thrombosis (CA-DVT), and assesses patient response to treatment.

Key Points
- Identify risk factors for CA-DVT in patients who require a VAD
  - Older adults may be more prone to clot formation in a vein of the upper extremities or chest with the presence of a CVAD or a diagnosis of cancer.
  - Older adults may present with venous thrombosis due to vessel wall damage; alterations in the blood flow due to immobility, chronic heart disease, or varicosities; and hypercoagulability of the blood due to malignancy and diabetes.
- Risk factor for CA-DVT include:
  - Diabetes mellitus
  - Obesity
  - Chemotherapy administration
  - Thrombophilia (eg, factor V Leiden, protein C deficiency, protein S deficiency)
  - Critical illness
  - History of thrombosis
  - Chronic diseases including:
    - Inflammatory bowel disease
    - Congenital heart disease
    - Sickle cell disease
    - End-stage renal failure
  - Surgery/trauma patients
  - Pregnancy
  - History of prior CVADs
Evaluate the risk of CA-DVT during the process of VAD selection:

» The risk of CA-DVT is reduced with appropriate VAD selection and placement as follows:
  - PICCs are associated with higher risk in patients who are critically ill and/or have a cancer diagnosis when compared to other types of CVADs. However, the risk of CA-DVT may not be increased when compared to non-PICC CVADs when smaller diameter and single-lumen PICCs are used.
  - Avoid placement of multilumen PICCs unless necessary for patient infusion requirements; place small-diameter catheters.
  - Consider use of a risk scoring system when evaluating PICC placement. For example, the Michigan Risk Score identified risk for PICC-associated CA-DVT based on 5 risk factors:
    • History of deep vein thrombosis (DVT)
    • Multilumen PICC
    • Active cancer
    • Presence of another CVAD at the time of PICC insertion
    • White blood cell count > 12,000
  - Consider the risks of non-PICC CVADs.
    • CVADs placed via the subclavian sites are associated with a lower risk of symptomatic, ultrasound confirmed CA-DVT than jugular or femoral sites in adult patients in ICUs.
  - Consider risk for CA-DVT with midline catheters.
    • Midline catheters are associated with a significant risk for CA-DVT as well as superficial venous thrombophlebitis.
    • Avoid placement of multilumen midline catheters or those > 4 Fr diameter.
  - Use catheters with smaller diameter; choose a CVAD with a catheter-to-vein ratio of ≤ 45%, because it will take up less space within the vein.
  - Ensure proper placement of all CVAD tips in the lower third of the superior vena cava (SVC) or cavoatrial junction (CAJ) as tips located in the mid-to-upper portion of the SVC are associated with greater rates of DVT.

Flushing and locking procedures have no effect on CVAD-associated venous thrombosis, because such interventions are aimed at the internal CVAD lumen, not the vein lumen.
- Do not remove a CVAD in the presence of CA-DVT when the catheter is correctly positioned, functional, and necessary for infusion therapy.

**Patient Education**
- Teach patient and caregiver:
  - Signs and symptoms of CA-DVT and how/where to report them.
  - Nonpharmacologic strategies for thrombosis prevention, including early mobilization of the catheterized extremity, performance of normal activities of daily living, gentle limb exercise, and adequate hydration.

**Assessment**
- Monitor for signs, symptoms, and potential consequences of CA-DVT; recognize that CA-DVT is often clinically silent and does not produce overt signs and symptoms.
- Measure midarm circumference between insertion site and axilla before PICC and midline catheter insertion and during clinical assessments to assess the presence of edema and possible CA-DVT.
- Assess all patients with CVADs for signs and symptoms related to obstruction of venous blood flow and may include:
  - Pain in the extremity, shoulder, neck, or chest
  - Edema in the extremity, shoulder, neck, or chest
  - Erythema in the extremity
  - Engorged peripheral veins on the extremity, shoulder, neck, or chest wall
  - Difficulty with neck or extremity motion
  - Signs and symptoms of pulmonary emboli, including dyspnea, apprehension, pleuritic discomfort or pain, diaphoresis, tachycardia, cyanosis

**Interventions**
1. Take immediate action in the event of signs and symptoms of pulmonary embolus.
   A. Initiate code team.
      i. Perform basic life support as needed.
   B. Continue to monitor vital signs and observe patient.
   C. Perform interventions and treatments as ordered.
2. For nonemergent CA-DVT signs and symptoms, anticipate the following:
   A. Diagnostic testing: Doppler ultrasound in veins of upper extremity (noninvasive, no radiation exposure) or venography with contrast injection, computed tomography (CT) scan, or magnetic resonance imaging (MRI) may be used to assess veins obscured by clavicle or ribs.
   B. Therapeutic doses of anticoagulant medication, which is usually continued for at least 3 months after CVAD removal.

**Documentation**
- Document in the patient’s health record:
  - Provider notification
  - Interventions taken
  - Patient assessment data
  - Patient condition and response to interventions
  - Patient education
- Complete an Adverse Event Report according to organizational policy.
Central Vascular Access Device Malposition

Policy
The clinician assesses for CVAD malposition and uses appropriate interventions when suspected.

Key Points
- Obtain diagnostic tests including chest radiograph with or without contrast injection, fluoroscopy, echocardiogram, CT scan, and/or MRI to diagnose CVAD malposition based on clinical signs and symptoms and problems with catheter function.
- Primary intravascular malposition occurs during or immediately after the insertion procedure.
  - Intravascular malposition includes the aorta, lower portion of the right atrium and right ventricle, ipsilateral and contralateral brachiocephalic (innominate) and subclavian veins, ipsilateral and contralateral internal jugular veins, aygous vein, and many other smaller tributary veins. Femoral insertion sites may produce malposition of the catheter in the lumbar, iliolumbar, and common iliac veins.
  - Causes of malposition include:
    - Inadequate catheter length and insertion depth.
    - Patient position changes (eg, from supine to upright).
    - Respiratory movement of the diaphragm and use of mechanical ventilation.
    - Upper extremity and shoulder movement.
    - Body habitus (eg, obesity, breast size).
    - Congenital venous abnormalities including persistent left superior vena cava (PLSVC) and variations of the inferior vena cava (IVC), aygous vein, and pulmonary veins. Many of these anatomical variations are undiagnosed until placement of a CVAD is required. Cardiac imaging studies are needed as blood flow into the left atrium and the presence of right-to-left cardiac shunting pose significant risks for air or thrombotic emboli to a variety of anatomical locations (eg, brain, kidney).
    - Acquired venous changes including thrombosis, stenosis, and malignant or benign lesions compressing the vein.
Secondary intravascular malposition, also known as tip migration, occurs any time during the dwell and is related to sporadic changes in intrathoracic pressure (eg, coughing, vomiting); original tip located high in the SVC; DVT; congestive heart failure; neck or arm movement; and positive pressure ventilation.

Primary and secondary extravascular CVAD malposition includes location in the:

- Mediastinum producing infiltration/extravasation.
- Thoracic duct producing chylothorax.
- Pleura producing hemothorax or pleural effusion.
- Pericardium producing pericardial effusion and cardiac tamponade.
- Peritoneum producing intra-abdominal bleeding and abdominal compartment syndrome.
- Trachea and other structures due to fistula formation.

Never advance any external portion of a CVAD that has been in contact with skin into the insertion site. No antiseptic agent or technique applied to skin or the external catheter will render skin or the catheter sterile, and no studies have established an acceptable length of time after insertion for such catheter manipulation.

Use only a CVAD labeled for power injection of contrast agents.

Patient Education

- Teach patient and caregiver:
  - Signs and symptoms of CVAD malposition to report and how/where to report them.

Assessment

- There may be no obvious signs and symptoms of catheter migration. However, the inability to flush, infuse, or aspirate may mean the CVAD tip is no longer at the desired position.

- Assess the patient and the CVAD for signs and symptoms of catheter dysfunction and associated complications before each CVAD infusion:
  - Absence of blood return from all catheter lumens
  - Changes in blood color and pulsatility of the blood return from all catheter lumens
  - Difficulty or inability to flush the CVAD
  - Atrial and ventricular dysrhythmias
  - Changes in blood pressure and/or heart rate
» Shoulder, chest, or back pain
» Edema in the neck or shoulder
» Changes in respiration
» Complaints of hearing gurgling or flow stream sounds on the ipsilateral side
» Paresthesia and neurological effects due to retrograde infusion into the intracranial venous sinuses

- Measure the external CVAD length and compare it to the external CVAD length documented at insertion. Dislodgement could indicate the tip location is suboptimal, increasing the risk for CA-DVT.

**Interventions**

1. **During insertion:**
   
   - A. Use real-time ultrasound during the insertion procedure to reduce the risk of inadvertent arterial insertion.
   - B. Use tip location technology to enhance awareness of primary CVAD malposition during the insertion procedure.
   - C. If arterial placement of a CVAD is suspected, assess waveforms using a pressure transducer, blood gas values for a sample taken from the CVAD, or CT angiogram with contrast. Pulsatile flow and color of the blood are not always reliable indicators for arterial location. Withdrawal of large catheters from an accessed artery (e.g., carotid) with site compression increases risk of brain ischemia from lack of blood flow, hematoma, or emboli.
   - D. Consult with interventional radiology and/or surgeon to develop a plan for urgent removal. Delay can increase the risk of thrombosis.

2. **For PICCs with primary malposition:**
   
   - A. Intracardiac location more than 2 cm below the CAJ: retract catheter based on electrocardiogram results or based on measurement of the specific distance on the chest radiograph.
   - B. Jugular vein location: use noninvasive techniques singly or in combination, including elevating the patient’s head, flushing the catheter, and walking. If noninvasive techniques fail, possible invasive techniques include catheter retraction and flush while advancing or retraction and advancement under fluoroscopy.

3. **During CVAD dwell time:**
   
   - A. Report signs and symptoms to provider; anticipate diagnostic tests, including chest radiograph with or without contrast injection, fluoroscopy, echocardiogram, CT scan, and/or MRI.
B. Provide the radiology department with clinical information to enhance its ability to identify the problem.

C. Withhold infusion through a malpositioned catheter until proper tip position has been established. Assess the infusion therapy being administered and, if possible, insert a PIVC to continue therapy. If the infusion therapy is not possible through a peripheral vein, assess the potential risk for discontinuing therapy and consult with the provider regarding changing the infusion therapy until the proper CVAD tip location can be reestablished.

D. Fluid aspiration through the CVAD before removal may be indicated if cardiac tamponade is suspected. Consult with the provider.

E. When infiltration or extravasation from a CVAD has occurred, develop a treatment plan for the specific medication involved.

**Documentation**

- Document in the patient’s health record:
  - Provider notification
  - Interventions taken
  - Patient assessment data
  - Patient condition and response to interventions
  - Patient education
Catheter-Associated Skin Injury

Policy

VAD sites are routinely assessed for signs and symptoms of skin injury. Appropriate intervention(s) are implemented to reduce the risk of, and manage, skin injury.

Key Points

- The epidermis becomes thin and inelastic with age. Collagen fibers decrease in number and function, contributing to the skin’s loss of flexibility and elasticity. The epidermis is rendered more fragile and heals more slowly as the skin-cell turnover rate decreases. A thinner outer skin layer makes the skin a less effective barrier against the introduction of microorganisms. Looser skin and a loss of subcutaneous tissue make the veins less stable, and a thinner surface makes the skin more fragile, increasing risk of skin tears. The clinician should select an area with adequate tissue to provide catheter stabilization. Use a skin barrier solution to reduce the risk of medical adhesive-related skin injury (MARSI). MARSI is exhibited when there is redness, tears, erosion of the skin, or development of vesicles or bullae in an area exposed to medical adhesive and lasting for 30 minutes or more following adhesive removal.
- The technique for VAD insertion and selection of site dressing materials should be adapted to the older adult patient’s more fragile skin and vascular access status. Care should be taken when applying a tourniquet to minimize bruising. A blood pressure cuff inflated to 60 mm Hg can be more effective than a tourniquet in vein dilation. The patient’s infusion history should address phlebitis or infiltration occurrences associated with previous infusions, as well as any allergic reactions to adhesives, adhesive removers, skin-disinfection solutions, medications, and patient-reported difficulty with access.
- Employ quality improvement measures (eg, audits, preprinted order sets, documentation of signs and symptoms) to monitor and address increases in the incidence of catheter-associated skin injury (CASI).
- Employ strategies to protect skin integrity, promote skin regeneration and protect VAD site.
- Identify and promptly avoid suspected irritant/allergen and substitute products (eg, antiseptic agent, adhesive securement, dressing).
- Report changes in skin condition or suspected/apparent CASI to provider.
- Access supportive professional consultation/assistance from wound and skin specialists when available.

**Assessment**

- Assess the patient and skin at the VAD site to promptly recognize signs and symptoms of skin impairment.
  - Assess color, texture, uniformity of appearance, and integrity of skin.
  - Determine type and severity of skin damage:
    - Contact dermatitis, including redness lasting more than 30 minutes after dressing removal/application.
    - Skin injury, including skin stripping, skin tears, and tension blisters.
    - Weeping, oozing drainage.
    - Exit site infection.
  - Describe skin damage based upon:
    - Color (eg, pink, red, purple, tan, white).
    - Shape (eg, papule, vesicle, pustule).
    - Arrangement (eg, linear, ring-like).
    - Size and depth (eg, superficial, partial thickness, or full thickness).
    - Distribution or extent of skin disruption (eg, confined to dressing surface area or found on other body sites).
  - Assess exudate if present for:
    - Color (eg, clear, amber, cloudy, pink or red, green, yellow or brown)
    - Consistency (eg, high viscosity: thick, sometimes sticky, or low viscosity: thin, ”runny”)
    - Odor of the exudate (eg, unpleasant)
    - Dressing leakage
    - Noninfectious exudate
  - Rule out presence of infiltration, extravasation, thrombophlebitis, and skin conditions related to other body regions (eg, eczema, impetigo, cellulitis, erysipelas, or drug eruptions) and treat accordingly.
  - Assess for signs of localized or systemic infection, including fungal infection (eg, Candida, whitish or raised red areas unresponsive to other treatment).
Obtain patient’s history of known or suspected allergies or episodes of contact dermatitis, including the type of skin antiseptic agent, skin barrier, and previous use of products.

Assess site with impaired skin integrity regularly and monitor for signs and symptoms of skin damage or infection.

- If no improvement with inflammation and pruritus at the site, consider short-term use of topical low- to-moderate potency corticosteroid (do not apply directly on exit site; agent is nonsterile) and consider obtaining swab of site for culture and sensitivity.
- If no improvement in skin condition within 3 to 7 days or skin condition deteriorates with above measures, seek expert advice (eg, consult wound/skin specialist).
- Consider device removal and reassess plan for vascular access.

Patient Education

- Teach patient and caregiver:
  - Importance of reporting any history of severe skin reactions to medications, antiseptics, adhesives, or other substances.
  - Signs and symptoms to report and how/where/whom to report them.

Procedure

1. Prior to initiating infusion therapy, obtain a thorough patient history of allergies, sensitivities, and current medications.
   A. Confer with patient and/or caregiver regarding history of skin condition(s), skin reactions to antiseptic agents or adhesives, allergies/sensitivities to medications or skin care products, and episodes of contact dermatitis.

2. Develop a plan of care for infusion therapy with patient’s health care team to accommodate known allergies, sensitivities, and skin condition(s).
   A. Implement interventions to reduce the risk of, and manage, skin injury throughout the course of infusion therapy.

3. Assess patient’s skin condition at dressing, securement, and VAD insertion sites during each clinical assessment and/or dressing change. Observe for signs and symptoms of:
   A. Skin injury
   B. Skin irritation
   C. Catheter exit site infection
4. Notify provider of skin assessment findings that indicate potential or apparent CASI.


**Documentation**

- Document in the patient’s health record:
  - Provider notification
  - Interventions taken
  - Patient assessment data
  - Patient condition and response to interventions
  - Patient education
Allergic Reaction and Anaphylactic/Anaphylactoid Reactions

Policy

Patients are assessed for known allergies/anaphylactic reactions.

Patients are monitored for allergic reactions throughout the course of care.

Antineoplastic agents, blood products, and biologic infusion therapies (eg, colony-stimulating factors, gene therapy, monoclonal antibodies, fusion proteins, interleukin inhibitors, and immunoglobulins) are administered in a setting in which the clinician is prepared to recognize and manage severe adverse reactions.

Drugs for treatment of adverse reactions, including those used to treat anaphylaxis, are available in the treatment setting.

Whenever possible, the patient should receive the first dose of an infusion medication in a controlled environment (eg, hospital, ambulatory infusion center) with access to emergency medical equipment and medications (refer to Chapter 8, First Dose Administration).

For first dose administration, ensure that emergency medications (eg, epinephrine, diphenhydramine) are readily available with orders for their use and that the clinicians are certified in basic life support.

The clinician must remain with the patient the entire duration of the infusion of the first-dose medication and for at least 30 minutes after completion.

Key Points

- Anaphylaxis is a medical emergency that may result in death due to respiratory failure and cardiovascular collapse.
  - Common causes of anaphylaxis include:
    - Foods such as nuts, fish, shellfish, milk, eggs, and sesame
    - Latex
    - Medications (eg, penicillin, biologic agents, antineoplastic agents)
  - Blood and blood components

- As an individual advances in years, the chance of developing various disease processes increases, leading to exposure to more drugs for treatment or intervention. The more drugs the older adult is exposed
to the greater the risk for allergic reaction, as well as adverse drug interactions.

- It is important when assessing the older adult to obtain a comprehensive medication history and any past experiences with reactions or sensitivities, including over-the-counter medications, herbal remedies, and culturally based preparations.

- Allergic and anaphylaxis reactions are mediated by the immune system, often immunoglobulin E (IgE).

- Anaphylactoid reactions are mediated by physical or chemical stimulation of mast cells (eg, “red man syndrome”) and are not associated with the presence of IgE.

- A premedication may be ordered in some cases (eg, acetaminophen, diphenhydramine, and methylprednisolone for known mild allergic reactions with blood transfusions or biologics).

- It is recognized that reactions can happen at any point after exposure; it requires antigen exposure and antibody development.

**Patient Education**

- Teach patient and caregiver:
  - Importance of reporting any history of severe reactions to medications or other substances
  - Signs and symptoms and actions to take in the event of a reaction
  - Importance of wearing/carrying identification bracelet/card to identify allergies

**Assessment**

- Obtain a thorough allergy and drug history; note any cross sensitivity.

- Identify risk factors for anaphylaxis, including history of severe drug reactions and family history of same, and when administering blood/blood components and the first dose of an infusion medication.

- Identify and respond to signs and symptoms of anaphylaxis, which is the likely type of reaction when all the following criteria are met:
  - Sudden onset and rapid progression of symptoms
  - Life-threatening airway/breathing/circulatory symptoms, such as laryngeal edema, stridor, severe dyspnea/wheezing, confusion, signs of shock, tachycardia, hypotension, cardiac arrest
  - Skin or changes in mucosa, such as flushing, urticaria, angioedema
Symptoms associated with less severe systemic reactions may include:

- Neurological: dizziness, headache, weakness, syncope, seizures
- Psychiatric: anxiety
- Respiratory: dyspnea, wheezing, bronchospasm, tachypnea
- Cardiovascular: tachycardia, hypotension, arrhythmias
- Cutaneous: flushing, erythema, pruritis, urticaria, angioedema

**Interventions**

1. Stop infusion immediately.
2. Discontinue any medication suspected of causing reaction.
3. Initiate code team.
   - A. Perform basic life support as needed.
4. Maintain vascular access for emergency supportive therapies with 0.9% sodium chloride using a new administration set.
5. Perform interventions and treatments as ordered or according to organizational protocol. Anticipate treatment with epinephrine, oxygen, IV fluids.
6. Administer emergency medications, such as epinephrine or steroids, as ordered.
7. Monitor patient’s vital signs. Monitor and observe patient for at least 6 hours.

