# Contents

**PREFACE** ......................................................... 6

1. **GENERAL ORGANIZATIONAL POLICIES**
   - Infusion Team ............................................. 8
   - Competence and Competency Validation .................. 10
   - Product Evaluation, Integrity, and Defect Reporting ... 13
   - Informed Consent ......................................... 15
   - First Dose Administration in Alternative Care Settings ... 19
   - Latex Sensitivity or Allergy ................................ 22
   - Adverse and Serious Adverse Events ...................... 24

2. **INFECTION PREVENTION AND SAFETY COMPLIANCE**
   - Hand Hygiene ............................................. 28
   - Sharps Management ........................................ 31
   - Medical Waste Disposal ................................... 33
   - Durable Medical Equipment Disinfection ................. 35
   - Standard Precautions ...................................... 37
   - Transmission-Based Precautions ......................... 39

3. **VASCULAR ACCESS DEVICE PLACEMENT**
   - Vascular Access Device (VAD) Planning .................. 42
   - Local Anesthesia .......................................... 48
   - Short Peripheral Catheter Placement ..................... 52
   - Ultrasound-Guided Short Peripheral Catheter Placement ... 58
   - Short Peripheral Catheter Insertion via the External Jugular (EJ) Vein ... 63
   - Ultrasound-Guided Midline Catheter Insertion ........... 68
   - Ultrasound-Guided Peripherally Inserted Central Catheter (PICC) Insertion
     Using Modified Seldinger Technique (MST) ............. 77
   - Ultrasound-Guided Nontunneled Central Vascular Access Device (CVAD)
     Insertion Using Modified Seldinger Technique (MST) ...... 87
   - Ultrasound-Guided Nontunneled Central Vascular Access Device (CVAD)
     Insertion Using Seldinger Technique ................... 97
4. SITE CARE AND MAINTENANCE
   Administration Set Change ........................................... 108
   Maintaining Vascular Access Device (VAD) Patency:
     Flushing and Locking ............................................. 111
   Vascular Access Devices (VADs): Ongoing Assessment, Site Care, and
     Dressing Change .................................................. 116
   Vascular Access Device (VAD) Removal .......................... 121

5. INFUSION-RELATED COMPLICATIONS: IDENTIFICATION &
   INTERVENTION
   Air Embolism ............................................................ 126
   Allergic Reaction and Anaphylactic/Anaphylactoid Reactions .... 129
   Catheter Damage ....................................................... 133
   Central Vascular Access Device (CVAD) Malposition .......... 137
   Central Vascular Access Device (CVAD) Occlusion ........... 141
   Central Vascular Access Device (CVAD)-Associated
     Venous Thrombosis ................................................. 148
   Circulatory Overload .................................................. 151
   Infiltration/Extravasation .......................................... 153
   Nerve Injuries .............................................................. 163
   Phlebitis ................................................................. 166
   Vascular Access Device (VAD)-Associated Infection ........ 170

6. OTHER INFUSION-RELATED PROCEDURES
   Preparing Immediate-Use Parenteral Medications .............. 176
   Implanted Vascular Access Port: Accessing and Deaccessing .. 179
   Phlebotomy: Blood Sampling from a Vascular Access Device (VAD) 185

7. OTHER INFUSION ACCESS
   Intraspinal Access Device: Care and Management ............ 194
   Subcutaneous Access Device: Placement and Infusion
     Administration ......................................................... 202
   Intraosseous Access Device: Placement, Care, and Management .. 206
8. INFUSION THERAPIES

IV (Intravenous) Administration: Continuous Infusion, IV Push,
    Intermittent Infusion .................................................. 212
    Transfusion .............................................................. 223
    Parenteral Nutrition .................................................. 230
    Antineoplastic Therapy ............................................. 234
    Biologic Therapy ..................................................... 241
    Patient-Controlled Analgesia (PCA). ......................... 245
    Moderate Sedation .................................................. 249
    Therapeutic Phlebotomy .......................................... 252

Illustrations

Vein Anatomy .......................................................... 257

The Policies and Procedures for Infusion Therapy is intended to reflect current knowledge and practices of the clinical specialty of infusion therapy. Because clinical practice continually evolves based on ongoing research, users should make an independent assessment of the appropriateness and applicability of a policy or procedures in any specific instance, and should also consider the applicable federal and state laws and regulations, 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 the use of the Policies and Procedures.
Preface

In our effort to ensure safe, quality infusion patient care, the Infusion Nurses Society (INS) develops resources to guide clinicians in their practice. We recognize the invasive nature and risks associated with infusion care, not only to our patients, but to clinicians as well. Therefore, it’s imperative the resources are supported by the most current research and best available evidence. Better patient outcomes result when there is consistency in practice among health care professionals. Incorporating practices from the Policies and Procedures for Infusion Therapy provides the framework to do just that.

The fifth edition of the Policies and Procedures complements INS’ Infusion Therapy Standards of Practice (2016). Keeping in alignment with the Standards and recognizing the interprofessional approach in health care delivery, the title of this publication was changed from the previous edition. Infusion therapy does not “belong” to one group of clinicians but is the responsibility of all those who are involved with infusion practice. The new title is Policies and Procedures for Infusion Therapy.

As the basis for professional practice, clinicians are accountable within the boundaries of their scope of practice. With variations among health care organizations, knowledge of the policies, procedures, and practice guidelines of one’s organization is essential, as well as any directives from federal, state, or regulatory bodies. While the policies and procedures are written in general terms, there may be device-specific features or specifications that need to be followed for proper function, so clinicians need to adhere to the manufacturer’s directions for use.

The format for this version of the Policies and Procedures has been expanded. Not only does it include the policy, which defines a course and purpose of an action, and the procedure, the steps to be taken, but sections on key points, assessment, patient education, and home care/alternative site implications have also been added. While there are areas of care, such as infusion-related complications and infusion therapies, that don’t fit the typical policy and procedure format, inclusion was important as these areas directly impact the delivery of infusion care.

A bibliography accompanies each policy and procedure as a resource for those seeking more information. Since the 2016 Infusion Therapy Standards of Practice was the primary reference for development of the policies and procedures, to minimize repetition, the individual standards are not cited in the Bibliography.

I want to thank the authors, led by Lisa Gorski, Standards of Practice Committee Chair; Lynn Hadaway; Mary Hagle; Mary McGoldrick; Britt Meyer; and Marsha Orr; for their contributions to this edition. I appreciate the time and commitment devoted to this project and their willingness to share their knowledge and expertise.

Mary Alexander, MA, RN, CRNI®, CAE, FAAN
Chief Executive Officer, INS
1. General Organizational Policies

Infusion Team ................................................................. 8
Competence and Competency Validation .......................... 10
Product Evaluation, Integrity, and Defect Reporting .............. 13
Informed Consent ............................................................. 15
First Dose Administration in Alternative Care Settings .......... 19
Latex Sensitivity or Allergy ............................................... 22
Adverse and Serious Adverse Events ................................. 24
**Policies and Procedures for Infusion Therapy**

**Infusion Team**

**Policy**
The team is structured through its scope of service to meet patient and organizational needs for safe, effective, and high-quality infusion therapy.

Vascular access device (VAD) insertion and/or VAD management and surveillance are performed by clinicians and/or teams with validated competency.

The infusion team is evaluated for effectiveness through collection, monitoring, and reporting of quality outcome and process data.

**Key Points**
The scope of services and hours of operation for the infusion team are clearly identified.

When the infusion team works in multiple areas with many patient populations, responsibilities for each aspect of infusion therapy are clearly delineated based on the required knowledge, skill(s), availability, and outcomes from clinicians and the team as well as the complexity, risks, and volume of the patients’ infusion therapies.

Although there is overlap between groups of professionals within infusion therapy, no single profession may claim ownership of any skill, activity, or task.

Use the infusion team for infusion therapy product evaluation, education, quality improvement initiatives, and to collaborate in the evaluation and implementation of standardized evidence-based infusion therapy practices.

Preferably the infusion team is led by a certified infusion nurse specialist (eg, CRNI®) with a staffing mix that may include registered nurses, licensed practical/vocational nurses, and/or unlicensed assistive personnel.

A designated infusion team increases first-attempt cannulation success rates with short peripheral catheters and decreases hospital-acquired bloodstream infections, other complications, and accidental removals.

A designated infusion team provides standardized methods for midline catheter and central vascular access device (CVAD) insertion, including preinsertion assessment of vascular access needs, adherence to all aseptic techniques, completion of the insertion checklist, and decreased insertion-related complications.

A designated infusion team that is accountable for management of peripheral and central VADs through daily assessment of need, site care and dressing changes, implanted port access, and other designated infusion-related procedures (eg, catheter clearance) decreases infusion-related complications and related costs and increases patient satisfaction.
Bibliography


Competence and Competency Validation

Policy
As a method of public protection to ensure patient safety, clinicians are competent in the safe delivery of infusion therapy and vascular access device (VAD) insertion and/or management within her or his scope of practice.

The clinician is responsible and accountable for attaining and maintaining competence with infusion therapy administration and VAD insertion and/or management within her or his scope of practice.

The organization is responsible for assessment and validation of clinician competency initially (before providing patient care) and on an ongoing basis, and when the scope of practice changes and with introduction of new procedures, equipment, or technology.

Documentation of competency validation is maintained in individual personnel records according to organizational policy.

Performance expectations for contracted clinicians are established and should include documentation of competency, compliance with organizational requirements (eg, policies and procedures), and outcome monitoring.

For contracted clinicians who are learning new procedures through clinical practice on the organization’s patients, ensure adequate supervision during the period required to assess and validate their initial competency.

Invasive procedures (eg, venipuncture) are not performed on clinician peers for educational purposes.

Key Points
Competence includes application of knowledge, critical thinking skills, decision-making abilities, and psychomotor skills.

Competence addresses specific patient populations, including age-specific needs and cultural needs of ethnically diverse populations.

Use organizational clinical outcome data, adverse and serious adverse events, changes in patient population, and patient satisfaction data to identify procedures/skills/tasks for ongoing competency validation.

Use multiple methods to deliver education such as lecture, reading materials, simulation, self-study, and repeat education over time; combine education with outcome monitoring and feedback to increase its impact on professional behavior.
Use a combination of different competency measurement techniques such as:

- Self-assessment processes to promote self-efficacy and confidence levels
- Written tests to assess knowledge
- Clinical scenarios to assess critical thinking skills
- Psychomotor skills in a simulation laboratory
- Observation of performance of knowledge and skills in the work environment (preferred method for invasive infusion therapy procedures). Note that there is no set number of times for performing a procedure that will ensure competency.
- Inclusion of professional activities, such as presentations at seminars and conferences, maintaining national board certification, publishing in a scholarly journal, conducting clinical research, and portfolio development

Specialized skills (eg, central vascular access device placement, antineoplastic administration) require multiple components involving knowledge acquisition and supervised clinical performance for initial competency assessment and validation.

Validate performance using well-designed forms or checklists that include objective and measurable assessment points. Components of such forms include a competency statement, specific performance criteria or crucial behaviors, method of demonstrating competence, criteria for achieving success, and assessor signature.

Develop criteria for the role of the competency assessor to ensure an unbiased and objective process.

Achieving board certification is one method for documenting continued nursing competence. Clinical competencies for the infusion nurse specialist are based on the infusion nursing core curriculum:

- Technical and clinical applications
- Fluid and electrolyte balance
- Pharmacology
- Infection prevention
- Special patient populations
- Transfusion therapy
- Antineoplastic and biologic therapy
- Parenteral nutrition
Bibliography


Product Evaluation, Integrity, and Defect Reporting

Policy
Evaluation of infusion-related products and devices includes input from a multi-disciplinary group of direct and indirect end users.

Input is obtained, and solicitation of this input is documented as part of the Exposure Control Plan, from nonmanagement clinicians responsible for direct patient care who are potentially exposed to injuries from contaminated sharps, in the identification, evaluation, and selection of effective engineering and work practice controls.

Infusion equipment and supplies are inspected for product integrity and functionality before, during, and after use as determined by verification of inspection or expiration date and visual inspection of the product.

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

When a defective product or device is identified, it is removed from patient use and reported to the appropriate department and/or agency or manufacturer.

Key Points
Infusion-related products and devices should be evaluated with consideration given to cost, safety, and effectiveness, and according to parameters designated by the organization’s product evaluation committee.

Product defect reporting includes suspected and known intrinsic and extrinsic contamination; product damage; product tampering; improper, unclear, or confusing patient or user instructions or labeling; similar or confusing product names; packaging problems; and reliance on color coding.

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.

Monitor and obtain reports of internally and externally reported adverse events for the committee/individual managing product evaluation and product procurement.

Bibliography


Informed Consent

Policy
Informed consent is obtained for all invasive procedures and treatments in accordance with local or state laws and organizational policy.

Informed consent is required for human subject participation in research according to federal rules and regulations.

The clinician who performs the invasive procedure (eg, central vascular access device [CVAD] insertion) facilitates the process and obtains informed consent.

The patient has the right to refuse treatment. In the event that a patient is deemed incompetent or unable to give consent, the consent of a surrogate is obtained.

Key Points
Informed consent is an educational process involving the patient in shared decision making that includes dialogue between the patient/surrogate and the licensed independent practitioner (LIP) or qualified clinician performing the procedure, and concludes with the patient/surrogate signing a consent document or providing verbal consent according to organizational policy (eg, via phone conversation).

Not all procedures require written informed consent forms.

Continued confirmation of informed consent may be necessary for ongoing treatments (eg, hemodialysis or antineoplastic administration).

There may be condition-based exceptions to requirements for informed consent (eg, emergency/life-threatening situations); adhere to the organizational policy for managing such situations.

Informed consent for neonatal, pediatric, and adolescent patients is obtained from the parent or legal guardian.

Verify assent (ie, agreement) from the pediatric or adolescent patient, using language and learning methods appropriate for the age and/or cognitive stage of the individual; while there is lack of consensus over the age of assent, this is generally considered 7 years old or school-age.
Photographs of patients may or may not require informed consent.

- 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.

The process of informed consent includes the following elements:

- Consent is voluntarily given and is free from coercion or persuasion.
- The patient/surrogate is capable of understanding 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.
- The patient/surrogate comprehends the information and can apply it to her or his specific situation.
- The decision is authorized by the patient/surrogate and documented on the signed form.

**Assessment**

Identify cultural differences that may affect the process of informed consent. For example, the foundation of informed consent is self-determination, which may not fit with cultures in which 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.

**Patient Education**

Use learning methods appropriate for the patient’s age 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.
• Provide a qualified medical interpreter for non–English-speaking patients and for those who cannot read their primary language.
• Provide appropriate resources for patients/surrogates who have vision or hearing limitations.
• Allow sufficient opportunity for the patient/surrogate to ask questions and receive answers.
• 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.
• 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 medical record:
• Completion of the informed consent process, including organizational written consent form, if applicable
• Patient/surrogate education and response
Bibliography


First Dose Administration in Alternative Care Settings

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).

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 allergic, life-threatening reactions to previous drug therapies (see Allergic Reaction and Anaphylactic/Anaphylactoid Reactions).
- Patient is alert, cooperative, and able to respond appropriately.
- Collaboration with the licensed independent practitioner (LIP) regarding concerns and alternative solutions to first dose administration in a non–acute care setting.
- Collaboration with other health care providers (eg, pharmacist) to determine the safety of administering the prescribed medication.
- Informed consent by LIP: the patient is provided with sufficient information regarding the risks of a first dose in a non–acute care setting in a culturally and linguistically appropriate format, and at an education level understood by the patient (see Informed Consent).
- Drugs for treatment of adverse reactions, including those used to treat anaphylaxis, are ordered and available in the treatment setting.
- The clinician administers the medication and observes the patient for a minimum of 1/2 hour after completion of the infusion.
- Emergency Medical Services (EMS) are available in the geographic area.
- Location has access to working telephone/clinician cellular phone.

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 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 LIP.

**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 LIP and collaborate to develop an alternative plan of care.

Confirm that the informed consent process is completed; refer back to LIP if patient has concerns or declines.

Anaphylactoid reactions have been associated with midline catheter and peripherally inserted central catheter (PICC) insertion and other medications such as vancomycin and morphine.

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**
Signs and symptoms of allergic, anaphylactic/anaphylactoid reactions as these events may occur after multiple doses of the medication (see *Allergic Reaction and Anaphylactic/Anaphylactoid Reactions*).

**Documentation**
Document in the patient’s medical record:

- Assessment and risk factors related to first dose
- Any communication with LIP related to first dose
- 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
Bibliography


Latex Sensitivity or Allergy

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

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

Key Points
Powdered gloves made of natural rubber latex are not used as they are associated with the greatest risk of sensitization and subsequent allergic reactions in individuals.

Low-allergen, powder-free gloves, nitrile gloves, glove liners, or other similar alternatives are used, especially if sensitive or allergic to latex.

Labels on medical devices, equipment and supplies should be reviewed prior to use for the presence of latex, which is a component of product labeling required by the US Food and Drug Administration (FDA).

Patient Education
How to avoid latex exposure

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

- Fruit allergies can create cross-reactions with latex including, but not limited to, avocado, mangoes, pears, bananas, citrus fruits, chestnuts, and other tropical foods.
- Exposure to latex may cause a hypersensitivity response either locally at the site of contact or systemically, resulting in breathing difficulty, chest tightness and pain, anxiety, palpitations, cutaneous erythema and urticaria, angioedema, shock, and death.

Assess the mother for known latex allergy to prevent inadvertent exposure of an infant to latex sensitization.
**Documentation**

Document in the patient’s medical record:
- Existence of latex
- Post LATEX ALLERGY sign outside the patient’s room.

**Bibliography**


Adverse and Serious Adverse Events

Policy
Adverse events or serious adverse events (also called sentinel events) associated with infusion therapy are reported and documented.

Serious adverse events are immediately investigated to ensure prompt action and improvement in safety.

Clinicians are active participants in the development, implementation, and evaluation of improvement plans.

Errors are responsibly disclosed to patients.

Key Points
It is critical that organizations establish a strong “just culture” that continuously strengthens safety and creates an environment that raises the level of transparency, encourages reporting, empowers the clinician to identify and implement appropriate actions to prevent adverse events and near misses, and promotes quality patient outcomes.

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, life threatening, requires initial or prolonged hospitalization, or requires intervention to prevent permanent damage.

Adverse and serious adverse events involving devices or drugs are reported to accrediting bodies as required and may be voluntarily reported to the US Food and Drug Administration (FDA). The FDA relies on voluntary reporting and uses such data to maintain the safety surveillance of products. A report may be the critical action that prompts a modification in use or design of the product, improves its safety profile, and leads to increased patient safety.

It is mandatory for user facilities (defined as hospitals, ambulatory surgical facilities, nursing homes, outpatient diagnostic facilities, or outpatient treatment facilities—not a physician’s office) to report a suspected medical device-related death to both the FDA and the manufacturer. User facilities must report a medical device-related serious injury to the manufacturer, or to the FDA if the medical device manufacturer is unknown. The Medical Device Reporting (MDR) regulation (21 CFR 803) contains mandatory requirements for manufacturers, importers, and device user facilities to report certain device-related adverse events and product problems to the FDA. The regulation specifies that reports be filed on FDA Medwatch Form 3500A or an electronic equivalent.
A standard document should be used to guide the documentation of objective and specific facts about an adverse or serious adverse event.

When serious adverse events occur, use a process such as a root cause analysis (RCA) or other systematic investigation and analysis to improve quality and safety. The process includes:

- Description and analysis of the event, identification of the cause(s), and implementation of specific strategies and/or actions for improvement to protect patients
- An interprofessional approach focusing on systems issues, procedures, human resources, peer and/or clinical review, products/equipment, processes, and training gaps

Consider using an RCA or other systematic investigation or analysis not only for serious adverse events but also for complex, recurrent problems and for “near misses.”

Employ interprofessional collaboration in planning and discussing information with the team responsible for disclosing information about the adverse event to the patient, caregiver, or surrogate.

**Documentation**

Document in the patient’s medical record:

- Complete description of only objective facts without speculation or comments about causes
- Complete organizational documentation as required for risk management department
Bibliography


Classen DC, Resar R, Griffith F. Global trigger tool shows that adverse events in hospitals may be ten times greater than previously measured. *Health Affairs*. 2011;30(4):581-589.


2. **Infection Prevention and Safety Compliance**

Hand Hygiene ................................................................. 28

Sharps Management ...................................................... 31

Medical Waste Disposal ................................................ 33

Durable Medical Equipment Disinfection ............................ 35

Standard Precautions ..................................................... 37

Transmission-Based Precautions ...................................... 39
Hand Hygiene

Policy
Hand hygiene is performed routinely during patient care activities.

Artificial fingernails or extenders are not worn when having direct contact with patients at high risk (eg, those in intensive-care units, operating rooms, or inserting a central vascular access device [CVAD]).

Keep the nail length short.

Key Points
Hand hygiene is a routine infection prevention practice that decreases the potential risk of microbial contamination and cross-contamination.

Use an alcohol-based hand rub routinely when performing hand hygiene unless the hands are visibly soiled or there is an outbreak of a spore-forming pathogen or norovirus gastroenteritis.

Perform hand hygiene with either a nonantimicrobial soap or an antimicrobial soap and water:

- When the hands are visibly contaminated with blood or other body fluids
- After providing care or having contact with patients suspected or confirmed of being infected with norovirus gastroenteritis or a spore-forming pathogen during an outbreak (eg, *Clostridium difficile*
- Before eating and after using a restroom

Store hand hygiene products in convenient locations at the point of use. Provide hand hygiene products that have a low irritancy potential and compatible hand lotions or creams.

Involve the employee with the evaluation of hand hygiene products to assess for product feel, fragrance, and skin irritation. Clinicians who have sensitivity to a particular product should be provided with an alternative. Other products for skin care such as gloves, lotions, and moisturizers should be assessed for compatibility with hand antisepsis products.

Do not add soap to a partially empty soap dispenser.

Provide employees with education on hand hygiene, monitor their hand hygiene performance, and provide feedback regarding their hand hygiene performance.
Patient Education
How to perform hand hygiene and to ask the employee to perform hand hygiene before having direct contact with the patient if it was not observed

Procedure
Perform hand hygiene with an alcohol-based hand rub or antimicrobial soap and water during patient care:

1. Before having direct contact with the patient
2. Before donning sterile gloves when inserting a central intravascular catheter
3. Before inserting a peripheral vascular catheter
4. After contact with the patient’s intact or nonintact skin
5. After contact with body fluids or excretions, mucous membranes, and wound dressings (if the hands are not visibly soiled)
6. After contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient
7. After removing gloves

Bibliography


Sharps Management

Policy
Regulated medical waste, which includes sharps, is discarded in the appropriate container and disposed of according to local, state, and federal laws and regulations.

Contaminated sharps are discarded in a nonpermeable, puncture-resistant, tamperproof biohazard container.

Safety-engineered devices, such as self-sheathing needles, that isolate or remove the blood-borne pathogens hazard, are available in the workplace and consistently activated or used.

The organization has an exposure control plan that is in accordance with the Occupational Safety and Health Administration (OSHA) blood-borne pathogen standard.

The organization educates employees how to safely handle and dispose of sharps and maintains documentation of employee education.

Key Points
The organization will have protocols for the safe handling of sharps that are based on local, state, and federal laws and regulations.

The organization will educate and train the employee in the use of the safety-engineered devices and maintain documentation of education.

Identify, report, and document exposures to potentially infectious materials or injury from sharps, and follow organizational protocols for postexposure follow-up. Monitor and analyze data for trends, and implement performance improvement as needed.

Consider the use of passive safety-engineered devices for needlestick injury prevention.

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

Procedure
1. Use a safety-engineered device for needlestick injury prevention.
2. Do not break or bend the sharps. Use a one-handed technique for recapping if necessary.
3. Activate the built-in safety controls during use, and discard as a single unit after use.
4. Dispose of sharps in a sharps container that is closable, puncture-resistant, leakproof, appropriately labeled or color-coded, and large enough to accommodate the disposal of the entire blood collection assembly (ie, holder and needle).
5. Place the sharps containers in the immediate area where sharps are used and are easily accessible.
6. Replace the sharps containers when about three-fourths full to avoid overfilling and disposal-related injuries.

**Bibliography**


Medical Waste Disposal

Policy
The organization has protocols for the safe handling of regulated medical waste that are based on local, state, and federal laws and regulations.

The organization has an exposure control plan that is in accordance with the Occupational Safety and Health Administration (OSHA) blood-borne pathogen standard.

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

The organization that handles, generates, and disposes of medical waste educates its employees and maintains documentation of employee education.

Key Points
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.

Identify, report, and document exposure to potentially infectious materials and follow organizational protocol for postexposure follow-up. Monitor and analyze data for trends, and implement performance improvement as needed.

Procedure
1. Don gloves and other personal protective equipment (PPE) as appropriate before handling medical waste.
2. Place medical waste in a red bag that contains a biohazard label.
3. Transport the medical waste to the designated area for temporary collection or storage. If transporting medical waste by vehicle (eg, in the home care setting), ensure that medical waste is properly contained and separated from clean equipment and supplies.
4. Restrict access of medical waste storage areas to authorized personnel.
Bibliography

Durable Medical Equipment Disinfection

Policy
Durable medical equipment (DME) is cleaned and disinfected using an Environmental Protection Agency (EPA)-registered disinfectant.

Cleaning and disinfectant products are used in accordance with the equipment and manufacturers’ directions for use.

Key Point
DME includes, but is not limited to, IV poles, flow-control devices, ultrasound or infrared devices for vascular visualization and other nondisposable, hard nonporous surface, infusion-related equipment.

Procedure
1. Inspect the DME’s surfaces for breaks in integrity that would impair either cleaning or disinfection. Discard or repair equipment that no longer functions as intended or cannot be properly cleaned and disinfected.
2. Clean and disinfect the DME’s surfaces when visibly soiled, on a regular basis (eg, at a frequency defined by organizational policies and procedures) and at established intervals during long-term single-patient use.
3. Clean and disinfect the DME surfaces with an EPA-registered hospital disinfectant according to the label’s safety precautions and directions for use, as well as safety data sheets (SDS).
4. Handle the DME according to Standard Precautions. Wear personal protective equipment (PPE) (eg, gloves, gown), according to the level of anticipated contamination, when handling patient-care equipment, and instruments/devices are visibly soiled or may have been in contact with blood or body fluids.
5. Implement patient-dedicated use of DME when a patient is placed on Contact Precautions. If common use of medical equipment for multiple patients is unavoidable (eg, ultrasound or infrared devices for vascular visualization), clean and disinfect the equipment before use on another patient.
6. When possible, limit the amount of DME that is brought into the home of patients infected or colonized with multidrug-resistant organisms (MDROs) or on Contact Precautions, and leave the DME in the home until the patient is discharged.
7. Used DME (eg, IV poles, flow-control devices) is placed in a plastic bag or decontaminated prior to transport to another location (ie, soiled utility area or warehouse) for subsequent cleaning and disinfection.
Bibliography


Standard Precautions

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

The organization ensures that sufficient and appropriate personal protective equipment (PPE) is available and readily accessible at the point of care.

Key Points
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.

When wearing PPE, keep the hands away from the face, and limit surfaces touched in the patient’s environment.

Patient Education
Implementation of 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

How to implement Standard Precautions, including the importance of carefully removing PPE to avoid self-contamination and contamination of the environment, and when and how to perform hand hygiene

Procedure
1. Select PPE based on the nature of the patient interaction and potential for exposure to blood, body fluids, or infectious agents, and the Centers for Disease Control and Prevention (CDC) isolation precaution guidelines in effect at the time of the patient encounter for specific communicable diseases (eg, Ebola virus disease).

2. 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.

3. 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), body fluids, mucous membranes, nonintact skin, or contaminated equipment.
4. Change gloves during patient care when torn or heavily contaminated, or if moving from a contaminated body site to a clean body site.
5. Wear a gown to protect skin and clothing during procedures or activities in which contact with blood or body fluids is anticipated.
6. Do not wear the same gown or gloves when caring for more than 1 patient.
7. 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.
8. Educate the employee 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.
9. In the home setting when caring for a patient with a multidrug-resistant organism (MDRO), follow Standard Precautions, limit reusable patient care equipment, and leave in the home until discharged. Clean and disinfect reusable patient care equipment before removing from the home or transport in a container (eg, plastic bag) to an appropriate site for cleaning and disinfection.

**Bibliography**


Transmission-Based Precautions

Policy
Transmission-Based Precautions, including Airborne Precautions, Droplet Precautions, and/or Contact Precautions, are implemented when infection control 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, or as recommended by the Centers for Disease Control and Prevention (CDC) isolation guidelines in effect at the time of the patient encounter.

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 maintained until it is determined that the cause of the symptoms are not due to an infectious agent or the duration of the recommended isolation precautions have been met.

Key Points
Transmission-Based Precautions, including Airborne Precautions, Droplet Precautions, and/or Contact Precautions, will be adapted and applied as appropriate in non–acute care settings where infusion therapy is provided, including long-term care facilities, home care, and other settings.

Transmission-Based Precautions will be used when patients are suspected or known to be infected or colonized with infectious agents that cannot be controlled with Standard Precautions alone.

Patient Education
How to implement Transmission-Based Precautions, including the importance of carefully removing personal protective equipment (PPE) to avoid self-contamination and contamination of the environment, and when and how to perform hand hygiene

Procedure
1. 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 the CDC isolation precaution guidelines in effect at the time of the patient encounter for specific communicable diseases (eg, Ebola virus disease).
2. Wear a face mask, and observe Droplet Precautions, in addition to Standard Precautions, when there is potential contact with respiratory secretions and sprays of blood or body fluids.

3. Perform hand hygiene immediately in between each step of removing PPE worn if the hands become contaminated, immediately after removing all PPE and before leaving the patient’s environment.

4. Wear a fit-tested, NIOSH-certified N95-or-higher respirator and observe Airborne Precautions, in addition to Standard Precautions, if the patient is suspected or confirmed of having an infection spread by airborne route or Ebola virus disease to prevent the potential exposure to infectious agents transmitted via the airborne route (e.g., *M. tuberculosis*). Perform fit testing prior to its initial use and at least annually thereafter.