**Documentation**

- Document in the patient’s health record:
  - Presence of allergies/reactions
  - Observations and patient assessment
  - Provider notification
  - Interventions taken and outcomes
  - Patient condition and response to interventions
- Complete an Adverse Event Report according to organizational policy.
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Implanted Vascular Access Port: Accessing and Deaccessing

Policy

Only implanted vascular access ports (ports) and noncoring safety needles designed for power injection are used with power-injection equipment for radiologic imaging in accordance with manufacturers’ directions for use.

Skin antisepsis is performed prior to each access of a port.

A sterile dressing is maintained over the access site if the port remains accessed.

Radiographic confirmation of tip location is performed prior to initiation of infusion therapy at intervals established by the organization or as indicated by complications.

The noncoring needle is replaced according to manufacturers’ directions for use or in accordance with organizational procedures.

Key Points

- In the older adult, decreases in tissue turgor, changes in nerve conduction contributing to hypersensitive or delayed response to pain, and delayed wound healing will contribute to changes in skin integrity, bruising and hematoma development, skin tearing, and infectious processes. The older adult may be anxious or fearful about accessing the implanted port. As with every patient, assessment of pain and fear about infusion-related procedures should be incorporated into the plan of care.

- Implanted vascular access ports are usually located in the chest; they may also be placed in the forearm as an alternative site for patients in whom chest ports cannot be implanted.

- Use a patient’s port, unless contraindicated (eg, existing complication with the device) as the preferred intravenous (IV) route in preference to insertion of an additional vascular access device (VAD).

- Access
  - Access the port with the smallest-gauge noncoring needle to accommodate the prescribed therapy.
  - Reduce the risk of needle dislodgement after access; use a noncoring needle of length that allows the external components (eg, wings) to sit level with the skin and securely within the port (needle touches bottom of port upon insertion).
Orient the bevel of the noncoring needle in the opposite direction from the outflow channel where the catheter is attached to the port body. In vitro testing demonstrates that a greater amount of protein is removed when flushing with this bevel orientation.

**Site Preparation and Infection Prevention**

- Adhere to Aseptic Non Touch Technique (ANTT) during port access (refer to Chapter 2, *Aseptic Non Touch Technique*).
- Assess port site in preparation for port access: observe/palpate for swelling, pain, erythema, and drainage; presence of venous collaterals on the chest wall that may signal occlusion; erosion of the portal body through the skin; or signs of catheter-associated deep vein thrombosis (CA-DVT). Refer to Chapter 6, *Catheter-Associated Deep Vein Thrombosis*.
- Perform skin antisepsis prior to port access and allow skin antiseptic agent to fully dry prior to port access (refer to Chapter 3, *Vascular Access Site Preparation and Skin Antisepsis*).
- Don sterile gloves when port site palpation is required after skin antisepsis and prior to noncoring needle insertion (refer to Chapter 2, *Aseptic Non Touch Technique*).

**Dressing**

- Use a transparent semipermeable membrane (TSM) dressing that covers the noncoring needle and access site when the port is accessed.
- Change the TSM dressing at least every 7 days; if gauze is needed over the noncoring needle and access site, change the dressing every 2 days (refer to Chapter 5, *Vascular Access Device Assessment, Care, and Dressing Changes*).
- When gauze is used under the TSM dressing to solely support the wings of a noncoring needle, does not obscure the access site, and its integrity is not compromised (eg, not visibly soiled and remains free of moisture, drainage, or blood), change the TSM dressing at least every 7 days.
- Guidelines for oncology patients suggest use of a chlorhexidine-impregnated dressing around the needle insertion site based on duration of infusions exceeding 4 to 6 hours.
- Secure the noncoring needle to reduce the risk for needle dislodgement and subsequent risk for infiltration/extravasation; the use of sterile tape strips was found to be successful in a quality improvement initiative.
• Flushing and Locking
  » Flush and aspirate for a blood return upon insertion of a noncoring
     needle and prior to each infusion to ensure patency (refer to
     Chapter 5, Maintaining Vascular Access Device Patency: Flushing
     and Locking).
  » Flush and lock ports not accessed for infusion:
    - Use a volume of at least 10 mL of 0.9% sodium chloride when
      flushing a port.
    - Use of 0.9% sodium chloride alone may be as effective as heparin
      in locking to maintain port patency; if heparin is used, 5 mL of
      heparin 10 to 100 units/mL is commonly recommended every 4 to
      12 weeks.
    - Consider extending maintenance flushing and locking to every 3
      months with 10 mL 0.9% sodium chloride and 3 to 5 mL heparin
      (100 units/mL).
    - Flush ports accessed for intermittent infusions immediately
      before/after each infusion.
    - Consider use of antimicrobial lock therapy to treat a port-related
      infection or if the patient is at high risk for infection (refer to
      Chapter 5, Maintaining Vascular Access Device Patency: Flushing
      and Locking).

Assessment
• Assess patient’s pain tolerance and preferences regarding use of local
  anesthetic prior to port access.
• Assess port site for redness, tenderness, swelling, and drainage or
  leakage of infusing or injected fluids, also dehiscence of surgical
  incision or erosion of port body through the skin by visual inspection
  and palpation.
• Assess for swelling or pain near the clavicle or subclavian insertion
  sites. This could indicate pinch-off syndrome; notify provider if pain or
  swelling is present.

Patient Education
• Teach patient and caregiver:
  » Prior to insertion: placement procedure, type of port, routine care
    expectations (frequency of flushing, expectations of ANTT during
    access, use for power injection, if indicated), and identification of
    potential complications and interventions.
  » Importance of carrying port identification card.
» Report any signs or symptoms of pain, burning, stinging, or soreness at the site
» Potential complications and interventions, and how/whom to report.
» How to protect accessed port and avoid pulling at the noncoring needle during activities of daily living (eg, use of seatbelts, when dressing/undressing, bathing).

**Procedures**

**Port Access**

1. Perform hand hygiene before direct contact with the patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review the provider’s order for implanted port access or organizational protocol.
4. Obtain informed consent according to organizational policy or patient assent.
5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
6. Prepare for port access, collect necessary supplies, and set up sterile field.

**Supplies**

» Central vascular access device (CVAD) dressing kit (preferred)
» If no dressing kit:
  - Mask
  - Sterile gloves
  - Sterile gauze
  - Sterile barrier drape
  - Antiseptic solution
  - TSM dressing
  - Sterile tape
» Noncoring needle and extension set with clamp
» Sterile gauze or foam pad as needed
» Needleless connector
» Packaged sterile, prefilled 10-mL syringe of preservative-free 0.9% sodium chloride (package should indicate sterile and able to drop
onto sterile field); alternative is a vial of 0.9% sodium chloride with vial adaptor and sterile packaged 10-mL syringe

» Local anesthetic, if applicable
» Additional sterile gloves if packaged sterile sodium chloride syringe not available

7. Administer local anesthetic, as indicated (refer to Chapter 3, Pain Management for Venipuncture and Vascular Access Procedures).

8. Place patient in a comfortable position with head turned away from implanted port.

9. Assess skin over and around implanted port; palpate port to locate septum.


11. Don mask and sterile gloves.

12. Attach needleless connector to hub of extension set on noncoring needle with extension set, and prime set with preservative-free 0.9% sodium chloride.

A. Alternative procedure if packaged sterile sodium chloride syringe not available
   i. Don mask.
   ii. Scrub (disinfect) top of vial and allow to dry.
   iii. Don sterile gloves.
   iv. Assemble vial adapter and sterile syringe.
   v. Draw up 10 mL 0.9% sodium chloride from vial. Use nondominant hand to hold nonsterile vial. Maintain sterility of syringe in dominant hand while drawing from vial.
   vi. Place sterile syringe of sodium chloride on sterile field.
   vii. Remove gloves and perform hand hygiene.
   viii. Don new sterile gloves.

13. Prep the skin in the entire area where the dressing will cover. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, Vascular Access Site Preparation and Skin Antisepsis).

A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.

B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.
14. With nondominant hand, stabilize implanted port.

15. Insert noncoring needle perpendicular to the skin, through septum of the port, until the needle tip comes in contact with the back of the port.

16. Slowly inject preservative-free 0.9% sodium chloride into implanted port, noting any resistance or sluggishness of flow; slowly aspirate for blood return the color and consistency of whole blood, and then complete 0.9% sodium chloride flush.

   A. **ALERT:** If an antimicrobial locking solution was used, withdraw solution from the port prior to flushing and discard. Flushing the lock solution into the patient’s bloodstream could increase development of antibiotic resistance and other adverse effects.

   B. Never inject against resistance.

   C. Inability to flush or absence of a blood return requires further investigation about the cause (e.g., mechanical problem, fibrin/thrombosis over VAD tip, extravascular tip location).

   D. A pulsatile flushing technique may be effective at removing solid deposits.

17. Place sterile gauze or foam pad to support wings of noncoring needle if needed, making sure gauze does not obscure needle insertion site. Cover with TSM dressing.

18. Initiate infusion therapy as prescribed.

19. Discard supplies in appropriate receptacle(s).

20. Remove gloves and perform hand hygiene.

### Port Deaccess

1. Perform hand hygiene.

2. Gather supplies.

   - Supplies
     - Nonsterile gloves
     - Prefilled syringe preservative-free 0.9% sodium chloride flush
     - Prescribed locking solution
     - Dressing as indicated

3. Verify the patient’s identity using 2 independent identifiers, according to organizational policy (e.g., name and date of birth).

4. Explain procedure to patient.

5. Apply nonsterile gloves.
6. Flush port with 5 to 10 mL of preservative-free 0.9% sodium chloride, and lock port with prescribed locking solution (eg, sodium chloride, heparin, antimicrobial solution).

7. Remove dressing, noting any drainage, and discard.

8. Stabilize port using thumb and forefinger of nondominant hand.

9. Grasp needle with dominant hand and remove device, engage safety mechanism according to manufacturers’ directions for use, and discard into sharps container.

10. Apply dressing to site if bleeding occurs.

11. Discard materials in appropriate receptacles.

12. Remove gloves and perform hand hygiene.

**Documentation**

- Document in the patient’s health record:
  - Appearance of port site
  - Performance of procedure
  - Noncoring needle gauge/length
  - Medication/solution administration
  - Pain management interventions
  - Flush/lock solution and volume
  - Patient’s response to the procedure
  - Patient education
Subcutaneous Access Device: Placement and Infusion Administration

Policy

Insertion, care and management, and complication management for subcutaneous access are established in organizational policies, procedures, and/or practice guidelines.

The subcutaneous route is assessed as an alternative to IV access as part of a vessel health preservation strategy.

The patient is assessed for appropriateness of the subcutaneous route in relation to the prescribed medication or solution, the patient’s clinical condition, and the presence of adequate subcutaneous tissue.

Key Points

- **Site Selection**
  - Consider patient’s comfort, mobility, and site preference.
  - Select areas with intact skin and adequate subcutaneous tissue (e.g., 1.0-2.5 cm), abdomen (at least 4 fingers-width away from the umbilicus, left iliac fossa (considered the preferred zone due to maximal distance between colon and abdominal wall), infraclavicular, deltoid, intrascapular, flank, hips, thighs, and/or as recommended by the drug manufacturer.
  - Avoid sites near bony prominences, joints, previous surgical incisions, radiotherapy, damaged skin, intercostal space in patients with cachexia (due to high risk of pneumothorax), mastectomy, tumors, ascites, lymphedema, inner thigh if urinary catheter present, or thigh if peripheral vascular insufficiency exists.

- **Device Selection**
  - Use a small-gauge (e.g., 24- to 27-gauge) and short-length nonmetal cannula with luer-lock design for infusions. Use a subcutaneous needle labeled for high flow rates when indicated by the drug manufacturer.

- **Infection Prevention and Dressing**
  - Adhere to ANTT during subcutaneous access device placement and infusion; perform skin antisepsis prior to inserting the subcutaneous
access device (refer to Chapter 2, Aseptic Non Touch Technique and Chapter 3, Vascular Access Site Preparation and Skin Antiseptis).

» Apply a TSM dressing over the site to allow for continuous observation and assessment. Change the TSM dressing with each subcutaneous site rotation or immediately if the integrity of the dressing is compromised.

- **Medication and Solution Administration**
  - Isotonic solutions (eg, 0.9% sodium chloride, dextrose/sodium chloride solutions)
  - Opioids
  - Nonvesicant antineoplastic agents
  - Immunoglobulins
  - Certain antibiotics (eg, ceftriaxone, ertapenem)
  - Endocrine medications (eg, hydrocortisone, pamidronate, parathormone)
  - Gastrointestinal medications (eg, granisetron, metoclopramide, ondansetron, palonosetron)
  - Monoclonal antibodies (eg, alemtuzumab, trastuzumab)
  - Other medications (eg, midazolam and furosemide)

- **Infusion Rates**
  - Adjust the rate and volume/dosage of continuous subcutaneous infusions based on the patient’s age, weight, clinical condition, individual subcutaneous absorption, laboratory values, and as recommended by the drug manufacturer. Do not exceed those employed for IV infusion.
  - Reported hydration infusion rates:
    - Older adults: 5 to 167 mL/h, or boluses of 500 mL over 2 to 6 hours.
    - Palliative care patients: 42 to 72 mL/h
  - Reported medication infusion rates range up to 5 mL/h.
  - May use 2 sites, as required for high-volume solutions (eg, up to 1 L/d per site).

- **Hyaluronidase**
  - Consider the use of hyaluronidase for continuous subcutaneous infusions to facilitate the dispersion and absorption of the infusate, particularly if the infusion is not well-tolerated due to swelling or pain.
Site Rotation Recommendations
» Hydration solutions every 24 to 48 hours or after 1.5 to 2 liters of solution have infused, and as clinically indicated based on the access site assessment findings.
» Continuous medication administration every 2 to 7 days, and as clinically indicated based on the access site assessment findings.
» Intermittent infusions (eg, subcutaneous immunoglobulin [SCIg]), change site with each infusion.

Assessment
» Pre-subcutaneous access device insertion:
  » Adequate subcutaneous tissue
» Post-subcutaneous access device insertion:
  » Assess the subcutaneous infusion site for erythema, swelling, leaking of fluid, bruising, bleeding, burning, or pain. Remove the device, and rotate site based on assessment.
  » SCIg: local site reactions, including some swelling and site erythema, pain, and pruritis are common, and the site is not necessarily rotated based on these. Such reactions tend to decrease over time. Persistent reactions may require a slower infusion rate or decreased volume per site, a longer needle, or a site change.
  » Assess for adverse reactions of hyaluronidase of mild local access site reactions such as redness, pain, anaphylactic-like reactions, and allergic reactions.

Patient Education
» Teach patient and caregiver:
  » Subcutaneous access device insertion and infusion procedure.
  » Signs and symptoms of access site complications and how/where to report.
  » Activity limitations and how to protect the subcutaneous access site.

Procedure
1. Perform hand hygiene before direct contact with the patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review the provider’s order for subcutaneous administration and appropriateness of prescribed infusion solution or medication, subcutaneous administration, dose, rate of administration.
4. Obtain informed consent according to organizational policy or patient assent.
5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
6. Prepare for subcutaneous access, collect necessary supplies, and set up work area.
   - Supplies
     - Gloves
     - TSM dressing
     - Tape
     - Subcutaneous needle or subcutaneous infusion set, 24- to 27-gauge, one-half inch
     - Syringe
     - Antiseptic solution
     - Administration set
     - Prefilled medication container or cassette
     - Electronic infusion pump, if used
7. Place patient in a comfortable position.
8. Perform hand hygiene.
9. Don gloves.
10. Identify an appropriate insertion site based on the clinical situation and the manufacturers’ directions for the specific device, as each device has approval for specific sites:
    A. Areas with adequate subcutaneous tissue and intact skin
    B. Based on patient’s anticipated mobility and comfort
    C. Sites may include upper arm, subclavicular chest wall, abdomen (at least 2 inches away from umbilicus), upper back, or thighs
    D. Avoid areas that are scarred, acutely inflamed, with evidence of infection
11. Prepare insertion site:
    A. If visibly soiled, cleanse with antiseptic soap and water.
    B. Remove excess hair, if necessary, by clipping.
12. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, Vascular Access Site Preparation and Skin Antisepsis).
   A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.
   B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

13. Grasp skin between thumb and forefinger and insert device according to manufacturers’ directions for use.

14. Aspirate the subcutaneous device to ascertain the absence of blood. If blood is present with aspiration, remove device, discard, and place new device in a different site.

15. Attach administration set, and infuse fluids or medication:
   A. Medications: infuse via an electronic infusion pump
   B. Hydration fluids: infuse using a manual flow regulator; electronic infusion pumps are not typically used
   C. SCIg: infuse via syringe pump (most common); manually pushing the SCIg is also an option for some patients. Refer to manufacturers’ guidelines for specific volume limitations as some product guidelines may vary.

16. Apply a TSM dressing. Label with the date and time of insertion and initials of the clinician inserting the subcutaneous device.

17. Discard used supplies in the appropriate receptacles.

18. Remove gloves and perform hand hygiene.

**Documentation**

- Document in the patient’s health record:
  - Date and time of insertion, site preparation, and location
  - Medication or solution, amount and type of diluent, infusion rate, and method
  - Site assessment
  - Patient’s response to the procedure
  - Patient education
Intraspinal Access Device: Care and Management

Policy

Insertion, care and management, and complication management for intraspinal access are established in organizational policies, procedures, and/or practice guidelines. Intraspinal access devices and administration sets are identified and labeled as a specialized infusion administration system and differentiated from other infusion administration and access systems.

Medications administered via an intraspinal route are free of preservatives.

Intraspinal infusion solutions are filtered using a 0.2-micron, surfactant-free, particulate-retentive, and air-eliminating filter.

Intraspinal access device placement, removal, and medication administration are performed either by or upon the order of the provider in accordance with regulations established by regulatory and accrediting bodies and in accordance with organizational policies and procedures.

Peripheral IV access is maintained for at least 24 hours due to the potential need for naloxone administration for evidence of respiratory depression.

Key Points

- Clinicians must be aware of the absolute contraindications to the use of intraspinal medications such as analgesics in the older adult. Contraindications may include spinal column deformities, a laminectomy, low back pain, severe headaches, backaches, inability to cooperate, and unstable neurological disease. Due to the potential for underlying comorbidities in the older adult, placement of intraspinal access devices, such as epidural, intrathecal, and intraventricular, must be carefully assessed for the appropriateness of the specific device and therapy.

- Indications for Intraspinal Access
  - Intraspinal (epidural/intrathecal) medication infusions may be indicated for patients across all practice settings.
    - Management of short-term acute pain associated with surgical procedures, trauma pain, and during labor in hospitalized patients; a temporary intraspinal catheter is placed for analgesic/anesthetic medication administration.
- Chronic cancer and non–cancer-related pain refractory to medical management and/or intolerable side effects associated with systemically administered analgesics. Infusions may include opioids alone, opioids in combination with dilute local anesthetics, and opioids in combination with local anesthetics and clonidine. Options for intraspinal access for chronic pain include long-term tunneled catheters, implanted ports with epidural/intrathecal catheters, and implanted pumps with an epidural/intrathecal catheter.
- Spasticity treated with intrathecal baclofen.
- Treatment of primary central nervous system cancers and leptomeningeal metastases.
- For patients with chronic refractory pain, the use of intrathecal infusions is increasing; the benefits of intrathecal infusion, as compared to epidural infusion, include higher analgesic efficacy and lower rates of treatment failures and technical complications.

- Infection Prevention, Dressing, and Securement
  » Maintain Surgical-ANTT using a Critical Aseptic Field during catheter placement and implanted intraspinal port access; wear a mask during all intraspinal medication injections to reduce the risk of droplet transmission of oropharyngeal flora (refer to Chapter 2, Aseptic Non Touch Technique).
  » Apply and maintain a sterile dressing that is clean, dry, and intact over the insertion site and secure the access site.
  » Use a securement product or tape a tension loop of tubing to the patient’s body to reduce the risk of accidental dislodgement.
  » Perform site care and dressing changes over a tunneled and accessed implanted epidural device in accordance with organizational policy.
  » Avoid use of alcohol with device access and when site care is performed; use aqueous chlorhexidine solution or povidone iodine solution; however, allow any skin antiseptic agent to fully dry as all antiseptic agents have the potential to be neurotoxic.
  » Use a TSM dressing to allow for site visualization; consider the use of chlorhexidine-impregnated dressings for patients with an epidural access device. A significant reduction in epidural skin colonization and catheter tip colonization has been demonstrated with their use.
- Prevention of Administration Set Misconnections
  » Trace all catheters/administration sets/add-on devices between the patient and the container before connecting or reconnecting any infusion/device, at each care transition to a new setting or service, and as part of the handoff process.
  » Use International Organization for Standardization (ISO)-approved connectors to prevent misconnections among IV, enteral, and intraspinal infusions (ie, neuraxial [NRFit] and enteral [EnFit]) when available.

Assessment
- Assess the patient’s current anticoagulation therapy; anticoagulants must be withheld before intraspinal insertion and before removal due to risk for epidural hematoma and paralysis.
  » Obtain dosage, route, date, and time of last anticoagulant administration.
  » Review coagulation panel results.
  » Consult with provider regarding how long to withhold anticoagulants before the planned procedure.
- Perform a medication reconciliation with every patient encounter, asking patients to report every medication including prescription, over-the-counter (OTC), and complementary/herbal medications. Concomitant medication use may increase the risk of complications of intraspinal therapy.
- Assess and monitor patients after initiating or restarting an intraspinal infusion in a fully equipped and staffed environment according to organizational policy.
- Be especially vigilant when monitoring high-risk patients, such as those with sleep apnea, psychiatric conditions, or patients taking concomitant (eg, sedatives or other analgesics) medications.
- Assess and monitor patients after initiating or restarting an intraspinal infusion for at least the first 24 hours; assess every 1 to 2 hours until stable, then every 4 hours. Include the following assessment parameters:
  » Pain rating using a validated, appropriate pain scale based on the patient’s age and condition (eg, 0-10), both at rest and with activity.
  » Blood pressure, pulse, respiratory rate, temperature.
  » Level of sedation if opioid is being administered.
  » Number of bolus doses, if used (eg, patient-controlled epidural analgesia).
» Presence of any side/adverse effects such as pruritus, nausea, urinary retention, orthostatic hypotension, motor block, ringing in the ears.
» Signs of catheter insertion site infection or epidural abscess, such as back pain, tenderness, erythema, swelling, drainage, fever, malaise, neck stiffness, progressive numbness, or motor block.
» Dressing for intactness and absence of moisture/leakage.
» Catheter and administration set connections.
» Changes in sensory or motor function that may indicate an epidural hematoma, including unexplained back pain, leg pain, bowel or bladder dysfunction, and motor block.
» History of analgesic use and correct administration parameters of electronic infusion pump.
» Oxygen saturation levels via pulse oximeter and end-tidal carbon dioxide levels (capnography) in accordance with organizational policy; use of capnography is more sensitive in identifying respiratory depression than oxygen saturation monitoring.
  - Identify catheter tip dislodgement by routinely assessing for changes in external catheter length; clinical evidence of catheter tip dislodgement may include decrease in pain control (eg, intrathecal placement dislodges to epidural space) or an increase in side effects (eg, epidural placement dislodges to intrathecal space).

**Patient Education**
  - Teach patient and caregiver:
    » Principles of intraspinal access device placement and what to expect during the insertion procedure.
    » The importance of reporting alcohol use and all medications used, including prescription, OTC, and complementary medications.
    » Signs and symptoms to report, including changes in pain perception, new or worsening side effects, and fever.
    » Clinical signs of overdose including dizziness, sedation, euphoria, anxiety, seizures, and respiratory depression.
    » Patients with implanted infusion pump systems: no bending/twisting at the waist for 6 weeks and overall caution with active repetitive bending or twisting of spine as these may increase the risk for catheter damage or dislodgement; increased pain and withdrawal symptoms may be indicative of problems.
Procedures

Site Care and Dressing Change for Long-Term External Intraspinal Catheter

1. Perform hand hygiene before direct contact with the patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review the provider’s order for site care and dressing change.
4. Obtain informed consent according to organizational policy or patient assent.
5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
6. Prepare for procedure, collect necessary supplies, and set up sterile field. Place supplies on sterile field.
   - Supplies
     - Clean gloves
     - Dressing kit (preferred) or components (sterile barrier, sterile gloves, mask, povidone-iodine, gauze, TSM dressing, sterile tape, sterile tape measure)
     - Antimicrobial dressing based on organizational policy
7. Place patient in comfortable position.
8. Perform hand hygiene.
9. Don mask and clean gloves, and carefully remove existing dressing and discard.
10. Remove gloves.
11. Perform hand hygiene.
12. Don sterile gloves.
13. Observe insertion site for redness, drainage, swelling, or pain.
14. Measure external catheter length with sterile tape measure.
15. Cleanse the skin with povidone-iodine and allow to air dry completely.
16. Place antimicrobial dressing around the insertion site if used.
17. Place TSM dressing over entire area, centering it over the catheter insertion site, anchoring catheter with extra tape on skin as needed.
18. Remove gloves and mask and discard all used supplies properly.
19. Complete label indicating date, time, and initials of clinician providing site care and dressing change.

20. Perform hand hygiene.

**Documentation**
- Document in the patient’s health record:
  - External length of catheter, site assessment
  - Dressing and stabilization method used (date and initial on dressing)
  - Patient’s response to the procedure
  - Patient education

**Medication Administration via External Intraspinal Catheter**

1. Perform hand hygiene before direct contact with the patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).

2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).

3. Obtain and review the provider’s order for medication administration via an external intraspinal catheter and appropriateness of prescribed infusion solution or medication, subcutaneous administration, dose, rate of administration.

4. Obtain informed consent according to organizational policy or patient assent.

5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.

6. Prepare for subcutaneous access, collect necessary supplies, and set up work area.

- Supplies
  - Gloves
  - Mask
  - Povidone-iodine
  - Sterile gauze
  - Prescribed preservative-free medication in syringe or solution container attached to primed administration set
  - Sterile 3- to 5-mL syringe (used only to assess for aspiration of cerebrospinal fluid [CSF] or blood)
  - Preservative-free 0.9% sodium chloride, 10-mL prefilled syringe, for intermittent infusion only
7. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.
8. Assess vital signs and neurological status, then explain procedure.
9. Place patient in comfortable position.
11. Don mask and gloves.
12. Disinfect catheter hub or needleless connector using povidone-iodine solution and allow solution to dry.
13. Attach empty syringe to catheter hub/needleless connector and gently aspirate from the device prior to the injection of medication.
   A. Epidural: observe for the absence of CSF or blood. If > 0.5 mL of clear fluid or blood is obtained, do not inject medication. Notify provider.
   B. Intrathecal: observe for the presence of CSF. If blood is present, do not inject medication. Notify provider.
14. For a continuous infusion, attach primed administration set and begin infusion via electronic infusion pump as ordered.
15. For an intermittent dose, slowly administer the medication in accordance with the pharmacy label. Flush the catheter with 1 to 2 mL of preservative-free 0.9% sodium chloride to ensure medication has reached epidural or intrathecal space.
16. Discard used supplies.
17. Remove gloves and mask, and discard.
18. Perform hand hygiene.

Documentation
- Document in the patient’s health record:
  » Medication, amount and type of diluent, infusion rate, and method
  » Patient’s response to the procedure
  » Patient education

Implanted Epidural/Intrathecal Port Access and Medication Administration
1. Perform hand hygiene before direct contact with the patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review the provider’s order for port access and medication administration via an implanted epidural/intrathecal device and appropriateness of prescribed infusion solution or medication, subcutaneous administration, dose, rate of administration.

4. Obtain informed consent according to organizational policy or patient assent.

5. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.

6. Prepare for subcutaneous access, collect necessary supplies, and set up sterile field. Place sterile supplies on field.
   - **Supplies**
     - Noncoring safety needle size 22-gauge or smaller (needle length dependent on port depth, usually three-fourths to 1 inch) with attached extension tubing
     - Sterile 10-mL syringe
     - Needleless connector (intermittent infusion)
     - Dressing kit (preferred) or components (sterile barrier, sterile gloves, mask, povidone-iodine, sterile gauze, TSM dressing, sterile tape)

7. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.

8. Assess vital signs and neurological status, then explain the procedure.

9. Place patient in a comfortable position with head turned away from implanted port.

10. Assess skin over and around implanted port; palpate port to locate septum.

11. Perform hand hygiene.

12. Don mask and sterile gloves.

13. Disinfect implanted port access site using povidone-iodine and allow to air dry completely.

14. Attach needleless connector (if port accessed for intermittent infusions) to noncoring safety needle with extension set and prime set with preservative-free 0.9% sodium chloride.

15. With nondominant hand, palpate and stabilize implanted port.

16. Insert noncoring needle perpendicular to the skin, through septum of the port until the needle tip comes in contact with the back of the port.

17. Attach syringe to catheter hub/needleless connector and gently aspirate from the device prior to the injection of medication:
A. Epidural: observe for the absence of CSF or blood. If > 0.5 mL of clear fluid or blood is obtained, do not inject medication. Notify provider.

B. Intrathecal: observe for the presence of CSF. If blood is present, do not inject medication. Notify provider.

18. Stabilize noncoring needle with sterile tape; place sterile gauze to support wings of noncoring needle if needed, making sure gauze does not obscure needle insertion site.

19. Apply TSM dressing.

20. For a continuous infusion, attach primed administration set and begin infusion via electronic infusion pump as ordered.
   A. Primed administration set can be attached directly to the hub of the noncoring needle extension set.

21. For an intermittent dose, slowly administer the medication in accordance with the pharmacy label. Flush the port with up to 3 mL of preservative-free 0.9% sodium chloride to ensure medication has reached epidural or intrathecal space.

22. Discard used supplies.

23. Remove gloves and mask and discard.

24. Perform hand hygiene.

**Documentation**

- Document in the patient’s health record:
  » Date and time of insertion, access procedure
  » Patient’s response to the procedure
  » Patient education

**Removal of Intraspinal Access Devices**

1. Only clinicians with specialized training may remove intrathecal or epidural catheters; consult organizational policy and procedure.

2. Implanted ports and ventricular reservoirs are considered permanent devices and are not intended to be removed.
Intraosseous Access Device: Placement, Care, and Management

Policy

Insertion, care and management, and complication management for intraosseous (IO) access are established in organizational policies, procedures, and/or practice guidelines.

The clinician evaluates the patient and anticipates appropriate use of the IO route in the event of difficult vascular access for emergent, urgent, and medically necessary situations.

Promptly remove the IO device within 24 hours, when therapy is complete, or if signs of dysfunction occur. Dwell time for specific devices may be extended (not to exceed 48 hours total) in instances where alternative vascular access is not successfully established. Follow manufacturers’ directions for use and removal of IO device to reduce risk of complications.

Key Points

- The older adult’s venous status can be compromised from fragile veins, intravascular depletion, and previous infusion history. Rapid absorption of fluids by IO infusion into the central circulation is equivalent or better than that resulting from peripheral venous access. In a nonemergent event a careful assessment of the older adult is essential in order to detect any underlying comorbidities, such as osteoporosis. IO access may not be an option for the older adult with osteoporosis, which could lead to increased risk of fractures.

- Indications and Contraindications for Use
  - Anticipate use of the IO route in the event of cardiac arrest if IV access is not available or cannot be obtained quickly.
  - Consider the IO route for emergent and nonemergent use in patients with limited or no vascular access; when the patient may be at risk of increased morbidity or mortality if access is not obtained, such as during shock, life-threatening or status epilepticus, extensive burns, major traumatic injuries, transfusion, or severe dehydration; and/or when delay of care is compromised without rapid vascular access.
IO infusion has been successfully used in:
- Administration of anesthesia
- Rapid sequence intubation
- Hypertonic saline administration in acute intracranial hypertension
- Radiologic imaging with radiologic confirmation of placement prior to contrast administration

Restrict IO access in the following sites/situations:
- Absolute contraindications (related to anatomic issues): compartment syndrome in target extremity, previously used IO site or recent failed IO attempt, fractures at or above the site, previous orthopedic surgery/hardware, presence of infection or severe burns near the insertion site, and local vascular compromise.
- Avoid use of IO access in the presence of bone diseases such as osteogenesis imperfecta, osteopetrosis, and osteoporosis.

Site Selection
- Select an appropriate IO site based on the clinical situation and in accordance with manufacturers’ directions for use.
  - Consider sites most commonly used, including the proximal and distal tibia and the proximal humerus, and the sternum in adults.
  - Sites less commonly used include the medial surface of the ankle, radius, ulna, pelvis, and clavicle.
  - Ensure proper landmarks are identified prior to insertion, when clinically possible, to avoid complications related to improper placement.
  - When using a drill or driver to place the IO device, a 25-mm needle is recommended for obese patients who have a nonpalpable tibial tuberosity and body mass index (BMI) ≤ to 43; a 45-mm needle is recommended in patients with a BMI > 43 and for humeral head insertion in the obese patient.

Analgesia and Pain Management
- Consider the use of subcutaneous lidocaine as a local anesthetic prior to insertion at the intended site. For infusion-related pain, consider IO administration of 2% preservative-free and epinephrine-free lidocaine given slowly prior to infusion initiation.

Infection Prevention and Securement
- Adhere to ANTT during IO placement and infusion; consider the complexity of placement of the IO access device; use Standard-
ANTT if there is no need to touch Key-Parts directly; for more complex insertion techniques and/or need to touch Key-Parts, use Surgical-ANTT, including use of sterile gloves when placing IO devices.

» Perform skin antisepsis using an appropriate solution (eg, alcohol-based chlorhexidine, povidone-iodine, 70% alcohol) based on organizational policies and procedures.

» Apply a sterile dressing over the IO access site and secure the device.

» Ensure that securement is intact prior to transport to prevent dislodgement.

- Complications
  » The most common reported complication is infiltration/extravasation from dislodgement and compartment syndrome. The risk for infiltration/extravasation is reduced by:
    - Avoiding multiple attempts at IO access at the same site
    - Ensuring proper needle placement
    - Securing IO device
    - Rechecking IO placement with transport or repositioning of the patient and before infusing highly irritating solutions/known vesicants and large volume infusions
    - Ongoing and frequent assessment of the IO site and extremity

Assessment

- Monitor appearance of IO site, IO needle placement and securement, and intactness of dressing.

- Identify signs of complications such as:
  » Improper access device placement or dislodgement, which increases the risk of infiltration/extravasation
  » Inflammation at site

Patient Education

- Teach patient and caregiver:
  » Rationale for IO access and what to expect.
  » Risks, benefits, common complications, and how/whom to report.
Procedure

1. Perform hand hygiene before direct contact with the patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).

2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).

3. Obtain and review the provider’s order for IO access and appropriateness of prescribed infusion solution or medication for the patient’s age and condition, IO administration, dose, rate of administration.
   A. Standard protocols may apply for emergent situations (eg, clinician teams that respond to codes or rapid response situations).

4. Obtain informed consent according to organizational policy or patient assent as appropriate based on level of consciousness and/or availability of a surrogate in an emergent situation.

5. Assess for history of allergies to analgesics, adhesives, or antiseptic solutions.

6. Gather supplies.
   - Personal protective equipment
   - Gloves
   - IO access device
   - IO insertion kit
   - Antiseptic solutions (alcoholic chlorhexidine preferred)
   - TSM dressing
   - Lidocaine, if ordered
   - Administration set
   - Electronic infusion pump

7. Perform hand hygiene.

8. Don gloves.

9. Identify the most appropriate site based on the clinical situation and the manufacturers’ directions for the specific device, since each device has approval for specific sites.

10. Prepare insertion site:
    A. If visibly soiled, cleanse with antiseptic soap and water.
    B. Remove excess hair, if necessary, by clipping.
11. Administer local anesthesia if patient is conscious and according to organizational protocol or provider order.
   A. Subcutaneously at the insertion site (refer to Chapter 3, *Pain Management for Venipuncture and Vascular Access Procedures*).
   B. May also inject into the IO space after access is established and before infusion.

12. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, *Vascular Access Site Preparation and Skin Antisepsis*).
   A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.
   B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

13. Stabilize extremity.

14. Insert IO device in accordance with manufacturers’ directions for use.

15. Confirm proper placement of the IO device.
   A. Assess needle position.
   B. Sense loss of resistance on bone penetration.
   C. Note absence of any signs of infiltration with flushing with 5 to 10 mL of 0.9% preservative-free sodium chloride that should enter by free flow or infuse without resistance.
   D. Ability to aspirate blood or bone marrow may be difficult in some patients (eg, dehydration); inability to aspirate is not an indication of improper placement with confirmation of the above factors.

16. Attach administration set and infuse solutions or medication via gravity or electronic infusion pump.

17. Apply a TSM dressing. Label with the date and time of insertion and name of the clinician inserting the IO device.

18. Stabilize the IO needle to prevent dislodgement. Dressings and tape or specially designed devices may be used.

19. Discard used supplies in the appropriate receptacles.

20. Remove gloves and perform hand hygiene.

21. After access device removal, inspect site and change dressing until site has epithelialized and drainage has ceased.
Documentation

- Document in the patient’s health record:
  » Patient assessment data
  » IO site and site preparation
  » Number/location of attempts
  » Patency
  » Medications/solutions administered
  » Anesthetic, if used
  » Patient’s condition and response to interventions
  » Patient education
Blood Sampling from a Vascular Access Device

Policy

Patient identification and proper labeling of all blood sample containers are performed at the time of sample collection and in the presence of the patient.

Blood conservation techniques are employed for blood sampling to reduce the risk of hospital-acquired anemia.

Collaboration among managers, clinicians, and providers from all departments is necessary to decrease overuse of blood sampling and reduce preanalytical errors.

Key Points

- Laboratory assays are necessary to ascertain disease progress and management strategies. Consideration should be given to careful and creative integration of parenteral medication and infusate administration schedules in order to minimize venipuncture procedures. Careful venipuncture site selection for laboratory assay procedures will also preserve venous access while minimizing vein trauma.

- In the older adult, decreases in tissue turgor, changes in nerve conduction contributing to hypersensitive or delayed response to pain, and delayed wound healing will contribute to changes in skin integrity, bruising and hematoma development, skin tearing, and infectious processes. Changes in physiologic coagulation functions or as a result of medication protocols will impact bruising and hematoma potential. Older adults may not comprehend education processes necessary to maintain hemostasis post-sampling procedures.

- To reduce hospital-acquired anemia, use blood conservation strategies that include eliminating unnecessary laboratory tests; reducing the frequency of obtaining blood samples; drawing blood samples based on clinical need rather than a routine schedule; using small-volume collection tubes, (eg, requiring < 2 mL of blood); using point-of-care testing methods; and using closed loop systems for VADs, as these systems return the blood to the patient; and using the push-pull or mixing method.
- Tourniquets or blood pressure cuffs may be used to promote venous dilation; however, the total time should be no more than 1 minute to reduce hemolysis and inaccurate chemistry laboratory values.

- **Error Prevention:**
  - Use 2 different unique identifiers to confirm patient identification before obtaining the sample.
  - Label all evacuated collection tubes, one at a time, in the presence of the patient and ensure all information is visible.
  - Use the correct evacuated collection tube for the specific test required. Evacuated collection tubes contain different additives as indicated by the colored closure top and labeling and are based on international standards. Do not remove the closure from the tube.
  - Obtain blood samples using the correct sequence according to the evacuated tube manufacturers’ directions for use (eg, color of the closure) to prevent carryover of additives between collection tubes.
  - Prevent erythrocyte damage and hemolysis by gentle inversion of the collection tube according to the manufacturers’ directions for use. Avoid vigorous shaking to mix the tube contents.
  - Fill evacuated collection tubes with at least 90% of the total volume or the manufacturers’ stated volume as underfilling can cause inaccurate values due to the incorrect ratio between blood and additives.
  - Prevent venous stasis and other causes of spurious laboratory data by avoiding repetitive fist clenching or hand pumping, limiting tourniquet time to less than 1 minute, and removing tourniquet as soon as blood begins to flow into evacuated tube.