5. In the home setting when caring for a patient with a multidrug-resistant organism (MDRO) or on Contact Precautions, limit reusable patient care equipment and leave in the home until discharged. Disinfect before removing from the home in a container (e.g., plastic bag) or transport to an appropriate site for cleaning and disinfection.

**Bibliography**


3. **Vascular Access Device Placement**

Vascular Access Device (VAD) Planning ....................................................... 42

Local Anesthesia ......................................................................................... 48

Short Peripheral Catheter Placement ......................................................... 52

Ultrasound-Guided Short Peripheral Catheter Placement ......................... 58

Short Peripheral Catheter Insertion via the External Jugular (EJ) Vein ........ 63

Ultrasound-Guided Midline Catheter Insertion .......................................... 68

Ultrasound-Guided Peripherally Inserted Central Catheter (PICC) Insertion
Using Modified Seldinger Technique (MST) .............................................. 77

Ultrasound-Guided Nontunneled Central Vascular Access Device (CVAD)
Insertion Using Modified Seldinger Technique (MST) .............................. 87

Ultrasound-Guided Nontunneled Central Vascular Access Device (CVAD)
Insertion Using Seldinger Technique ....................................................... 97
Vascular Access Device (VAD) Planning

Policy
The type and location (peripheral or central) of a vascular access device (VAD) is selected to best accommodate the patient’s needs based on factors such as the prescribed therapy or treatment regimen, anticipated duration of therapy, and patient characteristics such as age, history of vascular access and infusion therapy, comorbidities, venue of care, resources, and ability to care for the VAD.

Selection of the most appropriate VAD occurs as a collaborative process among the interprofessional team, the patient, and the patient’s caregivers.

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

Key Points
An overarching goal is to choose the least invasive VAD that has the greatest likelihood of reaching the end of the planned infusion therapy with the fewest number of replacements and the lowest rate of complications.

Selection of the most appropriate VAD and site of placement are critical decisions that impact the clinical outcome as well as the patient experience and satisfaction with care. Such decisions require critical thinking and analysis; the decision is generally not based on a single factor, such as the drug or solution category of vesicant or irritant. For example, while a continued need for a vesicant infusion requires a central vascular access device (CVAD), short-term emergent needs may demand peripheral administration or a relatively few intermittent doses may be administered peripherally. Vein choice (larger vein of the forearm and not close to any area of joint flexion), the need for frequent assessment, and the importance of patient education accompany such decisions. A CVAD is preferred for continuous infusion of hypertonic (osmolarity > 900 mOsm/L) or vesicant infusates when the patient factors and venue of care indicate a clear benefit greater than the risk.

Choices for peripheral venous access include short peripheral catheters and midline catheters. Characteristics of the prescribed infusion therapy are similar for both types of catheters. When the anticipated length of therapy will be 1 week or less, a short peripheral catheter is preferred. When the prescribed solutions and medications are well tolerated by peripheral veins and the patient has difficult venous access, use ultrasound to place a short peripheral catheter or a midline catheter in a larger vein.

Central vein access device placement should be avoided unless necessary. It is recommended that an evidence-based list of CVAD indications guide practice; examples of indications include:
• Clinical instability of the patient or complex infusion regimen
• Chemotherapy with duration of more than 3 months or episodic administration
• Continuous infusion therapy (vesicant, parenteral nutrition, fluid and electrolytes, medications, blood or blood products)
• Invasive hemodynamic monitoring
• Long-term intermittent infusion therapy
• History of difficult or failed peripheral access when vascular visualization technology has not enhanced placement

Peripherally inserted central catheters (PICCs) are associated with a higher rate of venous thrombosis, particularly in patients with cancer and those who are critically ill. The risk for catheter-related bloodstream infection (CR-BSI) in hospitalized patients is similar to other types of nontunneled CVADs, and selection of a PICC should not be construed as an infection prevention strategy.

Implanted vascular access ports and tunneled, cuffed catheters are considered for patients who require long-term infusion needs (eg, parenteral nutrition, antineoplastic therapy).

Special VAD features:
• Consider anti-infective CVADs in the following circumstances: emergency insertions, high central line-associated bloodstream infection (CLABSI) rate in the presence of other infection prevention strategies, prolonged anticipated duration of therapy (eg, greater than 5 days), and patients who have no history of allergy to the anti-infective agent on the CVAD.
• Consider the need for a VAD designed for power injection for patients who require ongoing diagnostic testing that requires rapid injection of contrast media (eg, computed tomography [CT] scans).

Vein preservation is an important consideration when planning for vascular access in all patients. For patients with end-stage renal disease, it is especially important to preserve veins for a future arteriovenous fistula or graft.

To avoid needlestick injuries during insertion and removal, VADs with a safety-engineered device are selected.

**Assessment**
Consider the potential for changes in the infusion therapy (eg, culture results, increasing nutritional support requirements) and potential transfer to another venue of care during the anticipated length of dwell.

Use vascular visualization technology (near infrared, ultrasound) to identify veins and enhance the success rate for peripheral access device placement, especially for patients who are known to have difficult access.
When using ultrasound guidance to place a short peripheral catheter, choose a catheter with adequate length for the depth of the vein; longer catheter length is associated with longer duration of dwell; veins that are more than 0.5-cm deep are associated with an increased risk for infiltration due to catheter length that is too short for the vein’s depth (see *Ultrasound-Guided Short Peripheral Catheter Placement*).

Consideration for the VAD’s outer diameter is based on the risk of venous thrombosis; a catheter-to-vein ratio of 45% or less, as assessed by ultrasound, is recommended for PICCs due to risk of venous thrombosis.

When planning for specific infusates, recognize that the internal diameter of each lumen may vary on a multiple-lumen VAD. Use the most appropriate VAD lumen size, based on type, volume, and rate of infusate.

**Patient Education**

Rationale for VAD

Types of VADs appropriate for needed infusion therapy

Advantages and disadvantages of VAD types

Care and management requirements

Potential risks/complications

**Home Care/Alternative Site Implications**

For home care patients, consider patient hand dominance, need to participate in activities of daily living, and involvement with delivery of infusion therapy when choosing the type of VAD and the site of insertion.
Table 1. VAD Planning by Location of Catheter

<table>
<thead>
<tr>
<th>Catheter Locations</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peripheral</td>
<td>Consider infusate characteristics in relation to anticipated duration of therapy</td>
</tr>
<tr>
<td></td>
<td>Duration of infusion therapy for less than 1 week</td>
</tr>
<tr>
<td></td>
<td>Use vascular visualization technology to identify veins and to increase cannulation success, especially for those with difficult access.</td>
</tr>
<tr>
<td></td>
<td>Use 20 to 24 gauge for most infusates and blood transfusion (adults) and 22 to 24 gauge for neonates, pediatrics, and the elderly. Research has demonstrated that peripheral catheters larger than 20 gauge are more likely to cause phlebitis.</td>
</tr>
<tr>
<td></td>
<td>Consider larger-gauge catheters when rapid fluid replacement is a necessity.</td>
</tr>
<tr>
<td></td>
<td>Avoid the use of steel winged devices except for single-dose administration.</td>
</tr>
<tr>
<td>Midline</td>
<td>Consider infusate characteristics in relation to anticipated duration of therapy.</td>
</tr>
<tr>
<td></td>
<td>Duration of therapy (eg, 1-4 weeks)</td>
</tr>
<tr>
<td></td>
<td>Consider for infusates including antimicrobials, fluid replacement, and analgesics that are well tolerated by peripheral vein.</td>
</tr>
<tr>
<td></td>
<td>Avoid in patients with a history of thrombosis, hypercoagulability, end-stage renal disease, and decreased vascular flow to the extremities.</td>
</tr>
<tr>
<td></td>
<td>Use caution with intermittent vesicant administration (eg, calcium solutions, contrast agents) because of the risk of extravasation, which may be more difficult to detect in deeper veins. Short-term administration (eg, less than 1 week) of vancomycin via a midline catheter was found to be safe in 1 study.</td>
</tr>
</tbody>
</table>
### Table 1. VAD Planning by Location of Catheter (continued)

<table>
<thead>
<tr>
<th>Central Vascular Access</th>
<th>Can be used for any type of infusion therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Selected on the basis of an evidence-based list of indications</td>
</tr>
<tr>
<td></td>
<td>Increased risk of catheter-associated venous thrombosis with PICCs, particularly in patients with cancer and those who are critically ill</td>
</tr>
<tr>
<td></td>
<td>Consider use of an anti-infective CVAD when specific criteria are met.</td>
</tr>
<tr>
<td></td>
<td>Consider an implanted port or a tunneled cuffed catheter for patients who have long-term infusion therapy needs.</td>
</tr>
<tr>
<td></td>
<td>Consider the need for a CVAD that is designed for power injection.</td>
</tr>
<tr>
<td></td>
<td>Plan proactively for patients with chronic kidney disease because the arteriovenous fistula or graft is preferred for hemodialysis access. Vein preservation is critical. Avoid PICCs and subclavian placement due to risks of central vein stenosis and thrombosis.</td>
</tr>
</tbody>
</table>

*Abbreviations: VAD, vascular device; CVAD, central vascular access device; PICC, peripherally inserted central catheter.*

### Bibliography


Local Anesthesia

Policy
Local anesthesia is used to minimize pain associated with placement of a vascular access device (VAD) or with access of an implanted vascular access port based upon an assessment of patient condition, needs, risks, and benefits.

Key Points
Local anesthesia may be used to reduce pain and discomfort prior to each painful VAD puncture, implanted vascular port access, intraosseous access in children, and adults who request it or have a history of vasovagal reactions.

The local anesthetic agent and method that is least invasive and carries the least risk for allergic reaction or infection is selected.

Types of local anesthesia used include:
- Transdermal analgesic cream
- Anesthetic dermal patch
- Intradermal injection of lidocaine hydrochloride 1% solution; buffered lidocaine may be used but is not commercially available and must be compounded by the pharmacy
- Intradermal injection of bacteriostatic sodium chloride (the preservative, benzyl alcohol, acts as a local anesthetic)
- Iontophoresis technology: use of an electric current to deliver the anesthetic into the skin
- Pressure-accelerated lidocaine
- Ice: may be placed over the implanted vascular port for a few minutes prior to accessing the VAD
- Topical vapocoolant spray: an issue is short duration of action; however, recent research suggests that application after skin disinfection did not result in a significant increase in skin bacterial count.

Use the most effective and available local anesthetic method and/or agent, considering time to peak effectiveness, as well as adjunctive and less invasive anxiolytic, cognitive, behavioral, and complementary therapies (eg, distraction, positioning).

Assessment
Patient tolerance to pain and patient preferences related to pain management
Patient anxiety about the procedure
Allergic reactions, tissue damage
Patient Education
Information on the selected local anesthetic agent, including benefits, management, and potential complications

Supplies
- Transdermal (topical) analgesic cream with following supplies:
  - Transparent semipermeable (TSM) dressing
  - Antiseptic solutions
  - Gauze pads
  - Gloves
- Lidocaine hydrochloride 1% solution with following supplies:
  - Antiseptic solution
  - Gauze pads
  - Gloves
  - 1-mL (tuberculin) syringe
- Iontophoresis equipment

Procedure
1. Obtain and review licensed independent practitioner’s (LIP’s) order or standard protocol.
2. Verify patient’s identity using 2 independent identifiers, not including patient’s room number and bed number.
3. Assess for any history of hypersensitivity 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.

Use of Transdermal (Topical) Anesthetic Cream
a. Apply recommended amount of transdermal analgesic cream to intended venipuncture site or implanted port needle insertion site.
b. Cover analgesic cream with TSM dressing.
c. Remove dressing material after recommended application time, and cleanse skin of remaining transdermal cream.
d. Proceed with device insertion procedure.
e. Assess for response and any reactions to topical anesthetic cream.
Use of Anesthetic Dermal Patch
a. Apply anesthetic dermal patch to intended venipuncture site or implanted port needle insertion site.
b. Leave on skin for the recommended application time.
c. Remove patch.
d. Proceed with device insertion procedure.
e. Assess for response and any reactions to anesthetic dermal patch.

Use of Intradermal Anesthetic (may be used with peripheral venipuncture and percutaneous central vascular access device [CVAD] insertion)
a. Cleanse skin of intended venipuncture site with antiseptic solution and allow to dry.
b. Draw 0.3 cc of injectable anesthetic into 1-mL (tuberculin) syringe.
c. With needle bevel up, gently insert needle intradermally lateral to intended venipuncture site.
d. Aspirate to confirm no blood return.
e. Inject 0.1 cc to 0.3 cc anesthetic to form wheal at intended access site.
f. Remove needle and discard syringe in appropriate sharps container.
g. Proceed with device insertion.
h. Assess for response and any reactions to intradermal anesthetic.

Use of Iontophoresis
a. Refer to manufacturer’s directions for use.
b. Assess for response and any reactions to iontophoresis procedure.
   aa. Skin irritation or burns associated with use
   bb. Erythema under electrodes, which is usually transient

Documentation
Document in the patient’s medical record:
• Local anesthetic used
• Date, time of administration
• Patient education
• Patient response to effectiveness of local anesthetic and VAD procedure
Bibliography


Short Peripheral Catheter Placement

Policy
The decision to place a short peripheral catheter as the most appropriate vascular access device (VAD) for the patient occurs as an interprofessional collaboration with the patient and caregiver(s) based on the projected treatment plan.

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

Peripheral vein preservation is considered when planning for vascular access.

A short peripheral catheter is chosen for nonirritant, nonvesicant, and nonhyperosmolar infusion therapy with a relatively short anticipated duration of infusion therapy (eg, less than 1 week).

No more than 2 attempts at short peripheral catheter placement will be made by any 1 clinician, and no more than 4 attempts per patient. Attempts at peripheral catheter insertion should be made only if venous access is felt to be adequate.

Competency is validated for clinicians who insert short peripheral catheters.

Key Points
The smallest-gauge peripheral catheter that will accommodate the prescribed therapy will be chosen.

Use steel winged devices for single-dose administration only, and do not leave this device in place.

The clinical need for each short peripheral catheter is assessed on a daily basis.

If 4 unsuccessful attempts have been made, another plan for vascular access is required.

Avoid areas of joint flexion, including the hand, all surfaces of the wrist, and the antecubital fossa. Choose insertion sites in the forearm to increase dwell time, decrease complications, promote self-care, and prevent accidental removal.

Sudden complaints of paresthesia-type pain, including electrical shock-like pain, tingling, severe burning, and/or numbness indicate nerve damage and require immediate removal of the catheter.

Consider methods to reduce pain and discomfort of catheter insertion, such as:

• Local anesthetic agents including, but not limited to, topical vapocoolant sprays, topical transdermal agents, intradermal lidocaine, and pressure-accelerated lidocaine

• Adjunctive and less invasive anxiolytic, cognitive, behavioral, and complementary therapies
Assessment
Assess the characteristics of the prescribed infusion therapy and the anticipated length of therapy to determine if a short peripheral catheter is the most appropriate VAD.

Assess the condition of the skin and previous sites of venipunctures and/or infusion complications (eg, phlebitis, infiltration) and avoid these areas for short peripheral catheter insertion.

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

Assess the number and location of peripheral veins that are easily seen and palpated. If venous sites are not found, avoid blind venipuncture and use a vascular visualization (eg, visible or near infrared light and ultrasound) method.

- Avoid veins in the upper extremity of the side of breast surgery with axillary node dissection, with lymphedema, or with an arterio-venous fistula/graff; after radiation therapy to that side of the body; or the affected extremity from a cerebrovascular accident.
- For patients with chronic kidney disease, collaborate with the patient and licensed independent practitioner (LIP) to discuss the risks and benefits of using the upper extremity when future dialysis graft or fistula is planned.
- For adult patients, do not use veins of the lower extremities unless necessary due to risk of tissue damage, thrombophlebitis, and ulceration.
- For pediatric patients, consider veins in the hand, forearm, and upper arm below the axilla.
  - Avoid the antecubital area, which has a higher failure rate.
  - For infants, also consider veins of the scalp.
  - Avoid the hand or fingers, or the thumb/finger used for sucking.
  - Avoid veins in the right arm of infants and children after procedures treating congenital cardiac defects that may have decreased blood flow to the subclavian artery.

Patient Education
Purpose of short peripheral catheter insertion procedure including risks, benefits, signs, and symptoms of common complications

Need to avoid getting the dressing and/or site wet during bathing, handwashing, etc.

What to report to the clinician: signs or symptoms of increasing redness, pain, or swelling within the 48 hours after the catheter was removed
Home Care/Alternative Site Implications
Performance of activities of daily living without disruption of the dressing or insertion site.

Patient and/or caregiver instruction includes:
- Infection prevention, including aseptic technique and hand hygiene before any catheter access
- Disinfection of needleless connector before every catheter access
- Flushing and locking frequency, technique, and solution
- Dressing change frequency; this is not generally performed by the clinician
- Signs and symptoms of complications and whom to and how to report
- Living with an SPC, including activity limitations and protecting the device while performing activities of daily living, including protection from water during bathing

Instructions include demonstration, return demonstration of procedures, and use of teach-back technique.

Comprehension and performance are evaluated throughout the period of catheter dwell time

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

1. Obtain and review the LIP’s order for insertion of short peripheral catheter.
2. Assess for history of allergies to analgesia, adhesives, or antiseptic solutions.
3. Verify patient’s identity using 2 independent identifiers, not including the patient’s room number or bed number.
4. Obtain informed consent per organizational policy or patient assent to perform procedure.

Procedure

1. Gather supplies.
2. Place patient in sitting or recumbent position, as appropriate.
3. Perform hand hygiene.
4. Place tourniquet on the upper extremity.
5. Assess vasculature of the upper extremity, and identify potential sites that are easily seen and/or palpated.
6. If no venous sites are visible or easily palpated, use technology to improve cannulation 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 cannula or catheter.
   b. For near-infrared light devices, follow the manufacturer’s directions for use to identify bifurcating veins, tortuosity of veins, and palpable but nonvisible veins.
7. Remove tourniquet.
8. Prepare insertion site:
   a. If visibly soiled, cleanse with antiseptic soap and water.
   b. Remove excess hair, if necessary, by clipping.
9. Administer local anesthesia if needed (see Local Anesthesia).
11. Don gloves.
12. Cleanse insertion site with antiseptic solution; allow to dry completely.
   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.
13. Reapply a tourniquet above the intended venipuncture site, or use alternative methods to promote venous distention.
14. Use vein visualization technology if needed.
15. If vein palpation is necessary after application of skin antiseptic, apply sterile gloves.
16. Stabilize the selected vein below the intended venipuncture site by stretching the skin taut with the nondominant hand.

17. Align the short peripheral catheter on top of the vein at a 10- to 15-degree angle from the skin. Puncture the skin and anterior vein wall, taking note of blood in the catheter and/or flashchamber of the short peripheral catheter.

18. While continuing to hold skin taut, use the push-off tab to separate the catheter from the needle stylet and advance the catheter into the vein. Do not push from the open catheter hub, as this will contaminate the lumen.

19. Release the tourniquet.

20. Activate the safety mechanisms according to manufacturer’s directions for use.

21. If extension set is to be attached, compress the skin well above the catheter tip to stop the flow of blood, and attach the extension set to the catheter hub and tighten the luer lock. Do not allow the male luer of the extension set to touch the skin.

22. For intermittent use, attach needleless connector and disinfect the connection surface.

23. Aspirate to remove air from pre-attached extension set and to assess for blood return, flush with preservative-free 0.9% sodium chloride (USP).

24. For continuous infusion, attach primed administration set.

25. Observe the site for signs of swelling, or if patient complains of discomfort or pain, removing catheter if present.

26. Stabilize the catheter, preferably with an engineered stabilization device. If not available, use only sterile tape.

27. Apply a TSM dressing over the insertion site.

28. For added securement, curl the extension set to the side, and tape to the arm.

29. Discard used supplies in the appropriate receptacles.

30. Remove gloves, and perform hand hygiene.

31. Label dressing with the date performed or date to be changed.

**Documentation**

Document in the patient’s medical record:

- Use of visualization technology as appropriate
- Date and time of insertion, number of attempts, functionality of device, local anesthetic, if used
- Identification of the insertion site by anatomical descriptors, laterality, landmarks, or appropriately marked drawings
- Patient response to the procedure
- Patient education
Bibliography


Ultrasound-Guided Short Peripheral Catheter Placement

Policy
The decision to place an ultrasound-guided short peripheral catheter (SPC) as the most appropriate vascular access device (VAD) for the patient occurs as an interprofessional collaboration with the patient and caregiver(s) based on the projected treatment plan.

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

Peripheral vein preservation is considered when planning for vascular access.

Competency is validated for clinicians who use ultrasound technology for SPC insertion.

Key Points
Ultrasound-guided SPC insertion is an important clinical adjunct for patients with difficult vascular access.

Visualization of vessels can lead to less insertion trauma.

Infusion therapies expected to last more than 1 week may be better suited to peripherally inserted central catheter (PICC) or midline catheter placement.

Assessment

- 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.
- Assessment of vessel depth is critical since selection of the appropriate length catheter will prevent inadvertent infiltration.
- Vessels more than 0.5 cm deep have an increased risk for inadvertent infiltration due to use of short catheters; choose catheters long enough to ensure at least 2/3 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 deeper than 1.5 cm should be avoided, and an alternative vascular access plan should be developed.
Patient Education
Purpose of SPC, risks, benefits, common complications and what to report
Rationale for use of ultrasound

Home Care/Alternative Site Implications
It may be less common for a patient to be discharged from an acute care facility with an ultrasound-guided SPC in place, and this procedure is not typically performed in an alternative care setting. If so, patients and/or caregivers may be involved in various aspects of care.

Supplies
- Gloves, nonsterile (sterile gloves are needed for site palpation after skin antisepsis)
- Short peripheral catheter with safety mechanism (1.75-inch – 1.88-inch catheters provide better stabilization and prevent infiltration in deeper vessels)
- Vein visualization device, if needed
- Single-use clippers or scissors for hair removal, if indicated
- Local anesthetic, as indicated
- Stabilization device
- Short extension set, if not permanently attached to the catheter
- Needleless connector
- Preservative-free 0.9% sodium chloride (USP) prefilled syringe(s) or primed administration set
- IV start kit (preferred) or the following:
  - Single-use tourniquet
  - Antiseptic solution
  - Transparent semipermeable membrane (TSM) dressing (preferred)
  - Sterile gauze and sterile tape for dressing, if indicated
  - Label
- For ultrasound:
  - Disinfectant wipe
  - Sterile water-based ultrasound gel
  - Portable ultrasound machine

Preprocedure
1. Obtain and review licensed independent practitioner’s (LIP’s) order for insertion of SPC.
2. Assess for history of allergies to analgesia, adhesives, or antimicrobial solutions.
3. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
4. Obtain informed consent per organizational policy or patient assent to perform procedure.

**Procedure**

1. Assess vasculature using ultrasound.
   a. Sanitize the ultrasound probe with a disinfectant wipe.
   b. Perform hand hygiene.
   c. Don clean gloves.
   d. Apply liberal amount of ultrasound gel to the patient’s arm.
   e. Apply probe to the skin: 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.
   f. Without a tourniquet, assess veins for vessel size, path, round shape, and compressibility.
   g. Assess depth of intended vessel for venipuncture.
   h. Assess for adequacy of vessel size comparative to proposed outer catheter diameter to promote hemodilution and preserve vessel health.
   i. Smaller vessels should be avoided to prevent phlebitis and thrombosis.
   j. Remove gloves and discard.

2. Prepare for insertion, collecting necessary insertion supplies and setting up a sterile field.
   a. Perform hand hygiene.
   b. Position patient for comfort and equipment for visualization of the vasculature.
   c. Apply a bead of ultrasound gel to the probe and cover with sterile TSM dressing or probe cover; avoid contamination of the probe cover or TSM dressing that will be in contact with the patient’s skin.
   d. Create a sterile field by opening a paper sterile barrier on a clean surface.
   e. Don clean gloves.
   f. Prepare the insertion site:
      i. If visibly soiled, cleanse with antiseptic soap and water.
      ii. Remove excess hair, if necessary, by clipping.
   g. Administer local anesthesia, if needed (see *Local Anesthesia*).
   h. Cleanse insertion site with antiseptic solution; allow to dry completely.
i. Chlorhexidine solution (preferred): apply using a back-and-forth motion for at least 30 seconds.

ii. Povidone-iodine: apply using applicator and allow to remain on the skin for 1.5 to 2 minutes or longer to dry completely for adequate antisepsis. The use of concentric circles or a back-and-forth motion for this skin preparation has not been studied.

i. Apply tourniquet.

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

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

l. 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.

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

n. 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.

o. Confirm slow venous blood return. (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.)

p. Place the ultrasound probe on the sterile field.

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

r. Release tourniquet.

s. 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.

t. Connect the primed extension set if not using a catheter with a preattached extension set.

u. Retrieve probe from the sterile field, and position over the catheter tip in the longitudinal view.
v. 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.

w. Stabilize and secure the catheter hub and attached extension set using aseptic technique, preferably with an engineered stabilization device (ESD), and apply a TSM dressing.

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

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

z. Apply a TSM dressing over the insertion site.

aa. Discard used supplies in the appropriate receptacles.

bb. Remove gloves and perform hand hygiene.

cc. Label dressing with the date performed or date to be changed.

**Documentation**

Document in the patient’s medical record:

- Use of ultrasound for catheter placement, catheter size, vessel depth, catheter length, and insertion location
- Date and time of insertion, number of attempts, functionality of device, local anesthetic, if used
- Identification of the insertion site by anatomical descriptors, laterality, landmarks, or appropriately marked drawings
- Patient response to the procedure
- Patient education

**Bibliography**


Short Peripheral Catheter Insertion via the External Jugular (EJ) Vein

Policy
The decision to place a short peripheral catheter via the external jugular (EJ) vein as the most appropriate vascular access device (VAD) for the patient occurs as an interprofessional collaboration with the patient and caregiver(s) based on the projected treatment plan.

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

Peripheral vein preservation is considered when planning for vascular access.

Competency is validated for clinicians who insert short peripheral catheters via the EJ vein.

Key Points
An EJ short peripheral catheter should be considered a short-term placement due to the risk for dislodgment 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.

An EJ short peripheral catheter 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 external jugular vein

An EJ short peripheral catheter 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.

To prevent complications when inserting the catheter, it is recommended that no more than 2 attempts on 1 side be performed and the patient be placed in a 10- to 15-degree Trendelenburg position for insertion.

EJ short peripheral catheter placement 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 external jugular vein is a very superficial vein.


**Assessment**
Assess both sides of the neck for the most visible EJ vein.

Care should be taken to keep hair away from the EJ short peripheral catheter insertion site. Hair may need to be clipped for patients with beards.

**Patient Education**
Purpose of short peripheral catheter, risks, benefits, common, and what to report

Rationale for use of ultrasound

**Supplies**
- Gloves, nonsterile (sterile gloves are needed for site palpation after skin antisepsis)
- Short peripheral catheter with safety mechanism
- Vein visualization device, if needed
- Single-use clippers or scissors for hair removal, if indicated
- Local anesthetic, as indicated
- Stabilization device
- Short extension set, if not permanently attached to the catheter
- Needleless connector
- Preservative-free 0.9% sodium chloride (USP) prefilled syringe(s) or primed administration set
- IV start kit (preferred) or the following:
  - Single-use tourniquet
  - Antiseptic solution
  - Transparent semipermeable membrane (TSM) dressing (preferred)
  - Sterile gauze and sterile tape for dressing, if indicated
  - Label
- For ultrasound:
  - Disinfectant wipe
  - Sterile water-based ultrasound gel
  - Portable ultrasound machine

**Preprocedure**
1. Obtain and review licensed independent practitioner’s (LIP’s) order for insertion of EJ short peripheral catheter.
2. Assess for history of allergies to analgesia, adhesives, or antimicrobial solutions.
3. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
4. Obtain informed consent per organizational policy or patient assent to perform procedure.
5. Place patient in a supine position for vessel assessment. Place patient in 10- to 15-degree Trendelenburg position for catheter insertion.

Procedure
1. Assess vasculature using ultrasound.
   a. Sanitize the ultrasound probe with a disinfectant wipe.
   b. Perform hand hygiene.
   c. Don clean gloves.
   d. Apply liberal amount of ultrasound gel to the patient’s neck.
   e. Apply probe to the skin: 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.
   f. Assess external jugular vein for vessel size, path, round shape, and compressibility.
   g. Assess for adequacy of vessel size comparative to proposed outer catheter diameter to promote hemodilution and preserve vessel health.
   h. Remove gloves and discard.
2. Prepare for insertion, collecting necessary insertion supplies, and setting up a sterile field.
   a. Perform hand hygiene.
   b. Position patient in 10- to 15-degree Trendelenburg position.
   c. Don clean gloves.
   d. Turn the patient’s head gently to the opposite side to expose the external jugular vein. Turning the head too far will flatten and obscure the vein.
   e. Cleanse insertion site with antiseptic solution; allow to dry completely.
      i. Chlorhexidine solution (preferred): apply using a back-and-forth motion for at least 30 seconds.
      ii. 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.
   f. If vein palpation is necessary after application of skin antiseptic, apply sterile gloves.
   g. Place thumb distal to the insertion site, pulling the skin upward to stabilize the vein.
h. Position the catheter on top of the vein with the bevel facing up using a 10- to 30-degree insertion angle. Puncture skin and insert the catheter into the vein.

i. Observe for blood in the catheter or flashback chamber of the catheter.

j. Lower the insertion angle, and advance the catheter 3 to 5 mm further into the vein to ensure the needle tip and catheter are inside the lumen of the vein.

k. Use the push-off tab to separate the catheter from the needle stylet, and advance the catheter into the vein. Do not push from the open catheter hub as this will contaminate the lumen.

l. Activate the safety mechanism according to manufacturer’s directions for use.

m. If extension set is to be attached, compress the skin well above the catheter tip to stop the flow of blood and attach the primed extension set to the catheter hub and tighten the luer lock. Do not allow the male luer of the extension set to touch the skin.

n. If using a catheter with a preattached extension set, attach a prefilled flush syringe, aspirate to remove air, and assess for blood return.

o. Observe the site for signs of swelling, or if patient complains of discomfort or pain, removing catheter if present.

p. Stabilize the catheter preferably with an engineered stabilization device. If not available, use only sterile tape.

q. Apply a TSM dressing over the insertion site.

r. Discard used supplies in the appropriate receptacles.

s. Remove gloves, and perform hand hygiene.

t. Label dressing with the date performed or date to be changed.