- Place all blood samples in a closed, leakproof container and dispatch to the laboratory immediately using an appropriate delivery method. Maintain ambient temperature between 15° C and 25° C. Maintain the closure-up position for samples containers.

- **Infection Prevention:**
  - Perform hand hygiene before the procedure and appropriate use of gloves.
  - Adhere to ANTT.
  - Use single-patient tourniquets.
  - Use venipuncture and sampling devices according to manufacturers’ directions for use including activation of safety-engineered devices.
  - Use a needleless transfer device to transfer blood from syringe to the evaluated tube.
Use appropriate skin antisepsis agents and application technique. Do not repalpate site after cleansing.

- **Safety:**
  - Discard the needle and tube holder as 1 unit; do not attempt to recap the needle or separate the double-end needle from the holder.

- **Blood Sampling from a VAD:**
  - Analyze risks vs benefits before deciding to use a VAD for obtaining blood samples.
    - Risks of venipuncture include pain, damage to skin and nearby nerves, and hematoma in patients receiving anticoagulants or with bleeding disorders, as well as psychological stress, anxiety, and dissatisfaction with care.
    - Risks associated with sampling from peripheral intravenous catheters (PIVCs) include hemolysis of the sample, contamination of the sample from infusing solutions and medications, local complications from excessive catheter movement (eg, phlebitis, infiltration), and dislodgement from the insertion site.
    - Risks associated with sampling from a CVAD include increased hub manipulation and the potential for intraluminal contamination, alterations in VAD patency, and erroneous laboratory values associated with adsorption of medications infused through the VAD.

  - **PIVC**
    - Do not obtain blood cultures from short PIVCs at the time of insertion or during the dwell.
    - Note that higher hemolysis rates are associated with blood sampling from short PIVCs. However, using a specially designed small tube device advanced through an existing short PIVC is associated with decreased hemolysis rates.
    - Indwelling short PIVCs may be used for short duration blood sampling. Longer-term therapies and very frequent blood sampling may require placement of a CVAD.

  - **CVAD**
    - Do not obtain blood samples for culture from a CVAD unless intended for diagnosis of a catheter-related bloodstream infection (CR-BSI). Do not discard the initial sample drawn to capture planktonic organisms from the intraluminal biofilm.
    - Do not routinely use CVADs infusing parenteral nutrition (PN) for blood sampling as manipulation may increase the risk for catheter-associated bloodstream infection (CABSI).
- Draw the blood sample from a dedicated lumen not used for administration of the drug being monitored, if possible.
- Methods used to obtain blood samples from a CVAD include the discard method and the push-pull or mixing method. The discard method is most commonly used. The advantage to the push-pull method is reduction in blood loss, because there is no discarded blood.
- Do not reinfuse the discard specimen into the VAD after obtaining the sample due to risk of contamination and blood clot formation.
- The use of vacuum tubes/holders may not be recommended for use on smaller CVADs (eg, 1.9 Fr and 2.6 Fr peripherally inserted central catheters [PICCs]).

Assessment
- Evaluate risks vs benefits for blood sampling from a VAD:
  » Risks of venipuncture include anxiety, pain, damage to skin and nearby nerves, and hematoma in patients receiving anticoagulants or with bleeding disorders.
  » Risks associated with use of a VAD include increased hub manipulation and the potential for intraluminal contamination, alterations in VAD patency, and erroneous lab values associated with adsorption of medications infused through the VAD.
- Assess the patient for fasting prior to collection of blood samples, if appropriate for the requested laboratory values.

Patient Education
- Teach patient and caregiver:
  » Purpose and process of blood sampling
  » To avoid any exercise for 24 hours before blood sampling.

Procedures

Blood Sampling from a PIVC
1. Perform hand hygiene before direct contact with the patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review the provider’s order for laboratory tests.
4. Obtain informed consent according to organizational policy or patient assent.

5. Identify the laboratory tests needed, choose the correct vacuum tubes, and identify correct order for obtaining the laboratory tests, as recommended by the manufacturers’ directions for use or laboratory guidelines.

6. Gather supplies.
   - Supplies
     - Gloves
     - Disinfectant pads
     - Sterile end cap
     - For syringe method:
       - 2 syringes, 3- to 5-mL fill volume as needed for the volume of blood to be aspirated
       - Needleless transfer device
     - For vacuum tube method:
       - Vacuum tube holder with luer-lock mechanism
       - Vacuum tubes, as appropriate, for the ordered laboratory tests
       - 10 mL of preservative-free 0.9% sodium chloride

7. Place patient in sitting or recumbent position, as appropriate.

8. Perform hand hygiene.


10. Assess peripheral catheter site for signs and symptoms of complications (eg, redness, edema, pain), and do not use for blood sampling if present.

11. Stop all infusions through the catheter, close the clamp on the extension set, and wait for 2 minutes.

12. **For syringe method:**
   - A. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry; then attach an empty syringe to the needleless connector.
   - B. Detach the administration set from the extension set on the PIVC if a separate injection site is not available. Cover the male luer end of the administration set with a sterile end-cap. Do not allow the male luer end to touch any other object to prevent contamination.
   - C. Attach an empty syringe to the needleless connector or extension set hub and open the clamp on the extension set.
D. Aspirate 1 to 2 mL of blood, detach syringe, and discard.
E. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry.
F. Attach an empty syringe and aspirate the needed blood volume. Use slow, gentle technique to withdraw syringe plunger rod. The flow of blood is improved with a small syringe (eg, 3 mL) over a large syringe (eg, 10 mL).
G. If unsuccessful, place a tourniquet on the arm several inches above the catheter site and attempt withdrawal again.
H. Detach filled syringe.
I. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry.
J. Flush the catheter and extension set with 10 mL of preservative-free 0.9% sodium chloride; reattach the administration set and regulate fluid flow rate, resuming infusion as ordered.
K. Using a needleless transfer device, fill the appropriate vacuum tubes with the designated volume of blood in the correct sequence.

13. **For vacuum tube method:**
   A. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry.
   B. If a separate injection site is not available, detach the administration set from the extension set on the peripheral catheter. Cover the male luer end of the administration set with a sterile end-cap. Do not allow the male luer end to touch any other object to prevent contamination.
   C. Attach the luer vacuum tube holder to the needleless connection or extension set hub and open the clamp on the extension set.
   D. Insert a vacuum tube into the holder, aspirate 1 to 2 mL of blood, and discard.
   E. Insert the vacuum tubes into the holder in the correct sequence and allow each tube to fill to the needed volume.
   F. If unsuccessful, place a tourniquet on the arm several inches above the catheter site and attempt withdrawal again.
   G. Detach the holder after all tubes are filled and discard in sharps container.
   H. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry.
I. Flush the catheter and extension set with 10 mL of preservative-free 0.9% sodium chloride; reattach the administration set and regulate fluid flow rate, resuming infusion as ordered.

14. Label blood samples before leaving the patient’s side with:
   A. Patient’s name
   B. Patient’s identification number
   C. Date and time of specimen collection

15. Remove gloves and perform hand hygiene.

16. Send samples to testing laboratory or place blood specimen in sealed container for transport to a designated testing laboratory. Specimens may need to be placed on ice during transport; check with laboratory used by the organization.

**Blood Sampling from a CVAD**

1. Perform hand hygiene before direct contact with the patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).

2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).

3. Obtain and review the provider’s order for laboratory tests.

4. Obtain informed consent according to organizational policy or patient assent.

5. Identify the laboratory tests needed, choose the correct vacuum tubes, and identify correct order for obtaining the laboratory tests, as recommended by the manufacturers’ directions for use or laboratory guidelines.

6. Gather supplies.
   - Supplies
     » Gloves
     » Disinfectant pads
     » Sterile end cap
     » For syringe method:
       ‒ 2 syringes, 3- to 5-mL fill volume as needed for the volume of blood to be aspirated
       ‒ Needleless transfer device
     » For vacuum tube method:
       ‒ Vacuum tube holder with a luer-lock mechanism
» Vacuum tubes as appropriate for the ordered laboratory tests
» Needleless connector
» 10 mL of preservative-free 0.9% sodium chloride

7. Place patient in sitting or recumbent position, as appropriate.
8. Perform hand hygiene.
10. Remove needleless connector and replace with new connector, if withdrawing blood for blood culture to decrease the risk of false-positive culture results.
11. Stop all infusions through the catheter, clamping lumens and/or stopping infusions as appropriate. Withdraw blood from most distal lumen, if drawing from staggered multilumen CVAD or use the lumen recommended by the manufacturer.
12. **For syringe method:**
   A. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry; then attach an empty syringe to the needleless connector.
   B. Detach the administration set from the CVAD hub if administering a continuous infusion and attach an empty syringe. Cover the male luer end of the administration set with a sterile end-cap. Do not allow the male luer end to touch any other object to prevent contamination.
   C. Open CVAD clamp, if present, and aspirate 4 to 5 mL of blood into syringe, and discard into sharps container.
   D. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry.
   E. Attach an empty syringe and aspirate the needed blood volume. Use slow, gentle technique to withdraw blood. The flow of blood is improved with a small syringe (eg, 3 mL) over a large syringe (eg, 10 mL).
   F. Detach filled syringe.
   G. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry.
   H. Flush the CVAD with 10 mL of preservative-free 0.9% sodium chloride, and lock CVAD or reattach the administration set, and resume infusion as ordered.
   I. Using a needleless transfer device, fill the appropriate vacuum tubes with the designated volume of blood in the correct sequence.
13. **For vacuum tube method:**
   A. Disinfect the needleless connector by scrubbing with a new disinfectant pad and allowing to dry; then attach the vacuum tube holder to needleless connector.
   B. Insert a vacuum tube into the holder, aspirate 4 to 5 mL of blood, and discard this tube of blood into sharps container.
   C. Insert the vacuum tubes into the holder in the correct sequence and allow each tube to fill to the needed volume.
   D. After all tubes are filled and withdrawn from the holder, detach the holder and discard into sharps container.
   E. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry.
   F. Flush CVAD with 10 mL of preservative-free 0.9% sodium chloride, and lock CVAD or resume infusion as ordered.

14. **For push-pull or mixing method:**
   A. Disinfect the needleless connector by scrubbing with a new disinfectant pad and allowing to dry.
   B. Attach 10 mL of preservative-free 0.9% sodium chloride to needleless connector and flush CVAD.
   C. Without removing syringe, aspirate 6 mL of blood, then reinject blood into CVAD.
   D. Repeat this process. There is no consensus on the required number of push-pull cycles or the volume of blood to be pulled; however, 3 to 5 cycles are common.
   E. Remove the empty syringe and attach new syringe/vacuum tube holder to obtain needed blood sample as per procedures above.

15. **Label blood samples before leaving the patient’s side with:**
   A. Patient’s name
   B. Patient’s identification number
   C. Date and time of specimen collection

16. **Remove gloves and perform hand hygiene.**

17. **Send samples to testing laboratory or place blood specimen in sealed container for transport to a designated testing laboratory. Specimens may need to be placed on ice during transport; check with laboratory used by the organization.**
Documentation

- Document in the patient’s health record:
  » Date and time of phlebotomy
  » Route and specific VAD or lumen used for phlebotomy
  » Amount of blood withdrawn and specific laboratory tests
  » VAD flushing and locking
  » Patient response to the procedure
  » Patient education
Therapeutic Phlebotomy

Policy
Selection of the most appropriate type of VAD for therapeutic phlebotomy occurs in collaboration with the patient/caregiver and the health care team based on the projected treatment plan.

Interventions to reduce the risk for side effects and/or adverse reactions associated with therapeutic phlebotomy are implemented.

All medical waste, including the blood from the therapeutic phlebotomy, is disposed of in accordance with organizational policies, procedures, and/or practice guidelines.

A provider’s order is required for therapeutic phlebotomy, including the specific volume to be removed.

Key Points
- Establish parameters for therapeutic phlebotomy: laboratory values to be assessed specific to the patient’s diagnosis, parameters for laboratory values guiding the indication for phlebotomy, frequency of phlebotomy, type of VAD, and specific volume (mL or grams) of blood to be withdrawn.
- Establish acceptable limits or parameters for weight, blood pressure, pulse, temperature, and steps to take when these values are outside of these parameters.
- Prevent, manage, and recognize common side effects such as hypovolemia and nausea/vomiting or rare adverse events:
  » Use a reclining chair or exam table/bed for the procedure.
  » Monitor vital signs before and after the procedure.
  » Encourage oral hydration before and after the procedure.
  » Ask about fear of needles or blood.
  » Administer parenteral solution replacement if prescribed.
- Select the most appropriate VAD based on patient condition, anticipated duration of treatment, and other infusion therapies:
  » Short PIVC using a 16- to 20-gauge device and inserted before phlebotomy and removed upon completion.
  » CVAD (including implanted vascular access port) if already placed, and therapeutic phlebotomy will not compromise other infusion therapies.
• Blood collection receptacles may include collection bags used for volunteer blood donation or bags specifically designed for therapeutic phlebotomy; syringes may also be used based on the VAD. Do not use vacuum bottles to facilitate blood flow due to risk of air embolism.
  » Scales may be used to determine the amount of blood to be removed by weight rather than volume. One mL of blood weighs 1.06 grams. Consider the weight of the bag and anticoagulant contents, if present.

Assessment
• Review patient’s health record:
  » Assess patient for allergies, current medications, medical diagnosis, and contraindications.
  » Pretreatment signs/symptoms associated with specific disease state
  » Pretreatment laboratory results as ordered (eg, hemoglobin, hematocrit)
  » Patient weight
• Obtain vital signs before procedure:
  » Blood pressure
  » Heart rate
  » Respiratory rate
  » Temperature
• Vascular Access
  » Assess preexisting VAD. Confer with health care team to determine if appropriate for therapeutic phlebotomy.
  » Assess the condition of the skin and previous sites of venipunctures and/or infusion complications (eg, phlebitis, infiltration) and avoid these areas for short PIVC insertion.
  » Discuss arm preference with the patient (refer to Chapter 3, Site Selection).
  » Assess the number and location of peripheral veins that are easily seen and palpated (refer to Chapter 3, Site Selection).

Patient Education
• Teach patient and caregiver:
  » Potential side effects such as a hematoma, dizziness, syncope, headache, nausea/vomiting, and fatigue.
Type and amount of physical activity, for specified time period(s) before and after the procedure.

Encourage oral hydration before and after the procedure.

To remain in a reclining position for several minutes after the procedure then instruct patient to rise slowly.

**Procedure**

1. Perform hand hygiene before direct contact with the patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).

2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).

3. Obtain and review provider’s order for therapeutic phlebotomy procedure. Order must include:
   
   A. Amount of blood to be drawn
   
   B. Frequency of therapeutic phlebotomy procedures

4. Orders may also include:
   
   A. Pre-phlebotomy hematocrit and hemoglobin levels
   
   B. Goal for hematocrit and hemoglobin levels post-phlebotomy
   
   C. Fluid replacement, including type of fluid, rate, route, and amount

5. Obtain informed consent according to organizational policy or patient assent.

6. Disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.

7. Prepare for phlebotomy, collect necessary supplies.
   
   **Supplies**
   
   - Nonsterile gloves
   
   - Tourniquet
   
   - Blood collection bag/container without a permanently attached needle or syringes for manual aspiration
   
   - 16- to 20-gauge peripheral VAD (steel-winged needle or plastic catheter)
   
   - Macrobore administration set, if not already attached to collection bag
   
   - Scale, if applicable
   
   - Antiseptic solution
- Local anesthesia, as indicated
- Gauze
- Tape
- Labels

8. Place patient in a supine position in a reclining chair or exam table/bed for the procedure.

9. Assess the upper extremities for an appropriate venipuncture site. Choose a large vein in the forearm.


11. Perform hand hygiene.

12. Attach phlebotomy collection set to blood collection bag/container if needed. Collection container should remain below the venipuncture site, and the tubing remains straight throughout procedure. Close the clamp on the collection set or use a padded hemostat to clamp.

13. Don nonsterile gloves.

14. Cleanse insertion site using the preferred skin antiseptic agent of alcohol-based chlorhexidine solution according to manufacturers’ directions for use; allow to dry completely (refer to Chapter 3, Vascular Access Site Preparation and Skin Antisepsis).

   A. Use an iodophor (eg, povidone-iodine) or 70% alcohol if chlorhexidine solution is contraindicated.

   B. Use aqueous chlorhexidine if there is a contraindication to alcohol-based chlorhexidine.

15. Apply tourniquet proximal to intended venipuncture site. A blood pressure cuff may be used as a tourniquet; activate and hold at approximately 50 to 75 mm Hg. Stabilize the selected vein below the intended venipuncture site with the nondominant hand.

16. Insert the needle/catheter following the manufacturers’ directions for use. Stabilize with a piece of tape. If the site is in or near the antecubital fossa, remind patient not to bend the arm.

17. Connect phlebotomy administration set to winged needle/catheter.

18. Remove tourniquet as indicated by blood flow rate. For patients with thick, viscous blood (eg, polycythemia vera), blood flow may be facilitated by leaving the tourniquet on during the procedure. Use of a blood pressure cuff will allow for slowing of the blood flow rate by lowering the pressure on the cuff.

20. Monitor volume or weight of collected blood until prescribed quantity is withdrawn, then clamp administration set.

21. Withdraw needle/catheter and apply manual pressure to venipuncture site with gauze pad until the bleeding has stopped. Apply a dressing.

22. Monitor patient’s response and vital signs. Instruct the patient to remain in a reclining position for several minutes, and then to rise slowly.

23. Observe venipuncture site for bleeding.

24. Discard used supplies.

25. Label phlebotomy container.

26. Dispose of collected blood according to organizational policy for biohazardous waste handling/disposal.

**Documentation**

- Document in the patient’s health record:
  - Performance of procedure
  - Total volume or weight of blood withdrawn
  - Vital signs before and after procedure
  - Parenteral solution administered: type, amount, and rate of infusion
  - Dressing applied after VAD removal or VAD locking as appropriate
  - Patient’s response to the procedure
  - Patient education
8. Infusion Therapies

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Medication Verification

Policy

Medications and infusion solutions are identified, compared against the medication order and infusion control device (if applicable), and verified by reviewing the label for the name (brand and generic), dosage and concentration, total volume, beyond-use/expiration date, route of administration, frequency, rate of administration, and any other special instructions.

At least 2 patient identifiers, including patient’s full name are used to ensure accurate patient identification when administering medications.

Key Points

- Perform a medication reconciliation at each care transition and when a new medication(s) is ordered (eg, admission, transfers to different levels of care, discharge to new health care setting). Include verification of discontinued medications to reduce the risk of medication errors, including omissions, duplications, dosing errors, and drug interactions.

- Confirm the “rights” for safe medication administration (eg, right patient, drug, dose, route, time, reason), including expiration dates and patient allergy status.

- Avoid interruptions during all phases of medication administration and educate staff, patients, and families, as there is a significant association between medication errors and interruptions.

- Trace all catheters/administration sets/add-on devices between the patient’s access device and the solution container before connecting or reconnecting any infusion/device, at each care transition to a new setting or service, and as part of the handoff process.

- High Alert Medications
  - Implement safeguards to reduce the risk of medication errors with high-alert medications, such as:
    - Standardize storage, preparation, and administration (eg, standard order sets, standardized drug concentrations and dosing units); improve access to drug information; limit access (eg, stored securely, limited quantities); use supplementary labels and automated alerts.
- Perform an independent double check by 2 clinicians for the organization’s selected high-alert medications that pose the greatest risk of harm (eg, opioids, insulin, heparin, chemotherapy).

- Develop a standard process and educate staff in how to perform the double check. Consider the use of a checklist.