**Documentation**

Document in the patient’s medical record:

- Use of ultrasound for vessel assessment, catheter size, vessel depth, catheter length, and insertion location
- Date and time of insertion, number of attempts, functionality of device, local anesthetic, if used
- Identification of the insertion site by anatomical descriptors, laterality, landmarks, or appropriately marked drawings
- Patient response to the procedure
- Patient education
Bibliography


Ultrasound-Guided Midline Catheter Insertion

Policy
The decision to place a midline catheter as the most appropriate vascular access device (VAD) for the patient occurs as an interprofessional collaboration with the patient and caregiver(s) based on the projected treatment plan.

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

Peripheral vein preservation is considered when planning for vascular access.

Competency is validated for clinicians who place midline catheters.

Key Points
A midline catheter is defined as a catheter inserted into the upper arm via the basilic, cephalic, or brachial vein, with the internal tip located level at or near the level of the axilla and distal to the shoulder.

Consider a midline catheter for medications and solutions such as antimicrobials, fluid replacement, and analgesics with characteristics that are well tolerated by peripheral veins.

Use caution for noncontinuous (or intermittent) vesicant administration due to risk of undetected extravasation.

Therapies that are intended for longer than 2 weeks may be better suited to peripherally inserted central catheter (PICC) placement.

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

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

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

Midline catheters may also incorporate new techniques designed to reduce the number of individual pieces required, potentially decreasing the risk of insertion-related complications. This technique integrates the guidewire within a sterile housing followed by catheter advancement from that same housing. Use
manufacturer’s directions for use for each brand of these devices. Consider the use of maximum barrier precautions for their insertion.

**Assessment**

- Select sites in the upper arm (preferred) or (secondarily) the region of the antecubital fossa, using the basilic, cephalic, median cubital, and brachial veins, with the basilic vein preferred. For neonates and pediatric patients, additional site selections include veins in the leg with the tip below the groin and in the scalp with the tip in the neck, above the thorax.
- Avoid cannulation 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 in order to decrease chances of accidental removal.
- 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.
- Without a tourniquet, assess veins for vessel size, path, round shape, and compressibility.
- Assess depth of intended vessel for venipuncture.
- Assess for adequacy of vessel size comparative to proposed outer catheter diameter to promote hemodilution and preserve vessel health.
- Smaller vessels (catheter-to-vein ratios of less than 45%) should be avoided to reduce the risk of phlebitis and thrombosis.

**Patient Education**

Purpose of midline catheter, risks, benefits

What to expect with the procedure/purpose for the use of the ultrasound
Care and maintenance requirements, patient responsibilities

Common complications, signs and symptoms to report

**Home Care/Alternative Site Implications**

Many patients who have a midline catheter placed for longer courses of infusion therapy will be cared for at home or in another type of alternative site (eg, outpatient, long-term care facility).

Patients and/or caregivers instruction includes:

- Infection prevention, including aseptic no-touch technique and hand hygiene before any catheter access
- Disinfection of needleless connector before every catheter access
- Flushing and locking frequency, technique, and solution
- Dressing change frequency
- Signs and symptoms of complications and whom to and how to report
- Living with a midline catheter, including activity limitations and protecting the device while performing activities of daily living, including protection from water during bathing

Instructions include demonstration, return demonstration of procedures and use of teach-back technique.

Comprehension and performance is evaluated throughout the period of catheter dwell time.

**Supplies**

- Insertion kit for Modified Seldinger procedure should include:
  - Midline catheter
  - 21 g safety micro-introducer needle
  - Introducer/dilator appropriate to the catheter size
  - 20 cm guidewire
  - Safety scalpel
  - Tourniquet: single use
- Insertion tray should include:
  - Maximum barrier supplies
    - Head covering
    - Mask
    - Sterile gloves (2 pair)
    - Sterile gown
    - Underarm sterile drape
    - Large sheet sterile drape with fenestration
    - Antiseptic solution (alcoholic chlorohexidine preferred; may substitute 70% isopropyl alcohol and povidone-iodine for chlorhexidine gluconate sensitivities)
Vascular Access Device Placement

- Sterile gauze
- Disposable tape measure
- Disposable skin marker
- Engineered stabilization device (ESD)
- Extension set (needed for some catheters)
- Needleless connector(s) for each lumen
- Prefilled syringe preservative free 0.9% sodium chloride (USP)flushes for each lumen
- Prefilled syringe of heparin flush solution for each lumen if needed
- Transparent semipermeable membrane (TSM) dressing; antimicrobial sponge or antimicrobial gel dressing if used
- Skin protectant solution
- Sterile ultrasound gel
- Sterile ultrasound probe cover
- Disinfectant wipe
- Ultrasound machine
- Clean gloves
- Local anesthetic, as needed per protocol or as ordered
- 3-mL syringe and small-gauge needle for subcutaneous anesthetic administration

For the Seldinger technique, add components for the procedure not included in the insertion kit.

Preprocedure

1. Obtain and review licensed independent practitioner’s (LIP’s) order for insertion of midline catheter.
2. Collaborate with the prescribing LIP for any relative contraindication to placement before placing a midline catheter.
3. Assess for history of allergies to analgesia, adhesives, or antimicrobial solutions.
4. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
5. Obtain informed consent per organizational policy or patient assent to perform procedure.
6. Position patient supine in a reclining position, with arm extended at a 90-degree angle away from body. Elevate the head of the bed for patient comfort if the flat position cannot be tolerated.
7. Perform hand hygiene.
8. Assemble insertion equipment on a clean, flat work space.
Procedure

1. Assess vasculature using ultrasound.
   a. Sanitize the ultrasound probe with a disinfectant wipe.
   b. Perform hand hygiene.
   c. Don clean gloves.
   d. Apply liberal amount of ultrasound gel to the patient’s arm.
   e. Apply probe to the skin: visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site.
   f. Without a tourniquet, assess veins for vessel size, path, round shape, and compressibility.
   g. Assess depth of intended vessel for venipuncture, and measure the intended vessels’ diameter; select a catheter with a catheter-to-vein-ratio of 45% or less. Smaller vessels should be avoided to prevent thrombosis.
   h. Mark the level of the proposed insertion site with 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.
   i. Remove the ultrasound gel from the patient’s skin.
   j. Measure the baseline arm circumference 10 cm above the antecubital fossa.
   k. If using topical anesthetic cream, apply to proposed insertion site, cover with TSM dressing, and allow 15 to 60 minutes before continuing with procedure as per the manufacturer’s directions for use.
   l. Remove gloves and discard.

2. Prepare for insertion, collecting necessary insertion supplies, and setting up a sterile field.
   a. Perform hand hygiene.
   b. Position patient for comfort and equipment for visualization of the vasculature.
   c. Don head covering and mask.
   d. Perform hand hygiene.
   e. Open the insertion tray and midline catheter kit to create a sterile field and add additional items to the field, using sterile technique as needed.
   f. Don sterile gown and 2 pairs of sterile gloves.
   g. Prime any needed extension set(s) and catheter with 0.9% sodium chloride.
   h. 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.
i. If the catheter is to be trimmed, use of a guillotine or scalpel is preferred to scissors for trimming in a blunt cut.

j. Apply sterile underarm drape.

k. Prep the skin in the entire area where the dressing will cover with an alcoholic chlorhexidine gluconate (CHG) applicator for 30 seconds using a back-and-forth motion and allow to air-dry for at least 3 minutes on hairless skin. Refer to the manufacturer's directions for the appropriate size applicator for the proposed dressing area. Prep the entire area that the dressing will cover.

l. For patients with CHG sensitivities, 70% isopropyl alcohol and povidone-iodine may be used for skin disinfection; allow to dry completely.

m. Apply a tourniquet proximal to the insertion site.

n. Remove outer set of gloves after prepping the skin and tying the tourniquet.

o. Apply 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.

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

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

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

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

t. While visualizing the vessel, insert the micro-introducer needle through the skin and into the vein using a 45-degree angle. Place the tip of the micro-introducer 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.
u. The tip of the micro-introducer needle will appear as an echogenic white dot on the screen.

v. 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.

w. Confirm slow venous blood return. 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.

x. Observe for blood return in micro-introducer needle hub, and visualize the needle tip in the center of the vein on ultrasound before proceeding.

y. Put the ultrasound probe down on sterile field.

z. Reduce the angle of the micro-introducer needle, and stabilize the micro-introducer needle.

aa. Insert the floppy-tipped guidewire into the micro-introducer needle, threading at least 10 cm, but not more than 15 cm, into the vein. The guidewire should never be inserted into a position beyond the level of the axilla.

bb. Carefully remove the micro-introducer needle from the vein and skin, pulling it back over the guidewire.

cc. Do not allow the guidewire to move outward through the micro-introducer needle due to risk of severing the guidewire.

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

e. Make a skin nick, if needed.
   i. Using a scalpel, hold the blade with the blunt side against the wire.
   ii. 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.

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

gg. Remove the guidewire.

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

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

jj. Slowly advance the catheter through the introducer sheath.

kk. Continue to advance the catheter slowly to the measured length.
II. Attach sterile saline-filled syringe, and aspirate for blood from catheter and flush to determine patency.

mm. 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.

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

oo. Apply a needleless connector to each lumen.

pp. Clean excess blood from the insertion site using chlorhexidine gluconate solutions or dry gauze.

qq. Stabilize the catheter:
   i. If using a subcutaneous ESD, use according to manufacturer’s directions for use.
   ii. If using an adhesive-based ESD, apply skin protectant solution to the area to be covered by the ESD and dressing and allow to dry.

rr. For oozing sites, apply sterile gauze and TSM dressing to the insertion site and change in 24 hours; hemostatic agents may be required for sites that continue to ooze for longer than 24 hours; use in accordance with manufacturer’s directions for use.

ss. If using a CHG-impregnated dressing, do not apply skin protectant solution directly under this sponge or gel patch, as the solution will block its action at the puncture site. Apply the TSM dressing to dry sites.

tt. Flush and lock the midline catheter per organizational policy.

**Documentation**

Document in the patient’s medical record:

- Date/time of insertion, number of attempts, functionality of catheter, local anesthetic, if used
- Insertion site: vessel and size
- Catheter length, size, and number of lumens
- Length of any external catheter
- Dressing and securement method used (date and initial on dressing)
- Baseline arm circumference 10 cm above the antecubital fossa
- Patient response to procedure and pain management
- Patient education
Bibliography


Ultrasound-Guided Peripherally Inserted Central Catheter (PICC) Insertion Using Modified Seldinger Technique (MST)

Policy

The decision to place a peripherally inserted central catheter (PICC) as the most appropriate vascular access device (VAD) for the patient occurs as an interprofessional collaboration with the patient and caregiver(s) based on the projected treatment plan.

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

Peripheral vein preservation is considered when planning for vascular access.

Competency is validated for clinicians who place PICCs.

A checklist is completed by a trained observer to ensure that all steps have been completed without contamination. This observer is trained in how to observe and assist with the procedure and may be an unlicensed person without insertion skills.

Tip location is the cavoatrial junction (superior or inferior) and is confirmed and documented before infusion therapy is initiated through the PICC.

Key Points

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 central vascular access devices (CVADs), including PICCs, in both adults and children.

To minimize unnecessary CVAD placement, including PICCs, ensure that placement of the PICC is based on evidence-based indications for CVAD placement such as:

- Clinical instability of the patient and/or complexity of infusion regimen (multiple infusates)
- Episodic chemotherapy treatment anticipated for more than 3 months
- Prescribed continuous infusion therapy (eg, parenteral nutrition, fluid and electrolytes, medications, blood or blood products)
- Need for invasive hemodynamic monitoring
- Long-term intermittent infusion therapy (eg, any medication including anti-infectives in patients with a known or suspected infection)
• History of failed or difficult peripheral venous access, if use of ultrasound guidance has failed

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

Power injection of ultrasound-guided 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, AV fistula); prolonged bleeding time; history of unresolved deep vein thrombosis (DVT) or superior vena cava (SVC) filter; end-stage renal disease requiring vein preservation; and the right arm of infants and 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.

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

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

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.

**Assessment**

• Select sites in the upper arm, using the basilic, cephalic, and brachial veins, with the basilic vein preferred.

• Avoid cannulation 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.

• PICCs may be the preferred CVAD in patients with coagulopathy disorders or receiving anticoagulants, as direct pressure can be applied to control bleeding and in patients with respiratory diagnoses or intracranial bleeding when Trendelenburg position is difficult or contraindicated.

• Discuss arm preference with the patient and the recommendation for use of the nondominant arm in order to decrease chances of accidental removal.
Vascular Access Device Placement

- 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.

- Without a tourniquet, assess veins for vessel size, path, round shape, and compressibility.

- 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.

- Smaller vessels (catheter-to-vein ratios of less than 45%) should be avoided to reduce the risk of phlebitis and thrombosis.

Patient Education

Purpose of PICC, risks, benefits

What to expect with the procedure/purpose for the use of the ultrasound

Care and maintenance requirements, patient responsibilities

Common complications, signs and symptoms to report

Home Care/Alternative Site Implications

Most patients who have a PICC placed for longer courses of infusion therapy will be cared for at home or in another type of alternative site (eg, outpatient, long-term care facility).

Patients and/or caregiver instruction includes:

- Infection prevention, including aseptic technique and hand hygiene before any catheter access

- Disinfection of needleless connector before every catheter access

- Flushing and locking frequency, technique, and solution

- Dressing change frequency

- Signs and symptoms of complications and whom to and how to report
• Living with a PICC, including activity limitations and protecting the device while performing activities of daily living, including protection from water during bathing

Instructions include demonstration, return demonstration of procedures, and use of teach-back technique.

Comprehension and performance is evaluated throughout the period of catheter dwell time.

Supplies

• Insertion kit for Modified Seldinger procedure should include:
  ° PICC
  ° 21g safety micro-introducer needle
  ° Introducer/dilator appropriate to the catheter size
  ° 20 cm or longer guidewire for accessing the vein
  ° 45- to 60-cm stylet for stiffening the catheter
  ° Safety scalpel
  ° Tourniquet: single use

• Insertion tray should include:
  ° Maximum barrier supplies
    ■ Head covering
    ■ Mask
    ■ Sterile gloves (2 pair)
    ■ Sterile gown
    ■ Underarm sterile drape
    ■ Large, full-body sheet sterile drape with fenestration
    ■ Antiseptic solution (alcoholic chlorhexidine preferred; may substitute 70% isopropyl alcohol and povidone-iodine for chlorhexidine gluconate sensitivities)
  ° Sterile gauze
  ° Disposable tape measure
  ° Disposable skin marker

• Engineered stabilization device (ESD)

• Needleless connector(s) for each lumen

• Preservative-free 0.9% sodium chloride (USP) flushes for each lumen

• Prefilled syringe of heparin lock solution 10 units per mL or as indicated by organizational policy or licensed independent practitioner (LIP) order.

• Transparent semipermeable membrane (TSM) dressing; antimicrobial sponge or antimicrobial gel dressing if used

• Skin protectant solution

• Sterile ultrasound gel

• Probe cover
Vascular Access Device Placement

- Ultrasound machine
- Disinfectant wipes
- Clean gloves
- Local anesthetic, as needed per protocol, or as ordered
- 3-mL syringe and small-gauge needle for subcutaneous anesthetic administration
- Tip-locating device

Preprocedure
1. Obtain and review LIP’s order for insertion of PICC.
2. Collaborate with the prescribing LIP for any relative contraindication to placement before placing a PICC.
3. Assess for history of allergies to analgesia, adhesives, or antimicrobial solutions.
4. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
5. Obtain informed consent per organizational policy and/or patient assent to perform procedure.
6. Position patient supine in a flat reclining position, with arm extended at a 90-degree angle away from body. Elevate the head of the bed for patient comfort if the flat position cannot be tolerated.
7. Perform hand hygiene.
8. Assemble insertion equipment on a clean, flat work space.

Procedure
1. Assess vasculature using ultrasound.
   a. Sanitize the ultrasound probe with a disinfectant wipe.
   b. Perform hand hygiene.
   c. Don clean gloves.
   d. Apply liberal amount of ultrasound gel to the patient’s arm.
   e. Apply probe to the skin; visualize and note the location of the veins, arteries, and nerves surrounding the proposed insertion site.
   f. Without a tourniquet, assess veins for vessel size, path, round shape, and compressibility.
   g. Assess depth of intended vessel for venipuncture, and measure the intended vessels’ diameter; select a catheter with a catheter-to-vein ratio of 45% or less. Smaller vessels should be avoided to prevent thrombosis.
   h. Mark the level of the proposed insertion site with 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.
i. Remove the ultrasound gel from the patient’s skin.

j. Measure the baseline arm circumference 10 cm above the antecubital fossa.

k. To approximate the desired terminal tip location at the lower one-third of the SVC at the level of the cavoatrial junction, 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 to determine the distance from the clavicle to the level of the cavoatrial junction. Add length as needed to facilitate use of chosen adhesive-based ESD.

l. If using topical anesthetic cream, apply to proposed insertion site, cover with TSM dressing, and allow 15 to 60 minutes before continuing with procedure according to the manufacturer’s directions for use.

m. Remove gloves and discard.

2. Prepare for insertion, collecting necessary insertion supplies and setting up a sterile field.
   
a. Perform hand hygiene.

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

c. Don head covering and mask.

d. Perform hand hygiene.

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

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

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

h. Use stylet wires according to manufacturer’s directions for use.
   
i. Never cut a wire of any kind.

ii. 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.

iii. 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.

iv. Stylet wires provide stiffness for ease of catheter insertion. The stylet wire should not extend beyond the catheter tip.

v. Follow manufacturers’ directions for use of other types of wires.
i. If the catheter is to be trimmed, use of a guillotine or scalpel is preferred to scissors for trimming in a blunt cut.
j. Apply sterile underarm drape.
k. Prep the skin in the entire area where the dressing will cover with an alcoholic chlorhexidine gluconate (CHG) applicator for 30 seconds using a back-and-forth motion and allow to air-dry for at least 3 minutes on hairless skin. Refer to the manufacturer’s directions for the appropriate size applicator for the proposed dressing area. Prep the entire area that the dressing will cover.
l. For patients with CHG sensitivities, 70% isopropyl alcohol and povidone-iodine may be used for skin disinfection; allow to dry completely.
m. Apply a tourniquet proximal to the insertion site.
n. Remove outer set of gloves after prepping the skin and tying the tourniquet.
o. Apply 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.
p. Cover the ultrasound with sterile probe cover, and secure.
q. Apply sterile ultrasound gel to skin over the proposed insertion site.
r. Relocate the intended vein with the ultrasound probe, verifying it is nonpulsatile and compressible.
s. Inject local anesthetic subcutaneously at the insertion site, if needed. Before injection, aspirate for absence of blood return.
t. While visualizing the vessel, insert the micro-introducer needle through the skin and into the vein using a 45-degree 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.
u. The tip of the micro-introducer needle will appear as an echogenic white dot on the screen.
v. 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.
w. Confirm slow venous blood return. 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.
x. Observe for blood return in micro-introducer needle hub, and visualize the needle tip in the center of the vein on ultrasound before proceeding.
y. Put the ultrasound probe down on sterile field.
z. Reduce the angle of the micro-introducer needle, and stabilize the micro-introducer needle.
   aa. Insert the floppy-tipped guidewire into the micro-introducer needle, threading at least 10 cm, but not more than 15 cm, into the vein. The guidewire should never be inserted into a position beyond the level of the axilla without fluoroscopy guidance.
   bb. Carefully remove the micro-introducer needle by removing it from the vein and skin and pulling it back over the guidewire.
   cc. Do not allow the guidewire to move outward through the micro-introducer needle due to risk of severing the guidewire.
   dd. Secure the guidewire with your nondominant hand to prevent migration in or out of the vein.
   ee. Make a skin nick, if needed.
      i. Using a scalpel, hold the blade with the blunt side against the wire.
      ii. 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.
   ff. Advance the peel-away dilator/introducer over the guidewire through the skin completely into the vein using a twisting motion.
   gg. Remove the guidewire.
   hh. Release the tourniquet, using caution not to break sterile technique.
      ii. Slowly remove the dilator, leaving the peel-away introducer sheath in the vein.
   jj. Slowly advance the catheter through the introducer sheath.
   kk. Continue to advance the catheter slowly to the measured length.
ll. If using a tip-locating device, follow the manufacturer’s directions for use to determine proper tip placement, using air emboli precautions.

mm. If tip-location technology is not being used, withdraw the stylet wire from the catheter lumen, using air emboli precautions.

nn. Attach sterile 0.9% sodium chloride-filled syringe, and aspirate for blood from catheter and flush to determine patency.

oo. 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.

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

qq. Apply a needleless connector to each lumen.

rr. Clean excess blood from the insertion site using CHG solution or dry gauze.

ss. Stabilize the catheter.
   i. If using a subcutaneous ESD, use according to manufacturer’s directions for use.
   ii. If using an adhesive-based ESD, apply skin protectant solution to the area to be covered by the ESD and dressing and allow to dry.

tt. For oozing sites, apply sterile gauze and TSM dressing to the insertion site and change in 24 hours; hemostatic agents may be required for sites that continue to ooze for longer than 24 hours. Use in accordance with manufacturer’s directions for use.

uu. If using a CHG-impregnated dressing, do not apply skin protectant solution directly under this sponge or gel patch, as the solution will block its action at the puncture site. Apply the TSM dressing to dry sites.

vv. Flush and lock the PICC per organizational policy.

ww. If using a tip-locating device, document the terminal tip location in the medical record.

xx. If not using a tip-locating device, obtain a chest radiograph to determine tip placement, and follow organizational policy for activating the catheter for use.

yy. Catheters may be withdrawn after insertion to ensure proper tip location, using a sterile dressing change procedure, but should never be advanced after the initial insertion procedure.
Policies and Procedures for Infusion Therapy

Documentation
Document in the patient’s medical record:

- Date/time of insertion, number of attempts, functionality of catheter, local anesthetic, if used
- Insertion site: vessel and size
- Catheter length, size, and number of lumens
- Length of any external catheter
- Terminal tip location, if using a tip-locating device
- Dressing and stabilization method used (date and initial on dressing)
- Baseline arm circumference 10 cm above the antecubital fossa
- Patient response to procedure and pain management
- Patient education

Bibliography


Ultrasound-Guided Nontunneled Central Vascular Access Device (CVAD) Insertion Using Modified Seldinger Technique (MST)

Policy
The decision to place a central vascular access device (CVAD) as the most appropriate vascular access device for the patient occurs as an interprofessional collaboration with the patient and caregiver(s) based on the projected treatment plan.

The CVAD selected is of the smallest outer diameter with the fewest number of lumens and is of sufficient length to reach the vena cava.

Peripheral vein preservation is considered when planning for vascular access.

Competency is validated for clinicians who place CVADs.

A checklist is completed by a trained observer to ensure that all steps have been completed without contamination. This observer is trained in how to observe and assist with the procedure and may be an unlicensed person without insertion skills.

CVADs may be placed in the internal jugular (IJ), external jugular (EJ), subclavian, axillary, or femoral veins; the site selected should present the least risk of all complications based on patient assessment.

Tip location is the cavoatrial junction (superior or inferior) and is confirmed and documented before infusion therapy is initiated through the CVAD.

Key Points
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 in both adults and children.

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

MST is advantageous as it offers an 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.
To minimize unnecessary CVAD placement, ensure that placement is based on evidence-based indications for CVAD placement such as:

- Clinical instability of the patient and/or complexity of infusion regimen (multiple infusates)
- Prescribed continuous infusion therapy (e.g., parenteral nutrition, fluid and electrolytes, medications, blood or blood products)
- Need for invasive hemodynamic monitoring
- Short-term intermittent infusion therapy (e.g., any medication including anti-infectives in patients with a known or suspected infection)
- History of failed or difficult peripheral venous access, if use of ultrasound guidance has failed

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 stabilization 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.
- **Internal jugular 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.
- **External jugular veins** are more tortuous than the internal jugular 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 central line-associated bloodstream infection (CLABSI).
Relative contraindications to CVAD placement depending on the choice of insertion site include prolonged bleeding time, history of unresolved deep vein thrombosis (DVT) of the IJ, EJ, axillary, femoral, or subclavian vein on the ipsilateral side, or superior vena cava (SVC) filter, inferior vena cava 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.

**Assessment**

- The right IJ is preferred over the left as the path to the SVC is straight.
- Avoid cannulation 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.
- 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 comparative to proposed outer catheter diameter to promote hemodilution and preserve vessel health.
- Smaller vessels should be avoided to reduce the risk of phlebitis and thrombosis.
- CVADs inserted via the IJ, EJ, axillary, and subclavian veins require chest radiograph verification to determine the terminal tip location and to rule out pneumothorax or hemothorax postinsertion. Femoral CVADs require an abdominal radiograph to determine tip location.
• For inserters with documented competency, ultrasound may be used 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. If the sliding lung assessment creates suspicion for pneumothorax, immediately contact the provider to request a STAT chest radiograph.

Patient Education
Purpose of CVADs, risks, benefits
What to expect with the procedure/purpose for the ultrasound
Care and maintenance requirements, patient responsibilities
Common complications, signs and symptoms to report

Home Care/Alternative Site Implications
Most patients who have a CVAD placed for longer courses of infusion therapy will be cared for at home or in another type of alternative site (eg, outpatient, long-term care facility).

Patients’ and/or caregivers’ instruction includes:
• Infection prevention, including correct technique for handling all supplies and hand hygiene before any catheter access
• Disinfection of needleless connector before every catheter access
• Flushing and locking frequency, technique, and solution
• Dressing change frequency
• Signs and symptoms of complications and to whom and how to report
• Living with a CVAD, including activity limitations and protecting the device while performing activities of daily living, including protection from water during bathing

Instructions include demonstration, return demonstration of procedures, and use of teach-back technique.

Comprehension and performance is evaluated throughout the period of catheter dwell time.

Supplies
• Insertion kit for Modified Seldinger procedure should include:
  o CVAD kit that includes the appropriate-length catheter
  o 21 g safety micro-introducer needle
  o Introducer/dilator appropriate to the catheter size
  o 20 cm or longer guidewire
  o Safety scalpel
Vascular Access Device Placement

- **Insertion tray should include:**
  - Maximum barrier supplies
    - Head covering
    - Mask
    - Sterile gloves (2 pair)
    - Sterile gown
    - Large full-body sheet sterile drape with fenestration
    - Antiseptic solution (alcoholic chlorhexidine preferred; may substitute 70% isopropyl alcohol and povidone-iodine for chlorhexidine gluconate [CHG] sensitivities)
  - Sterile gauze
  - Disposable tape measure
  - Disposable skin marker
- Engineered stabilization device (ESD)
- Needleless connector(s) for each lumen
- Preservative-free 0.9% sodium chloride (USP) flushes for each lumen
- Prefilled syringe of heparin lock solution 10 units per mL or as indicated by organizational policy or licensed independent practitioner’s (LIP’s) order
- Transparent semipermeable membrane (TSM) dressing; antimicrobial sponge or antimicrobial gel dressing, if used
- Skin protectant solution
- Sterile ultrasound gel
- Probe cover
- Ultrasound machine
- Disinfectant wipes
- Clean gloves
- Local anesthetic as needed per protocol, or as ordered
- 3-mL syringe and small-gauge needle for subcutaneous anesthetic administration

**Preprocedure**

1. Obtain and review LIP’s order for insertion of CVAD.
2. Collaborate with the prescribing LIP for any relative contraindication to placement before placing a CVAD.
3. Assess for history of allergies to analgesia, adhesives, or antimicrobial solutions.
4. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
5. Obtain informed consent per organizational policy or patient assent to perform procedure.
6. Place patient in supine position for vessel assessment. After prepping and draping the insertion site, place the patient in a 10- to 15-degree Trendelenburg position for catheter insertion when using the vessels above the level of the heart.

7. Perform hand hygiene.

8. Assemble insertion equipment on a clean, flat work space.

Procedure

1. Assess vasculature using ultrasound:
   a. Sanitize the ultrasound probe with a disinfectant wipe.
   b. Perform hand hygiene.
   c. Don clean gloves.
   d. Apply liberal amount of ultrasound gel to the patient’s neck, chest or groin.
   e. Apply probe to the skin: visualize and note the location of the proposed vein and any surrounding nerves or arteries.
   f. Assess the proposed vein for vessel size, path, round shape, depth, and compressibility.
   g. Smaller vessels should be avoided to prevent thrombosis.
   h. Remove the ultrasound gel from the patient’s skin.
   i. To approximate the desired terminal tip location at the lower one-third of the SVC at the level of the cavoatrial junction, 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 cavoatrial junction. Add length as needed to facilitate use of chosen adhesive-based ESD.
   j. If using the femoral vein, measure from the groin to the level just above diaphragm.
   k. Remove gloves and discard.

2. Prepare for insertion, collecting necessary insertion supplies, and setting up a sterile field.
   a. Perform hand hygiene.
   b. Position patient for comfort and equipment for visualization of the vasculature.
   c. Don head covering and mask.
   d. Perform hand hygiene.
   e. Open the insertion tray and CVAD kit to create a sterile field, and include additional items in the field, using sterile technique as needed.
   f. Don sterile gown and 2 pairs of sterile gloves.
   g. Prime any needed extension set(s) and catheter with 0.9% sodium chloride.
h. If the catheter is to be trimmed, use of a guillotine or scalpel is preferred to scissors for trimming in a blunt cut. IJ, EJ, femoral, subclavian, and axillary CVADs generally have manufactured tips (eg, rounded, formed, separate lumen exit sites) and are not usually trimmed.

i. Prep the skin in the entire area where the dressing will cover with an alcoholic CHG applicator for 30 seconds using a back-and-forth motion, and allow to air-dry for at least 3 minutes on hairless skin. Refer to the manufacturer’s directions for use for the appropriate size applicator for the proposed dressing area. Prep the entire area that the dressing will cover.

j. For femoral insertions, the site should be cleansed for 2 minutes and allowed to dry for at least 3 minutes on hairless skin. The prep must be allowed to completely dry on hair, and drying time could be as long as 1 hour.

k. For patients with CHG sensitivities, 70% isopropyl alcohol and povidone-iodine may be used for skin disinfection; allow to dry completely.