- Monitor compliance with use of independent double checks.

- **Technology**
  
  » Use technology when available to verify medications prior to administration, as 1 of multiple infusion safety strategies. Analyze effectiveness and limitations related to technology through organizational quality improvement (QI) processes.

  » Use barcode scanning or similar technology immediately prior to the administration of medication.

  » Use electronic infusion pumps that include dose error reduction systems ([DERS] ie, smart pumps) with current and relevant drug libraries.

  » Consider implementation of interoperable infusion systems, incorporating medication orders, a drug library, electronic health record (EHR), barcoded medication administration, and reporting to satisfy the rights of medication safety.

  » Encourage use of medication labels consistent in format and content from the electronic infusion pump drug library to the infusion reservoir (eg, bag labels) to the health record documentation.

  » Use approved, standardized nomenclature for communication of medication information.

  » Use a list of error-prone drug names, abbreviations, symbols, and dose designations (eg, sound-alike, look-alike drugs) to implement safeguards to reduce the risk for medication errors, such as using both generic and brand names; including reason for medication on label; and changing the appearance of look-alike names by using approved, bolded, tall man (mixed case) lettering.

**Assessment**

- Perform a cognitive review of all components of the medication assessment, beyond the medication rights (eg, appropriateness of drug, dose, route, compatibility of multiple drugs, monitoring test results, flow-control device settings, correct infusion is activated).
- Use critical reasoning and situational awareness when verifying medication, as well as recognizing limitations of technology if used.
- Monitor compliance with use of independent double checks.
- Ensure standardized, facility-approved resources are readily available at the point of care to guide the safe practice of intravenous (IV) medication administration.

**Patient Education**

- Teach patient and caregiver:
  - To confirm medication rights (right patient, drug, dose, route, time, reason) when self-administering medications.
  - The importance of avoiding interruptions during medication preparation and administration.

**Documentation**

- Document in the patient’s health record:
  - Medication verification performed according to organizational policy
  - Independent double check performed for high-alert medication(s)
  - Patient education
Compounding and Preparation of Parenteral Solutions and Medications

Policy
The organization establishes the process for compounding and preparing parenteral solutions and medications in accordance with laws, rules, and regulations established by regulatory and accrediting bodies in each jurisdiction (eg, countries, states, provinces).

Parenteral solutions and medications are compounded and/or prepared following processes to create a sterile product.

Key Points
- Administer, whenever possible, medications that have been compounded (prepared, mixed, packaged, and labeled) in a pharmacy that complies with compounding standards and regulations.
- Use single-use, commercially prepared, prefilled syringe of appropriate solution to flush and lock vascular access devices (VADs) to reduce the risk of catheter-associated bloodstream infection (CABSI) and save time for syringe preparation (refer to Chapter 5, Maintaining Vascular Access Device Patency: Flushing and Locking).
- Do not use IV solutions in containers intended for infusion, including minibags, as common-source containers (multidose product) to dilute or reconstitute medications.
- Prepare a single-dose medication for an individual patient in accordance with labeling provided by the manufacturer.
  » Prepare medications and assemble needed supplies in a clean area using a General Aseptic Field/Micro Critical Aseptic Fields in accordance with Aseptic Non Touch Technique (ANTT). Refer to Chapter 2, Aseptic Non Touch Technique.
  » Use IV push medications for adults in a ready-to-administer form to minimize the need for manipulation outside the pharmacy sterile compounding area; only dilute when recommended by the manufacturer or in accordance with organizational policies, procedures, or practice guidelines.
  - Do not use prefilled flush syringes for dilution of medications. Differences in gradation markings, an unchangeable label on prefilled syringes, partial loss of the drug dose, and possible
contamination increase the risk of serious medication errors with syringe-to-syringe drug transfer (refer to Chapter 5, *Maintaining Vascular Access Device Patency: Flushing and Locking*).

» Prepare medications immediately prior to administration; if not immediately administered, label all clinician-prepared medications at the location of preparation without any break in the procedure (refer to Chapter 8, *Infusion Medication and Solution Administration*).

» Limit preparation to the pharmacy, whenever possible, when it is necessary to combine more than 1 medication in a single syringe for IV push administration.

» Use a syringe appropriately sized for the medication being injected after confirmation of VAD patency by detecting no resistance and the presence of a blood return during the flushing procedure.
  - Do not withdraw IV push medications from commercially available, cartridge-type syringes into another syringe for administration.
  - Do not transfer the medication to a larger syringe.

» Adhere to safe injection practices when preparing parenteral medications and solutions outside of the pharmacy environment; improper infusion and injection practices have resulted in transmission of bloodborne viruses and other microbial pathogens.

» Adhere to ANTT when preparing medications (refer to Chapter 2, *Aseptic Non Touch Technique*).

» Use medications packaged as single-dose or single-use for only 1 patient.

» Discard a single-dose vial after a single entry.

» Dedicate a multidose vial for a single patient.

» Use a multidose vial for up to a maximum of 28 days of opening or puncture unless there is a specified expiration date labeled by the manufacturer.
  - Label a multidose vial with the beyond-use date (BUD) and store the vial according to the manufacturers’ recommendations. Discard if the vial lacks a BUD, the sterility is compromised or questionable, and after the BUD has been met.

» Disinfect the vial septum before each entry and the neck of a glass ampoule with 70% alcohol prior to vial access or breaking of the ampoule; allow the disinfectant to dry prior to entry.
- Use a blunt fill needle with filter or filter straw to withdraw medication from an ampoule and discard any leftover medication; do not infuse or inject medication through a filter needle.

» Use a new needle and syringe for every injection.

» Never use the same syringe to administer medication to more than 1 patient.

**Procedure**

1. Obtain and review provider’s order for:
   A. Absence of allergy or previous adverse reaction to prescribed medication
   B. Appropriateness of prescribed infusion solution or medication for the patient’s age and condition, VAD, dose, rate, and route of administration

2. Confirm order for medication and check compatibility with diluent (if indicated).

3. Perform hand hygiene.

4. Gather supplies.
   - Medication (vial/ampoule)
   - Appropriate diluent, as needed
   - Gloves
   - Antiseptic solution
   - Syringes
   - Needleless transfer device
   - Filter needle (if withdrawing from glass ampoule)
   - Label

5. Don gloves.

6. **Withdrawing from vial:**
   A. Scrub vial top and injection port of the diluent container and medication vial with antiseptic solution and allow to dry completely.
   B. If medication must be reconstituted, inject appropriate amount of diluent and thoroughly mix medication according to manufacturers’ directions for use. Direct stream of diluent towards wall of vial. Do not shake biologic preparations. Observe liquid and confirm no powder remains and inspect vial for particulate matter and color.
   C. Apply needleless transfer device to vial or use other transfer device in accordance with manufacturers’ directions for use.
D. Attach syringe to needleless transfer device and withdraw medication from vial.

E. If not immediately administered, label medication syringe with patient’s name, medication, dose, date and time prepared, and initials of person preparing medication.

F. Start medication administration immediately after preparation.

7. **Withdrawing from ampoule:**
   
   A. Attach filter needle to syringe.
   
   B. Disinfect the neck of the ampoule and allow to dry completely.
   
   C. Break ampoule with disinfectant pad and withdraw contents.
   
   D. Remove filter needle and replace with an appropriate sterile tip cap for medication administration.
   
   E. If not immediately administered, label medication syringe with patient’s name, medication, dose, date and time prepared, initials of person preparing medication.
   
   F. Start medication administration immediately after preparation.
First Dose Administration

Policy
Whenever possible, the patient should receive the first dose of an infusion medication in a controlled environment with access to emergency medical equipment and medications (eg, hospital, ambulatory infusion center).

Administer the first dose of medications with an appreciable risk of a severe allergic/anaphylactic reaction or other unknown response (eg, antimicrobials, immunoglobulins [Igs]) in nonacute care settings (eg, home, skilled nursing facility) only if conditions for safe administration are evaluated and verified.

Clinicians who administer first doses are certified in basic life support.

Key Points
- Patient safety is a priority when considering a non–acute-care treatment setting for initiation of infusion therapy.
- Anaphylaxis is a rare event with first dose medication administration but is a medical emergency that may result in death due to respiratory failure and cardiovascular collapse.
- Recommended components of an anaphylaxis kit include epinephrine and diphenhydramine; specific orders for dosage and use are to be obtained from the provider.
- The first dose of an infusion medication is considered for administration in a home, skilled nursing facility, or other non–acute-care setting under the following circumstances:
  » Patient has no history of allergy to medications in the same class.
  » Patient is alert, cooperative, and able to respond appropriately.
  » The first dose is administered under clinician supervision with ability to respond to a life-threatening immediate hypersensitivity or anaphylactic reaction; the patient is observed for at least 30 minutes after infusion of the first dose is completed.
  » Recognize that the first exposure may not result in or cause a reaction and that the risk exists with subsequent exposures. Educate the patient/caregiver in signs and symptoms of reactions and actions to take.
Assessment

- Obtain a thorough allergy and drug history; note any cross-sensitivity.
- Identify risk factors for anaphylaxis, including history of severe drug reactions and family history of same, and when administering first dose of an infusion medication.
- Ensure that patient meets criteria for first dose administration as listed above; if not, notify the provider and collaborate to develop an alternative plan of care.
- Vancomycin is associated with a reaction called “red man syndrome.” This anaphylactoid reaction results in the release of histamine and causes signs and symptoms such as an erythematous rash on the face, neck, and upper torso and hypotension. Vancomycin infusion should be administered over at least 1 hour to reduce the risk of this syndrome. Slower infusions and treatment with diphenhydramine may be necessary in some patients.

Patient Education

- Teach patient and caregiver:
  » Signs and symptoms of allergic, anaphylactic/anaphylactoid reactions as these events may occur after multiple doses of the medication (refer to Chapter 6, Allergic Reaction and Anaphylactic/Anaphylactoid Reactions).

Documentation

- Document in the patient’s health record:
  » Assessment and risk factors related to first dose administration
  » Any communication with provider related to first dose administration
  » Orders for drugs for treatment in the event of a potential adverse reaction
  » Signs/symptoms of adverse reaction and interventions including administration of ordered drugs
  » Patient’s response to the first dose administration
  » Patient education
Infusion Medication and Solution Administration

Policy
The prescribed medication/solution including indications, dosing/diluent, acceptable infusion routes/rates, compatibility data, and adverse/side effects, is reviewed for appropriateness prior to administration.

Medications and infusion solutions are identified, compared against the medication order, and verified by reviewing the label for the name (brand and generic); dosage and concentration; BUD; expiration date; sterility state; route, rate, and frequency of administration; and any other special instructions.

Concerns about the appropriateness of orders are addressed with the pharmacist, provider, supervisor, and/or risk management or as defined in organizational policy.

The infusion system is inspected for clarity of the solution and integrity of the system (ie, leakage, secure connections), accurate flow rate, and for expiration date and BUD of the infusate and administration set prior to infusion.

Organization-approved medication resources, including special considerations for IV preparation and administration, are readily available.

Key Points

- Older adults often have compromised cardiac, hepatic, or renal systems which puts them at particular risk for infusion complications. If the condition is not identified and immediately corrected, it can lead to congestive heart failure, shock, and cardiac arrest. The infusion of too much fluid or at too rapid a rate will often precipitate these complications. The older adult may not be able to articulate symptoms due to preexisting conditions such as stroke, intubation, tracheotomy, or dementia and delirium. Frequent monitoring of the older adult and all infusions is essential.

- Unlike pulmonary edema, speed shock may result from the infusion of smaller volumes of medication or solution. Speed shock usually results from the administration of a bolus medication or solution at a rapid rate. The older adult may not be able to articulate symptoms of dizziness, headache, or other symptoms due to rapidity of onset.
The rate of administration of any parenteral medication or solution must be carefully controlled and the older adult closely observed. Early symptoms can progress to tightness in the chest, hypotension, irregular pulse, and anaphylactic shock.

- Recognize physiologic characteristics and effects on drug dosage and volume limitations, pharmacologic actions, interactions, side effects/toxicities, monitoring parameters, and response to infusion therapy when administering solutions and medications to older adults.
- Evaluate and monitor response to and effectiveness of prescribed therapy; documenting patient response, adverse events, and interventions; communicating the results of laboratory tests; and achieving effective delivery of the prescribed therapy.
- Administer solutions and medications prepared and dispensed from the pharmacy or as commercially prepared solutions and medications whenever possible; do not add medications to infusing solution containers (refer to Chapter 8, Compounding and Preparation of Parenteral Solutions and Medications).
- Prepare solutions and medications for administration as close as possible to the time of administration (eg, spiking infusion container, priming administration set).
- Limit the use of add-on devices (eg, extension sets) to only those clinically indicated due to increased risk for contamination from manipulation, increased risk for accidental disconnections and misconnections, delay in medications reaching the bloodstream, and need for additional fluids for flushing the medication from the administration set.

- Infection Prevention
  - Perform disinfection of connection surfaces (ie, needleless connectors, injection ports) before medication administration, flushing, and locking procedures.

- Administering IV Push Medications
  - Administer at the rate recommended by the drug manufacturer and/or in accordance with organization policy, procedures and/or practice guidelines; follow with an appropriate volume of flush solution at the same injection rate to ensure the entire dose has reached the bloodstream.
  - Administer through the injection port closest to the patient in an existing IV infusion to allow the medication to reach the circulatory system as soon as possible.
Infusion Pump Use

» Choose an appropriate flow-control device for infusion, considering factors such as age, acuity, and mobility of the patient; severity of illness; type of therapy; dosing considerations; health care setting; and the potential for side effects or adverse effects of the therapy. Correlate these risk factors to the accuracy of each method of flow control.

» An electronic infusion pump is used for the administration of infusion therapies that require precise flow control and for patient safety.

» Manual flow-control devices, such as flow regulators, and mechanical pumps, such as elastomeric balloon pumps, spring-based pumps, and negative-pressure pumps, may be used for infusions that do not require strict rate control (eg, many antibiotics).

» Smart pumps with DERS are associated with reduced risk for infusion-related medication errors, including error interceptions (eg, wrong rate) and reduced adverse drug events.

Error Prevention With Multiple Infusions

» Labeling
  - When there are different access sites (eg, intraspinal, intraosseous, subcutaneous) or multiple solution containers connected to a VAD, label the administration set with the route and/or medication/solution near the connection to the solution container and near the patient’s access site.
  - Standardize labels using a consistent format for the information.
  - Distinguish the injection site where IV push medications are to be administered by applying a visually prominent label that is different in format from other labels.

» Organizing the infusion administration system
  - Separate IV infusions and minimize tangling of tubings.
  - Align the solution container/bag with the corresponding IV pump/channel.
  - Avoid connecting a continuous IV medication to a central venous pressure (CVP) monitoring port/cardiac output measurement port to reduce the risk for unintended boluses or interrupted infusions when calibrating or measuring CVP/cardiac output.

» Minimizing the amount of “shared infusion volume/space” and ensuring compatibility when 2 or more continuous infusions are connected to a single injection port.
Connect IV infusions as close as possible to the hub of the VAD.
Avoid using 3-way stopcocks to join multiple infusions; rather use an extension set with parallel lumens.

Setting up secondary intermittent IV infusions:
- Use a primary continuous administration set with a back-check valve to prevent retrograde flow of the medication into the primary solution container and connect to a port above the electronic infusion pump.
- When high-risk medications are given through the primary infusion system concurrently with the primary infusion, attach the administration set below the electronic infusion pump controlling the primary fluid flow and use a separate electronic infusion pump to control the rate of the high-risk medication.
- When administering a secondary intermittent medication, check compatibility with the primary solution; this avoids the need to disconnect the secondary administration set or replace the secondary administration set. If compatible, use the secondary administration set and back prime from the primary infusion container.

- If disconnection of a continuous or an intermittent infusion administration set is unavoidable, aseptically attach a new, sterile, compatible covering device to protect male luer ends on administration sets, ensuring correct connection of catheters/administration sets/add-on devices.
- If the secondary administration set is disconnected from the primary set, the secondary administration set is now considered a primary intermittent administration set and is changed every 24 hours.
- Follow manufacturers’ directions for use for the heights of the primary and secondary solution containers and the needed differences between these containers (ie, head height differential). Alterations in flow rate may occur due to differences in the level of solution in each container (eg, bag, glass bottle), the height of the IV pole, and the position of the pump (refer to Chapter 5, Administration Set Management and Chapter 8, Medication Verification).

Setting up multiple infusions 1 at a time; set up each infusion as completely as possible before beginning preparation of the next infusion (ie, label set and pump, spike and hang solution container, connect set to pump and program pump).
• Reduce Risk of Misconnections
  » Trace all catheters/administration sets/add-on devices between the patient and the container before connecting or reconnecting any infusion/device, at each care transition to a new setting or service, and as part of the handoff process.
  » Instruct the patient, caregivers, and unlicensed assistive personnel to ask for assistance whenever there is a real or perceived need to connect or disconnect devices or infusions unless the patient or caregiver is independently administering infusion medications, as in a home care setting.
  » Route tubing having different purposes in different directions (e.g., IV catheters routed toward the head; feeding tubes routed toward the feet)
  » Use ISO-approved connectors for enteral (EnFit) and neuraxial (NRFit) infusions to prevent misconnections among parenteral, enteral, and neuraxial (intraspinal) infusions (refer to Chapter 5, Administration Set Management).

• IV Solution Container Replacement
  » Replace IV solution containers in accordance with organizational policy, procedures, and/or practice guidelines. Frequency of routine replacement of IV solution containers is determined by each organization. Exceptions:
    - Parenteral nutrition (PN) solutions are replaced every 24 hours.
    - Injectable lipid emulsions (ILEs) are replaced every 12 hours with each new container.
    - Propofol infusions are replaced every 6 to 12 hours.

• Filter Use
  » Filter medications according to manufacturers’ instructions.
  » Avoid using a filter with very small drug volumes, as the filter will retain the drug and decrease the amount of medication delivered.
  » Use an air-eliminating filter for patients with a right-to-left shunting heart defect.
  » Consider using a filter for solution and medication filtration in critically ill patients to decrease the risk of system inflammatory response syndrome.

• Hazardous Drugs
  » Identify hazardous infusion medications used in the organization; ensure safe handling and administration (refer to Chapter 2, Hazardous Drugs and Waste and Chapter 8, Antineoplastic Therapy).
» Refer to the National Institute for Occupational Safety and Health (NIOSH) to review lists of antineoplastic, nonantineoplastic, other drug categories, and biologic agents that meet the definition of hazardous drugs. Use the most recent list as this list is updated periodically based on new drug information.

» Identify hazardous drugs used in the health care setting and revise list as needed. Health care organizations in the United States are required to review this list annually and to review new drugs and agents as their use begins. Refer to Chapter 8, Antineoplastic Therapy, for safe handling and disposal instructions.

- **Vesicant Administration**
  
  » Clinicians are well educated in administration of vesicant medications and extravasation prevention (refer to Chapter 6, Infiltration and Extravasation).
  
  » Vesicants are agents capable of causing tissue damage upon escape from the intended vascular pathway into surrounding tissues. Examples include, but are not limited to, calcium preparations; high-concentration dextrose (> 10%); phenytoin; promethazine; sodium bicarbonate; vasopressin; and vasopressors, such as dopamine, epinephrine, and norepinephrine.
  
  » Recognize the differences among vesicant, nonvesicant, and irritant solutions and medications. Each organization should reach a consensus on what medication is considered to be a vesicant and irritant based on their internal formularies.

- **Discontinuing Infusion Medications and Solutions**
  
  » Discontinue infusion medication/solution upon provider order.
  
  » Stop infusion immediately in the event of a severe reaction (eg, anaphylactic reaction, speed shock, circulatory overload); notify code or rapid response team as available and provider immediately.