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

m. Apply large sterile sheet drape with insertion site fenestration over the entire patient.

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

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

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

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

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

s. While visualizing the vessel, insert the micro-introducer needle through the skin and into the vein using a 45-degree 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.
Policies and Procedures for Infusion Therapy

- The tip of the micro-introducer needle will appear as an echogenic white dot on the screen.
- Note that respiratory variation may cause the IJ and EJ vessel shape and size to change.
- 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.
- Confirm slow venous blood return. If blood return is pulsatile, immediately abort the procedure by removing the micro-introducer needle and applying pressure to the area for 10 minutes or until hemostasis is achieved.
- Observe for venous blood return in micro-introducer needle hub, and visualize the needle tip in the center of the vein on ultrasound before proceeding.
- Put the ultrasound probe down on sterile field.
- Reduce the angle of the micro-introducer, and stabilize it.
- Insert the floppy-tipped guidewire into the micro-introducer needle, threading at least 10 cm, but not more than 15 cm, into the vein.
- Carefully remove the micro-introducer needle by removing it from the vein and skin and pulling it back over the guidewire.
- Do not allow the guidewire to move outward through the micro-introducer needle due to risk of severing the guidewire.
- Secure the guidewire with your nondominant hand to prevent migration in or out of the vein.
- Use the longitudinal view to confirm the guidewire’s position in the vein on ultrasound.
- Make a skin nick, if needed.
  - Using a scalpel, hold the blade with the blunt side against the wire.
  - 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.
- Advance the peel-away dilator/introducer over the guidewire through the skin completely into the vein using a twisting motion.
- Remove the guidewire.
  - Place your thumb over the opening in the dilator/introducer to prevent air influx.
- If possible, have the patient exhale or remove the guidewire during exhalation cycle if the patient is ventilated.
kk. 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.

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

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

nn. Slowly advance the catheter through the introducer sheath.

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

pp. Withdraw any stylet wire from the catheter lumen, using air emboli precautions.

qq. Attach sterile 0.9% sodium chloride-filled syringe and aspirate for 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.

rr. 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.

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

tt. Apply a needleless connector to each lumen.

uu. Clean excess blood from the insertion site using CHG or dry gauze.

vv. Stabilize the catheter.
   i. If using a subcutaneous ESD, use according to manufacturer’s directions for use.
   ii. If using an adhesive-based ESD, apply skin protectant solution to the area to be covered by the ESD and dressing, and allow it to dry.

ww. For oozing sites, apply sterile gauze and TSM dressing to the insertion site and change in 24 hours; hemostatic agents may be required for sites that continue to ooze for longer than 24 hours; use in accordance with manufacturers’ directions for use.

xx. If using a CHG-impregnated dressing, do not apply skin protectant solution directly under this sponge or gel patch as the solution will block its action at the puncture site. Apply the TSM dressing to dry sites.

yy. Flush and lock the CVAD per organizational policy.

zz. Obtain a chest radiograph to determine tip placement and to rule out pneumothorax or hemothorax, and follow organizational policy for activating the catheter for use.
aaa. Catheters may be withdrawn after insertion to ensure proper tip location, using a sterile dressing change procedure, but should never be advanced after the initial insertion procedure.

**Documentation**

Document in the patient’s medical record:

- Date/time of insertion, number of attempts, functionality of catheter, local anesthetic, if used
- Insertion site: vessel and size
- Catheter length, size, and number of lumens
- Length of any external catheter
- Dressing and stabilization method used (date and initial on dressing)
- Patient response to procedure and pain management
- Patient education

**Bibliography**


Ultrasound-Guided Nontunneled Central Vascular Access Device (CVAD) Insertion Using Seldinger Technique

Policy
The decision to place a central vascular access device (CVAD) as the most appropriate vascular access device (VAD) for the patient occurs as an interdisciplinary collaboration with the patient and caregiver(s) based on the projected treatment plan.

The CVAD selected is of the smallest outer diameter with the fewest number of lumens and is of sufficient length to reach the vena cava.

Peripheral vein preservation is considered when planning for vascular access.

Competency is validated for clinicians who place CVADs.

A checklist is completed by a trained observer to ensure that all steps have been completed without contamination. This observer is trained in how to observe and assist with the procedure and may be an unlicensed person without insertion skills.

CVADs may be placed in the internal jugular (IJ), external jugular (EJ), subclavian, axillary, or femoral veins; the selected site should present the least risk of all complications based on patient assessment.

Tip location is the cavoatrial junction (superior or inferior) and is confirmed and documented before infusion therapy is initiated through the CVAD.

Key Points
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 in both adults and children.

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

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.
To minimize unnecessary CVAD placement, ensure that placement of the CVAD is based on evidence-based indications for CVAD placement such as:

- Clinical instability of the patient and/or complexity of infusion regimen (multiple infusates)
- Prescribed continuous infusion therapy (eg, parenteral nutrition, fluid and electrolytes, medications, blood or blood products)
- Need for invasive hemodynamic monitoring
- Short-term intermittent infusion therapy (eg, any medication, including anti-infectives in patients with a known or suspected infection)
- History of failed or difficult peripheral venous access, if use of ultrasound guidance has failed

Carotid or femoral artery puncture, hematoma, air embolism, pneumothorax, and hemothorax are unique 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 stabilization 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.
- **Internal jugular vein** insertion 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.
- **External jugular veins** are more tortuous than the internal jugular 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 central line-associated bloodstream infection (CLABSI).
Relative contraindications to CVAD placement depending on the choice of insertion site include prolonged bleeding time, history of unresolved deep vein thrombosis (DVT) of the IJ, EJ, axillary, femoral, or subclavian vein on the ipsilateral side, or superior vena cava (SVC) 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.

**Assessment**

- The right IJ is preferred over the left, as the path to the SVC is straight.
- Avoid cannulation 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.
- 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 comparative to proposed outer catheter diameter to promote hemodilution and preserve vessel health.
- Smaller vessels should be avoided to reduce the risk of phlebitis and thrombosis.
- CVADs inserted via the IJ, EJ, axillary, and subclavian veins require chest radiograph verification to determine the terminal tip location and to rule out pneumothorax or hemothorax postinsertion. Femoral CVADs require an abdominal radiograph to determine tip location.
For inserters who have this specific documented competency, ultrasound may be used 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. If the sliding lung assessment creates suspicion for pneumothorax, immediately contact the provider to request a STAT chest radiograph.

**Patient Education**

Purpose of CVADs, risks, benefits

What to expect with the procedure/purpose for the ultrasound

Care and maintenance requirements, patient responsibilities

Common complications, signs and symptoms to report

**Home Care/Alternative Site Implications**

Most patients who have a CVAD placed for longer courses of infusion therapy will be cared for at home or in another type of alternative site (eg, outpatient, long-term care facility)

Patients’ and/or caregivers’ instruction includes:

- Infection prevention, including correct technique for handling all supplies and hand hygiene before any catheter access
- Disinfection of needleless connector before every catheter access
- Flushing and locking frequency, technique, and solution
- Dressing change frequency
- Signs and symptoms of complications and to whom and how to report
- Living with a CVAD, including activity limitations and protecting the device while performing activities of daily living, including protection from water during bathing

Instructions include demonstration, return demonstration of procedures, and use of teach-back technique.

Comprehension and performance is evaluated throughout the period of catheter dwell time.

**Supplies**

- Insertion kit for Seldinger procedure should include:
  - CVAD kit that includes the appropriate-length catheter
  - 18 g safety introducer needle
  - Dilator appropriate to the catheter size
Vascular Access Device Placement

- 60 cm J-tip guidewire
- Safety scalpel

- Insertion tray should include:
  - Maximum barrier supplies
    - Head covering
    - Mask
    - Sterile gloves (2 pair)
    - Sterile gown
    - Large full-body sheet sterile drape with fenestration
    - Antiseptic solution (alcoholic chlorhexidine preferred; may substitute 70% isopropyl alcohol and povidone-iodine for chlorhexidine gluconate [CHG] sensitivities)
  - Sterile gauze
  - Disposable tape measure
  - Disposable skin marker

- Engineered stabilization device (ESD)
- Needleless connector(s) for each lumen
- Preservative-free 0.9% sodium chloride (USP) flushes for each lumen
- Prefilled syringe of heparin lock solution 10 units per mL or as indicated by organizational policy or licensed independent practitioner’s (LIP’s) order.
- Transparent semipermeable membrane (TSM) dressing; antimicrobial sponge or antimicrobial gel dressing if used
- Skin protectant solution
- Sterile ultrasound gel
- Probe cover
- Ultrasound machine
- Disinfectant wipes
- Clean gloves
- Local anesthetic as needed per protocol or as ordered
- 3-mL syringe and small-gauge needle for subcutaneous anesthetic administration

Preprocedure

1. Obtain and review LIP’s order for insertion of CVAD.
2. Collaborate with the prescribing LIP for any relative contraindication to placement before placing a CVAD.
3. Assess for history of allergies to analgesia, adhesives, or antimicrobial solutions.
4. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
5. Obtain informed consent per organizational policy or patient assent to perform procedure.
6. Place patient in supine position for vessel assessment. After prepping and draping the insertion site, place the patient in a 10- to 15-degree Trendelenburg position for catheter insertion when using the vessels above the level of the heart.

7. Perform hand hygiene.

8. Assemble insertion equipment on a clean, flat work space.

**Procedure**

1. Assess vasculature using ultrasound.
   a. Sanitize the ultrasound probe with a disinfectant wipe.
   b. Perform hand hygiene.
   c. Don clean gloves.
   d. Apply liberal amount of ultrasound gel to the patient’s neck, chest, or groin.
   e. Apply probe to the skin: visualize and note the location of the proposed vein and any surrounding nerves or arteries.
   f. Assess the proposed vein for vessel size, path, round shape, depth, and compressibility.
   g. Smaller vessels should be avoided to prevent thrombosis.
   h. Remove the ultrasound gel from the patient’s skin.
   i. To approximate the desired terminal tip location at the lower one-third of the SVC at the level of the cavoatrial junction, 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 cavoatrial junction. Add length as needed to facilitate use of chosen adhesive-based ESD.
   j. If using the femoral vein, measure from the groin to the level just above diaphragm.
   k. Remove gloves and discard.

2. Prepare for insertion, collecting necessary insertion supplies, and setting up a sterile field.
   a. Perform hand hygiene.
   b. Position patient for comfort and equipment for visualization of the vasculature.
   c. Don head covering and mask.
   d. Perform hand hygiene.
   e. Open the insertion tray and CVAD kit to create a sterile field, and include additional items in the field using sterile technique as needed.
   f. Don sterile gown and 2 pairs of sterile gloves.
   g. Prime any needed extension set(s) and catheter with 0.9% sodium chloride.
Vascular Access Device Placement

103

h. If the catheter is to be trimmed, use of a guillotine or scalpel is preferred to scissors for trimming in a blunt cut. IJ, EJ, femoral, subclavian, and axillary CVADs generally have manufactured tips (e.g., rounded, formed, separate lumen exit sites) and are not usually trimmed.

i. Prep the skin in the entire area where the dressing will cover with an alcoholic CHG applicator for 30 seconds, using a back-and-forth motion and allow to air-dry for at least 3 minutes on hairless skin. Refer to the manufacturer’s directions for use for the appropriate size applicator for the proposed dressing area. Prep the entire area that the dressing will cover.

j. For femoral insertions, the site should be cleansed for 2 minutes and allowed to dry for at least 3 minutes on hairless skin. The prep must be allowed to dry completely on hair, and drying time could be as long as 1 hour.

k. For patients with CHG sensitivities, 70% isopropyl alcohol and povidone-iodine may be used for skin disinfection; allow to dry completely.

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

m. Apply large sterile sheet drape with insertion site fenestration over the entire patient.

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

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

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

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

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

s. While visualizing the vessel, insert the needle through the skin and into the vein using a 45-degree 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.
t. The tip of the needle will appear as an echogenic white dot on the screen.

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

v. 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.

w. Confirm slow venous blood return. If blood return is pulsatile, immediately abort the procedure by removing the needle and applying pressure to the area for 10 minutes or until hemostasis is achieved. Note that larger needles increase the risk of uncontrolled bleeding should arterial puncture occur. Follow organizational protocol for management of arterial puncture.

x. Observe for venous blood return, 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.

y. Put the ultrasound probe down on sterile field.

z. Reduce the angle of needle and stabilize it.

aa. Insert the J-tip guidewire into needle, threading it into the vein to the 15 cm mark on the guidewire.

bb. Carefully remove the needle by withdrawing it from the vein and skin and pulling it back over the guidewire. Follow manufacturer’s directions for use of Raulerson syringe or valved dilator to reduce risk of air embolus.

cc. Do not allow the guidewire to move outward through the introducer needle due to risk of severing the guidewire.

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

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

ff. Make a skin nick, if needed.

   i. Using a scalpel, hold the blade with the blunt side against the wire.

   ii. Make a small nick at the insertion site on the side of the guidewire to facilitate insertion of the vessel dilator into the skin.

gg. Advance the dilator over the guidewire through the skin using a twisting motion. The dilator is intended to dilate the subcutaneous tissue.

hh. 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.
ii. Remove the dilator, leaving the guidewire in place.
jj. 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 guidewire at all times. Observe air embolus precautions by clamping any additional lumens for the insertion procedure.

kk. Secure the wire as it protrudes from the lumen, while advancing the catheter through the skin and vein to its measured length.
ll. Slowly remove the guidewire once the catheter is in place. Immediately place gloved thumb over the catheter hub to prevent air entrance.

mm. If possible, have the patient exhale or remove the guidewire during exhalation cycle if the patient is ventilated.
nn. Attach sterile 0.9% sodium chloride-filled syringe, and aspirate for 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.

oo. Apply a needleless connector to each lumen.
pp. Clean excess blood from the insertion site using CHG or dry gauze.

qq. Stabilize the catheter.
   i. If using a subcutaneous ESD, use according to manufacturer's directions for use.
   ii. If using an adhesive-based ESD, apply skin protectant solution to the area to be covered by the ESD and dressing, and allow it to dry.

rr. For oozing sites, apply sterile gauze and TSM dressing to the insertion site, and change in 24 hours; hemostatic agents may be required for sites that continue to ooze for longer than 24 hours; use in accordance with manufacturer's directions for use.

ss. If using a CHG-impregnated dressing, do not apply skin protectant solution directly under this sponge or gel patch, as the solution will block its action at the puncture site. Apply the TSM dressing to dry sites.

tt. Flush and lock the CVAD per organizational policy.

uu. Obtain a chest radiograph to determine tip placement and to rule out pneumothorax or hemothorax, and follow organizational policy for activating the catheter for use.

vv. Catheters may be withdrawn after insertion to ensure proper tip location, using a sterile dressing change procedure, but should never be advanced after the initial insertion procedure.
Policies and Procedures for Infusion Therapy

Documentation

Document in the patient’s medical record:

- Date/time of insertion, insertion method, number of attempts, functionality of catheter, local anesthetic, if used
- Insertion site: vessel and size
- Catheter length, size, and number of lumens
- Length of any external catheter
- Dressing and stabilization method used (date and initial on dressing)
- Patient response to procedure and use of pain management
- Patient education

Bibliography


4. Site Care and Maintenance

Administration Set Change .................. 108

Maintaining Vascular Access Device (VAD) Patency: Flushing and Locking . . . 111

Vascular Access Devices (VADs): Ongoing Assessment, Site Care, and Dressing Change .................. 116

Vascular Access Device (VAD) Removal .................. 121
Administration Set Change

Policy
Administration sets, including add-on devices, are changed at established intervals depending on the type of administration and infusate and immediately when contamination is suspected or when product integrity is compromised.

Administration set changes, including add-on devices, will coincide with peripheral device replacement and central vascular access device (CVAD) insertion.

Administration sets used with lipid-based infusates, such as intravenous fat emulsions, will be free of di-ethylhexyl-phthalate (DEHP).

All administration sets, any add-on devices, and needleless connectors are of a luer-lock design to ensure a secure junction.

Administration sets are attached and primed just prior to administration.

Minimize the number of manipulations and entries into the system.

All catheters/administration sets/add-on devices between the patient and the solution container are traced before connecting or reconnecting any infusion/device, at each care transition to a new setting or service, and as part of the hand-off process.

Key Points
Use a vented administration set for solutions supplied in glass or semirigid containers and a nonvented administration set for plastic fluid containers.

Minimize the use of add-on devices for administration sets because each device is a potential source of contamination, misuse, and disconnection. Whenever possible, use an administration set with devices as an integral part of the set (eg, filter).

For intermittent administration sets that are used more than once in 24 hours, 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.
Label administration sets for infusion via vascular access devices (VADs) with the date of initiation or date of change based on organizational procedures. Label administration sets used for medications that are administered via specialized access devices (ie, intraspinal, intraosseous, subcutaneous) to indicate the correct administration route and device, and place the label near the connection to the device.

**Table 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 hours</td>
</tr>
<tr>
<td>Intermittent</td>
<td>Primary and secondary sets</td>
<td>Every 24 hours</td>
</tr>
<tr>
<td>Hemodynamic and arterial pressure monitoring</td>
<td>Disposable or reusable transducer and/or dome and other components of the system, including the administration set</td>
<td>Every 96 hours</td>
</tr>
</tbody>
</table>

**Table 2. Administration Set Change Frequency by Infusate**

<table>
<thead>
<tr>
<th>Infusate Type</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 hours</td>
</tr>
<tr>
<td>Intravenous fat emulsion (IVFE)</td>
<td>Continuous or single dose</td>
<td>Every 24 hours</td>
</tr>
<tr>
<td>Parenteral nutrition</td>
<td>Continuous with intravenous fat emulsion</td>
<td>Every 24 hours</td>
</tr>
<tr>
<td></td>
<td>Continuous without intravenous fat emulsion</td>
<td>Every 24 hours</td>
</tr>
<tr>
<td></td>
<td>Cyclic or intermittent delivery</td>
<td>Every 24 hours</td>
</tr>
<tr>
<td>Propofol infusions</td>
<td></td>
<td>Every 6-12 hours</td>
</tr>
</tbody>
</table>

*Note: Change administration set immediately if contamination is suspected or product integrity is compromised.*
Bibliography


Maintaining Vascular Access Device (VAD) Patency: Flushing and Locking

Policy
Vascular access devices (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.

The VAD is locked after completion of the final flush to decrease the risk of intraluminal occlusion and catheter-related bloodstream infection (CR-BSI), depending on the solution used.

Single-use flushing and locking systems are used.

A VAD is never forcibly flushed.

The patency of the VAD is assessed using a 10-mL syringe to reduce the risk of catheter damage.

Key Points
Do not use intravenous (IV) solution containers (eg, bags or bottles) as a source for obtaining flush solutions.

For VAD flushing, use a minimum volume equal to twice the internal volume of the VAD system.

For VAD locking, use volume that is equal to the internal volume of the VAD system plus 20%.

After confirmation of patency using a 10-mL syringe, use syringes appropriately sized for the medication and locking solution being injected.

Needleless connectors are available with 3 different internal mechanisms to displace blood reflux. These mechanisms have an impact on the sequence of clamping and disconnecting. There is no way to determine the type of internal mechanism by simply looking at the device, therefore advanced knowledge of the type being used is required for correct technique.

Recommendations for locking solutions include:

- Short peripheral catheters: preservative-free 0.9% sodium chloride (USP)
- Short peripheral catheters (neonates and pediatrics): heparin 0.5 units to 10 units per mL or preservative-free 0.9% sodium chloride (USP)
Policies and Procedures for Infusion Therapy

- Midline catheters: no evidence-based recommendations; consider either heparin 10 units per mL or preservative-free 0.9% sodium chloride (USP), according to the directions for use for the midline and needleless connector.
- CVADs: either heparin 10 units per mL or preservative-free 0.9% sodium chloride (USP), according to the directions for use for the VAD and needleless connector; consider using heparin 10 units per mL for locking peripherally inserted central catheters (PICCs) in home care patients.

Antimicrobial locking solutions may be used for therapeutic and prophylactic purposes in patients with long-term CVADs, patients with a history of multiple CR-BSIs, high-risk patient populations, and in facilities with unacceptably high rates of central line-associated bloodstream infection (CLABSI), despite application of other methods of CLABSI reduction.

- Antibiotic lock solutions contain supratherapeutic concentration of antibiotic and may be combined with heparin.
- Antiseptic locking solutions include ethanol, taurolidine, citrate, 26% sodium chloride, methylene blue, fusidic acid, and ethylenediaminetetraacetic acid (EDTA) used alone or in various combinations.
- Follow VAD manufacturers’ instructions for intraluminal locking with ethanol. Changes in CVADs made of polyurethane material, but not silicone, has led to catheter rupture and splitting.
- There is not clear evidence guiding the length of time that antimicrobial lock solutions should reside inside the CVAD lumen; up to 12 hours per day may be required. This limits use in patients receiving continuous or frequent intermittent infusions.

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

Patient Education
What to expect with the procedure
May experience disturbances in taste and odor

Home Care/Alternative Site Implications
Address questions about noted differences in flushing and locking procedures between the hospital and alternative settings.
Supplies
VAD Flushing and Locking

- Gloves
- Antiseptic wipes (eg, alcohol)
- Preservative-free 0.9% sodium chloride (USP) prefilled syringe(s)
- Lock solution as indicated (eg, preservative-free 0.9% sodium chloride [USP], heparin lock solution [10 units/mL], or other solution) in prefilled syringe
- 10-mL syringe(s) for aspiration of locking solution, if needed

Procedure
Flushing

1. Perform hand hygiene.
2. Gather supplies.
3. Don gloves.
4. Disinfect needleless connector.
   a. If using a disinfection cap, remove it 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.
5. Attach syringe of preservative-free 0.9% sodium chloride (USP) to needleless connector while maintaining the sterility of the syringe tip.
6. Open VAD clamp, if present.
7. Slowly inject preservative-free 0.9% sodium chloride (USP) 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 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. 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 (see Central Vascular Access Device [CVAD] Malposition; Central Vascular Access Device [CVAD] Occlusion).
   c. Inability to flush or absence of a blood return from a short peripheral 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.
8. Remove syringe, and discard.
9. Initiate infusion therapy as prescribed (see IV [Intravenous] Administration: Continuous Infusion, IV Push, Intermittent Infusion).
10. Detach syringe and discard or detach administration set and cover male luer tip with a sterile cap if the set is to be used for up to 24 hours.
11. Scrub the needleless connector with a new disinfectant wipe.
12. Attach syringe of preservative-free 0.9% sodium chloride (USP) to needleless connector while maintaining the sterility of the syringe tip.
13. Slowly inject preservative-free 0.9% sodium chloride (USP) 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.
14. Ensure the correct flow rate if continuous fluids are infusing or proceed with locking the VAD.

**Locking**
1. Perform hand hygiene.
2. Gather supplies.
3. Don gloves.
4. Disinfect needleless connector with antiseptic using friction and a scrubbing motion and allow to dry.
5. Attach syringe with locking solution to needleless connector while maintaining the sterility of the syringe tip.
6. Slowly inject solution into VAD.
7. Follow appropriate clamping sequence to reduce blood reflux based on type of needleless connector used:
   b. Negative-displacement needleless connector: maintain pressure on the syringe plunger while closing the clamp on the VAD or extension set, then disconnect the syringe.
   c. Neutral-displacement needleless connector: is not dependent on flushing technique and can be clamped either before or after syringe disconnection.
8. Discard syringe and used supplies in appropriate receptacles.
9. Remove gloves and perform hand hygiene.
Documentation
Document in the patient’s medical record:
• Flush/lock solution and volume
• Date, time of administration
• Route, specific VAD or lumen used for administration
• Patient’s response to the procedure

Bibliography


Policies and Procedures for Infusion Therapy

Vascular Access Devices (VADs): Ongoing Assessment, Site Care, and Dressing Change

Policy
A sterile dressing is applied and maintained on all peripheral, nontunneled, peripherally inserted central catheters, and accessed implanted vascular access devices (VADs). For tunneled, cuffed catheters, a sterile dressing is applied and maintained until the insertion site is well healed.

Short peripheral access site care and dressing changes are performed when the integrity of the dressing is compromised, if moisture, drainage, or blood is present, or for further assessment if site infection or inflammation is suspected.

Central vascular access device (CVAD) and midline catheter site care and dressing changes are performed at established intervals, and immediately when the integrity of the dressing is compromised, if moisture, drainage, or blood is present, or for further assessment if site infection or inflammation is suspected.

Gauze dressings are changed every 2 days.

Transparent semipermeable membrane (TSM) dressings are changed every 5-7 days.

Key Points
The preferred skin antiseptic agent is >0.5% chlorhexidine in alcohol solution; for any contraindications to alcoholic chlorhexidine solution, alternative antiseptic solutions include tincture of iodine, an iodophor (povidone-iodine), or 70% alcohol.

Chlorhexidine is used with care in premature infants and infants under 2 months of age due to risks of skin irritation and chemical burns.

For neonates with compromised skin integrity, remove dried povidone-iodine with sterile 0.9% sodium chloride (USP) or sterile water.

Use chlorhexidine dressings over CVADs to reduce infection risk when the extraluminal route is the primary source of infection. Even when organizations show a low baseline central line-associated bloodstream infection (CLABSI) rate, further reduction in CLABSI rate has been demonstrated with use of chlorhexidine dressings.

A skin barrier solution is used to reduce the risk of medical adhesive-related skin injury (MARS1). Avoid use of compound tincture of benzoin due to increased risk of MARS1 because it may increase the bonding of adhesives to skin, causing skin injury when the adhesive-based engineered stabilization device (ESD) is removed.
Do not use rolled bandages, with or without elastic properties, to secure any type of VAD.

**Assessment**
Assess the VAD catheter-skin junction site and surrounding area for redness, tenderness, swelling, and drainage by visual inspection and palpation through the intact dressing and through patient reports about any discomfort including pain, paresthesias, numbness, or tingling.

Short peripheral catheters:
- Assess minimally at least every 4 hours.
- Assess every 1 to 2 hours for patients who are critically ill/sedated or have cognitive deficits.
- Assess hourly for neonatal/pediatric patients.
- Assess minimally every hour, or more often, for any patient receiving infusions of vesicant medications.

CVADs and midline catheters: assess at least daily.

Assess for MARSI associated with the use of adhesive-based ESD. 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.

Measure upper-arm circumference when clinically indicated to assess the presence of edema and possible deep vein thrombosis (DVT). Take this measurement 10 cm above the antecubital fossa; identify the location and other characteristics, such as pitting or nonpitting edema. Compare to baseline measurement to detect possible catheter-associated venous thrombosis.

Measure external length of CVAD or midline catheter and compare to the external length documented at insertion when catheter dislodgment is suspected.

**Patient Education**
What to expect with the procedure

Signs or symptoms, such as redness, pain, or swelling, and where to report

**Home Care/Alternative Site Implications**
Patients receiving outpatient or home care: instruct the patient or caregiver to check the VAD site at least once per day for signs of complications and to report signs/symptoms or dressing dislodgment immediately to their health care provider; for continuous infusions via a short peripheral catheter, instruct to check the site every 4 hours during waking hours.
Dressing changes and procedures may be different at home or alternative settings than what was experienced in an acute care hospital setting. For a healed exit site with a tunneled, cuffed VAD, no dressing may be needed.

Use caution regarding scissors, razors, and other sharps near VADs.

**Supplies**

**Short peripheral catheter**

- Gloves, nonsterile
- Antiseptic solution
- Securement
  - Stabilization device
- Skin barrier solution
- Site dressing
  - Gauze pad and tape
  - TSM dressing
- Label

**Procedure**

**Short peripheral catheter**

1. Perform hand hygiene.
2. Gather supplies.
3. Explain procedure to patient.
4. Don gloves.
5. Assess insertion site for absence of redness, tenderness, swelling, or drainage. If present, the catheter should be removed.
6. Remove existing dressing, beginning at device hub and gently pulling 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.
7. Remove stabilization device according to manufacturer’s directions for use.
8. Cleanse skin with antiseptic solution; allow to dry completely.
   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 has not been studied.
9. Apply skin barrier solution.
10. Apply stabilization device.
11. Apply TSM (or gauze and tape) dressing to insertion site.
12. Discard used supplies in appropriate receptacles.
13. Remove gloves, and discard.
15. Label dressing with date performed.

**Supplies**

**CVAD or midline catheter**
- Mask
- Gloves, nonsterile
- Gloves, sterile
- Antiseptic solution
- Tape measure, sterile, if indicated
- Securement
  - Stabilization device
- Skin barrier solution
- Site dressing
  - Antimicrobial dressing
  - Gauze pad and tape
  - TSM dressing
- Label

*Note: a CVAD dressing kit is recommended*

**Procedure**

**CVAD or midline catheter**
1. Perform hand hygiene.
2. Gather supplies.
3. Explain procedure to patient.
4. Don mask.
5. Assemble supplies on sterile field.
6. Don nonsterile gloves.
7. Assess insertion site for absence of redness, tenderness, swelling, or drainage; palpate site for any local tenderness. If present, contact the licensed independent practitioner (LIP) for a collaborative decision regarding interventions, including potential device removal.
8. Remove existing dressing, beginning at device hub and gently pulling the dressing perpendicular to the skin toward the insertion site. Avoid inadvertently dislodging the catheter, as it may be adhered to the dressing.
9. Remove stabilization device according to manufacturer’s directions for use. A subcutaneous ESD is not removed with each dressing change. If sutures or staples have been used, carefully assess their integrity. If loosened, other methods of stabilization may be necessary.
10. Remove gloves.
11. Perform hand hygiene.
12. Don sterile gloves.
Policies and Procedures for Infusion Therapy

13. Cleanse skin with antiseptic solution; allow to dry completely.
   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 has not been studied.