**Assessment**

- Patency of the VAD, including aspiration of a blood return the color and consistency of whole blood; absence of any resistance when flushing the catheter with 0.9% sodium chloride; absence of any patient complaints of pain or discomfort of any kind; absence of signs and symptoms of all VAD complications
  
  - Integrity of the infusion system, including secure luer-lock connections and correct flow rate for infusing fluids, if present
  
  - Compatibility of the intermittent medication with the solutions and/or medications in the primary continuous infusion, if present
- Medication label or medication resources (eg, computer program or medication book) for appropriate rate of administration, and expiration date
- Physiologic characteristics and effects on drug dosage and volume limitations, pharmacologic actions, interactions, side effects/toxicities, monitoring parameters for older adults
- Signs/symptoms of adverse drug reactions of the prescribed medication or other special precautions (eg, risk for extravasation)
- IV push: signs of a systemic reaction (“speed shock”) as a result of too rapid administration (eg, dizziness, facial and neck flushing, pounding headache, chest tightness, hypotension, irregular pulse)

Patient Education
- Teach patient and caregiver:
  » Reason for medication
  » Side effects/adverse reactions to report and how/whom to report
  » Prepare patients and caregivers for discharge who will need to self-administer infusion by reviewing the teaching plan.

Procedures

Continuous Infusion
1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review provider’s order for:
   A. Appropriateness of prescribed infusion solution or medication for the patient’s age, health status, medical diagnosis, acuity, VAD type and tip location, dose, frequency, and route of administration
   B. Ascertain absence of allergy or previous adverse reaction to prescribed medication/solution.
4. Gather supplies and disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.
- Supplies
  - Antiseptic for disinfection of needleless connector/injection port
  - Prescribed medication/solution
  - Administration set
Flow-control device (manual or electronic infusion pump)
- Prefilled syringes: preservative-free 0.9% sodium chloride flushes

5. Perform hand hygiene.

6. Check medication/solution for expiration or BUD; inspect for leaks, cracks, particulate matter, and clarity of medication/solution.

7. Compare medication/solution label against order for accuracy.
   A. Use available technology for medication verification in accordance with organizational procedures (eg, barcode scanning).

8. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.

   A. Obtain appropriate administration set.
   B. Spike solution container/prime administration set/insert into electronic infusion pump according to manufacturers’ directions for use while maintaining sterility of the spike.
   C. Attach filter or extension set if needed.
   D. Purge all air from the entire administration set.
   E. If used, program the smart pump according to the parameters set in the drug library for the specific infusing solution to reduce risk of infusion errors. Do not override alerts.

10. Confirm VAD patency. Attach 10-mL syringe of 0.9% sodium chloride (or compatible flush solution) and confirm patency by aspiration of blood return and ability to easily flush the VAD, and absence of patient complaints.
   A. Never forcibly flush any VAD with any syringe size. If resistance is met and/or no blood return noted, take further steps (eg, checking for closed clamps or kinked sets, removing dressing, etc) to locate an external cause of the obstruction (refer to Chapter 6, Central Vascular Access Device Occlusion and Central Vascular Access Device Malposition).
   B. Flush 1 to 2 mL then aspirate for a blood return, observing for the color and consistency of whole blood. Flush the remaining volume into the VAD and disconnect syringe.

11. Attach male luer end of administration set directly to catheter hub or alternatively to needleless connector after disinfection.

12. Enter the correct infusion flow rate and other required information (eg, volume to be infused), and start the electronic infusion pump.
13. Observe infusion site and assess patient for any adverse reaction (eg, peripheral IV infiltration, reactions such as rash, urticaria). NOTE: Stop infusion immediately and notify provider of any adverse reaction.

14. Assess patient response and any side effects/adverse reactions initially and during infusion; ensure ongoing plan in place for continued monitoring as appropriate.

15. Discard expended equipment and used supplies appropriately.

16. Perform hand hygiene.

17. Verify infusion rate of continuous IV solutions and VAD site condition and patency based on frequency indicated by the solution/medication and patient factors.

**IV Push**

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).

2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).

3. Obtain and review provider’s order for:
   A. Appropriateness of prescribed infusion solution or medication for the patient’s age, health status, medical diagnosis, acuity, VAD type and tip location, dose, frequency, and route of administration.
   B. Ascertain absence of allergy or previous adverse reaction to prescribed medication.

4. Gather supplies and disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.

- **Supplies**
  - Antiseptic for disinfection of needleless connector/injection port
  - Prescribed medication prepared and labeled in syringe
  - Prefilled syringes: preservative-free 0.9% sodium chloride flushes
  - Prefilled syringe of heparin flush solution, if indicated by provider order or protocol

5. Perform hand hygiene.

6. Check medication for expiration or beyond-use dates; inspect syringe for leaks, cracks, particulate matter, and clarity of medication.

7. Compare medication label against order for accuracy.
   A. Use available technology for medication verification in accordance with organizational procedures (eg, barcode scanning).
8. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.

9. Disinfect needleless connector on VAD hub.
   A. Manual disinfection: use a vigorous scrubbing action for disinfection for a designated length of time. Discard each disinfectant swab pad immediately.
   B. Passive disinfection: when a disinfectant cap has been in place for the required amount of time over a needleless connector or injection port, remove, discard, and proceed with site and VAD assessment through flushing.

10. If administering the IV push medication through an existing continuous IV infusion:
    A. Select an injection port on the administration set that is closest to the patient. Do not disconnect the administration set from the VAD hub.
    B. Based on compatibility information, stop continuous infusion, if necessary.

11. Confirm VAD patency. Attach 10-mL syringe of 0.9% sodium chloride (or compatible flush solution) and confirm patency by aspiration of blood return and ability to easily flush the VAD, and absence of patient complaints.
    A. Never forcibly flush any VAD with any syringe size. If resistance is met and/or no blood return noted, take further steps (eg, checking for closed clamps or kinked sets, removing dressing, etc) to locate an external cause of the obstruction (refer to Chapter 6, Central Vascular Access Device Occlusion and Central Vascular Access Device Malposition).
    B. Flush 1 to 2 mL, then aspirate for a blood return, observing for the color and consistency of whole blood. Flush the remaining volume into the VAD and disconnect syringe.

12. Disinfect needleless connector or injection port of administration set with a new swab pad, and discard. Allow to dry completely.

13. Attach medication syringe and administer medication per rate on label using a syringe appropriately sized for the medication being injected; use a watch or clock with a second hand to time IV push administration. Consult organizational medication resources if rate is not specified.

14. Observe infusion site and assess patient for any adverse reaction (eg, peripheral IV infiltration, reactions such as rash, urticaria). NOTE: Stop infusion immediately and notify provider of any adverse reaction.
15. Detach medication syringe and disinfect needleless connector on VAD hub or injection port of administration set with a new swab pad, and discard.

16. Attach 10-mL syringe of 0.9% sodium chloride (or compatible flush solution) to needleless connector or injection port, flushing at the same rate as the drug was injected until the entire drug dose has been cleared from the infusion system and VAD lumen and to prevent precipitation due to solution/medication incompatibility.

17. For continuous infusion, resume correct flow rate, if stopped. If not stopped, verify that the correct rate is infusing.

18. If no continuous infusion, disinfect the needleless connector on the VAD hub, attach syringe with the appropriate locking solution, and inject into the VAD lumen. Detach and discard the syringe.

19. Assess patient response and any side effects/adverse reactions; ensure ongoing plan in place for continued monitoring as appropriate.

20. Discard expended equipment and used supplies appropriately.


**Intermittent Medication Infusion**

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).

2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).

3. Obtain and review provider’s order for:
   A. Appropriateness of prescribed infusion solution or medication for the patient’s age, health status, medical diagnosis, acuity, VAD type and tip location, dose, frequency, and route of administration
   B. Ascertain absence of allergy or previous adverse reaction to prescribed medication.

4. Gather supplies and disinfect work area (ie, overbed table) with antimicrobial solution; allow to dry completely.

   - **Supplies**
     - Antiseptic for disinfection of needleless connector/injection port
     - Prescribed medication
     - Administration set
     - Prefilled syringes: preservative-free 0.9% sodium chloride flushes
     - Prefilled syringe of heparin flush solution, if ordered
5. Perform hand hygiene.
6. Check medication for expiration or beyond-use date; inspect infusion container for leaks, cracks, particulate matter, and clarity of medication.
7. Compare medication label against order for accuracy.
   A. Use available technology for medication verification, in accordance with organizational procedures (eg, barcode scanning).
8. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.
9. Choose appropriate length of medication administration set.
   A. For piggybacking into a continuous infusion on an electronic infusion pump, determine if the most appropriate injection port is above or below the pumping mechanism.
   B. For piggybacking into a continuous gravity infusion, use a short secondary administration set.
   C. For attaching directly to a VAD hub, choose a regular administration set with enough length to allow for correct height of the solution container.
    A. Open the administration set and close the roller clamp.
    B. Remove the cover from the solution container outlet.
    C. Remove the cover from the spike of the administration set and insert into the solution container without touch contamination.
    D. Hang secondary administration set higher than the primary solution container if infusing by gravity.
    E. Squeeze drip chamber, and prime administration set by purging all air.
11. Disinfect the chosen injection port on the continuous administration set or the needleless connector on the VAD hub with a new swab pad. Allow to dry completely.
12. Confirm VAD patency. Attach 10-mL syringe of 0.9% sodium chloride (or compatible flush solution) and confirm patency by aspiration of blood return and ability to easily flush the VAD, and absence of patient complaints.
    A. Never forcibly flush any VAD with any syringe size. If resistance is met and/or no blood return noted, take further steps (eg, checking for closed clamps or kinked sets, removing dressing) to locate an external cause of the obstruction (refer to Chapter 6, Central Vascular Access Device Occlusion and Central Vascular Access Device Malposition).
B. Flush 1 to 2 mL, then aspirate for a blood return, observing for the color and consistency of whole blood. Flush the remaining volume into the VAD and disconnect syringe.

13. Remove the cap from the male luer end of the chosen administration set and attach to the injection port or needleless connector.

14. Open roller clamp of attached medication administration set and regulate flow according to order/label on medication container.

   A. Calculate drip rate for gravity infusions and regulate by manually counting drops per minute.

   B. Alternative: for manual flow regulators, set rate according to printed numbers on the dial, but double check the accuracy of this setting by counting drops or observing for a specific quantity of fluid infusion in a designated amount of time. Accuracy of these devices is the same as roller clamps.

   C. For an electronic infusion pump with the medication attached above the pumping mechanism, assess if multiple flow rates can be programmed into it. Enter the correct infusion flow rates and volume to be infused for primary and secondary solutions, according to manufacturers’ directions for use.

   D. For an electronic infusion pump with the medication attached below the pumping mechanism, manually regulate the medication flow rate by counting drops.

15. Observe infusion site, and assess patient for any adverse reaction (eg, peripheral IV infiltration, reactions such as rash, urticaria). NOTE: Stop infusion immediately and notify provider of any adverse reaction.

16. When the secondary medication has infused, close clamp of medication administration set.

17. If attached to a continuous infusion, do not detach administration set from the injection port or remove the empty solution container. Allow this set to remain connected and use the back-priming method for administering the next medication dose with the same administration set.

   A. When the subsequent dose of medication is needed, hold the empty medication container below the primary solution container and allow primary solution to backflow through the secondary set to fill with solution and move air into the empty container.

   B. Remove the cover from the new medication container.

   C. Detach the empty container and insert spike into the new container, being careful to prevent touch contamination of the spike.
D. Hang medication container (above the primary container for gravity infusion), open roller clamp, and regulate flow rate as appropriate for gravity or electronic infusion pump.

E. All primary and secondary administration sets should be replaced simultaneously at 96 hours.

18. If attached directly to a needleless connector on the VAD hub without continuous infusion, detach the administration set and place new sterile end-cap over the male luer end if the set will be used again; sets used for this type of intermittent medication administration should be replaced every 24 hours.

A. Disinfect needleless connector or injection port of administration set with a new swab pad and discard. Allow to dry completely.

B. Attach 10-mL syringe of 0.9% sodium chloride (or compatible flush solution) to needleless connector or injection port, flushing at the same rate as the drug was injected until the entire drug dose has been cleared from the infusion system and VAD lumen and to prevent precipitation due to solution/medication incompatibility.

C. Disinfect needleless connector or injection port of administration set with a new swab pad and discard. Allow to dry completely.

D. Attach syringe containing the appropriate locking solution and inject into the VAD lumen.

19. If primary continuous solutions are infusing, ensure that the correct flow rate has resumed.

20. Assess patient response and any side effects/adverse reactions; ensure ongoing plan in place for continued monitoring as appropriate.

21. Discard expended equipment and used supplies appropriately.

22. Perform hand hygiene.

**Documentation**

- Document in the patient’s health record:
  - Medication, amount, and type of diluent
  - Date, time of administration
  - Route, specific VAD or lumen used for administration
  - Patient’s response to the procedure
  - Patient education
Blood Administration

Policy
Administration of blood and blood components, including the use of infusion devices and ancillary equipment, and the identification, evaluation, and reporting of adverse events related to transfusion are established in organizational policies, procedures, and/or practice guidelines.

Verification of the correct patient and blood product is performed in the presence of the patient prior to transfusion.

Blood and blood components are transfused through a transfusion administration set that has a filter designed to retain potentially harmful particles.

Key Points
- This procedure is indicated for the transfusion of human blood and blood components, including whole blood, red blood cells, plasma and plasma components, platelets, granulocytes, and cryoprecipitate.
- The older adult is also at risk for cardiovascular changes in the structure, function, and disease associated with aging. Because of the increased risk for circulatory overload, close monitoring is essential.
- Rapid administration of blood products can result in fluid overload. Red blood cell (RBC) and plasma products and 25% albumin are the components most associated with circulatory overload. At greatest risk are adults older than 70 years, as well as those with existing cardiopulmonary disease.
- Blood and blood components should be transfused only after alternative therapy has been considered. Blood and blood components are transfused in accordance with evidence-based indications to ensure patient safety, optimal patient outcomes, and unnecessary transfusions.
- Choose an appropriate VAD based on patient condition and transfusion needs and ensure adequate and patent vascular access prior to obtaining the unit of blood from the blood bank.
  - Peripheral intravenous catheters (PIVCs):
    - Use 20- to 24-gauge based on vein size and patient preference. Use a large-gauge catheter when rapid transfusion is required (eg, 18- to 20-gauge).
- Transfuse RBCs at a slower rate when using small-gauge catheters; the pressure with rapid transfusion via a small-gauge catheter may cause hemolysis.

» Central vascular access devices (CVADs) are acceptable for blood administration.

- Administer blood or blood components with 0.9% sodium chloride. Do not add or infuse any other solutions or medications through the same administration set with blood or blood components (do not piggyback blood administration sets into other infusion administration sets).

- Filter all blood components and follow the manufacturers’ directions for filter use.
  » Use a filter designed to remove blood clots and harmful particles; standard blood administration sets include a 170- to 260-micron filter.
  » Do not use microaggregate filters routinely; these may be used for reinfusion of blood shed during high blood loss surgical procedures.
  » Leukocyte reduction filtration is generally preferred “prestorage” or shortly after blood collection. Bedside leukocyte reduction is a less efficient method and has been associated with dramatic hypotension in some patients. Use of leukocyte-reduced blood products (RBCs and platelets) decreases the risk of febrile transfusion reactions, risk of human leukocyte antigen (HLA) alloimmunization, and transmission of cytomegalovirus (CMV).
  » Never use leukocyte filtration when transfusing granulocyte or hematopoietic progenitor cells.

- Administer and complete each unit of blood or blood component within 4 hours.
  » Ask the transfusion service to divide a unit of RBCs or whole blood into smaller aliquots when it is anticipated that the unit cannot be transfused within 4 hours (eg, adult patients at risk for fluid overload).
  » Administer platelets over 1 to 2 hours.
  » Administer plasma as quickly as tolerated by the patient or over 15 to 60 minutes.
  » Electronic infusion pumps that have a labeled indication for blood transfusion should be used. Electronic infusion pumps can be used to deliver blood or blood components without significant risk of hemolysis of RBCs or platelet damage. Follow manufacturers’ directions for use.
Manual pressure cuffs can be used to increase RBC flow rate when rapid transfusion is required. Externally applied compression devices should be equipped with a pressure gauge, totally encase the blood bag, and apply uniform pressure against all parts of the blood container. Pressure should not exceed 300 mm Hg. A standard sphygmomanometer is never used for this purpose. For rapid infusion, a large-gauge catheter may be more effective than a pressure device.

- Change the transfusion administration set in conjunction with manufacturers’ directions for use.
  
  » In accordance with the AABB, if the first unit requires 4 hours for transfusion, the administration set and filter is not reused. Transfusion guidelines from other countries recommend changing the administration set every 12 hours.
  
  » Note that most standard filters have a 4-unit maximum capacity; follow manufacturers’ directions for use.

- Monitor for adverse transfusion reactions.
  
  » Check the patient’s vital signs within 30 minutes prior to transfusion, 15 minutes after initiating transfusion, upon completion of the transfusion, 1 hour after the transfusion has been completed, and as needed if warranted by clinical observation of the patient’s condition. Assess the patient for any adverse reactions at least every 30 minutes throughout the transfusion.
  
  » Initiate nonemergent transfusions slowly and remain near the patient; major reactions usually appear before the first 50 mL have been transfused; increase the transfusion rate after 15 minutes when there are no signs of a reaction and to ensure the completion of the unit within 4 hours.
  
  » Stop the transfusion immediately if signs and symptoms of a transfusion reaction are present; notify the provider and transfusion service and administer emergency medications as prescribed.
    
    - Do not administer emergency medications through the blood administration set; prime a new administration set with 0.9% sodium chloride for infusion through the VAD.
  
  » Monitor patients for transfusion reactions for at least 4 to 6 hours to detect febrile or pulmonary reactions associated with the transfusion; for patients not under direct observation after the transfusion, provide patient education about signs and symptoms of a delayed transfusion reaction and importance of reporting.
- Use blood and fluid warmers when warranted by patient history, clinical condition, and prescribed therapy including to:
  » Avoid or treat intraoperative hypothermia.
  » Manage blood loss due to trauma.
  » Manage exposure.
  » Use during plasma exchange for therapeutic apheresis.
  » Manage transfusion for patients known to have clinically significant cold agglutinins.
  » Use during replacement of large blood volumes.

**Assessment**

- Assess benefits vs the risks of transfusion prior to administering human blood and blood components (whole blood, RBCs, plasma and plasma components, platelets, granulocytes, cryoprecipitate).
- Obtain baseline physical assessment prior to obtaining blood for transfusion:
  » Vital signs
  » Breath sounds
  » Identification of conditions that may increase the risk of transfusion-related adverse reactions (eg, current fever, heart failure, renal disease, or risk of fluid volume excess)
- Assess patency of VAD
- Assess current laboratory values, especially hemoglobin and hematocrit levels
- During/after transfusion: monitor for signs/symptoms of immediate transfusion reaction.*
  » Hemolytic (eg, fever, chills, tachycardia, hypotension, dyspnea, red/dark urine)
  » Febrile nonhemolytic (eg, fever rise of 2° F, chills, headache, vomiting)
  » Allergic (eg, itching, urticaria, flushing, runny eyes, angioedema)
  » Anaphylactic/anaphylactoid (refer to Chapter 6, Allergic Reaction and Anaphylactic/Anaphylactoid Reactions)
  » Transfusion-related acute lung injury (eg, fever, chills, dyspnea, cyanosis, hypoxemia, hypotension, bilateral pulmonary edema)
  » Transfusion-associated circulatory overload

*This is not a complete list; education and competency assessment should include all potential transfusion reactions, both immediate and delayed, and actions to take.
Patient Education

- Teach patient and caregiver:
  » Risks, benefits, and treatment alternatives to blood transfusion
  » Allow opportunity to ask questions and the right to accept or refuse the transfusion
  » Allow the opportunity for patients to discuss their religious/cultural beliefs regarding blood transfusion.
  » Include the following in the educational process:
    - Elements of the transfusion procedure (e.g., compatibility testing, vascular access)
    - Signs/symptoms associated with complications of transfusion therapy (e.g., vague uneasy feeling, pain, breathing difficulties, chills/flushing/fever, nausea, dizziness, rash/urticaria, dark/red urine)
  » Rationale for frequent monitoring during transfusion

Preprocedure
1. Obtain and review provider’s order for transfusion.
2. Perform baseline physical assessment, including vital signs.
3. Obtain appropriate vascular access or check patency of existing VAD.
4. Obtain informed consent per organizational policy and/or patient assent.
5. Gather supplies.
   - Gloves
   - Solution container of 0.9% sodium chloride
   - Blood component
   - Blood administration set
   - Antiseptic wipes

Procedure
1. Obtain blood product from the transfusion service.
2. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, Hand Hygiene).
3. Perform patient and blood identification process at time of obtaining blood.
A. Verify recipient’s 2 independent identifiers according to organizational policy (eg, name and date of birth), ABO group, and Rh type, if required; donation identification number; crossmatch test interpretation, if performed; special transfusion requirements; expiration date/time; and date/time of issue.

B. Inspect each blood component prior to transfusion; do not use if container is not intact or if the appearance is not normal (eg, excessive hemolysis, significant color change in blood bag compared to tubing, presence of floccular material, cloudy appearance), and return it to the transfusion service.

4. Perform patient and blood identification process using an independent double check by 2 adults in the presence of the patient.
   A. Verify patient identity using 2 independent patient identifiers according to organizational policy and ask the patient to state his or her name and date of birth, if possible.
   B. Verify the blood component
   C. Review the provider’s order for transfusion
   D. Patient blood-type compatibility with the unit to be transfused
   E. Crossmatch test interpretation, if performed
   F. Donor identification number
   G. Unit expiration date/time
   H. Any product modification, such as irradiation or cytomegalovirus seronegative

5. Prepare to transfuse.
   A. Perform hand hygiene.
   B. Don gloves.
   C. Open blood administration set and close all clamps.
   D. Spike bag of 0.9% sodium chloride with one of the Y-administration set spikes.
   E. Hang on IV pole and prime administration set according to manufacturers’ directions for use.
   F. Attach primed administration set to VAD either directly to catheter hub or to needleless connector after disinfection.
   G. Initiate slow infusion of 0.9% sodium chloride solution.

6. Initiate transfusion.
   A. Spike blood component with the other Y-administration set spike; close clamp to sodium chloride container.
   B. Open clamp and initiate transfusion.
c. Start the transfusion slowly at approximately 2 mL per minute for the first 15 minutes and remain near the patient; if there are no signs of a reaction, increase the transfusion rate and ensure the completion of the unit within 4 hours.

7. Monitor patient.
   A. Check vital signs within 5 to 15 minutes after starting transfusion, after the transfusion, and as needed depending on patient condition.
   B. Compare to baseline vital signs to identify any early signs of a transfusion reaction.
   C. Observe VAD site.

8. Stop the transfusion immediately if any signs and symptoms of a transfusion reaction are present; disconnect the blood administration set from the catheter hub. Start a 0.9% sodium chloride infusion with new primed administration set and infuse at a rate to maintain catheter patency.
   A. Notify the provider and transfusion service, administer emergency medications as prescribed, and obtain prescribed blood sample for additional lab tests as prescribed. Return blood container with remaining blood and set attached to the transfusion service.

9. Complete RBCs within 4 hours; plasma 15 to 60 minutes; platelets 1 to 2 hours.
   A. Close clamp to blood product on completion.
   B. Open clamp to 0.9% sodium chloride to clear the administration set and VAD of blood.
   C. Discard empty blood container and administration set in biohazard container.

10. Continue to monitor patient, as reactions may occur after the completion of the transfusion; instruct patient in signs and symptoms to report.

Documentation
- Document in the patient’s health record:
  » Pretransfusion assessment and vital signs
  » VAD placement, if indicated, and VAD assessment
  » Blood component, blood unit/donor/recipient identification, compatibility, and expiration date
  » Vital signs and assessment during posttransfusion
  » Volume of blood component/0.9% sodium chloride administered
  » Patient’s response to the procedure
  » Patient education
Parenteral Nutrition

Editor’s Note: Revised guidance on filter use for parenteral nutrition (PN) is included in this edition of Policies and Procedures for Infusion Therapy: Older Adult based on a position paper¹ by American Society for Parenteral and Enteral Nutrition (ASPEN) that was published in February 2021, shortly after the 2021 Infusion Therapy Standards of Practice was released in January. ASPEN has also created a 2-page fact sheet that includes best practices for filter use, helpful illustrations, and guidance in troubleshooting high pressure/occlusion alarms and potentially occluded filters.² INS makes every effort to align with the most current recommendations from other specialty organizations like ASPEN so that consistent information is provided and confusion by clinicians is minimized.

Policy

The decision to implement PN occurs in collaboration with the patient and caregiver and the health care team based on the projected treatment plan.

PN is administered using a 1.2-micron filter for all types of solutions.

PN is administered using an electronic infusion pump with anti–free-flow-control and appropriate alarms.

Medications are not added or co-infused with the PN solution before or during infusion without consultation with a pharmacist regarding compatibility and stability.

Key Points

- Older adults are at increased risk of partial or complete loss of independence due to acute and/or chronic disease often associated with protein caloric malnutrition. Nutritional care and support should be a vital part of their management. Enteral nutrition is always the first choice for nutrition support. However, when patients cannot meet their nutritional requirements adequately via the enteral route, PN is indicated.

- PN is safe and effective, and age is not a reason to exclude patients from this treatment. The use of PN should always be balanced against a realistic chance of improvement in the general condition of the patient. Lower glucose tolerance, electrolyte and micronutrient deficiencies and lower fluid tolerance should be assumed in older patients treated by PN. In the terminal, demented, or dying patient,
the use of PN or hydration should only be given in accordance with other palliative treatments.

- Insulin resistance and hyperglycemia together with impairment of cardiac and renal function are the most relevant metabolic features in older adults. Deficiencies in vitamins, trace elements, and minerals should be evaluated when considering nutritional support. Restoration of depleted body cell mass through nutritional support is lower in the older adult. Conversely, oxidation capacity when using a lipid emulsion is not influenced by age.

- There are no specific complications of PN in older adults compared to patients of other ages, but complications tend to be more frequent due to associated comorbidities. Indications for PN are similar in younger and older adults.

- PN is administered as a continuous infusion or as a cyclic infusion. A cyclic infusion lasts a portion of the day, usually overnight (eg, 8-16 hours). Advantages of this infusion method include freedom from the infusion/pump, increased mobility, more physiologic hormonal responses, and prevention/treatment of liver toxicity associated with continuous PN.

- PN solutions are refrigerated and protected from light until shortly before the time of administration to avoid oxidation of vitamins.

- **VAD Selection**
  - Administer PN solutions/emulsions containing final concentrations that result in an osmolarity > 900 mOsm/L via a CVAD.
  - Use phlebitis mitigation techniques when PN is infused through a peripheral vein. All PN solutions are hyperosmolar and, when infused via a peripheral vein, are associated with an increased risk of phlebitis.

- **Filter Use With Administration**
  - Use a 1.2 micron in-line filter for administration of total nutrient admixtures (TNAs), dextrose-amino acid admixtures and ILEs.\(^1\)
  - For TNA, place the filter as close to the catheter hub as possible.
  - For dextrose-amino acid admixtures, below the Y-site where the dextrose-amino acid admixture and the ILE co-infuse.\(^1\)
  - Change all filters used for PN solutions in accordance with manufacturers’ directions for use, which is generally every 24 hours (often an integral part of the administration set). Change all filters used for lipid emulsions every 12 hours. Prime filters immediately before use.
• Administration Sets
  » Replace administration sets for PN solutions (TNA and amino acid/dextrose formulations) with each new PN container, which is typically every 24 hours; replace administration sets used for ILE with each new infusion; hang time for ILE should not exceed 12 hours (refer to Chapter 5, Administration Set Management).
  » Use administration sets free of Di[2-ethylhexyl]phthalate (DEHP) to administer lipid-based solutions, such as ILE or PN solution containing ILE. DEHP is lipophilic and is extracted into the lipid solution with commonly used polyvinyl chloride administration sets and containers. DEHP is considered a toxin, and studies have demonstrated increased DEHP levels in lipid solutions.

• Electronic Infusion Pumps
  » Use electronic infusion pumps with anti–free-flow protection and alarms for occlusion.
  » Consider the use of electronic infusion pumps with DERS (ie, smart pumps), as they are associated with reduced risk for infusion-related medication errors, including error interceptions (eg, wrong rate), and reduced adverse drug events.

• Infection Prevention
  » Reduce the risk of CABSI when administering PN.
    - Avoid blood sampling via the CVAD used for PN.
    - Consider dedication of a single lumen for PN administration when a multilumen CVAD has been placed; this remains an area of needed research.
    - Avoid attaching administration sets until the time of infusion.

Assessment
• Patient assessment includes:
  » Nutritional assessment, metabolic tolerance, and glucose control
  » Signs of nutritional deficiencies (eg, changes in hair, skin, nails, mouth)
  » Anthropometric measurements (height, weight)
  » Signs and symptoms of electrolyte imbalance
  » Signs and symptoms of infection, since catheter-related bloodstream infection is a serious complication associated with PN
  » Physical assessment and functional performance
  » Psychological responses
- Monitoring:
  » Review/monitor all laboratory findings (eg, serum albumin, serum transferrin, prealbumin, glucose, nitrogen balance, hemoglobin/hematocrit, electrolytes, vitamin/trace element levels)
  » Cyclic infusions:
    - Monitor blood glucose on and off PN during initial cycling.
    - Test for rebound hypoglycemia 1 hour after discontinuation and upon any symptoms associated with hypoglycemia (eg, tremors, sweating, anxiety, lethargy).
    - Monitor cardiovascular status due to the risk of fluid overload with an increased rate of PN rate due to fewer hours of infusion.

**Patient Education**

- Teach patient and caregivers:
  » Purpose and expected duration of PN
  » Risks and benefits of PN
  » Physiological, sociological, and psychological effects PN
  » Side effects and adverse reactions to report and how/whom to report

- Preparing patients for discharge with PN, teach patients and caregivers:
  » Purpose and expected duration of PN
  » Proper storage of PN containers in the refrigerator; remove from refrigerator 60 minutes prior to infusion
  » Storage of infusion supplies safe from children and pets
  » Inspection of the PN solution prior to administration for evidence of particulate matter, cloudiness, or solution separation
  » Checking label for accuracy
  » How to safely inject any additives into PN solution; multivitamins must be added to the PN solution just prior to administration
  » Infection prevention, such as hand hygiene and maintaining sterile components of the infusion system
  » Infusion pump management, including IV administration set priming, program resetting, alarms
  » Proper disposal of used infusion supplies
  » Supply inventory
  » Emergency preparedness in the event of power outage
  » Action to take for missed/late administration
» Signs and symptoms of metabolic intolerance (hypo- and hyperglycemia; alterations in electrolytes (eg, potassium, calcium), infection, and CVAD complications

» Teach the need for self-monitoring response to PN, which includes monitoring weight, temperature, blood glucose, output (urine/stool/ostomy/wound), CVAD site.

» Teach about the schedule for ongoing laboratory work studies.

» Provide patients with information about the Oley Foundation (www.oley.org). Founded in 1983, the organization provides support and education for patients/families requiring home enteral and PN nutrition.

Procedure

Refer to content outlined in Chapter 8, *Infusion Medication and Solution Administration*.

Documentation

- Document in the patient’s health record:
  » Specific VAD lumen used
  » VAD patency and presence of blood return
  » PN solution administered, including lipids
  » Pertinent patient assessment
  » Pertinent laboratory results
  » Patient’s response to the procedure
  » Patient education

References


Antineoplastic Therapy

Policy

The organization establishes the process for administering antineoplastic agents in accordance with laws, rules, and regulations established by regulatory and accrediting bodies in each jurisdiction (eg, countries, states, provinces). Verbal orders are acceptable only if antineoplastic agents are to be placed on hold or discontinued.

Antineoplastic agents are prepared and administered with attention to ensuring the safety of patients and health care workers and providing environmental protection.

Clinicians who prepare and administer antineoplastic medications are educated about potential hazards and special handling to reduce the risk of occupational exposure and risk for significant adverse health effects.

Key Points

- Ensure that only qualified clinicians administer antineoplastic therapy based on completion of a specialized education and competency program (refer to Chapter 1, Competency and Competency Assessment).
- Ensure that informed consent was obtained prior to initiation of antineoplastic therapy, which should include a description of risks, benefits, and treatment alternatives; an opportunity to ask questions; and the right to accept or refuse treatment. A variety of approaches may be used to obtain informed consent (refer to Chapter 1, Informed Consent).
- Age is related to a gradual decline in the immune system which is associated with increased morbidity and mortality from infectious diseases, autoimmune diseases, and cancer.
- Antineoplastic therapy for the older adult requires dosing and administration considerations according to the individual’s age, functional status, and comorbidity. Additional considerations would include evaluation of dependency in 1 or more activities of daily living, 3 or more comorbid conditions, and 1 or more older adult syndromes (including dementia, delirium, depression, incontinence, falls, osteoporosis, failure to thrive, gait disturbances, pressure ulcers, and sleep disorders).
- Personal Protective Equipment
  - Use personal protective equipment (PPE) and engineering controls when working with antineoplastic drugs as there is no known level of exposure that is considered to be safe.
» Provide access to PPE, safety data sheets, spill kits, containment bags, and designated waste disposal containers in all areas where hazardous drugs are prepared and administered.

» Use appropriate PPE and safe techniques in managing hazardous drugs during all stages of handling including receipt and storage, compounding and preparation, administration, spill control, and waste disposal.

» Employ safety precautions during transportation of hazardous drugs (refer to Chapter 2, *Hazardous Drugs and Waste*).

» Employ safety precautions when handling a patient’s body fluids for at least 48 hours after drug administration; however, some antineoplastic agents may be present for longer; consult with pharmacy for questions regarding metabolism and excretion time for a drug in question (refer to Chapter 2, *Hazardous Drugs and Waste*).

- Reduce Risk of Medication Errors

  » Implement safeguards to reduce the risk of medication errors with antineoplastic drugs. Antineoplastic drugs are high-alert medications.

    - Review laboratory tests prior to each treatment. Laboratory values may be ordered to calculate doses, assess for toxicity from prior treatments, and ensure that the agent will be adequately metabolized and excreted. Examples of laboratory tests include: complete blood count, serum creatinine and creatinine clearance, total bilirubin and liver function tests, electrolytes, hepatitis B antibodies, and thyroid function tests.

    - Use standardized orders, standardized dosage calculation, established dosage limits, computerized prescriber order entry (CPOE), barcode technology, and electronic infusion pumps with DERS (ie, smart pumps). Refer to Chapter 8, *Medication Verification*.

    - Consult with the pharmacist to review drug interactions with any changes in the patient’s medication list.

    - Perform an independent double check to verify the antineoplastic order.

    - Involve the patient and family members in medication identification; patients often observe and report errors and adverse events. Strategies to involve patients in the process of medication verification should be considered a risk-reduction strategy.
Monitor cumulative chemotherapy dose, as appropriate, to ensure that the drug is discontinued if the maximum lifetime dose is reached.

- **PIVC Use for Cytotoxic Vesicant Medications**
  - Follow steps for safe administration of cytotoxic vesicant medications via a PIVC:
    - Limit to IV push or infusions lasting ≤ 30 minutes and remain with the patient to assess for blood return during the infusion.
    - Do not use an infusion pump for peripheral vesicant administration.
    - Choose a vein that is large, smooth, and palpable, or if technology-assisted insertion is necessary, choose a vein with a straight venous pathway (refer to Chapter 3, Site Selection).
    - Avoid the following sites: ventral and dorsal surface of the hand, wrist, antecubital fossa, near a joint, lower extremities, areas distal to a recent venipuncture, including laboratory draws, and in the limb where there is impaired sensation, circulation, or lymphatic drainage, and/or history of lymph node dissection.
    - Do not use an established IV site that is > 24 hours old. If a new IV site is initiated, use the smallest-gauge catheter possible. If the IV attempt is unsuccessful, additional attempts should be proximal to the previous attempt or on the opposite arm.
    - Instruct patient in the importance of immediately reporting any pain, burning, sensation changes, or feeling of fluid on skin during the infusion.
    - Confirm and document a blood return prior to vesicant administration. Do not administer in the absence of a blood return (refer to Chapter 6, Infiltration and Extravasation).
    - Provide dilution by administering through a free-flowing infusion of a compatible solution.
    - Assess and verify blood return every 2 to 5 mL for IV push and every 5 minutes during an infusion; remain with the patient during the entire infusion.
    - Discontinue infusion at first sign of extravasation (refer to Chapter 6, Infiltration and Extravasation).

- **CVAD Use for Vesicant Medications**
  - Administer vesicant medications safely via a CVAD:
    - Confirm and document a blood return prior to vesicant administration. Do not administer in the absence of a blood return (refer to Chapter 6, Infiltration and Extravasation).
- Do not administer if signs of inflammation, swelling, or venous thrombosis are present (refer to Chapter 6, *Catheter-Associated Deep Vein Thrombosis*).
- Ensure proper placement, and adequately secure and stabilize the noncoring needle within implanted vascular access ports.
- Provide dilution by administering through a free-flowing infusion of a compatible solution.
- Assess and verify blood return every 2 to 5 mL for IV push; for infusions: assess and verify blood return before infusion, during the infusion in accordance with organizational policy, and after the infusion.
- Discontinue infusion at first sign of extravasation (refer to Chapter 6, *Infiltration and Extravasation*).

### Exposure Control

- Safely dispose of hazardous waste and materials contaminated with hazardous drugs (refer to Chapter 2, *Hazardous Drugs and Waste*).
- Contain, manage, and treat any cytotoxic spill as soon as possible to reduce the risk of environmental contamination and exposure to health care workers.

### Assessment

- Prior to each treatment cycle the clinician should assess:
  - Results of current laboratory data/diagnostic tests
  - Current medications, including over-the-counter and complementary/herbal medications
  - Vital signs and weight
  - Side effects of therapy from prior course and interventions implemented
  - Need to institute or modify symptom management plan prior to current drug administration course
  - Presence of new signs or symptoms of toxicity

- For initial cycle, patient height must be measured, not verbally reported

- Patency of the VAD, including aspiration of a blood return, absence of any resistance when flushing the catheter with 0.9% sodium chloride, absence of any patient complaints of pain or discomfort of any kind, absence of signs and symptoms of all VAD complications

- Integrity of the infusion system, including secure luer-lock connections, and correct flow rate for infusing solutions, if administered
- Patient level of understanding of treatment
- Patient psychosocial concerns

**Patient Education**

- Teach patient and caregiver:
  - Antineoplastic therapy: how it works, potential side effects, signs and symptoms to report/whom to call, physical and psychological effects, interventions to reduce VAD-related complications (eg, pain, swelling, redness at site)
  - Vesicant infusions: instruct in the importance of immediately reporting any pain, burning, sensation changes, or feeling of fluid on skin during the infusion.

**Vesicant Administration**

**Preprocedure**

1. Perform hand hygiene before direct contact with patient and subsequently as required throughout procedural steps (refer to Chapter 2, *Hand Hygiene*).
2. Verify patient’s identity using 2 independent identifiers according to organizational policy (eg, name and date of birth).
3. Obtain and review provider’s order for antineoplastic medication(s).
4. Confirm prescribed dose by comparing order to references such as drug therapy monographs or published dosing guidelines.
5. Ascertaining absence of allergy or previous adverse reaction to prescribed medication.
6. Verify results of pertinent laboratory studies/diagnostic tests.
7. Verify dosage accuracy at the time of the order:
   - Using an independent double check by 2 qualified clinicians, verify the dose by calculating the patient’s body surface area (BSA) or area under the curve, and calculate all drug doses to be delivered. A significant variation in BSA > 10% must be addressed with the prescribing provider. Dose amounts are compared to labeled dosage. Any discrepancies in dose of > 10% must be reconciled.
8. Obtain informed consent according to organizational policy.
9. Perform baseline physical assessment including vital signs.
10. Establish appropriate vascular access or check patency of existing VAD. For peripheral IV vesicant administration:
A. Avoid the following sites: dorsal hand, wrist, antecubital fossa, near a joint, and in the limb where there is impaired circulation or lymphatic drainage and/or history of lymph node dissection.