14. Apply antimicrobial dressing, if used.

15. Apply skin barrier solution. Do not apply this solution directly under the antimicrobial pad or gel component of the dressing.

16. Apply stabilization device.

17. Apply TSM (or gauze and tape) dressing to insertion site.

18. Discard used supplies in appropriate receptacles.

19. Remove gloves, and discard.

20. Perform hand hygiene.

21. Label dressing with date performed.

Documentation
Document in the patient’s medical record:
- Performance of procedure, including type of antiseptic solution/type of dressing
- Patient’s response to the procedure
- Instructions given to the patient

Bibliography


Vascular Access Device (VAD) Removal

Policy
A vascular access device (VAD) is removed on the order of a licensed independent practitioner (LIP) when therapy is completed, when clinically indicated, or when deemed no longer necessary for the plan of care.

Replace a VAD within 24 to 48 hours if the VAD was inserted under suboptimal aseptic conditions in any health care setting.

The clinical need for each short peripheral and nontunneled central vascular access device (CVAD) is assessed on a daily basis.

Key Points
Resistance during removal, particularly associated with peripherally inserted central catheters (PICCs), is possible.

- Never pull against resistance as the risk of catheter breakage, catheter embolism, or vein wall damage can occur.
- Venospasm or vein thrombosis could be the cause of resistance.
- When simple interventions listed in the procedure following do not result in the ability to remove the VAD, referral to interventional radiology is warranted.

Short peripheral catheters should be removed if no longer included in the plan of care or have not been used for 24 hours or more.

Assessment
Use a standardized tool and/or designated staff for the daily assessment of VAD needs.

For surgically placed CVADs (ie, tunneled, cuffed catheters and implanted ports), assess the clinical need on a regular basis, considering the possible need for therapy to resume in the future.

Assess for exposed subcutaneous cuff or port body, and notify LIP immediately if detected.

Know the reason for removal and any method to manage identified complications. Aspiration from the VAD is required before removal in the presence of extravasation.

For unplanned or early removal of a CVAD due to a complication, assess and report all signs and symptoms to the LIP. Assess the fluids and medications being given and their impact on patient stability. Begin the infusion therapy through a short peripheral catheter when possible or contact the LIP for altering the orders for peripheral infusion until a new CVAD is inserted.
Identify if 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 CVAD-associated vein thrombosis when the catheter is correctly positioned at the cavoatrial junction, the catheter is functioning correctly with a blood return, there is no evidence of any infection, and there is absence of severe deep vein thrombosis (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 catheter-associated infection. 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**

**What to expect with the procedure**

Signs or symptoms of increasing redness, pain, or swelling within the 48 hours after the catheter was removed and where to report this

**Home Care/Alternative Site Implications**

Nontunneled CVADs, PICCs, midline catheters, and short peripheral catheters may be removed in the alternative care setting. Tunneled, cuffed CVADs and implanted ports should not be removed in these settings.

**Supplies**

**Short peripheral or peripheral arterial catheter**

- Gloves, nonsterile
- Gauze, sterile
- Tape
- Band-aid, if indicated for short peripheral catheter

**Procedure**

**Short peripheral or peripheral arterial catheter**

1. Perform hand hygiene.
2. Don gloves.
3. Explain procedure to patient.
4. Discontinue all infusates and/or clamp extension set.
5. Place patient in sitting or recumbent position.
6. Remove dressing from insertion site.
7. Remove stabilization device if present; use appropriate solution as indicated to loosen dressing and securement device adhesive.
8. Inspect catheter-skin junction.
9. 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.
10. Apply pressure to site with gauze until hemostasis is achieved for a minimum of:
   a. 30 seconds – short peripheral catheter
   b. 3 to 5 minutes – peripheral arterial catheter
11. Apply gauze and tape dressing to peripheral arterial site; apply gauze and tape or Band-aid to short peripheral catheter site.
12. Inspect catheter: it is intact, tip is not jagged, and length is appropriate for product, to ensure entire catheter is removed.
13. Change or remove dressing as indicated.

**Supplies**

**Midline catheter and nontunneled CVAD removal**
- Personal protective equipment (PPE), as indicated
- Gloves, nonsterile
- Suture removal set, as needed
- Gauze, sterile
- Petroleum-based ointment, sterile
- Transparent semipermeable membrane (TSM) dressing

**Procedure**

**Midline catheter and nontunneled CVAD removal**

1. Perform hand hygiene.
2. Don gloves.
3. Explain procedure to patient.
   a. Educate patient in Valsalva’s maneuver for all CVAD removal procedures.
   b. If a Valsalva’s maneuver is contraindicated, have the patient exhale during the procedure (see Air Embolism).
4. Discontinue all infusates and/or clamp extension set.
5. Position patient:
   a. Sitting or recumbent – midline catheter
   b. Supine flat or Trendelenburg, unless contraindicated – any type of CVAD
6. Remove dressing from insertion site.
7. Remove stabilization device or sutures, if present. Use appropriate solution as indicated to loosen dressing and securement device adhesive. If a subcutaneous engineered stabilization device (ESD) is in place, follow manufacturer’s directions for removal.
8. Inspect catheter-skin junction.
9. 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, relaxations techniques, and limb elevation.
   ii. Reattempt removal after 15 to 30 minutes.
   iii. Consult with LIP if resistance continues.

10. Apply pressure to site with gauze for a minimum of 30 seconds or until hemostasis is achieved.

11. Apply petroleum-based ointment to exit site, and cover with occlusive gauze dressing or TSM dressing.

12. Patient should remain in supine position for 30 minutes post–CVAD removal.

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

14. 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 medical record:

- Date and time of procedure
- Patient’s response to procedure
- Instructions given to patient

**Bibliography**


<table>
<thead>
<tr>
<th>Complication</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Embolism</td>
<td>126</td>
</tr>
<tr>
<td>Allergic Reaction and Anaphylactic/Anaphylactoid Reactions</td>
<td>129</td>
</tr>
<tr>
<td>Catheter Damage</td>
<td>133</td>
</tr>
<tr>
<td>Central Vascular Access Device (CVAD) Malposition</td>
<td>137</td>
</tr>
<tr>
<td>Central Vascular Access Device (CVAD) Occlusion</td>
<td>141</td>
</tr>
<tr>
<td>Central Vascular Access Device (CVAD)-Associated Venous Thrombosis</td>
<td>148</td>
</tr>
<tr>
<td>Circulatory Overload</td>
<td>151</td>
</tr>
<tr>
<td>Infiltration/Extravasation</td>
<td>153</td>
</tr>
<tr>
<td>Nerve Injuries</td>
<td>163</td>
</tr>
<tr>
<td>Phlebitis</td>
<td>166</td>
</tr>
<tr>
<td>Vascular Access Device (VAD)-Associated Infection</td>
<td>170</td>
</tr>
</tbody>
</table>
Air Embolism

Policy
All add-on devices, needleless connectors, and administration sets are of a luer-lock design and properly tightened to ensure a secure junction.

Air is always purged from syringes, administration sets, needleless connectors, and any other add-on devices.

Key Points
Air embolism is a preventable complication when risk factors are mitigated, including the following additional actions:

- Ensure the vascular access device (VAD) is securely clamped when disconnecting/reconnecting a new administration set, needleless connector, or any other add-on device.
- When possible, the patient is positioned in a flat, supine manner any time the central vascular access device (CVAD) lumen is opened (ie, 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.
- All lines are traced between the catheter and the solution container.
- Never use scissors or razors near the VAD.
- Use an air-eliminating filter appropriately on administration sets, including when the patient has a right-to-left heart shunting defect.
- Safely remove CVADs (see Vascular Access Device [VAD] Removal).

Patient Education
Never disconnect or reconnect any intravenous (IV) administration sets or connectors from the catheter hub unless specifically instructed to do so and evaluated as competent in the procedure, such as with patients/caregivers in the home care setting.

Home Care/Alternative Site Implications
Instruct home care patients and/or caregivers with any type of VAD how to prevent an air embolism and critical actions to take if an air embolism is suspected.

Ensure availability of a clamp or hemostat to use in the event of a ruptured or damaged VAD and instruct how/when to use.
**Assessment**

1. Identify signs and symptoms of potential air embolism:
   - Sudden onset of dyspnea
   - Coughing
   - Chest pain
   - Hypotension
   - Tachyarrhythmias
   - Wheezing
   - Tachypnea
   - Altered mental status
   - Altered speech
   - Changes in facial appearance
   - Numbness
   - Paralysis
   - A loud continuous churning sound may be heard 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 the 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 basic life support as needed:
   a. Initiate rapid response team, “code” (eg, hospital).
   b. Call emergency services (eg, 911) if in patient home or other alternative care setting (eg, outpatient/physician office).

3. Notify licensed independent practitioner (LIP).

4. Continue to monitor vital signs and observe patient.

5. Perform interventions (eg, oxygen administration) and treatments as ordered.

**Documentation**

Document in the patient’s medical record:
- Patient assessment data
- Interventions taken and outcome
- LIP notification
- Patient’s condition and response to interventions

Complete an Adverse Event Report according to organizational policy.
Bibliography


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.

Patient safety is considered when selecting a non–acute care treatment setting for infusion therapy.

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 (see First Dose Administration in Alternative Care Settings).

Key Points
Anaphylaxis is a medical emergency that may result in death due to respiratory failure and cardiovascular collapse.

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.

Anaphylactoid reactions have been associated with midline catheter and peripherally inserted central catheter (PICC) insertion and medications such as vancomycin and morphine.

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.
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

A premedication may be ordered in some cases (eg, diphenhydramine for known mild allergic reactions with blood transfusions).

It is recognized that reactions can happen at any point after exposure; it requires antigen exposure and antibody development.

**Patient Education**

*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*

Encourage to wear/carry identification bracelet/card to identify allergies (beyond the acute care setting).

**Home Care/Alternative Site Implications**

*For first dose administration, ensure that emergency medications (eg, epinephrine, diphenhydramine) are readily available with orders for their use and that clinicians are certified in basic life support.*

The clinician must remain with the patient for the entire duration of the infusion of the first dose medication and for at least 30 minutes after infusion completion (see *First Dose Administration in Alternative Care Settings*).

**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/symptoms of anaphylaxis, which is the likely type of reaction when all of 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 basic life support as needed.
   a. Initiate rapid response team, “code” (eg, hospital).
   b. Call emergency services (eg, 911) if in patient home or other alternative care setting (eg, outpatient/physician office).
4. Maintain vascular access for emergency supportive therapies with 0.9% sodium chloride via a new administration set.
5. Perform interventions and treatments as ordered or according to organization 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 medical record:

- Presence of allergies/reactions
- Observations and patient assessment
- Licensed independent practitioner (LIP) notification
- Interventions taken and outcome
- Patient’s condition and response to interventions

Complete an Adverse Event Report, according to organizational policy.
Bibliography


Catheter Damage

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

Catheter repair is initiated upon the order of a licensed independent practitioner (LIP).

Central vascular access device (CVAD) exchange is initiated upon the order of an LIP.

Key Points
Catheter damage includes catheter fracture and embolism and loss of integrity to the external catheter (eg, crack or hole in catheter).

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.

Catheter damage is a preventable complication through the following actions:
- Use a 10-mL syringe to assess vascular access device (VAD) patency.
- Do not forcibly flush a VAD against resistance with any syringe size.
- Do not forcibly remove a VAD against resistance.
- Do not withdraw the catheter or wire from the needle during insertion.
- Employ well-qualified and competent clinicians for VAD insertion.
- Use ultrasound-guided CVAD placement.
- Do not use power injection with VADs that are not labeled for this purpose.

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. Factors to consider in making this decision include, but are not limited to, the patient’s age, immune status, length of time remaining on infusion therapy, characteristics of infusion therapy (eg, osmolarity), external catheter length, and resulting changes in proper tip location with repair.
**Patient Education**

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 embolism signs/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. 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 LIP to collaborate regarding other alternatives, such as catheter exchange or insertion of a new catheter.
2. If internal catheter damage is seen or suspected, contact LIP; a chest radiograph or further evaluation is warranted.
3. If external catheter damage is seen or suspected, immediately seal catheter proximal to damaged portion of the catheter.
Supplies
Catheter Repair
- Personal protective equipment (PPE)
- Clamp
- Repair kit supplied by manufacturer, specific to CVAD

Procedure
1. Obtain LIP’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.
2. Obtain sterile repair kit from the manufacturer specific to individual type and size of CVAD.
3. Use aseptic technique during the repair, and observe Standard Precautions throughout the procedure.
4. Perform hand hygiene.
5. Don mask and sterile gloves.
6. Disinfect external portion of catheter with antiseptic solution, allow to air-dry, and position external catheter on a sterile towel.
7. 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.
8. Complete repair according to manufacturer's directions for use.

Documentation
Document in the patient’s medical record:
- Observations and patient assessment
- LIP notification
- Interventions taken and outcome
- Patient’s condition and response to interventions

Complete an Adverse Event Report according to organizational policy.
Bibliography


Central Vascular Access Device (CVAD) Malposition

Policy
The clinician verifies the documented anatomic location of the central vascular access device (CVAD) tip upon insertion prior to initial infusion through the catheter.

The clinician employs preventative interventions, identifies signs/symptoms, and promptly intervenes when catheter malposition is suspected.

Key Points
CVAD tips move due to patient position, respiration, and arm movement. Descent of diaphragm and abdominal contents with position change from lying to standing, obesity, and breast tissue are associated with a change in CVAD tip position.

Primary malposition may occur during the insertion procedure, resulting in intravascular or extravascular tip location.

- Intravascular malposition includes the aorta; contralateral innominate and subclavian veins; ipsilateral or contralateral internal jugular veins and tributaries; azygos vein; right or left internal thoracic vein; pericardiophrenic vein; internal mammary vein; deep in the right atrium (more than 2 cm below cavoatrial junction); the right ventricle; and a number of small tributary veins of the innominate and superior vena cava (SVC). Femoral insertion sites may produce malposition of the catheter tip in the lumbar, iliolumbar, and common iliac veins.

- Extravascular malposition includes tip location in the mediastinum producing infiltration/extravasation; in the pleura producing hemothorax or pleural effusion; in the pericardium producing pericardial effusion and cardiac tamponade; and in the peritoneum producing intra-abdominal bleeding.

- Primary malposition with peripherally inserted central catheters (PICCs) is more common than with other CVADs.

- Risk factors for primary malposition include acquired and congenital anatomical variations (eg, stenosis, thrombosis, and malignant or benign lesions compressing the vein, persistent left superior vena cava [PLSVC] and variations of the inferior vena cava, azygos vein, and pulmonary veins).
Secondary malposition, also called tip migration, may occur at any time during the catheter dwell time; it is related to sporadic changes in intrathoracic pressure (e.g., coughing, vomiting); original tip located high in the SVC; deep vein thrombosis; congestive heart failure; neck or arm movement; and positive-pressure ventilation.

- The most common locations for secondary intravascular malposition include internal jugular; innominate (brachiocephalic); subclavian, axillary, andazygos veins; and deep in the right atrium.
- Secondary extravascular malposition is associated with erosion of catheter tip through the vessel wall and fistula formation between veins and arteries or veins and other structures.

Growth of infants and children results in suboptimal intravascular tip location when a CVAD is indwelling for extended periods of time.

Never advance any external portion of the 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 to be sterile, and no studies have established an acceptable length of time after insertion for such catheter manipulation.

Power injection through PICCs labeled for this purpose are known to cause tip migration, indicating the need for a scout scan before and after power injection.

**Patient Education**

**Signs/symptoms to report**

**Assessment**

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
- Arterial versus venous waveform from an attached pressure transducer
- 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 to the external CVAD length documented at insertion. Dislodgment could indicate the tip location is suboptimal, increasing the risk for catheter-related thrombosis (see *Central Vascular Access Device (CVAD)-Associated Venous Thrombosis*).

**Interventions**

1. **During insertion**
   a. Use dynamic 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 computed tomography (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 (eg, carotid) with site compression increases risk of brain ischemia from lack of blood flow, hematoma, or emboli. Consult with the licensed independent practitioner (LIP) before removal from arteries to determine if surgical removal or use of a percutaneous closure device is most appropriate.

2. **For PICC with primary malposition**
   a. Intracardiac location more than 2 cm below the cavoatrial junction: retract catheter based on electrocardiogram (ECG) 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/symptoms to LIP; anticipate diagnostic tests including chest radiograph with or without contrast injection, fluoroscopy, echocardiogram, CT scan, and/or magnetic resonance imaging (MRI).
   b. Provide the radiology department with clinical information to enhance their 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 short peripheral catheter 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 LIP 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 LIP.

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 medical record:
- Patient/CVAD assessment data
- LIP notification
- Interventions taken and outcome
- Patient’s condition and response to interventions

**Bibliography**


Central Vascular Access Device (CVAD) Occlusion

Policy
The central vascular access device (CVAD) is assessed for patency and proper function as defined by the ability to flush the catheter without resistance and the ability to yield a blood return.

A thorough assessment of the patient and the CVAD for the potential cause of an occlusion is performed, and the appropriate catheter-clearance agent is administered to preserve catheter patency as ordered by the licensed independent practitioner (LIP); an occluded CVAD lumen is not left untreated because another lumen is patent.

Catheter-clearance agents such as precipitate-clearing or thrombolytic agents are used only with CVADs.

The LIP is notified if catheter patency is not restored and appropriate alternative actions are implemented (eg, radiographic studies to identify catheter tip location, dye studies to evaluate catheter flow).

Competency is validated for clinicians who administer precipitate-clearing or thrombolytic agents.

Key Points
CVAD occlusion is a potentially preventable complication through the following interventions:

- Use proper flushing and locking procedures (see Maintaining Vascular Access Device [VAD] Patency: Flushing and Locking).
- Do not allow solution containers to “run dry.”
- Respond promptly to electronic infusion device (EID) 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.

Medications/solutions at high risk for precipitation if they come into contact with each other include phenytoin, diazepam, ganciclovir, acyclovir, ampicillin, imipenem, heparin, vancomycin, parenteral nutrition solutions, ceftriaxone, and all calcium preparations.

Home Care/Alternative Site Implications
Use of thrombolytic agents can be performed in home care and long-term care settings.
Instruct home care patients and/or caregivers how to reduce the risk of catheter occlusion, signs and symptoms, and actions to take, including how/when to call the home care organization.

**Assessment**
Identify signs of partial or complete catheter occlusion, including:
- Inability to withdraw blood or sluggish blood return
- Sluggish infusion flow
- Inability to flush or infuse
- Frequent occlusion alarms on an EID
- Infiltration/extravasation or swelling/leaking at infusion site

To discern the most likely cause of the occlusion, assess history of CVAD use and performance including the time of the signs and symptoms development (eg, sudden versus slowly decreasing flow rate over days), flushing techniques, and recent medications infused.

Evaluate/identify potential causes of occlusion
- Mechanical:
  - External: tight suture, catheter clamped, clamp not attached correctly, kinked tubing, filter obstruction
  - Internal: catheter malposition, catheter kinking, pinch-off syndrome
- Nonthrombotic: lipid buildup from patients receiving 3-in-1 parenteral nutrition 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)

Identify appropriate use of a 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 prior to 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 manufacturer’s directions for use.
6. Check the CVAD manufacturer’s directions for use when considering instillation of alcohol solutions such as ethanol, as they may damage catheters made of some types of polyurethane.

**Supplies for Single-Syringe Method**

**Use with Complete Occlusions**

- Gloves
- Antiseptic solution
- 10-mL syringe with precipitate-clearing or thrombolytic agent
- 10-mL syringe preservative-free 0.9% sodium chloride (USP)
- Needleless connector

**Procedure**

1. Perform hand hygiene.
2. Explain procedure to patient.
3. Don gloves.
4. Disinfect needleless connector with antiseptic solution and allow to air-dry.
5. Clamp CVAD, if appropriate.
6. 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.
7. Unclamp CVAD and while holding syringe vertically, gently aspirate until plunger reaches approximately 8-mL mark.
8. 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.
9. Leave syringe in place and secure. Label syringe “Do not use” with date, time, and initials.
10. Allow solution to dwell in CVAD lumen according to thrombolytic manufacturer’s directions for use; in the case of a precipitate-clearance agent, allow solution to dwell for 20 to 60 minutes.
11. After appropriate dwell time, unclamp CVAD and attempt to aspirate blood.
   a. A free-flowing blood return that is the consistency and color 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.
12. Attach 10-mL syringe of preservative-free 0.9% sodium chloride (USP), unclamp CVAD, and flush using positive-pressure method (see Maintaining Vascular Access Device [VAD] Patency: Flushing and Locking).

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

14. Dispose of used supplies in appropriate receptacles.

15. Remove gloves.

16. Perform hand hygiene.

17. Notify LIP if unable to achieve patency.

**Supplies for Stopcock Method**

**Use with Complete Occlusions**

- 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 (USP)
- Needleless connector

**Procedure**

1. Perform hand hygiene.
2. Explain procedure to patient.
3. Don gloves.
4. Disinfect junction of CVAD and needleless connector with antiseptic solution and allow to air-dry.
5. Clamp catheter.
6. Remove needleless connector and aseptically attach stopcock to the CVAD hub; turn off from the patient to the CVAD hub.
7. Attach empty sterile 10-mL syringe to 1 port of stopcock.
8. Attach 10-mL syringe of precipitate-clearing or thrombolytic solution to stopcock port.
9. Open stopcock port connected to empty syringe.
10. Aspirate empty syringe to 8 to 9 mL while maintaining plunger position, then close port, thus creating negative pressure within catheter lumen.
11. Open stopcock connected to syringe with precipitate-clearing or thrombolytic agent, allowing solution to enter the CVAD lumen.
   a. Procedure steps 10 to 12 may need to be repeated until solution is pulled into CVAD.
12. 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.

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

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

15. 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 consistency and color 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.

16. Attach 10-mL syringe of preservative-free 0.9% sodium chloride (USP), unclamp CVAD, and flush using positive-pressure method (see Maintaining Vascular Access Device [VAD] Patency: Flushing and Locking).

17. Resume ordered therapy or lock catheter as appropriate.

18. Dispose of used supplies in appropriate receptacles.

19. Remove gloves.

20. Perform hand hygiene.

21. Notify LIP if unable to achieve patency.

### Supplies for Direct Instillation Method

#### Use with Partial Thrombotic or Nonthrombotic Occlusions

- Gloves
- Antiseptic solution
- Needleless connector
- 10-mL syringe
- 10-mL syringe with precipitate-clearing or thrombolytic agent
- 10-mL syringe of preservative-free 0.9% sodium chloride (USP)

#### Procedure

1. Perform hand hygiene.
2. Explain procedure to patient.
3. Don gloves.
4. Disinfect needleless connector with antiseptic solution and allow to air-dry.
Policies and Procedures for Infusion Therapy

5. Clamp CVAD, if appropriate.

6. Attach syringe with precipitate-clearing or thrombolytic agent to the needleless connector.
   a. 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.

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

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

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

10. After appropriate dwell time, unclamp CVAD and attempt to aspirate blood.
    a. A free-flowing blood return that is the consistency and color 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.

11. Attach 10-mL syringe of preservative-free 0.9% sodium chloride (USP), unclamp CVAD, and flush using positive-pressure method (see Maintaining Vascular Access Device [VAD] Patency: Flushing and Locking).

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

13. Dispose of used supplies in appropriate receptacles.

14. Remove gloves.

15. Perform hand hygiene.

16. Notify LIP if unable to achieve patency.

Documentation

Document in the patient’s medical record:

• Patient and CVAD assessment data
• Interventions performed and outcome
• LIP notification
• Response to interventions
Table 1. 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 (0.1N)</td>
<td></td>
</tr>
<tr>
<td>Alkaline drug pH (&gt;7)</td>
<td>Sodium bicarbonate 8.4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sodium hydroxide 0.1 mmol/L</td>
<td></td>
</tr>
<tr>
<td>Intravenous fat 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.

Bibliography


Central Vascular Access Device (CVAD)-Associated Venous Thrombosis

Policy
The clinician employs preventative interventions, identifies signs/symptoms, and promptly intervenes upon recognition of central vascular access device (CVAD)-associated venous thrombosis.

Key Points
Risk factors associated with venous thrombosis include the following:
- History of deep vein thrombosis (DVT)
- Presence of chronic diseases associated with a hypercoagulable state such as cancer, diabetes, irritable bowel syndrome, congenital heart disease, and end-stage renal failure
- Surgical and trauma patients
- Critical care patients, hyperglycemia in critically ill nondiabetic children
- Known presence of genetic coagulation abnormalities (eg, Factor V Leiden, prothrombin mutation)
- Pregnancy or the use of oral contraceptives
- Fluid volume deficit
- History of multiple CVADs, especially with difficult or traumatic insertion and the presence of other intravascular devices (eg, pacemakers)

The risk of CVAD-associated venous thrombosis is reduced with appropriate vascular access device (VAD) selection and placement as follows:
- Peripherally inserted central catheters (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.
- PICC insertion through the internal jugular vein rather than veins of the upper extremity is associated with lower rates of DVT than insertion in arm veins.
- Use catheters with smaller diameter; choose a PICC with a catheter-to-vein ratio of 45% or less, as it will take up less space within the vein.
- Ensure optimal catheter tip location in lower one-third of the superior vena cava (SVC) or cavoatrial junction; catheter tips located in the mid-to-upper portion of the SVC are associated with increased DVT risk.

Flushing and locking procedures have no effect on CVAD-associated venous thrombosis, as such interventions are aimed at the internal CVAD lumen, not the vein lumen.
The CVAD is generally not removed in the presence of venous thrombosis if the catheter is in the correct position, is functioning correctly with a blood return upon aspiration, and when there is no evidence of infection. Patients will be treated with systemic anticoagulant therapy.

**Patient Education**

Signs/symptoms of CVAD-associated venous thrombosis and how/where to report

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**

Measure upper-arm circumference before PICC insertion and when clinically indicated to assess the presence of edema and possible DVT.

- Take this measurement 10 cm above the antecubital fossa.

Assess all patients with CVADs for signs and symptoms. The majority of the time, overt signs and symptoms are not apparent.

- 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 basic life support as needed (eg, severe dyspnea, suspected embolus).
   b. Initiate rapid response team, “code” (eg, hospital).
   c. Call emergency services (eg, 911) if in patient home or other alternative care setting (eg, outpatient/physician office).
   d. Continue to monitor vital signs and observe patient.
   e. Perform interventions and treatments as ordered.

2. For nonemergent signs/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 medical record:

- Patient assessment data
- Licensed independent practitioner (LIP) notification
- Interventions taken and outcome
- Patient’s condition and response to interventions
- Complete an Adverse Event Report according to organizational policy.

**Bibliography**


Circulatory Overload

Policy
The clinician employs preventative interventions, identifies signs/symptoms, and promptly intervenes when circulatory overload is suspected.

Key Points
Circulatory overload may be caused by rapid infusion of large amounts of isotonic or hypertonic crystalloid solutions. The risk is greater in patients who have cardiopulmonary or renal disease.

Three and five percent hypertonic sodium chloride solutions are potentially dangerous and are used in critical situations with very low serum sodium levels and neurologic signs. Such solutions are administered in intensive care settings with close monitoring for circulatory overload.

Rapid administration of blood products can also result in fluid overload. Red blood cell and plasma products and 25% albumin are the components most associated with circulatory overload. At greatest risk are infants and adults older than 70 years, as well as those with existing cardiopulmonary disease.

Circulatory overload may be prevented or detected early through:
• Identifying conditions that may increase risk (eg, heart failure or renal disease)
• Administering infusions at a slower rate
• Administering a diuretic when beginning infusions in at-risk patients
• Monitoring intake and output and daily weights
• Monitoring vital signs and for signs and symptoms
• Using electronic flow control and ensuring accuracy of prescribed flow rate

Patient Education
Instruct patients to report any type of pain or change in how they feel.

Home Care/Alternative Site Implications
Do not administer 3% or 5% hypertonic sodium chloride solutions in the home care setting. Mild/moderate dehydration may be treated with infusion of hydration fluids in an alternative care setting. Safe practice includes attention to risk factors for circulatory overload, slow infusion rates, electronic rate control, and frequent monitoring for signs and symptoms of circulatory overload. For patients treated in the home, instruct patient/caregiver in risks/signs and symptoms to report.
Assessment

1. Identify signs and symptoms of circulatory overload including:
   • Increased blood pressure, heart rate, bounding pulse
   • Greater intake than output
   • Weight gain
   • Increased central venous pressure
   • Jugular venous distention
   • Cough
   • Edema
   • Pulmonary edema: moist crackles, severe shortness of breath, anxiety/restlessness, blood-tinged sputum, pallor, cyanosis, hypoxia
   • Decreased urinary output

Interventions

1. Report signs and symptoms to licensed independent practitioner (LIP) immediately, along with details of type of fluid infusing, rate, and total volume infused in a specific period:
   a. Slow infusion rate while awaiting specific orders.
   b. Position patient in semi-Fowler’s position.
2. Anticipate and perform interventions as ordered:
   a. Administer loop diuretics.
   b. Administer oxygen.
3. Monitor vital signs, cardiovascular, and pulmonary status, and report changes to LIP.

Documentation

Document in the patient’s medical record:
   • Patient assessment data
   • Interventions taken and outcome
   • LIP notification
   • Patient’s condition and response to interventions
   • Complete an Adverse Event Report according to organizational policy.

Bibliography


Infusion-Related Complications: Identification & Intervention

Infiltration/Extravasation

Policy
An approved list of vesicant and irritant medications/solutions based on the organization’s internal formularies is available to clinicians.

The clinician assesses the peripheral and central vascular access device (CVAD) site for signs and/or symptoms of infiltration and extravasation before each infusion and on a regular basis.

Appropriate interventions are initiated promptly, as time is a critical element to reduce tissue damage.

Key Points
Infiltration is defined as inadvertent administration of a nonvesicant solution or medication into surrounding tissue, while 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.

Prevention of infiltration/extravasation is critical, as many medications do not have successful treatment methods.

Early recognition through frequent and comprehensive assessment is necessary to limit 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.

Causes of infiltration/extravasation include mechanical issues, pharmacologic properties of the infusion solution(s), and venous obstructions proximal to the vascular access device (VAD).

Vesicant medications include antineoplastic medications, as well as many noncytotoxic medications, and are associated with many forms of tissue damage.

Nonvesicant fluids and medications may produce tissue damage in neonates and infants.

A large volume of irritant medication could produce local tissue damage.

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

Pressure at the insertion site should not be used, as this will force the solution into contact with more tissue.
Risk factors by category include:

- **Mechanical factors**
  - Insertion sites in the hand, antecubital fossa, upper arm, foot, and ankle
  - Ultrasound-guided catheter insertion in deep veins (e.g., bariatric patients, veins of the upper arm) with insufficient catheter length
  - 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 stabilization and body movements, such as respiratory and cardiac function

- **Pharmacologic factors**
  - Medication concentration
  - Volume escaping into the tissue
  - Hyperosmolarity
  - Nonphysiological pH
  - Medication’s ability 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 (located above) the insertion site and tip location
  - Lymphedema

- **Patient-related factors**
  - Inability or difficulty with communicating pain, tightness, or other discomfort
  - Altered mental status or cognition (e.g., agitation, confusion, sedation)
  - Age-related changes to vasculature, skin, and subcutaneous tissue
  - Diseases that produce changes in vasculature or impaired circulation (e.g., diabetes, lymphedema, systemic lupus, Raynaud’s disease, peripheral neuropathy, peripheral vascular disease)
  - Medications that alter pain sensation (e.g., narcotics) or suppress the inflammatory response (e.g., steroids)
  - Current infection
Reduce risk by:
• Using appropriate methods for VAD planning, site selection, insertion, stabilization, and dressing the VAD
• Avoiding use of winged metal needles for infusion
• Having only clinicians with the highest skill level perform venipuncture in patients with difficult venous access
• Assessing all VADs for patency and the absence of signs and symptoms of infiltration and extravasation prior to each intermittent infusion and on a regular basis for continuous infusions
• Assessing short peripheral catheters frequently as follows: minimally at least every 4 hours; every 1 to 2 hours for patients who are critically ill, sedated or have cognitive deficits; hourly for neonatal/pediatric patients; and more often for patients receiving infusions of vesicant medications

Assessment
• 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 licensed independent practitioner (LIP) for appropriate type of VAD

Patient Education
• Information about the risk of vesicant medications and the possible progression of signs and symptoms after the event
• Care of VAD based on venue of care
• Signs and symptoms to report
• Treatment interventions, their purpose, and length of treatment
• Site protection
• Appropriate actions if the site worsens after discharge
• Required follow-up with LIP
**Home Care/Alternative Site Implications**
Prevention of infiltration/extravasation with any type of VAD
Protection of the infiltration/extravasation site from sunlight

**Assessment**
- Identify the nature (ie, vesicant, nonvesicant, or irritant) of antineoplastic and noncytotoxic medications prior to administration, and be prepared to use the correct thermal manipulation and antidote treatment for each medication.
- 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 for 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 (eg, contrast media) or may be delayed for days with antineoplastic agents. Progression to ulceration may vary from a few days to 1 to 2 weeks, depending upon 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, as this should not be considered “normal” with any infusion. Further assessment is required to determine appropriate intervention(s).
2. Assess the area distal (located below) 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.

For infiltration from a short peripheral catheter or midline catheter:
1. Remove the catheter, and apply a dressing.
2. Elevate the extremity.
3. Apply cold for infiltration of hyperosmolar fluids (greater than 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 LIP about alterations in the neurovascular assessment.

For 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 LIP 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 plan appropriate removal.
6. Estimate the amount of fluid that escaped from the vein.

For extravasation from a short peripheral catheter 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 peripheral catheter, and apply a dressing to achieve hemostasis.
5. Never apply pressure to the area.
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 LIP about the event, and activate the established treatment protocol or the prescribed treatment.
11. Use the appropriate thermal manipulation.
   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 (see Table 1).
13. Apply a sterile transparent occlusive dressing to the entire area.

For extravasation from a CVAD, including 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 manipulation and antidote injection should be considered.
5. For extravasation into other intrathoracic extravascular areas, collaborate with the LIP about radiographic diagnostic tests and a plan of care, which could involve surgical intervention.

For 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 medical record:

- 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
- Patient assessment data
- All solution and medications involved, method of administration (e.g., injection, rate of infusion), and estimate of amount of solution in the tissue
- Immediate nursing interventions used and patient’s response
- Medical interventions and outcome
- LIP notification and referrals to other specialists
- Follow-up evaluations
- Patient education

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 1. Antidote Table for Infiltration Procedures

<table>
<thead>
<tr>
<th>Extravasated Drug</th>
<th>Antidote</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>Phentolamine</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</td>
<td>Clean entire site with alcoholic chlorhexidine gluconate Use 25-gauge or smaller needles, and change for each injection Administer immediately or within 12 hours of the event.</td>
</tr>
<tr>
<td>Vasopressors (same drugs as above)</td>
<td>Terbutaline</td>
<td>1 mg in 10 mL of normal saline</td>
<td>Subcutaneous injection of 1 mL around area of extravasation</td>
<td>Clean entire site with alcoholic chlorhexidine gluconate Use 25-gauge or smaller needles, and change for each injection Used when phentolamine is not available</td>
</tr>
</tbody>
</table>
| Cytotoxic agents:  
  • Vinca alkaloids  
  • Suggested for use with others such as epipodophyllotoxins  
Noncytotoxic agents:  
  • Antibiotics such as vancomycin, nafcillin  
  • Electrolytes such as calcium solutions, sodium bicarbonate, potassium solution, hypertonic sodium chloride  
  • Dextrose 10% or greater  
  • Contrast agents | Hyaluronidase | 15 units in pediatric patients  
Up to 1500 units in adults  
For cytotoxic agents, 1 to 6 mL or 1 mL for each mL of extravasated drug  
3 brands are available. Follow manufacturer's directions for use. | Subcutaneous injection | Clean entire site with alcoholic chlorhexidine gluconate Use 25-gauge or smaller needles, and change for each injection Administer immediately. Delay of more than 1 hour decreases effectiveness. |
<table>
<thead>
<tr>
<th>Extravasated Drug</th>
<th>Antidote</th>
<th>Dosage of Antidote</th>
<th>Route of Administration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechlorethamine hydrochloride</td>
<td>Sodium thiosulfate</td>
<td>10% or 20% solution prepare according to manufacturer’s directions for use</td>
<td>Subcutaneous injection of 2 mL for each 1 mg of extravasated drug</td>
<td>Clean entire site with alcoholic chlorhexidine gluconate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Use 25-gauge or smaller needles, and change for each injection</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vasopressors</td>
<td>Nitroglycerin ointment</td>
<td>2% ointment 1-2 inch length for adults</td>
<td>Topical application</td>
<td>Reapplied every 8 hours if needed</td>
</tr>
<tr>
<td>Parenteral nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypo- and hyperosmolar agents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs containing propylene glycol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(etomidate, lorazepam, phenytoin)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anthracyclines</td>
<td>Dexrazoxane</td>
<td>Day 1 &amp; 2 = 1000 mg per m², not to exceed 2000 mg</td>
<td>IV infusion</td>
<td>1st dose within 6 hours of extravasation event; subsequent doses given at the same time each day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Day 3 = 500 mg per m², not to exceed 1000 mg</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Remove cold compresses 15 minutes before infusion begins</td>
</tr>
</tbody>
</table>

**Abbreviations:** IV, intravenous; mg, milligram; mL, milliliter; m², metered squared.
Bibliography


Nerve Injuries

Policy
Signs and/or symptoms of nerve injury are promptly reported to the licensed independent practitioner (LIP).

Key Points
Anatomical variations in veins, arteries, and nerves used for peripheral or central vascular access device (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:

- Dorsal hand: sensory branches of the radial and ulnar nerves
- Radial wrist area: superficial radial nerve at the cephalic vein
- Volar aspects of wrist: median nerve
- At or above the antecubital fossa: median and anterior interosseous nerve
- Antecubital fossa: lateral and medial antebrachial nerves
- Subclavian and jugular sites: brachial plexus nerve

Arterial sites with the greatest risk for nerve injury include:

- Brachial (median nerve)
- Radial (median and radial nerve)
- Axillary (brachial plexus)

Reduce the risk of nerve damage by:

- Avoiding venipuncture in areas with greater risk whenever possible
- Avoiding subcutaneous “probing” for a vein
- Avoiding multiple passes of a needle or catheter
- Reviewing patient medication profile for systemic anticoagulant use, and control bleeding appropriately; a hematoma could lead to nerve injury due to compression
- Immediately removing a peripheral catheter during venipuncture when the patient complains of paresthesias, including shock-like pain in either direction from the puncture site, tingling or feelings of “pins and needles,” burning, and/or numbness
- Immediately removing a peripheral catheter when there is evidence of infiltration or edema associated with hematoma or phlebitis, as fluid accumulation in the tissue can result in nerve compression injury
Patient Education
Explain the type of pain associated with nerve injury (paresthesias).
Instruct patient to immediately report any paresthesia-type of pain.

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.

Identify signs and symptoms of nerve injury during VAD placement or during VAD dwell including:
- “Electrical 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

Interventions
1. Take immediate action:
   a. Stop the VAD insertion procedure and carefully remove the VAD
2. Notify LIP; recognize that consultation with a medical specialist (eg, hand specialist) may be required
3. Monitor neurovascular status, and report changes to LIP.
   b. 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—see Infiltration/Extravasation)

Documentation
Document in the patient’s medical record:
- Patient assessment data
- Interventions taken and outcome
- LIP notification
- Patient’s condition and response to interventions

Complete an Adverse Event Report according to organizational policy.
Bibliography


**Phlebitis**

**Policy**
The clinician employs preventative interventions, identifies signs/symptoms, and promptly intervenes upon recognition of phlebitis.

**Key Points**
Phlebitis may result from chemical, mechanical, or bacterial causes.

Chemical causes of phlebitis include:
- Hyperosmolar solutions
- Known irritating solutions (e.g., potassium chloride, promethazine, amiodarone, some antibiotics)
- Particulate matter
- Failure to allow antiseptic solution to dry before catheter insertion

Mechanical causes of phlebitis result from vein wall irritation, such as:
- Multiple manipulations of infusion delivery system
- Large catheter gauge size
- Catheter material and diameter
- Failure to stabilize catheter adequately
- Failure to stabilize the joint if insertion site in or near a joint must be used

Bacterial causes of phlebitis result from:
- Inadequate hand hygiene and/or failure to use gloves
- Inadequate skin antisepsis prior to venipuncture
- Failure to adhere to aseptic technique during catheter placement and infusion administration
- Failure to stabilize 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
- Stabilizing the catheter to minimize movement at the insertion site
- Considering using a midline catheter or central vascular access device (CVAD) for infusates identified as causing phlebitis, depending on length of infusion time and anticipated duration of therapy (see *Vascular Access Device [VAD] Planning*).
Patient Education
Signs and symptoms of phlebitis and importance of reporting

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. Bacterial
4. Notify licensed independent practitioner (LIP) for 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 short peripheral catheter 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 (see Vascular Access Device [VAD] Planning).
7. Observe site for signs of postinfusion phlebitis after removal of all catheters.
   a. Postinfusion phlebitis may appear after removal when no signs/symptoms were present at removal or signs/symptoms could worsen when present at removal.
**Documentation**

Document in the patient’s medical record:
- Patient assessment data
- Interventions taken and outcome
- LIP notification
- Patient’s condition and response to interventions

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

Use a standardized phlebitis scale definition to rate the grade of phlebitis.
(See Tables 1 and 2.)

**Examples of Standardized Phlebitis Scales**

**Table 1. INS 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>
</tbody>
</table>
| 3     | Pain at access site with erythema  
|       | Streak formation  
|       | Palpable venous cord |
| 4     | Pain at access site with erythema  
|       | Streak formation  
|       | Palpable venous cord >1 inch in length  
|       | Purulent drainage |
Table 2. Visual Infusion Phlebitis (VIP) 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 |


**Bibliography**


Vascular Access Device (VAD)-Associated Infection

Policy
The clinician employs preventative interventions, identifies signs/symptoms, and promptly intervenes when vascular access device (VAD)-associated infection is suspected.

Key Points
Risk factors for infection and catheter-associated bloodstream infection include:
- Inadequate skin antisepsis prior to 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 prior to placing and before providing any VAD-associated interventions.
- Use maximal sterile barrier precautions during central vascular access device (CVAD) insertion and midline catheter insertion.
- Choose the optimal CVAD site; the subclavian vein is the preferred site for nontunneled catheters.
- Use chlorhexidine for skin antisepsis prior to CVAD insertion.
- Perform skin antisepsis prior to peripheral catheter insertion, using an acceptable antiseptic.
- Use sterile gloves to palpate the site of a peripheral catheter insertion after application of skin antiseptic agent.
- Disinfect needleless connectors prior to each entry into the VAD lumen.
- Maintain aseptic technique 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.
Patient Education
Teach all patients to avoid allowing VAD dressing and attached administration sets to get wet during handwashing or bathing.

Teach patients/caregivers who will self-manage their VAD/infusion 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

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 greater than 2 cm from catheter exit site

Identify signs and symptoms of catheter-associated bloodstream infection:
- Chills
- Backache
- Fever
- Hypothermia
- Nausea
- Malaise
- Vomiting
- Headache
- Hypotension

Be aware that fever as a single sign is not an indication to remove a CVAD.
Interventions

1. If signs and symptoms of exit infection are present:
   a. Obtain culture of purulent exudate.
   b. Notify licensed independent practitioner (LIP) of signs and symptoms.
   c. Assess infusion therapy needs and potential for changing therapy to another route, if possible.
   d. Implement orders as appropriate (e.g., antimicrobial therapy), usually including VAD removal.

2. If signs and symptoms of port-pocket or tunnel-tract infection are present:
   a. Notify LIP of signs and symptoms.
   b. Anticipate removal of device.

3. If signs and symptoms of catheter-associated bloodstream infection are present:
   a. Notify LIP immediately.
   b. Obtain blood cultures from VAD and from a separate peripheral vascular access site, as ordered (see Phlebotomy: Blood Sampling from a Vascular Access Device [VAD]).
   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 maintenance 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 solutions (total nutrient admixtures [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 medical record:
- Patient assessment data
- LIP notification
- Interventions taken and outcome
- Patient’s condition and response to interventions

Complete an Adverse Event Report according to organizational policy.

**Bibliography**


6. Other Infusion-Related Procedures

Preparing Immediate-Use Parenteral Medications .................. 176

Implanted Vascular Access Port: Accessing and Deaccessing ....... 179

Phlebotomy: Blood Sampling from a Vascular Access Device (VAD) . . . . 185
Preparing Immediate-Use Parenteral Medications

Policy
Sterile parenteral medications are provided in a ready-to-administer form to minimize the need for manipulation outside the pharmacy sterile compounding area.

Only pharmacy-prepared or commercially available prefilled syringes of appropriate intravenous (IV) solution are used to flush and lock vascular access devices (VADs).

If an immediate-use compounded sterile product (CSP) is prepared for infusion, the infusion is started within 1 hour after the start of the preparation or it is discarded.

If it is necessary to prepare more than 1 medication in a single syringe for IV push administration, limit preparation to the pharmacy.

IV solutions in containers intended for infusion, including minibags, are not used to dilute or reconstitute medications.

Single-dose containers (bottles, bags, vials, and syringes) are used within 1 hour of opening or needle entry; any contents remaining in the container are not saved for future use.

Immediate-use compounded medications are prepared in a clean, orderly area.

Key Points
An immediate-use compounded sterile preparation is used only in emergent situations or in situations where adhering to low-risk compounding procedures would add additional risk due to delays in patient care (eg, medications with short stability that must be prepared immediately before administration outside health care facilities, such as in home infusion).

All of the following are met during preparation of an immediate-use compounded sterile preparation:

- Hand hygiene is performed.
- Aseptic technique is followed.
- No hazardous drugs are used.
- Only simple transfer of no more than 3 sterile, nonhazardous drugs in the manufacturers’ original containers are involved in the compounding, and no more than 2 entries into any 1 container occur.
- No more than 1 hour elapses from the time compounding begins to the time of administration to the patient begins. (No intervening steps between compounding and administration should occur.)
- There is no “batching” or storage of CSPs.
• The preparation is labeled with patient identification, names, and amounts of all ingredients, name or initials of preparer, and exact 1-hour beyond-use date (BUD) and time.

Always employ safe injection practices:
• Use a new needle and syringe for every injection.
• Discard a single-dose vial after a single entry.
• Dedicate a multidose vial for a single patient.
  ° Use the multidose vial up to a maximum of 28 days of opening or puncture (except for vaccines or when original manufacturer’s expiration date is shorter), or when the manufacturer’s expiration date is reached if it is not opened in a direct patient-care area or a shorter period.
  ° Label the multidose vial with the BUD and store the vial according to the manufacturer’s recommendations. Discard if the vial lacks a BUD, the sterility is compromised or questionable, and after the BUD has been met.

Supplies
• Medication (vial/ampoule)
• Appropriate diluent, as needed
• Gloves
• Antiseptic solution
• Syringes
• Needleless transfer device
• Filter needle (if withdrawing from glass ampoule)
• Label

Procedure
1. Obtain and review licensed independent practitioner’s (LIP’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.
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.
Policies and Procedures for Infusion Therapy

b. If medication must be reconstituted, inject appropriate amount of diluent and thoroughly mix medication according to manufacturer’s directions for use.

c. Apply needleless transfer device to vial or use other transfer device in accordance with manufacturer’s 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, initials of person preparing medication, and exact 1-hour BUD and time.

f. Start medication administration no later than 1 hour after preparation.

g. See *IV (Intravenous) Administration: Continuous Infusion, IV Push, Intermittent Infusion*.

7. Withdrawing from ampoule:

a. Attach filter needle to syringe.

b. Disinfect the neck of the ampoule and allow to dry prior to entry.

c. Break ampoule, 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, and exact 1-hour BUD and time.

f. Start medication administration no later than 1 hour after preparation.

g. See *IV (Intravenous) Administration: Continuous Infusion, IV Push, Intermittent Infusion*.

**Bibliography**


Implanted Vascular Access Port: Accessing and Deaccessing

Policy
Radiographic confirmation of tip location will be performed prior to initiation of infusion therapy at intervals established by the organization or as indicated by complications.

Implanted vascular access ports are accessed using only a noncoring safety needle.

Power injection is performed only with implanted vascular access ports and noncoring needles identified and labeled as power-injection compatible.

When administering an infusion via an implanted port, the noncoring needle is replaced at least every 7 days.

A sterile dressing is maintained over the access site if the implanted vascular access port remains accessed.

Key Points
Most often, the implanted vascular access ports will be 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.

The preferred skin antiseptic agent is >0.5% chlorhexidine in alcohol solution; for any contraindications to alcoholic chlorhexidine solution, alternative antiseptic solutions include tincture of iodine, an iodophor (povidone-iodine), or 70% alcohol.

Chlorhexidine is used with care in premature infants and infants under 2 months of age due to risks of skin irritation and chemical burns.

For neonates with compromised skin integrity, remove dried povidone-iodine with sterile 0.9% sodium chloride (USP) or sterile water.

Implanted vascular access ports are locked with preservative-free 0.9% sodium chloride (USP) or heparin lock solution in accordance with organizational policy. Recommendations include:

- Lock accessed implanted vascular access ports daily.
- For vascular access ports that are not actively accessed for infusion therapy, there is insufficient evidence to recommend the optimal frequency for flushing and locking. Refer to manufacturers’ directions for use and organizational policy.

Use the smallest-gauge noncoring needle to accommodate the prescribed therapy.
Reduce the risk of needle dislodgment during access by choosing the length of the noncoring needle that allows it to sit flush to the skin and securely within the port; the needle may require padding and support if it does not sit level with skin.

Consider orienting the bevel of an implanted port access needle in the opposite direction from the outflow channel where the catheter is attached to the port body. In vitro testing demonstrates a greater amount of protein is removed when flushing with this bevel orientation.

**Assessment**

Patient’s pain tolerance and preferences regarding use of local anesthetic prior to port access

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

For subclavian insertion sites, assess for swelling or pain near the clavicle, as this could indicate pinch-off syndrome; notify licensed independent practitioner (LIP) if present (see *Catheter Damage*).

Prior to use for power injection, confirm power-injectable capabilities by using assessment techniques recommended in the manufacturer’s directions for use.

**Patient Education**

Port access procedure

Type of port placed (eg, power injectable, number of lumens)

Importance of carrying port identification card (eg, in wallet)

Expectations of routine care, including frequency of flushing

Potential complications and interventions

**Home Care/Alternative Site Implications**

Provide appropriate patient/caregiver education for patients who are receiving infusions via an accessed port:

- Checking the dressing daily
- How to dress and undress to avoid pulling at the noncoring needle
- Protecting the site during bathing
- Making sure women’s bra straps or car seat belts do not rub over the accessed area
- Reporting any signs or symptoms of pain, burning, stinging, or soreness at the site
• How to stop infusion pump if any wetness, leaking, or swelling is noted at the site
• How/when to call home care provider

**Supplies**

- Central vascular access device (CVAD) dressing kit (preferred)
- If no dressing kit:
  - Mask
  - Sterile gloves
  - Sterile gauze
  - Sterile barrier drape
  - Antiseptic solution (alcoholic chlorhexidine preferred)
  - Transparent semipermeable membrane (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 (USP) (package should indicate sterile and able to drop onto sterile field); alternative is a vial of 0.9% sodium chloride (USP) with vial adaptor and sterile packaged 10-mL syringe
- Local anesthetic, if applicable (note that ice placed over port site for a few minutes prior to access procedure can be a successful pain management strategy)

**Procedure**

**Port Access**

1. Perform hand hygiene.
2. Gather supplies.
3. Verify the patient’s identity using 2 independent identifiers, not including the patient’s room number or bed number.
4. Explain procedure to patient.
5. Administer local anesthetic as indicated. If using transdermal anesthetic cream, apply at least 1 hour prior to port access procedure.
6. Place patient in a comfortable position with head turned away from implanted port.
7. Assess skin over and around implanted port; palpate port to locate septum.
8. Perform hand hygiene.
9. Establish sterile field and place sterile supplies onto field (noncoring needle, needleless connector, and sterile syringe)
10. Don mask and sterile gloves.
11. Attach needleless connector to hub of extension set on noncoring needle with extension set, and prime set with preservative-free 0.9% sodium chloride (USP).
   a. **ALTERNATIVE PROCEDURE IF PACKAGED STERILE SODIUM CHLORIDE SYRINGE NOT AVAILABLE**
      i. Don mask.
      ii. Put first sterile glove onto dominant hand.
      iii. Use nondominant, ungloved hand to hold nonsterile vial, pick up sterile syringe with sterile gloved hand, and draw up 10 mL of 0.9% sodium chloride (the sterile gloved hand touches only the sterile syringe).
      iv. Place sterile syringe of sodium chloride onto sterile field.
      v. Put second sterile glove onto nondominant hand.
12. Cleanse skin with antiseptic solution; allow to dry completely.
   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 has not been studied.
13. With nondominant hand, stabilize implanted port.
14. 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.
15. Slowly inject preservative-free 0.9% sodium chloride (USP) into implanted port, noting any resistance or sluggishness of flow; slowly aspirate until brisk blood return is obtained, and then complete 0.9% sodium chloride (USP) flush.
   a. **ALERT:** If an antimicrobial locking solution was used, withdraw solution from the CVAD lumen 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 from a CVAD requires further investigation about the cause (eg, mechanical problem, fibrin/thrombosis over VAD tip, extravascular tip location) (see *Central Vascular Access Device (CVAD) Malposition; Central Vascular Access Device (CVAD) Occlusion*).
   d. A pulsatile flushing technique may be effective at removing solid deposits.
16. 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.
17. Initiate infusion therapy as prescribed (see IV [Intravenous] Administration: Continuous Infusion, IV Push, Intermittent Infusion).

18. Discard supplies in appropriate receptacle(s). Remove gloves, and perform hand hygiene.

**Port Deaccess**

1. Perform hand hygiene.
2. Gather supplies.
3. Verify the patient’s identity using 2 independent identifiers, not including the patient’s room number or bed number.
4. Explain procedure to patient.
5. Apply nonsterile gloves.
6. Flush port with 5 to 10 mL of preservative-free 0.9% sodium chloride (USP), and lock port with prescribed locking solution (eg, sodium chloride, heparin, antimicrobial solution (see Maintaining Vascular Access Device [VAD] Patency: Flushing and Locking).
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, engaging safety mechanism according to manufacturer’s directions for use, and discard into sharps container.
10. Apply dressing to site if bleeding occurs.
11. Remove gloves and discard materials in appropriate receptacles.
12. Perform hand hygiene.

**Documentation**

Document in the patient’s medical record:

- Appearance of port site
- Performance of procedure
- Noncoring needle gauge/length
- Medication/solution administration
- Pain management interventions
- Flush/lock solution and volume
- Patient education
- Patient’s response to the procedure
Bibliography


Phlebotomy: Blood Sampling from a Vascular Access Device (VAD)

Policy
Patient and sample identification are performed using the same unique numbers.

All blood sample containers are labeled immediately after sample collection in the presence of the patient.

Competency is validated for clinicians who perform blood sampling procedures from peripheral and central vascular access devices (CVADs).

Blood conservation techniques are used to reduce the risk of hospital-acquired anemia.

Key Points
Most errors that occur with blood sampling occur before the sample reaches the laboratory (“preanalytical phase”). In acute care settings, a centralized phlebotomy service is associated with a reduction in preanalytic errors, such as hemolysis and specimen-labeling errors, and a reduction in blood culture contamination.

Reduce the risk for bloodstream infection associated with vascular access device (VAD) access/blood sampling with proper hand hygiene, appropriate use of gloves, single-patient tourniquets, single-use venipuncture and sampling devices, use of safety-engineered devices, and appropriate skin antisepsis.

The needle and vacuum tube holder are discarded as 1 unit.

Never remove the rubber stopper from the vacuum tube, as this may produce errors in sample analysis.

Tourniquet 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.

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 less than 2 mL of blood); using point-of-care testing methods; and using closed loop systems for venous and arterial VADs, as these systems return the blood to the patient; and using the push-pull, or mixing, method.

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). The push-pull, or mixing, method produces accurate outcomes in measuring levels of actinomycin-D and vincristine, obtaining chemistry panels and complete blood counts, and therapeutic drug monitoring for gentamicin and doxorubicin from CVADs.

Do not use the reinfusion method (ie, delivery of the discard specimen into the VAD after obtaining the sample) due to risk of contamination and blood clot formation.

For therapeutic drug monitoring, draw the blood sample from a dedicated lumen not used for infusion of the drug being monitored. When a dedicated CVAD lumen cannot be used, test results may be falsely elevated, requiring careful evaluation if dosage adjustment is dependent upon the accuracy of the test results. Retesting via direct venipuncture may be necessary. Conflicting studies show elevated antibiotic levels with blood sampling from CVADs, while others have shown no difference.

Do not obtain blood samples for culture from a short peripheral catheter.

There is no evidence available regarding risks, benefits, or limitations related to blood sampling from midline catheters.

Obtaining blood samples for culture from a CVAD should be limited to diagnosis of a catheter-related bloodstream infection (CR-BSI). Do not discard the initial sample drawn to capture planktonic organisms from the intraluminal biofilm.

Avoid routine use of CVADs infusing parenteral nutrition for blood sampling, as this is a significant risk factor for CR-BSI.

**Assessment**

Risks versus 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.

Identify the appropriate fasting period, if required, for the requested laboratory values.

Identify the laboratory tests needed, choose the correct vacuum tubes, and identify correct order for obtaining the laboratory tests as recommended by the manufacturer’s directions for use or laboratory guidelines.
Patient Education
Purpose and process of procedure

Supplies
Blood Sampling from a Short Peripheral Catheter

- Gloves
- Disinfectant pads
- For syringe method:
  - 2 syringes, 3- or 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 (USP)

Procedure
1. Obtain and review the licensed independent practitioner’s (LIP’s) order for the laboratory tests.
2. Assess for history of allergies to analgesia, adhesives, or antiseptic solutions.
3. Verify patient’s identity using 2 independent identifiers, not including the patient’s room number or bed number.
4. Gather supplies.
5. Obtain informed consent.
6. Place patient in sitting or recumbent position, as appropriate.
7. Perform hand hygiene.
8. Don clean gloves.
9. Assess peripheral catheter site for signs and symptoms of complications (eg, redness, edema, pain), and do not use for blood sampling if present.
10. Stop all infusions through the catheter, close the clamp on the extension set, and wait for 2 minutes.
11. For syringe method:
   a. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry, and attach an empty syringe to the needleless connector.
   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 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 (ie, 3 mL) over a large syringe (ie, 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 (USP); attach 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.

12. 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 allow to dry.
i. Flush the catheter and extension set with 10 mL of preservative-free 0.9% sodium chloride (USP); attach the administration set and regulate fluid flow rate, resuming infusion as ordered.

13. Label all filled tubes with the patient’s name and identification numbers.
14. Remove gloves and perform hand hygiene.
15. Dispatch the filled and labeled tubes to the laboratory.

Supplies

Blood Sampling from a Central Vascular Access Device

- Gloves
- Disinfectant pads
- For syringe method:
  - 2 syringes, 3- or 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 (USP)

Procedure

1. Obtain and review the LIP’s order for the appropriate laboratory tests.
2. Assess for history of allergies to analgesia, adhesives, or antiseptic solutions.
3. Verify patient’s identity using 2 independent identifiers, not including the patient’s room number or bed number.
4. Gather supplies.
5. Obtain informed consent.
6. Place patient in sitting or recumbent position, as appropriate.
7. Perform hand hygiene.
8. Don clean gloves.
9. Remove needleless connector and replace with new connector, if withdrawing blood for blood culture to decrease the risk of false-positive culture results.
10. 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.

11. For syringe method:
   a. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad and allowing to dry, and attach an empty syringe to the needleless connector.
   b. If a continuous infusion, detach the administration set from the CVAD hub 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 (ie, 3 mL) over a large syringe (ie, 10 mL).
   f. Detach filled syringe.
   g. Disinfect the needleless connector, if present, by scrubbing with a new disinfectant pad; change needleless connector after phlebotomy according to the manufacturer’s directions for use or per organizational policy.
   h. Flush the CVAD with 10 mL of preservative-free 0.9% sodium chloride (USP), 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.