B. Do not use an established IV site that is > 24 hours old. If a new IV site is initiated, use the smallest catheter possible. If the IV attempt is unsuccessful, additional attempts should be proximal to the previous attempt or on the opposite arm.

11. Turn off all ceiling fans and humidifiers to reduce risk for spread of cytotoxic solution agent by aerosolization or vaporization.

**Procedure**

1. Perform hand hygiene.
2. Don appropriate PPE:
   
   A. Gloves: wash hands thoroughly with antimicrobial soap and water before applying the designated disposable chemotherapy gloves. Gloves should be disposed of immediately after use, if torn, punctured, if a drug spill occurs, or after 30 minutes of use.
   
   B. Protective disposable gown made of lint-free, low-permeability fabric with a closed front, long sleeves, and tight-fitting elastic or knit cuffs. Gowns are to be worn for one-time individual patient use.
   
   C. Eye protection if liquid could splash
   
   D. Respiratory protection if potential for inhalation

3. Cover working area with disposable, absorbent, plastic-backed barrier pad.
4. Gather supplies, and place on barrier pad.
   
   - Supplies
     
     - Antiseptic solution
     - Prescribed IV medication with preattached, preprimed administration set
     - Prefilled syringes: preservative-free 0.9% sodium chloride flushes
     - Prefilled syringe of heparin flush solution, if indicated by provider order or protocol
     - PPE
     - Solution container of 0.9% sodium chloride
     - Closed system transfer device (CSTD) as appropriate

5. Check medication for expiration or beyond-use dates; inspect syringe for leaks, cracks, particulate matter, and clarity of medication.
6. Verify antineoplastic order using an independent double check by two qualified clinicians to include drug name, dose, volume, rate of administration, expiration date, infusion pump rate, and appearance/physical integrity of the drug.

7. Administer an IV push medication through an existing continuous IV infusion.
   A. Select an injection port on the administration set that is closest to the patient. Do not disconnect administration set from the VAD hub.
   B. Disinfect needleless connector on VAD hub using a vigorous scrubbing action for disinfection for a designated length of time. Discard each disinfectant swab pad immediately. Allow to dry completely.

8. Attach 10-mL syringe of 0.9% sodium chloride and confirm patency of VAD by aspiration of blood return, ability to easily flush the VAD, and absence of patient complaints.
   A. Flush 1 to 2 mL, then aspirate for a blood return, observing for the color and consistency of whole blood. Flush the remaining volume into the VAD and disconnect syringe.


10. Administer vesicant.
    A. IV push: attach medication syringe and administer IV push medication per rate on label using a syringe appropriately sized for the medication being injected; use a watch or clock with a second hand to time IV push administration.
    B. Short infusion: initiate short intermittent infusion at specified rate.
    C. Continuous infusion: initiate infusion and observe patient for at least 20 minutes following infusion initiation for any adverse reaction

11. Assess and verify blood return.
    A. PIVCs: every 2 to 5 mL for IV push or every 5 to 10 minutes during infusions remaining with patient
    B. CVADs: every 2 to 5 mL for IV push or every 5 to 10 minutes during infusions of 30 minutes or less
    C. Assess for absence of swelling/edema and ask patients about presence of pain/burning or change in sensation before, during, and after infusion.
D. Stop infusion at first sign of extravasation (refer to Chapter 6, *Infiltration and Extravasation*).

12. Detach medication syringe and disinfect needleless connector on VAD hub or injection port of administration set with a new swab pad and discard. Allow to dry completely.

13. Attach 10-mL syringe of 0.9% sodium chloride to injection port, flushing at the same rate as the drug was injected (IV push) until the entire drug dose has been cleared from the infusion system and VAD lumen, and to prevent precipitation due to solution/medication incompatibility.

14. Assess patient response and any side effects/adverse reactions; ensure ongoing plan in place for continued monitoring as appropriate.

15. Dispose of all open, unused drug(s), equipment, and disposable gowns and gloves used to administer the drugs into the specially marked, covered container designated with the label indicating chemotherapy/biohazard waste.

16. Perform hand hygiene.

**Documentation**

- Document in the patient’s health record:
  - Location/type of VAD
  - Number/locations of venipuncture attempts for peripheral catheter
  - VAD patency and presence of blood return
  - Drug, dosage, diluent
  - Time of administration
  - Any evidence of adverse reactions and actions taken
  - Pertinent patient assessment
  - Patient’s response to the procedure
  - Patient education
Biologic Therapy

Policy
Biologic infusion therapies, such as colony-stimulating factors, gene therapy, monoclonal antibodies, fusion proteins, interleukin inhibitors, and Igs, are administered in a setting in which the clinician is prepared to recognize and manage severe adverse reactions.

Patients are assessed for contraindications before beginning a biologic infusion therapy and prior to each subsequent administration.

Key Points
- Aging is associated with anatomic and physiologic changes that can have an effect on how medications are metabolized. Such changes include alterations in various volumes of drug distribution and in drug absorption, metabolism, and clearance. Older adults may also experience increased or decreased drug effects because of alteration in receptor response. These changes in pharmacokinetics and pharmacodynamics may result in a prolonged drug half-life, an increased potential for drug toxicity, and a greater likelihood for adverse drug reactions in which close clinical monitoring is essential.
- Patient Safety and Adverse Reactions
  - Implement safeguards to reduce the risk of medication adverse reactions and errors with biologic therapies; immunosuppressant therapies are high-alert medications.
  - Standardize prescribing, storage, dispensing, and medication administration (refer to Chapter 8, Medication Verification).
  - Ensure clinician access to drug information.
  - Collaborate with the health care team regarding serious risks associated with some biologic agents; risk evaluation and mitigation strategies (REMS) may be required.
  - Anticipate potential orders for pre-medications, such as acetaminophen/paracetamol and diphenhydramine, which may help to prevent infusion reactions common to many biologics. Nonsteroidal anti-inflammatory agents may help prevent fevers when interleukin-2 is administered.
  - Ensure availability of drugs for treatment of adverse reactions and anaphylaxis.
• Flow-Control Devices
  » Select the most appropriate flow-control method for the biologic therapy, considering factors such as manufacturers’ recommendations for infusion rates; infusion route; dosing considerations; volume; duration and use of filters; age, acuity, and mobility of the patient; health care setting; and the potential for side effects or adverse effects of the therapy.

• Storage, Preparation, and Disposal
  » Store, prepare, and administer biologic infusion products according to the manufacturers’ directions for use and dispose of biologic waste in accordance with regulations established by regulatory bodies in each jurisdiction (eg, countries, states, provinces).
    - Do not use Ig products that have been frozen.
    - Reconstitute or prepare liquid products in a clean environment (refer to Chapter 8, *Compounding and Preparation of Parenteral Solutions and Medications*).
    - Ensure that biologic products are at room temperature before infusing.
    - Avoid switching Ig brands as this puts the patient at greater risk for adverse reactions.

Assessment

• Risk factors before initiation of therapy include, but are not limited to:
  » Comorbidities (eg, hypertension, cardiopulmonary/hepatic/renal/gastrointestinal disease)
  » Presence of infections (viral, fungal, or bacterial); results of tuberculosis testing, hepatitis B and C screening
  » Vaccination list (eg, live vaccines are not recommended during treatment with biologics and may delay therapy)
  » Allergy profile (food, medications, drug-drug interactions)
  » History of any previous treatment with and reaction to biologic therapies
  » History of malignancies
  » Weight changes
  » Possible drug interactions; obtain current medication list
- **Before/during each infusion:**
  - Any significant changes in health status prior to each infusion (eg, changes in weight, presence of any acute illness, infection, or diarrhea)
  - Any recent surgeries or planned surgeries
  - Any recent dental procedures or planned surgeries (eg, dental implants, dental extractions, gum tissue graft)
  - Open wounds or compromised skin conditions
  - Any changes in medication list (eg, antibiotics)
  - Pertinent laboratory results (eg, complete blood count, liver/kidney function)
  - Response to treatment
  - Vital signs

- **Signs and symptoms of infusion reactions:**
  - Anaphylactic/anaphylactoid/allergic reactions (refer to Chapter 6, *Allergic Reaction and Anaphylactic/Anaphylactoid Reactions*)
  - Refer to the manufacturers’ information for specific biologic therapy.

- If any changes to health history or presence of risk factors, clinician to consult with prescribing provider prior to initiating or continuing therapy.

**Patient Education**

- Teach patient and caregiver:
  - Risks and benefits of biologic therapy
  - Physical and psychological effects
  - Potential side and adverse effects and toxicities, signs and symptoms to report, and how/whom to report
  - Management of adverse events, such as infusion reactions and delayed reactions

**Procedure**

Refer to content outlined in Chapter 7, *Subcutaneous Access Device: Placement and Infusion Administration* and Chapter 8, *Infusion Medication and Solution Administration*. 
Documentation

- Document in the patient’s health record:
  » Name and dose of biologic therapy administered
  » Date/time of administration (start and stop)
  » Administration rate
  » Route, specific VAD or lumen used for administration, number of attempts and failed locations
  » Pertinent patient assessment (eg, initial assessment for contraindications, ongoing assessments of vital signs and IV site integrity, changes in infusion rate)
  » Pertinent laboratory results
  » Patient’s response during the procedure
  » Patient education
Patient-Controlled Analgesia

Policy
The decision to initiate patient-controlled analgesia (PCA) occurs in collaboration with the patient and the health care team based upon assessment of PCA risk factors and the patient’s level of understanding and ability to use PCA.

Pain management is comprehensive and individualized and involves the patient and caregiver in developing a treatment plan and setting realistic and measurable goals.

Key Points
- There is increased responsiveness to the effects of opioids in the older adult. This may result in an increased risk of respiratory depression. The older adult female patient demonstrates an increase in the duration of effects, but the risk of nausea is not augmented. Increased sensitivity of older adults to systemic opioids mostly involves pharmacokinetic factors such as a higher proportion of unbound and active substances as well as changes in drug redistribution. Because of a 40% reduction in stroke volume in the older adult, there is a protracted redistribution of opioids to the liver. This results in a prolonged metabolism, a lesser inactivation over time followed by an increase in duration of effects, mainly impairment of respiration.
- Since older adults present multimorbidity, therapy for chronic pain should be considered in the light of multidrug intake, which, due to interaction, results in marked side effects and a prolonged duration of action.
- Clinician Responsibility
  » Ensure clinicians receive education that addresses pain assessment, safe use of opioids, risk of concomitant use of sedating medications, operation of electronic infusion pump, and the need to individualize pain management based on individual needs of the patient.
  » Ensure adequacy of the pain management plan and patient stability during handoffs to different clinicians and/or settings.
  » Participate in selection and evaluation of PCA electronic infusion pump and monitoring equipment and in quality processes to promote patient safety, which include review of administration of opioid reversal and opioid-related resuscitation, DERS,
technology/decision support, barcoding technology, root cause analysis, Healthcare Failure Mode and Effect Analysis (HFMEA), and prescription drug monitoring programs to evaluate opioid utilization.

- **Standardization of Medication Concentration and Order Sets**
  - Use standardized medication concentrations and standardized or preprinted order sets for PCA and authorized agent-controlled analgesia (AACA) that allow for individualization of dose. At minimum, order set should include:
    - Concentration of opioid infusate
    - Dose
    - Lockout interval
    - Maximum limit
    - Loading dose
    - Continuous rate, if ordered
  - Range orders must have objective measures to direct correct medication dose adjustment.
  - Dosing should be based on comprehensive patient assessment and should not be based solely on pain assessment score (numeric or behavioral).

- **High-Alert Drug Procedure**
  - Perform an independent double check by 2 clinicians prior to initiation of the PCA and when the syringe, solution container, drug, or rate is changed. Verification includes:
    - Correct patient
    - Patient allergies
    - Concentration of opioid infusate
    - Correct dose
    - Correct lockout interval
    - Correct maximum limit
    - Correct continuous rate, if ordered
    - Correct loading dose, if ordered
  - Give special attention to drug, concentration, dose, and rate of infusion according to the order and as programmed into the electronic infusion pump in order to reduce the risk of adverse outcomes and medication errors (refer to Chapter 8, *Medication Verification*).
- Validate that the administration set is correctly connected for immediate delivery of analgesic and is configured to prevent retrograde flow of medication.

- Patient Safety Measures
  - Identify patient risk factors that include, but are not limited to, older age, morbid obesity, known/suspected sleep disorder breathing problems, pre-existing pulmonary and/or cardiac disease, renal insufficiency, impaired liver function, and continuous basal infusions.
  - Carefully evaluate patient safety in the setting of concomitant use of sedation medications.
  - AACA may be used if the patient is unable to actively participate in PCA, or parent/nurse-controlled analgesia (PNCA) may be used. AACA allows for a consistent, available, and competent person authorized by the provider who is educated to activate the PCA dose.
  - Evaluate the effectiveness of PCA/AACA/PNCA and potential adverse events, using valid and reliable monitoring and assessment methods for pain (eg, scales) and documentation tools, through:
    - Regular assessment and reassessment of patient self-report of pain or objective measure of pain using a valid, reliable, developmentally appropriate pain assessment tool individualized to the patient.
    - Monitoring for potential adverse effects based on type of opioid therapy, individual patient risk factors, and response to therapy including, but not limited to, sedation and respiratory depression.
      - Use a validated sedation scale and direct assessment of quality and adequacy of respirations.
  - In the presence of risk factors use continuous monitoring of capnography, pulse oximetry, and/or other clinically effective methods.
    - Continuous capnography monitoring provides an earlier warning of respiratory depression as compared to continuous oximetry and is associated with a significant reduction in the incidence of opioid-induced respiratory depression (OIRD), duration in opioid treatment, and opioid-related severe adverse events.
    - Consider nurse-worn or centralized monitoring of respiratory devices to improve alarm recognition.
    - Recognize the risk of supplementary oxygen delivery in masking reduced respiratory drive.
» Regular evaluation of PCA device function, number of injections and attempts, potential for patient manipulations.
» Regular assessment of the VAD path and patency to assure correct delivery of dose.
» Consider changing treatment method(s) as necessary. Adjust pain management plan based on pain relief and presence of adverse effects.

Assessment
- Prior to initiation of PCA, assess:
  » Appropriateness of PCA therapy and the patient’s comprehension of, and ability to participate in the intended therapy
  » Appropriateness of AACA or PNCA
  » Identify patients at high risk for respiratory depression who include, but are not limited to, the older adult, and those with morbid obesity, obstructive sleep apnea, chronic obstructive pulmonary disease, renal insufficiency, and continuous basal infusions for patients who have obstructive sleep apnea or are opioid naïve.
- At baseline and after initiation of the PCA therapy, assess heart rate, blood pressure and respiratory rate, depth, and quality according to intervals determined by organizational policy.
  » Hold use of the PCA and notify provider if the following occurs:
    - Respiratory rate < 8 in a nonterminal patient
    - Sedation score as specified by organization
    - Patient becomes unarousable or has a significant change in cognition
    - Patient has adverse reaction to prescribed medication
  » Administer naloxone as ordered.

Patient Education
- Teach patient and caregiver:
  » Purpose of PCA and expected duration of therapy
  » Use of the bolus dose function of the electronic infusion pump
  » Frequency of monitoring
  » Use of pain rating scale
  » Expected outcomes
  » Precautions, potential side effects, and contact information for support services, and how and to whom to report
Procedure
Refer to content outlined in Chapter 8, *Infusion Medication and Solution Administration*.

Documentation
- Document in the patient’s health record:
  - Baseline assessment: pain including, but not limited to, characteristics, location, intensity; level of consciousness; respiratory including rate, depth, quality, and effort; oxygenation saturation; and other assessments as indicated
  - Medication, concentration, PCA dose, and basal dose and rate, if used
  - Medication received and cumulative dose
  - Number of attempts, number of injections
  - Sedation assessment
  - Respiratory assessment: rate and depth, and other assessments as indicated
  - Patient’s response and pain intensity rating
  - Patient education
Moderate Sedation/Analgesia Using Intravenous Infusion

Policy
The registered nurse (RN) may administer moderate sedation/analgesia using IV infusion in accordance with rules and regulations promulgated by the state’s board of nursing and in accordance with organizational policies and procedures.

An emergency cart and reversal agents are immediately accessible, and clinicians with expertise in patient age and size appropriate airway management, emergency intubation, advanced cardiopulmonary life support, and management of potential complications are immediately available.

Key Points
- Age-related pharmacokinetic changes and the presence of comorbidities and polypharmacy complicate drug therapy. Aging results in impairment in the function of multiple organs, including the liver, which may also affect drug metabolism and pharmacokinetics. In addition, older adults often have to consume a variety of drugs, the bioavailability of which could be increased. Combined with reduced hepatic and renal clearance mechanisms, this prolonged half-life can prolong the recovery of older adults after sedation. In the older adult, hepatic drug clearance of some drugs can be reduced by up to 30%. Finally, renal excretion is decreased in most older adults because of the presence of hypertension and coronary heart disease.
- In the older adult population, conscious sedation practices are modified by the administration of fewer agents at a slower rate and lower cumulative dose.
- Identify a list of medications that may be administered by the clinician. Medications for moderate sedation that may be administered include benzodiazepines (midazolam, diazepam), narcotics (fentanyl, meperidine), propofol, neuroleptic tranquilizers (droperidol), and antihistamines (diphenhydramine).
- Initiate and maintain vascular access throughout the procedure and recovery for administration of medications and for potential need for emergency resuscitative medications and/or reversal agents; moderate sedation may convert to deep sedation and loss of consciousness due to the types of agents used, the patient’s physical status, and drug sensitivities.
- Establish the discharge plan prior to the procedure, including the need to have a family member/caregiver/friend drive the patient home and observe the patient after the procedure.
- The RN monitoring the patient receiving moderate sedation should have no other responsibilities during the procedure.
- Valid and reliable tools or established organizational criteria are used to assess adequacy of sedation and analgesia and readiness for discharge home or transfer to a hospital unit.

**Assessment**

**Preprocedure**
- Perform a comprehensive preprocedural assessment to include:
  » Medical history/current condition
  » Current medications
  » Allergies
  » Previous sedation experience
  » Drug/alcohol/tobacco use
  » Verification of nothing-by-mouth (NPO) status
- Consult with an anesthesia licensed independent professional, if problematic issues are identified during the assessment, such as significant opioid use, history of intolerance to moderate sedation, airway issues, allergies, and significant comorbidities.

**During Procedure**
- Monitor the patient continuously throughout the procedure, including blood pressure, respiratory rate, oxygen saturation, cardiac rate and rhythm, and level of consciousness.
  » Use of advanced monitoring techniques such as acoustic respiratory monitoring and processed electroencephalography may be useful in early detection of oxygen desaturation and respiratory depression.
  » Consider the use of capnography to measure adequacy of ventilation.

**Postprocedure**
- Observe the patient for at least 90 minutes after the procedure if reversal agent administration is required.
Patient Education

- Prior to procedure, teach patient and caregiver:
  » Sedation/analgesia infusion
  » What to expect before, during, and after the procedure
  » Postprocedure restrictions
  » Potential complications related to the VAD site and the procedure, emergency instructions, and 24-hour contact phone number

Procedure

Refer to content outlined in Chapter 8, *Infusion Medication and Solution Administration*.

Documentation

- Document in the patient’s health record:
  » Medication, amount and type of diluent
  » Route and specific VAD used for administration
  » Pertinent patient assessment
  » Sedation assessment: respiratory assessment, rate and depth, and other assessments as indicated
  » Patient’s response to the procedure
  » Patient education