12. For vacuum tube method:
   a. Disinfect the needleless connector by scrubbing with a new disinfectant pad and allowing to dry, and 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 needleless connector with antiseptic and allow to dry; change needleless connector after phlebotomy according to the manufacturer’s directions for use or per organizational policy.
fl. Flush CVAD with 10 mL of preservative-free 0.9% sodium chloride (USP), and lock CVAD or resume infusion as ordered.

13. 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 (USP) 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.

14. Remove gloves, and perform hand hygiene.

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. Send samples to testing laboratory or place blood specimen in sealed container for transport (eg, home care). Specimens may need to be placed on ice during transport; check with laboratory used by the organization.

**Documentation**

Document in the patient’s medical record:
- Date, time of phlebotomy
- Route, specific VAD or lumen used for phlebotomy
- Amount of blood withdrawn and specific laboratory tests
- VAD flushing and locking

**Bibliography**


7. **Other Infusion Access**

<table>
<thead>
<tr>
<th>Access Device</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intraspinal Access Device: Care and Management</td>
<td>194</td>
</tr>
<tr>
<td>Subcutaneous Access Device: Placement and Infusion Administration</td>
<td>202</td>
</tr>
<tr>
<td>Intraosseous Access Device: Placement, Care, and Management</td>
<td>206</td>
</tr>
</tbody>
</table>
Intraspinal Access Device: Care and Management

Policy
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 (intrathecal, epidural, ventricular reservoir) are preservative-free and labeled for “intraspinal infusion only.”

A 0.2-micron surfactant-free, particulate-retentive, and air-eliminating filter is used for the administration of intraspinal medications.

Peripheral intravenous access is maintained for at least 24 hours due to the potential need for naloxone administration for evidence of respiratory depression.

Removal of a temporary intraspinal access device (intrathecal and epidural) is performed either by or upon the order of a licensed independent practitioner (LIP) in accordance with rules and regulations promulgated by the state’s Board of Nursing and in accordance with organizational policy.

Access and administration of medications via a ventricular reservoir or an implanted infusion pump are performed by an LIP or a specially trained registered nurse (RN) as allowed by the individual’s state Board of Nursing Practice Act.

Competency is validated for clinicians who provide intraspinal access device care and administer intraspinal medications.

Key Points
Intraspinal (epidural/intrathecal) infusions are administered to patients in practice settings from acute care to outpatient and home care who require pain management (eg, during/after a surgical procedure, women in labor, chronic malignant and nonmalignant pain) and for spasticity control.

Preservative-free medications administered via an intraspinal route include, but are not limited to, morphine, fentanyl, hydromorphone, ziconotide, clonidine, bupivicaine, baclofen, and 0.9% sodium chloride (USP).

Antineoplastic agents and pain medications may be administered via an intraventricular access device.

Alcohol or alcohol-containing solutions, as well as acetone, are avoided for site preparation prior to device insertion, site care, and disinfection of the catheter hub/needleless connector.
A dressing should cover the intraspinal access insertion site; routine dressing changes for short-term catheters are not recommended due to the risk of dislodgment and infection.

For long-term catheters (eg, tunneled or implanted devices), a transparent semipermeable membrane (TSM) dressing is used to cover the site and changed every 7 days in conjunction with site antisepsis. After the first 24 hours postplacement of a ventricular reservoir, the site is usually not covered with a dressing.

Use of chlorhexidine-impregnated dressings is considered for short-term intraspinal catheters to reduce the risk of central nervous system-associated infection.

Removal of long-term implanted ports/reservoirs/pumps or tunneled intraspinal devices is considered a surgical procedure.

**Assessment**

Perform a medication reconciliation with every patient encounter asking patients to report every medication including prescription, over-the-counter, 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 (eg, hospital setting) for at least the first 24 hours.

Be especially vigilant when monitoring higher-risk patients, such as those with sleep apnea, psychiatric conditions, or patients taking concomitant (eg, sedatives or other analgesics) medications.

Assess the patient’s response to therapy at established intervals. Recommendations include assessing at the following time intervals: hourly for the first 24 hours and then every 4 hours; assessment of outpatients and patients receiving home care should occur with every patient encounter.

Assess:

- 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)
- Fetal status and response to intraspinal infusion for the patient in labor
- Presence of any side effects: pruritis, nausea, urinary retention, orthostatic hypotension, motor block
• 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
• Oxygen saturation levels via pulse oximeter and carbon dioxide levels as prescribed
• Electronic infusion device for history of analgesic use and correct administration parameters

Identify catheter tip dislodgment by routinely assessing for changes in external catheter length; clinical evidence of catheter tip dislodgment 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**

The importance of reporting alcohol use and all medications used including prescription, over-the-counter, 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: caution with active repetitive bending or twisting of spine as these may increase the risk for catheter damage or dislodgment; increased pain and withdrawal symptoms may be indicative of problems.

**Supplies**

**Site Care and Dressing Change for Long-Term External Intraspinal Catheter**

• 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
**Procedure**

1. Obtain and review LIP’s order.
2. Verify patient’s identity using 2 independent identifiers, not including patient’s room number or bed number.
3. Place patient in comfortable position.
4. Perform hand hygiene.
5. Adhere to aseptic technique and observe Standard Precautions throughout procedure.
6. Gather supplies.
7. Establish sterile field; place sterile supplies on field.
8. Don mask and clean gloves, and carefully remove existing dressing and discard.
9. Remove gloves.
11. Don sterile gloves.
12. Observe insertion site for redness, drainage, swelling, or pain.
13. Measure external catheter length with sterile tape measure.
14. Cleanse the skin with povidone-iodine and allow to air-dry completely.
15. Place antimicrobial dressing around the insertion site if used.
16. Place TSM dressing over entire area, centering it over the catheter insertion site, anchoring catheter with extra tape on skin as needed.
17. Remove gloves and mask, and discard all used supplies properly.
18. Complete label indicating date, time, and initials of clinician providing site care and dressing change.
19. Perform hand hygiene.

**Documentation**

Document in the patient’s medical record:

- External length of catheter, site assessment
- Dressing and stabilization method used (date and initial on dressing)
- Patient response to the procedure

**Supplies**

Medication Administration via External Intraspinal Catheter

- Gloves
- Mask
- Povidone-iodine wipes
- 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 (USP), 10-mL prefilled syringe, for intermittent infusion only
Procedure

1. Obtain and review LIP’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, intraspinal administration, dose, rate, and route of administration
2. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
3. Check medication for expiration or beyond-use dates; inspect syringe for leaks, cracks, particulate matter, and clarity of medication.
4. Compare medication label against order for accuracy.
   a. Use available technology for medication verification in accordance with organizational procedures (eg, bar-code scanning).
   b. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.
5. Assess vital signs and neurological status, and explain procedure.
6. Place patient in comfortable position.
7. Perform hand hygiene.
8. Adhere to aseptic technique and observe Standard Precautions throughout procedure.
9. Gather supplies.
10. Don mask and gloves.
11. Disinfect catheter hub or needleless connector using povidone-iodine solution, and allow solution to dry.
12. Attach empty 10-mL 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 LIP.
   b. Intrathecal: observe for the presence of CSF. If blood is present, do not inject medication. Notify LIP.
13. For a continuous infusion, attach primed administration set, and begin infusion via electronic infusion device (EID) as ordered.
14. 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 (USP) to ensure medication has reached epidural or intrathecal space.
15. Discard used supplies.
16. Remove gloves and mask, and discard.
17. Perform hand hygiene.
**Documentation**

Document in the patient’s medical record:

- Medication, amount and type of diluent, infusion rate, and method
- Patient response to the procedure

**Supplies**

*Implanted Epidural/Intrathecal Port Access and Medication Administration*

- Noncoring safety needle with attached extension tubing size 22 gauge or smaller (needle length dependent upon port depth, usually ¾ to 1 inch)
- 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)

**Procedure**

*Port Access*

1. Obtain and review LIP’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, intraspinal administration, dose, rate, and route of administration
2. Verify patient's identity using 2 independent identifiers, not including patient’s room or bed number.
3. Check medication for expiration or beyond-use dates; inspect syringe for leaks, cracks, particulate matter, and clarity of medication.
4. Compare medication label against order for accuracy.
   a. Use available technology for medication verification in accordance with organizational procedures (eg, bar-code scanning).
   b. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.
5. Assess vital signs and neurological status, and explain procedure.
6. Place patient in a comfortable position with head turned away from implanted port.
7. Perform hand hygiene.
8. Adhere to aseptic technique and observe Standard Precautions throughout procedure.
9. Gather supplies.
10. Assess skin over and around implanted port; palpate port to locate septum.
11. Perform hand hygiene.
12. Establish sterile field; place sterile supplies on field.
13. Don mask and sterile gloves.
14. Disinfect implanted port access site using povidone-iodine and allow to air-dry completely.
15. 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 (USP).
16. With nondominant hand, palpate and stabilize implanted port.
17. 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.
18. 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 LIP.
   b. Intrathecal: observe for the presence of CSF. If blood is present, do not inject medication. Notify LIP.
19. 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.
20. Apply TSM dressing.
21. For a continuous infusion, attach primed administration set and begin infusion via EID as ordered. Primed administration set can be attached directly to the hub of the noncoring needle extension set.
22. 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 (USP) to ensure medication has reached epidural or intrathecal space.
23. Discard used supplies.
24. Remove gloves and mask and discard.
25. Perform hand hygiene.

Documentation
Document in the patient’s medical record:
- Date and time of insertion, access procedure
- Patient response to the procedure

Procedure
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.
Bibliography


Subcutaneous Access Device: Placement and Infusion Administration

Policy
The clinician assesses the patient 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
Continuous subcutaneous access is an alternative infusion route for certain medications and solutions in selected patient situations, such as those with limited venous access, those requiring palliative care, and to allow maximum self-care in infusion administration.

Subcutaneous infusion of isotonic solutions (eg, 5% dextrose in water, 0.9% sodium chloride) may be used as an alternative to intravenous infusion for treatment of mild to moderate dehydration.

The subcutaneous route may be used for continuous opioid (eg, morphine, hydromorphone) and other infusion therapies/medications (eg, immune globulin therapy, terbutaline).

Hyaluronidase may be ordered by the licensed independent practitioner (LIP) to increase absorption and dispersion of subcutaneously administered medications and solutions.

Site rotation recommendations:

- Rotate the subcutaneous access site used for hydration solutions every 24 to 48 hours or after 1.5 to 2 liters of solution has infused, and as clinically indicated based on the access site assessment findings.

- Rotate the subcutaneous access site used for medication administration every 7 days, and as clinically indicated based on the access site assessment findings.

An optimal subcutaneous infusion rate is unknown. Medication infusion rates of 3 to 5 mL per hour are reported, and hydration infusion rates of up to 1500 mL over 24 hours are reported. More than 1 subcutaneous infusion site may be used to accomplish a larger fluid volume. Subcutaneous access devices that allow for infusion into 2 or more sites simultaneously are available.

Refer to the manufacturer’s recommended subcutaneous administration rate/infusion method for immunoglobulin infusions.
**Assessment**
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.

Subcutaneous immunoglobulin infusions (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**
Subcutaneous access device and infusion procedure, including benefits, management, and potential complications

**Home Care/Alternative Site Implications**
All subcutaneous infusions: site signs and symptoms to report

SCIg: drug preparation, subcutaneous administration, site rotation, what to do with missed doses, what to monitor or report during or after the infusion/injection

**Supplies**
- Gloves
- Transparent semipermeable membrane (TSM) dressing
- Tape
- Subcutaneous needle or subcutaneous infusion set, 24 to 27 gauge, ½ inch
- Syringe
- Antiseptic solution (alcoholic chlorhexidine preferred)
- Administration set
- Prefilled medication container or cassette
- Electronic infusion device (EID), if used

**Procedure**
1. Obtain and review licensed independent practitioner’s (LIP’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, subcutaneous administration, dose, rate, and route of administration
2. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
3. Check medication for expiration or beyond-use dates; inspect syringe for leaks, cracks, particulate matter, and clarity of medication.
4. Compare medication label against order for accuracy.
   a. Use available technology for medication verification in accordance with organizational procedures (eg, bar-code scanning).
   b. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.
5. Obtain informed consent per organizational policy or patient assent to procedure.
6. Perform hand hygiene.
7. Gather supplies.
8. Don gloves.
9. Adhere to aseptic technique, and observe Standard Precautions throughout procedure.
10. Identify an appropriate insertion site:
    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, thighs
    d. Avoid areas that are scarred, acutely inflamed, with evidence of infection
11. Wash site with soap and water if needed.
12. Remove excess hair from the intended insertion site with clippers or scissors if necessary.
13. Apply antiseptic solution and allow to air-dry completely.
    a. Cleanse insertion site for at least 30 seconds, using a back-and-forth motion
    b. If using povidone-iodine, it must remain on the skin for at least 2 minutes or longer until fully dry for adequate antisepsis.
14. Grasp skin between thumb and forefinger and insert device according to manufacturer’s directions for use.
15. 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.
16. Attach administration set, and infuse fluids or medication:
    a. Medications: infuse via an EID
    b. Hydration fluids: infuse using a manual flow regulator; EIDs are not typically used
    c. SCIg: infuse via syringe pump (most common); manually pushing the SCIg is also an option for some patients. Limit infusion volume of standard SCIg to no more than 30 mL per site. For hyaluronidase-facilitated SCIg, follow manufacturer’s recommendations for site volume limits.
17. Apply a TSM dressing, and label with the date and time of insertion and initials of the clinician inserting the subcutaneous device.
18. Discard used supplies in the appropriate receptacles.
19. Remove gloves, and perform hand hygiene.

**Documentation**

Document in the patient’s medical 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 response to the procedure
- Patient education

**Bibliography**


Intraosseous Access Device: Placement, Care, and Maintenance

Policy
Intraosseous (IO) access is used in emergent situations if intravenous access is not available or cannot be quickly obtained.

The dwell time of the IO device is limited to no longer than 24 hours, and a plan should be established for placement of an appropriate alternative vascular access device.

Key Points
Pediatric advanced life-support guidelines recommend the IO route as the initial vascular access route.

The IO route may also be considered 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, or severe dehydration; and/or when delay of care is compromised without rapid vascular access.

Use of IO infusion is also reported in anesthesia.

There are 3 types of IO devices: manual needles, impact driven, and drill powered.

Consider the use of lidocaine as a local anesthetic during insertion (subcutaneously 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.

The most common reported complication is infiltration/extravasation from dislodgment and compartment syndrome. Infants and young children may be at greater risk for extravasation and subsequent compartment syndrome due to small bone size and too long needle length.

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, especially before infusing highly irritating solutions/known vesicants and large volume infusions
- Ongoing and frequent assessment of the IO site and extremity

Rarely reported complications include iatrogenic fracture, infection, fat emboli, and osteomyelitis.
**Assessment**
Monitor appearance of IO site appearance, IO needle placement and securement, and intactness of dressing

Identify signs of complications such as:
- Improper access device placement or dislodgment, which increases the risk of infiltration/extravasation
- Inflammation at site

**Patient Education**
Rationale for IO access and what to expect

Risks, benefits, common complications, and what to report

**Supplies**
- Personal protective equipment (PPE)
- Gloves
- IO access device
- IO insertion kit
- Antiseptic solutions (alcoholic chlorhexidine preferred)
- Transparent semipermeable (TSM) dressing
- Lidocaine, if ordered
- Administration set
- Electronic infusion device (EID)

**Procedure**
1. Obtain and review licensed independent practitioner’s (LIP’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, IO administration, dose, rate of administration
2. Obtain informed consent per organizational policy or patient assent to procedure as appropriate based on level of consciousness and/or availability of a surrogate in an emergent situation.
3. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
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.
   a. Use available technology for medication verification in accordance with organizational procedures (eg, bar-code scanning).
b. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.

6. Perform hand hygiene.

7. Gather supplies.

8. Don gloves.

9. Adhere to aseptic technique, and observe Standard Precautions throughout procedure.

10. Identify the most appropriate site based upon the clinical situation and the manufacturer’s directions for the specific device, as each device has approval for specific sites.
   a. Insertion sites most commonly reported in the literature for use in both adults and children include the proximal and distal tibia and the proximal humerus, the distal femur for children, and the sternum in adults.
   b. Other sites less commonly reported in the literature and that may be off-label for IO access include the radius, ulna, pelvis, and clavicle.

11. Wash site with soap and water if needed.

12. Remove excess hair from the intended insertion site with clippers or scissors if necessary.

13. Administer local anesthesia if patient is conscious and per organizational protocol or LIP order.
   a. Subcutaneously at the insertion site (see Local Anesthesia)
   b. May also inject into the IO space after access is established and prior to infusion

14. Apply antiseptic solution (alcoholic chlorhexidine preferred) and allow to air-dry.
   a. Cleanse insertion site for at least 30 seconds, using a back-and-forth motion.
   b. If using povidone-iodine, it must remain on the skin for at least 2 minutes or longer until fully dry for adequate antisepsis.

15. Stabilize extremity.

16. Insert IO device in accordance with manufacturer’s directions for use.

17. Confirm proper placement of the IO device.
   a. Assess needle position.
   b. Sense loss of resistance upon bone penetration.
   c. Note absence of any signs of infiltration with flushing with 5 to 10 mL (adult) or 2 to 5 mL (pediatric) of 0.9% preservative-free sodium chloride (USP) 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.
18. Attach administration set, and infuse solutions or medication via gravity or EID.
19. Apply a TSM dressing, and label with the date and time of insertion and name of the clinician inserting the IO device. Stabilize the IO needle to prevent dislodgment. Dressings and tape or specially designed devices may be used.
20. Discard used supplies in the appropriate receptacles.
21. Remove gloves, and perform hand hygiene.
22. After access device removal, inspect site and change dressing until site has epithelialized and drainage has ceased.

**Documentation**

Document in the patient’s medical 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

**Bibliography**


8. **Infusion Therapies**

IV (Intravenous) Administration: Continuous Infusion, IV Push, Intermittent Infusion ................................................. 212

Transfusion ........................................................................... 223

Parenteral Nutrition ............................................................. 230

Antineoplastic Therapy ......................................................... 234

Biologic Therapy .................................................................. 241

Patient-Controlled Analgesia (PCA) ................................. 245

Moderate Sedation ............................................................... 249

Therapeutic Phlebotomy ....................................................... 252
IV (Intravenous) Administration: Continuous Infusion, IV Push, Intermittent Infusion

Policy
Organizationally approved medication resources, including special considerations for intravenous (IV) preparation and administration, are readily available.

The clinician reviews information regarding the prescribed medication including indications, contraindications, dosing, appropriateness of IV administration, compatibility data, and adverse/side effects prior to administration.

Clinician concerns about the appropriateness of orders are addressed with the pharmacist, prescribing licensed independent practitioner (LIP), supervisor, and/or risk management as defined in organizational policy.

Hazardous infusion medications used in the organization are identified, safely handled, and administered (see Antineoplastic Therapy).

Patient informed consent is obtained according to organizational policy and procedure.

Competency is validated for clinicians who administer IV medications and solutions.

Key Points
Clinicians who work in the realm of oncology and who administer antineoplastic medications are well educated in vesicant drugs and extravasation prevention, as this is an expectation of oncology practice. There are also nonantineoplastic medications/solutions that are vesicants, defined as agents capable of causing tissue damage upon escape from the intended vascular pathway into surrounding tissue. Examples include, but are not limited to, calcium preparations; high-concentration dextrose (>10%); vasopressors such as dopamine, epinephrine, and norepinephrine; vasopressin; sodium bicarbonate; promethazine; and phenytoin. It is important to consult drug references and resources to establish a list of known vesicant drugs. See Antineoplastic Therapy for safe practices and the procedure for vesicant administration.

Most hazardous drugs* are antineoplastic medications; however, there are a few infusion medications from other categories classified as hazardous (eg, ganciclovir, pentamidine); refer to bibliographic reference from the National Institute for Occupational Safety and Health (NIOSH). Also, certain antineoplastic medications are administered for noncancer indications (eg, methotrexate). Use

* Hazardous drugs are defined as drugs exhibiting 1 or more of the following 6 characteristics in humans or animals: carcinogenicity, teratogenicity or other developmental toxicity, reproductive toxicity, organ toxicity at low doses, genotoxicity, and structure and toxicity profiles of new drugs that mimic existing drugs determined hazardous by the above criteria.
of personal protective equipment, safe administration, and disposal of hazardous drugs is addressed in the *Antineoplastic Therapy* procedure.

**IV push medications:**

- Should be provided in a ready-to-administer form to minimize the need for manipulation outside of the pharmacy sterile compounding area; dilution of medications should occur in the pharmacy prior to dispensing
- Should never be withdrawn from commercially prepared drug cartridges or diluted/reconstituted with prefilled flush syringes
- Refer to *Preparing Immediate-Use Parenteral Medications* when reconstitution is necessary outside of the pharmacy

Choose an appropriate flow-control device for infusion, taking into account 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 device (EID) 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 dose error-reduction software are associated with reduced risk for infusion-related medication errors including error interceptions (eg, wrong rate) and reduced adverse drug events.

Consider using a filter for solution and medication filtration in critically ill patients to decrease the risk of system inflammatory response syndrome.

Avoid using a filter with very small drug volumes, as the filter will retain the drug and decrease the amount of medication delivered.

Use a 0.2-micron filter for crystalline solutions and a 1.2-micron filter for lipid-containing admixtures, and use an air-eliminating filter for patients with a right-to-left shunting heart defect.

Maintain aseptic technique during procedure: prevent all touch contamination (eg, hands, patient’s skin, clothing, linens) of syringe tip, the spike end of the administration set, and the male luer end of the administration set after cover removal. After disinfection of needleless connectors and injection ports, do not touch or allow these surfaces to come into contact with unsterile surfaces.
Assessment

Patency of the vascular access device (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-locked 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

Special patient populations (eg, neonatal, pediatric, pregnant, older adults): physiologic characteristics and effects on drug dosage and volume limitations, pharmacologic actions, interactions, side effects/toxicities, monitoring parameters

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

Reason for medication

Side effects/adverse reactions to report

For patients/caregivers who will learn to self-administer infusions, include the following in the teaching plan:

- Proper storage of solution containers in the refrigerator; remove from the refrigerator 30 to 60 minutes prior to infusion or as directed on container label
- Storage of infusion supplies safe from children and pets
- Inspection of the IV solution prior to administration for evidence of particulate matter, cloudiness, or solution separation, and for expiration date
- Check label for accuracy
- Infection prevention, including hand hygiene and aseptic technique
- Infusion pump management, including administration set, priming, program resetting, alarms
- Proper disposal of used infusion supplies
- Supply inventory
- Emergency preparedness in event of power outage, as appropriate
• Action to take for missed/late administration  
• Patient self-monitoring as indicated (eg, central vascular access device [CVAD])/peripheral site, laboratory work schedule)

**Home Care/Alternative Site Implications**

Organizations should develop a list of medications/solutions that are acceptable for administration based on patient safety, risk versus benefits, and the competency of the clinicians within the organization.

The most common IV push medications given outside of the acute care setting include certain IV antibiotics appropriate for IV push administration (eg, cefazolin, ceftriaxone). The safety and appropriateness of any IV push medications in such settings should be confirmed with the infusion pharmacy.

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) (see First Dose Administration in Alternative Care Settings).

**Supplies**

**Continuous Infusion**

- Acceptable agent for disinfection of needleless connector/injection port (isopropyl alcohol, iodophors, alcoholic chlorhexidine gluconate)
- Prescribed medication/solution
- Administration set
- Flow-control device (manual or EID)
- Prefilled syringes: preservative-free 0.9% sodium chloride (USP) flushes

**Procedure**

1. Obtain and review LIP’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
2. Ascertain absence of allergy or previous adverse reaction to prescribed medication/solution.
3. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
4. Perform hand hygiene.
5. Check medication/solution for expiration or beyond-use dates; inspect for leaks, cracks, particulate matter, and clarity of medication/solution.
6. Compare medication/solution label against order for accuracy.
   a. Use available technology for medication verification in accordance
with organizational procedures (eg, bar-code scanning).

b. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.

7. Prepare EID.
   a. Obtain appropriate administration set.
   b. Spike solution container/prime administration set/insert into EID according to manufacturer’s 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.

8. Confirm VAD patency. Attach 10-mL syringe of 0.9% sodium chloride, and confirm patency by aspiration of blood return and ability to easily flush the VAD, and absence of patient complaints (see Maintaining Vascular Access Device [VAD] Patency: Flushing and Locking).
   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 (see Central Vascular Access Device [CVAD] Occlusion; Central Vascular Access Device [CVAD] 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.

9. Attach male luer end of administration set directly to catheter hub or alternatively to needleless connector after disinfection.

10. Enter the correct infusion flow rate and other required information (eg, volume to be infused [VTBI]), and start the EID.

11. 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 LIP of any adverse reaction.

12. Assess patient response and any side effects/adverse reactions initially and during infusion; ensure ongoing plan in place for continued monitoring as appropriate.

13. Discard expended equipment and used supplies appropriately.


15. Verify infusion rate of continuous IV solutions and VAD site condition and patency based on frequency indicated by the solution/medication and patient factors.
Supplies
IV Push
- Acceptable agent for disinfection of needleless connector/injection port (isopropyl alcohol, iodophors, alcoholic chlorhexidine gluconate)
- Prescribed medication prepared and labeled in syringe
- Prefilled syringes: preservative-free 0.9% sodium chloride (USP) flushes
- Prefilled syringe of heparin flush solution, if indicated by LIP order or protocol

Procedure
1. Obtain and review LIP’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
2. Ascertain absence of allergy or previous adverse reaction to prescribed medication.
3. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
4. Perform hand hygiene.
5. Check medication for expiration or beyond-use dates; inspect syringe for leaks, cracks, particulate matter, and clarity of medication.
6. Compare medication label against order for accuracy.
   a. Use available technology for medication verification in accordance with organizational procedures (eg, bar-code scanning).
   b. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.
7. Disinfect needleless connector on VAD hub.
   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.
8. 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.

9. Attach 10-mL syringe of 0.9% sodium chloride and confirm patency of VAD by aspiration of blood return and ability to easily flush the VAD, and absence of patient complaints (see *Maintaining Vascular Access Device [VAD] Patency: Flushing and Locking*).
   
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 (see *Central Vascular Access Device [CVAD] Occlusion; Central Vascular Access Device [CVAD] 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.

10. Disinfect needleless connector or injection port of administration set with a new swab pad, and discard.

11. 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 with pharmacist if rate is not specified.

12. 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 LIP of any adverse reaction.

13. Detach medication syringe, and disinfect needleless connector on VAD hub or injection port of administration set with a new swab pad, and discard.

14. Attach 10-mL syringe of 0.9% sodium chloride 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.

15. For continuous infusion, resume correct flow rate if stopped. If not stopped, verify that the correct rate is infusing.

16. 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.

17. Assess patient response and any side effects/adverse reactions; ensure ongoing plan in place for continued monitoring as appropriate.

18. Discard expended equipment and used supplies appropriately.

19. Perform hand hygiene.
**Supplies**

**Intermittent Medication Infusion**

- Acceptable agent for disinfection of needleless connector/injection port (isopropyl alcohol, iodophors, alcoholic chlorhexidine gluconate)
- Prescribed medication
- Administration set
- Prefilled syringes: preservative-free 0.9% sodium chloride (USP) flushes
- Prefilled syringe of heparin flush solution, if ordered

**Procedure**

1. Obtain and review LIP’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
2. Ascertain absence of allergy or previous adverse reaction to prescribed medication.
3. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
4. Perform hand hygiene.
5. Check medication for expiration or beyond-use date; inspect infusion container for leaks, cracks, particulate matter, and clarity of medication.
6. Compare medication label against order for accuracy.
   a. Use available technology for medication verification in accordance with organizational procedures (eg, bar-code scanning).
   b. Employ an independent double check by 2 clinicians for high-risk medications in accordance with organizational procedures.
7. Choose appropriate length of medication administration set.
   a. For piggybacking into a continuous infusion on an EID, 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 or “piggyback” set.
   c. For attaching directly to a VAD hub, choose a regular administration set with enough length to allow for correct height of the fluid container.
8. Prepare infusion.
   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.

9. Disinfect the chosen injection port on the continuous administration set or the needleless connector on the VAD hub with a new swab pad.

10. Confirm VAD patency. Attach 10-mL syringe of 0.9% sodium chloride and confirm patency by aspiration of blood return and ability to easily flush the VAD, and absence of patient complaints (see Maintaining Vascular Access Device [VAD] Patency: Flushing and Locking).

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 (see Central Vascular Access Device [CVAD] Occlusion; Central Vascular Access Device [CVAD] 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. Remove the cap from the male luer end of the chosen administration set and attach to the injection port or needleless connector.

12. 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 EID 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 manufacturer’s directions for use.

d. For an EID with the medication attached below the pumping mechanism, manually regulate the medication flow rate by counting drops.

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 LIP of any adverse reaction.

14. When the secondary medication has infused, close clamp of medication administration set.
15. 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 backpriming 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 EID.
   e. All primary and secondary administration sets should be replaced simultaneously at 96 hours.

16. 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.
   b. Attach 10-mL syringe of 0.9% sodium chloride 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.
   d. Attach syringe containing the appropriate locking solution and inject into the VAD lumen.

17. If primary continuous solutions are infusing, ensure that the correct flow rate has resumed.

18. Assess patient response and any side effects/adverse reactions; ensure ongoing plan in place for continued monitoring as appropriate.

19. Discard expended equipment and used supplies appropriately.

20. Perform hand hygiene.
Policies and Procedures for Infusion Therapy

**Documentation**

Document in the patient’s medical 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
- Administering clinician's initials

**Bibliography**


Transfusion

**Policy**
Blood and blood components are filtered using an in-line or add-on filter appropriate to the prescribed therapy.

Verification of the correct patient and blood product is performed prior to transfusion.

Each unit of blood or blood component is completed within 4 hours.

The administration set is changed after the completion of each unit or every 4 hours; if more than 1 unit can be infused in 4 hours, the transfusion set can be used for a 4-hour period.

Patient informed consent is obtained according to organizational policy and procedure.

Competency is validated for clinicians who perform transfusions.

**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.

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.

Appropriate vascular access devices for transfusion include:
- Short peripheral catheters: 20 to 24 gauge based on vein size and patient preference. When rapid transfusion is required, a larger-size catheter gauge is recommended (14 to 18 gauge).
- Central vascular access devices (CVADs) are acceptable for transfusions; infusion may be slower with peripherally inserted central catheters due to catheter length and lumen size.
- Neonatal/pediatric patients: umbilical venous catheters or small saphenous vein catheters (24 gauge) may be used in infants.

Filter all blood components and follow the manufacturers’ directions for filter use.
- Standard blood administration sets include a 170- to 260-micron filter that removes blood clots and harmful particles.
- Microaggregate filters are not routinely used but are used for reinfusion of blood shed and collected during surgery.
Policies and Procedures for Infusion Therapy

- **Bedside leukocyte reduction filters** are not routinely used because they are associated with dramatic hypotension in some patients; leukocyte-reduction filtration is generally preferred “prestorage” or shortly after blood collection. Use of leukocyte-reduced blood products (red cells and platelets) decreases the risk of febrile transfusion reactions, risk of human leukocyte antigen (HLA) alloimmunization, and cytomegalovirus (CMV) transmission.

- **Leukocyte filtration** is never used with transfusions of granulocyte or hematopoietic progenitor cells.

Electronic infusion devices (EIDs) can be used to deliver blood or blood components without significant risk of red blood cell hemolysis; use EIDs that have a labeled indication for blood transfusion and follow manufacturers’ directions for use.

Blood warming devices are used when clinically indicated (eg, large-volume or rapid transfusions, exchange transfusions, patients with clinically significant conditions, and the neonate/pediatric population). The risk of clinically important hypothermia is increased when blood is transfused through a CVAD.

When rapid transfusion is required, an externally applied compression device or electronic rapid infusion device may be used in accordance with manufacturers’ directions for use. 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. For rapid infusion, a larger-gauge catheter may be more effective than a pressure device. Closely monitor the blood level in the container, as pressure devices are associated with air embolism.

Each unit of blood or blood component must be completed within 4 hours. When slower transfusion is required (eg, pediatrics, adults at risk for circulatory overload), ask the transfusion service to divide a unit of red blood cells or whole blood into smaller aliquots.

Platelets should be administered over 30 minutes to 4 hours.

Each unit of plasma should be administered as quickly as tolerated by the patient or over 15 to 60 minutes.

Blood and blood components are only administered with 0.9% sodium chloride. No other solutions or medications are added to or infused through the same administration set with blood or blood components unless they have been approved by the US Food and Drug Administration (FDA) for this use.

Ensure adequate and patent vascular access prior to obtaining the unit of blood from the blood bank.
Do not place blood container in any refrigerator outside of the transfusion service.

Ensure transfusion is started within designated time of removal from the transfusion service (eg, 30 minutes).

Establish parameters for vital signs that require licensed independent practitioner (LIP) notification before starting transfusion (eg, elevated body temperature).

**Assessment**

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)
- Patency of vascular access device (VAD)

Current laboratory values, especially hemoglobin and hematocrit levels

During/after transfusion: monitor for signs/symptoms of immediate transfusion reactions.*

- 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 (see Allergic Reaction and Anaphylactic/Anaphylactoid Reactions)
- Transfusion-related acute lung injury (TRALI) (eg, fever, chills, dyspnea, cyanosis, hypoxemia, hypotension, bilateral pulmonary edema)
- Transfusion-associated circulatory overload (see 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**

Rationale for transfusion

Rationale for frequent monitoring during transfusion

Signs and symptoms of transfusion reaction to report (eg, itching, swelling, dizziness, dyspnea, low back/chest pain)
Signs and symptoms of VAD-related complications (eg, pain, swelling, redness at site)

**Home Care/Alternative Site Implications**
A safe transfusion program in a non–acute care setting must include:
- Comprehensive policies and procedures in concert with an established relationship with a transfusion service
- Comprehensive staff education and competency program
- Patient selection criteria: history of transfusions with no identified adverse events during previous transfusions
- Immediate access to the LIP by phone during the transfusion
- Another competent adult present and available to assist with patient identification and calling for medical assistance if needed
- Ability to transport blood product in cooling containers verified for correct temperature
- Ability to appropriately dispose of medical waste
- Well-designed patient and caregiver education process, including clearly written instructions regarding transfusion reactions

**Supplies**
- Gloves
- Solution container of 0.9% sodium chloride
- Blood component
- Blood administration set
- Antiseptic wipes

**Preprocedure**
1. Obtain and review LIP’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 to continue procedure

**Procedure**
1. Obtain blood product from the transfusion service.
2. Perform patient and blood identification process at time of obtaining blood:
   a. Verify recipient’s 2 independent identifiers, 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.

3. Perform patient and blood identification process at patient bedside using an independent double check by 2 adults in the presence of the patient
   a. Verify patient identity using 2 independent patient identifiers and ask the patient to state his or her name, if possible.
   b. Verify the blood component
   c. Review the LIP’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 (CMV) seronegative

4. 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 manufacturer’s 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.

5. 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; increase the transfusion rate if there are no signs of a reaction and to ensure the completion of the unit within 4 hours.

   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.
7. 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 at a keep vein open rate.
   a. Notify the LIP 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.

8. Complete red blood cell/platelet transfusion within 4 hours; plasma within 1 hour.
   a. Close clamp to blood product upon 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.

9. 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 medical 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 education
- Patient response to the procedure
Bibliography


Policies and Procedures for Infusion Therapy

Parenteral Nutrition

Policy
Parenteral nutrition (PN) solutions are filtered; use a 0.22-micron filter for PN solutions without lipids, and use a 1.2-micron filter for 3-in-1 PN solutions (containing dextrose, amino acids, and lipid emulsions).

Medications are not added to or co-infused with the PN solutions/emulsions before or during infusion without consultation with a pharmacist regarding compatibility and stability.

The hang time for a container of PN solution should not exceed 24 hours; the hang time is limited to 12 hours for fat emulsions alone.

The administration set for all PN solutions is changed every 24 hours.

Administration sets used with lipid-based infusates, such as intravenous fat emulsions, will be free of di-ethylhexyl-phthalate (DEHP).

PN solutions/emulsions with a final concentration exceeding 10% dextrose or an osmolarity of greater than 900 mOsm/L are administered through a central vascular access device (CVAD).

Informed consent is obtained according to organizational policy and procedure.

Competency is validated for clinicians who administer parenteral nutrition.

Key Points
The enteral route is used in preference to the parenteral route for nutrition support whenever feasible.

The use of standardized order forms or templates and computerized prescriber order entry (CPOE) is recommended to reduce the risk of errors related to PN prescriptions.

Because there may be periodic shortages of PN components, consider development of licensed independent practitioner (LIP)-approved written protocols for PN component substitution or conservation methods.

PN is administered using an electronic infusion device with anti–free-flow protection.

PN is administered as a continuous infusion or as a cyclic infusion, such as in home care. A cyclic infusion lasts a portion of the day, usually overnight (eg, 8-16 hours). Advantages to 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.
The risk for bloodstream infection in patients receiving PN may be reduced by:
• Avoiding blood sampling via the CVAD used for PN when feasible
• Using a designated single-lumen catheter to administer lipid-containing PN solutions

PN solutions are refrigerated and protected from light until shortly before the time of administration to avoid oxidation of vitamins.

All PN solutions are hyperosmolar, and when infused through a peripheral vein are associated with an increased risk of phlebitis; phlebitis-mitigating techniques should be employed (see Phlebitis).

**Assessment**

Nutritional assessment including physical assessment

- Signs of nutritional deficiencies (eg, changes in hair, skin, nails, mouth)
- Anthropometric measurements (height, weight)
- Signs/symptoms of electrolyte imbalance
- Signs/symptoms of infection, as catheter-related bloodstream infection is a serious complication associated with PN

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 in the acute care or home setting.
• 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**

Purpose and expected duration of PN

- Signs and symptoms of hypo- and hyperglycemia
- Signs and symptoms of alterations in electrolytes (eg, potassium, calcium)
For patients going home requiring PN:

- Teach the need for self-monitoring response to PN, which includes monitoring of weight, temperature, blood glucose, output (urine/stool/ostomy/wound), CVAD site.
- Teach about the schedule for ongoing laboratory work studies.

**Home Care/Alternative Site Implications**

The goal for home care patients who receive PN is generally self-administration and management of PN.

Recognize that home care patients and families often need help in fitting PN into daily life. That may include alterations in body image, lifestyle, and dependence on medical equipment and health care personnel.

Inform patients about the Oley Foundation (www.oley.org). This organization, founded in 1983, provides support and education for patients/families requiring home enteral and parenteral nutrition.

Patient and caregiver education should address the following:

- 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
- Label checking 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 event of power outage
- Action to take for missed/late administration
- Signs and symptoms of metabolic intolerance, infection, and CVAD complications

**Procedure**

See *IV (Intravenous) Administration: Continuous Infusion, IV Push, Intermittent Infusion*. 

232
Bibliography


Antineoplastic Therapy

Policy
Antineoplastic agents are administered only upon written orders, including new orders or changes to existing orders. Verbal orders are acceptable only if antineoplastic agents are to be placed on hold or discontinued.

Hazardous antineoplastic drugs are identified, safely handled, and administered.

Informed consent is obtained according to organizational policy and procedure.

Competency is validated for clinicians who administer antineoplastic therapy.

Key Points
The informed consent should include a description of risks, benefits, and treatment alternatives, an opportunity to ask questions, and the right to accept or refuse treatment.

Only qualified clinicians administer antineoplastic therapy based on completion of a specialized education and competency program with a recommendation for annual assessment of competency.

Clinicians must be aware if a drug is a hazardous drug and handle appropriately.
- Personal protective equipment (PPE) and engineering controls must be in place.
- Provide access to PPE, safety data sheets (SDS; formerly material safety data sheets), spill kits, containment bags, eyewash stations, and designated waste disposal containers in all areas where hazardous drugs are handled.
- During drug administration, employ the following: double gloves, protective gown, eye protection if liquid could splash, respiratory protection if inhalation potential, and a closed system drug transfer device, drug administration sets should be attached and primed prior to administration.

Antineoplastic drugs are high-alert medications, and safeguards should be in place to reduce the risk of errors such as:
- Use of standardized orders, standardized dosage calculation, established dosage limits, computerized prescriber order entry (CPOE), bar-code technology, and smart pumps
- Consultation with the pharmacist to review drug interactions with each change in the patient’s medication list
• At the time of the order: independent verification of the antineoplastic order by 2 clinicians qualified in antineoplastic administration to include confirmation of 2 patient identifiers, drug names, dose, volume, route, rate, calculation for dosing, treatment cycle, and day
• Just prior to administration: independent verification of the antineoplastic order by 2 clinicians qualified in antineoplastic administration to include drug name, dose, volume, rate of administration, expiration date, infusion pump rate, and appearance/physical integrity of the drugs
• Involve the patient and family members in medication identification because patients often observe and report errors and adverse events.
• Monitor cumulative antineoplastic dose, as appropriate, to ensure that the drug is discontinued if the maximum lifetime dose is reached.

Some antineoplastic drugs are vesicants, defined as agents capable of causing tissue damage upon escape from the intended vascular pathway into surrounding tissue. Antineoplastic vesicants include, but are not limited to, dactinomycin, daunorubicin, doxorubicin, epirubicin, idarubicin, mechlorethamine, melphalan, mitomycin, vinblastine, vincristine, videsine, and vinorelbine; there are additional drugs that have vesicant potential. It is important to consult with antineoplastic references and resources to establish a list of known vesicant drugs. Safe practices must be in place, including:
• Limit peripheral vesicant infusion to intravenous (IV) push or infusions lasting less than 30 to 60 minutes.
  ° Do not use an infusion pump for peripheral vesicant administration.
  ° Do not use scalp veins in the neonate and pediatric patient.
  ° Never administer a vesicant in the absence of a blood return.
  ° 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 to 10 minutes during an infusion, remaining with the patient during the entire infusion.
• For vesicant infusion via a central vascular access device (CVAD): do not administer if signs of inflammation, swelling, leaking, or signs of venous thrombosis present (see Central Vascular Access Device [CVAD]-Associated Venous Thrombosis).
• Ensure proper placement, and adequately secure and stabilize the noncoring needle within implanted vascular access ports.
Assessment
Prior to each treatment cycle:

- Results of current laboratory data/diagnostic tests
- Current medications, including over-the-counter (OTC) and herbals
- Vitals signs and weight
- For initial cycle, patient height must be measured, not verbally reported
- 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

Patency of the vascular access device (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-locked connections, and correct flow rate for infusing solutions, if administered

Patient level of understanding of treatment

Patient psychosocial concerns

Patient Education
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.

Home Care/Alternative Site Implications
Organizations should develop a list of antineoplastic drugs that are acceptable for administration based on patient safety, risk versus benefits, and the competency of the clinicians within the organization.

Supplies
Procedure: Vesicant Administration

- Acceptable agent for disinfection of needleless connector/injection port (isopropyl alcohol, iodophors, alcoholic chlorhexidine gluconate)
- Prescribed IV medication with preattached, preprimed administration set
Preprocedure

1. Obtain and review LIP’s order for antineoplastic medication(s).
2. Confirm prescribed dose by comparing order to references such as drug therapy monographs or published dosing guidelines.
3. Ascertain absence of allergy or previous adverse reaction to prescribed medication.
4. Verify results of pertinent laboratory studies/diagnostic tests.
5. Verify dosage accuracy at the time of the order:
   a. 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 (AUC), and calculate all drug doses to be delivered. A significant variation in BSA greater than 10% must be addressed with the prescribing LIP. Dose amounts are compared to labeled dosage. Any discrepancies in dose of greater than 10% must be reconciled.
6. Obtain informed consent per organizational policy.
7. Perform baseline physical assessment including vital signs.
8. 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 greater than 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.
9. Turn off all ceiling fans and humidifiers to reduce risk for spread of cytotoxic solution agent by aerosolization or vaporization.

Procedure

1. Verify patient’s identity using 2 independent identifiers, not including patient’s room or bed number.
2. Perform hand hygiene.
3. **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 1-time individual patient use.**
   c. **Eye protection if liquid could splash**
   d. **Respiratory protection if inhalation potential**

4. **Cover working area with disposable, absorbent, plastic-backed barrier pad.**

5. **Gather supplies, and place on barrier pad.**

6. **Check medication for expiration or beyond-use dates; inspect syringe for leaks, cracks, particulate matter, and clarity of medication.**

7. **Verify antineoplastic order using an independent double check by 2 qualified clinicians to include drug name, dose, volume, rate of administration, expiration date, infusion pump rate, and appearance/physical integrity of the drugs.**

8. **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.**

9. **Attach 10-mL syringe of 0.9% sodium chloride, and confirm patency of VAD by aspiration of blood return and 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. **Disinfect injection port of administration set with a new swab pad and discard.**

11. **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. **Infusion pump: initiate infusion, and observe patient for at least 20 minutes following infusion initiation for any adverse reactions.**
   a. Peripheral IV catheters: 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 (see Infiltration/Extravasation).

13. Detach medication syringe, and disinfect needleless connector on VAD hub or injection port of administration set with a new swab pad and discard.

14. 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.

15. Assess patient response and any side effects/adverse reactions; ensure ongoing plan in place for continued monitoring as appropriate.

16. 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.

17. Perform hand hygiene.

Documentation

Document in the patient’s medical 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 education
Bibliography


Biologic Therapy

Policy
Biologic infusion therapy is administered in a setting in which the clinician is prepared to recognize and manage severe adverse reactions.

Patients are screened for the absence of contraindications to administration prior to the beginning of therapy and prior to each administration.

Drugs for treatment of adverse reactions, including drugs to treat anaphylaxis, are available in the treatment setting.

Informed consent is obtained according to organizational policy and procedure.

Competency is validated for clinicians who administer biologic therapy.

Key Points
Biologic infusion therapies include, but are not limited to, colony-stimulating factors, gene therapy, monoclonal antibodies, fusion proteins, interleukin inhibitors, and immunoglobulins. Infusion administration includes both the intravenous and subcutaneous routes. Biologic therapies are used in the treatment of cancer and a variety of immune system disorders (eg, autoimmune diseases and immune deficiencies).

It is common to have orders in place for premedications, such as acetaminophen and diphenhydramine, which may prevent infusion reactions common to many biologic therapies.

Refer to the manufacturers’ package inserts for information regarding storage, preparation, and administration of biologic infusion products.

Collaborate with the licensed independent practitioner (LIP) and pharmacy regarding special safeguards; due to serious risks associated with some biologic agents, risk evaluation and mitigation strategies (REMS) may be required by the US Food and Drug Administration (FDA).

Reconstitute or prepare liquid products in a clean environment consistent with USP Chapter <797> (see Preparing Immediate-Use Parenteral Medications).

Select the most appropriate flow-control method for the biologic therapy, taking into account 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.
Clinician competency should address knowledge of the clinical implications, safe preparation of the biologic, infection prevention, ability to establish venous access, knowledge of appropriate subcutaneous infusion sites, provision of patient/family education, and management of therapy-related adverse events.

**Assessment**

Risk factors before initiation of therapy, which include, but are not limited to:

- Comorbidities (eg, hypertension, cardiopulmonary/liver/renal disease)
- Presence of infections (viral, fungal or bacterial); results of tuberculosis testing, hepatitis B and C screening
- 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 changes in medication list
- Pertinent laboratory results (eg, complete blood count, liver/kidney function)
- Response to treatment
- Vital signs

Signs/symptoms of infusion reactions:

- Anaphylactic/anaphylactoid/allergic reactions (see *Allergic Reaction and Anaphylactic/Anaphylactoid Reactions*)
- Refer to the manufacturer’s information for specific biologic therapy.

**Patient Education**

Risks and benefits of biologic therapy

Physical and psychological effects

Potential side and adverse effects, and signs and symptoms to report

Management of adverse events, such as infusion reactions and delayed reactions
Home Care/Alternative Site Implications
Nurse-administered home administration of intravenous immunoglobulin (IVIG) may provide advantages, such as improved adherence to therapy and decreased cost, for long-term, stable patients who require extended therapy for primary immune deficiency diseases.

Self-administered subcutaneous immunoglobulin (SCIg) is an option for some patients. There is a low incidence of systemic effects with SCIg due to the slow equilibration of Ig into the circulation. Guidelines for administration include:

- The first SCIg dose is administered in a controlled setting under medical supervision.
- The infusion volume of standard SCIg is limited to no more than a 30-mL volume per site. There is a high incidence of local site reactions, such as swelling and erythema, which tend to resolve within 24 hours after infusion.
- Infusion administration is most often delivered via a syringe pump; another option for some patients is manually pushing the SCIg.
- Patient education for SCIg must address drug preparation, subcutaneous administration, the importance of site rotation, what to do with missed doses, and what to monitor or report during or after the injection.

Procedure
See IV (Intravenous) Administration: Continuous Infusion, IV Push, Intermittent Infusion; Subcutaneous Access Device: Placement and Infusion Administration.
Bibliography


**Patient-Controlled Analgesia (PCA)**

**Policy**
The patient and caregiver are educated in the use of patient-controlled analgesia (PCA). Patient and caregiver comprehension and ability to comply with procedures are evaluated and documented prior to and upon initiation of therapy. Informed consent is obtained according to organizational policy and procedure. Competency is validated for clinicians who administer PCA.

**Key Points**
PCA is a common method of pain management that allows the patient to deliver his or her own analgesic dose when needed. It is commonly used in postoperative patient care and also in palliative care and hospice care settings.

In postoperative patient care, PCA is programmed for an analgesic dose on demand. PCA may also be used in conjunction with a continuous basal rate of analgesic, primarily in hospice and palliative care.

Authorized agent-controlled analgesia (AACA) may be used if the patient is unable to actively participate in PCA, or parent/nurse-controlled analgesia (PNCA) may be used for infants. AACA allows for a consistent, available, and competent person authorized by the licensed independent practitioner (LIP) who is educated to activate the PCA dose.

Use standardized medication concentrations and standardized or preprinted order sets for PCA and AACA, which would include minimally:
- Concentration of opioid infusate
- Dose
- Lockout interval
- Maximum limit
- Loading dose
- Continuous rate if ordered

Only the LIP ordering the PCA/AACA/PNCA may order additional central nervous system (CNS)-depressant medications.

Use an independent double check of the PCA pump settings by 2 qualified clinicians at the start of the PCA therapy, the beginning of each shift, change in nursing assignment, change of infusion container, or change in PCA order (eg, drug, concentration, dose, rate). 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

In acute care settings, the PCA infusion is usually administered via an injection port of an existing continuous infusion of IV solution.

While most PCA is via the intravenous route, PCA is also used with epidural analgesia and via the subcutaneous route.

Clinician competency should address knowledge of the appropriate drugs used with PCA, including pharmacokinetics and equianalgesic dosing, contraindications, side effects and their management, appropriate administration modalities, and anticipated outcomes.

Assessment
Prior to initiation of PCA:

• 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 which include, but are not limited to, older age, 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 and blood pressure every 15 minutes x 4, every hour x 3, then every 4 hours while on PCA therapy
• Respiratory rate, depth, and quality; other respiratory assessment as ordered, such as oxygenation saturation via pulse oximetry (SpO₂) and/or end-tidal CO₂ (EtCO₂) via capnography; sedation; and pain intensity every 30 minutes x 4, every 2 hours x 24 hours, then every 4 hours and as needed
• Consider EtCO₂ monitoring via PCA pump for 24 hours after initiation of PCA therapy and for 24 hours after change in PCA therapy.
• Defer sedation, pulse oximetry, and pain scale assessment during sleep if respiratory rate >12 and EtCO₂ < 50.

After 24 hours, continue EtCO₂ monitoring at night for the following patients:

• Opioid naïve
• Receiving concurrent sedatives such as hypnotics, benzodiazepines
• Receiving phenothiazines
• Age 70 or older
• Receiving continuous basal infusion with PCA
• Chronic obstructive pulmonary disease, respiratory insufficiency
• Renal, hepatic, or cardiac dysfunction
• Suspected or history of sleep apnea
• Current postoperative upper abdominal or thoracic surgery
• Morbid obesity (body mass index greater than 40)

Hold use of the PCA, and notify LIP if the following occurs:
• Respiratory rate less than 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 self-report of pain or objective measure of pain using a consistent pain assessment scale appropriate to the patient, including regular evaluation of PCA injections and attempts.

**Patient Education**

Purpose of PCA therapy

Use of the bolus dose function of the electronic infusion device

Use of pain rating scale

Expected outcomes

Precautions, potential side effects, and contact information for support services

**Home Care/Alternative Site Implications**

Appropriateness and safety for patient

Home care teams are experienced in this modality.

**Procedure**

See *IV (Intravenous) Administration: Continuous Infusion, IV Push, Intermittent Infusion.*

**Documentation**

Document baseline assessment and other parameters regularly, per policy, in the patient’s medical record:
Policies and Procedures for Infusion Therapy

• 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 per shift 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

Bibliography


Moderate Sedation

Policy
The registered nurse (RN) may administer moderate sedation/analgesia using intravenous (IV) infusion in accordance with rules and regulations promulgated by the state’s Board of Nursing and in accordance with organizational policies and procedures.

The RN is competent in the administration of moderate sedation/analgesia, including knowledge of preprocedure assessment; different sedation levels; safe medication administration; reversal agents for moderate sedation/analgesia; airway management; monitoring of physiological parameters; common complications and interventions; and resuscitation through age-appropriate cardiac life-support validation.

Vascular access is maintained throughout the procedure and recovery for administration of medications and for potential need for emergency resuscitative medications and/or reversal agents.

An emergency cart and reversal agents are immediately accessible, and clinicians with expertise in airway management, emergency intubation, advanced cardiopulmonary life support, and management of potential complications are immediately available.

Informed consent is obtained according to organizational policy and procedure.

Key Points
A list of medications that may be administered by the RN is available within the organization: examples of medications for moderate sedation that may be administered include benzodiazepines (midazolam, diazepam); narcotics (fentanyl, meperidine); propofol; neuroleptic tranquilizers (droperidol); and antihistamines (diphenhydramine).

Recognize that 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.

The nurse who is monitoring the patient receiving moderate sedation should have no other responsibilities during the procedure.

A discharge plan should be established before the procedure (eg, the need to have a family member/caregiver/friend drive the patient home and observe the patient postprocedure).

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
- Medical history/current condition
- Current medications
- Allergies
- Previous sedation experience
- Drug/alcohol/tobacco use
- Verification of NPO (nothing by mouth) status
- Consult with an anesthesia licensed independent professional (LIP) 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, continuously monitor:
- Blood pressure, respiratory rate, oxygen saturation, cardiac rate and rhythm, and level of consciousness
- Capnography use is recommended 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
- Sedation/analgesia infusion
- What to expect before, during, after procedure
- Postprocedure restrictions
- Potential complications related to the infusion site and the procedure
- Emergency instructions
- 24-hour contact phone number

Procedure
See IV (Intravenous) Administration: Continuous Infusion, IV Push, Intermittent Infusion.
**Bibliography**


Therapeutic Phlebotomy

Policy
A licensed independent practitioner’s (LIP’s) order is required for therapeutic phlebotomy, including the specific volume to be removed.

Blood withdrawn for therapeutic phlebotomy will be considered hazardous waste and disposed of according to organizational policies and procedures.

Informed consent is obtained by organizational policy and procedures.

Competency is validated for clinicians who perform therapeutic phlebotomy.

Key Points
Orders for therapeutic phlebotomy should include laboratory values to be assessed specific to the patient’s diagnosis, parameters for laboratory values guiding the indication for phlebotomy, frequency of phlebotomy, and specific volume of blood to be withdrawn.

Suitable scales may be used to determine the amount of blood to be removed by weight rather than volume. 1 mL of blood weighs 1.06 grams. Consider the weight of the bag and anticoagulant contents, if present.

Appropriate vascular access device (VAD) choice is based on patient condition, anticipated length of treatments needed, and other infusion therapies:

• Short peripheral catheter using an 18- to 20-gauge device and inserted before phlebotomy and removed upon completion
• Central vascular access device (CVAD) if already placed, and therapeutic phlebotomy will not compromise other infusion therapies
• Apheresis catheter

Establish acceptable limits or parameters for weight, blood pressure, pulse, temperature and steps to take when these values are outside of these parameters.

Therapeutic phlebotomy is a short procedure performed as an inpatient or outpatient in alternative settings with the capability to perform the procedure safely and manage the safe discard of biohazardous waste.

Blood collection receptacles may include bags specifically designed for therapeutic phlebotomy or collection bags used for volunteer blood donation. Regular blood collection bags often have permanently attached 15- or 16-gauge needles, which may cause unnecessary pain and vein damage and bleeding upon removal. Large syringes may also be used for manual aspiration. Do not use vacuum containers to facilitate blood flow due to risk of air embolism.
Assessment
Pretreatment signs/symptoms associated with specific disease state

Vital signs before and after the procedure, including blood pressure, heart rate, respiratory rate and temperature

Patient weight

Patient Education
Encourage oral hydration before and after the procedure.

Potential side effects such as a hematoma, syncope, and nausea/vomiting

Type and amount of physical activity before and after the procedure

Supplies
- Nonsterile gloves
- Tourniquet
- Blood collection bag/container without a permanently attached needle or large syringes for manual aspiration
- 18- to 20-gauge peripheral IV device (metal winged needle or plastic catheter)
- Macrobore administration set, if not already attached to collection bag
- Antiseptic solutions, preferably alcoholic chlorhexidine gluconate; however, povidone-iodine or alcohol are acceptable
- Local anesthesia, if needed
- Gauze
- Tape
- Labels

Procedure
1. Obtain and review LIP’s order for therapeutic phlebotomy procedure. Orders must include:
   a. Amount of blood to be drawn
   b. Frequency of withdrawal
2. 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
3. Verify patient’s identity using 2 independent identifiers, not including patient’s room and bed number.
5. Obtain baseline vital signs.
6. Educate patient about the procedure.

7. Obtain informed consent.

8. Place patient in a supine position in a reclining chair or exam table/bed for the procedure.


10. Gather supplies.

11. Assess the upper extremities for an appropriate venipuncture site. Choose a large vein in the forearm.

12. Administer local anesthesia if indicated (see Local Anesthesia).

13. Perform hand hygiene.

14. Attach phlebotomy administration 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 administration set or use a padded hemostat to clamp.

15. Don nonsterile gloves.

16. Cleanse insertion site with antiseptic solution; allow to dry completely.
   b. Povidone-iodine: apply with applicator and allow to remain on the skin for 1.5 to 2 minutes or longer to dry completely for adequate antisepsis.

17. Prep insertion site for at least 30 seconds using a back-and-forth motion. If using povidone-iodine, it must remain on the skin for at least 2 minutes or longer until fully dry for adequate antisepsis.

18. 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.

19. Insert the needle/catheter following the manufacturer’s 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.

20. Connect phlebotomy administration set to winged needle/catheter.

21. 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.

22. Slowly open clamp of administration set, allowing retrograde blood flow into administration set and collection container.

23. Monitor volume or weight of collected blood until prescribed quantity is withdrawn, then clamp administration set.
24. Withdraw needle/catheter, and apply manual pressure to venipuncture site with gauze pad until the bleeding has stopped. Apply a dressing.
25. Monitor patient’s response and vital signs. Instruct the patient to remain in a reclining position for several minutes, and then to rise slowly.
26. Observe venipuncture site for bleeding.
27. Discard used supplies.
28. Label phlebotomy container.
29. Dispose of collected blood as directed by the blood bank and according to methods of handling biohazardous waste.

**Documentation**

Document in the patient’s medical record:
- Performance of procedure
- Total volume or weight of blood withdrawn
- Vital signs before and after procedure
- Weight
- Dressing applied after VAD removal or VAD locking as appropriate
- Patient education
- Patient’s response to the procedure

**Bibliography**


Figure 1. Principal Veins of the Body

Figure 2. Lateral View: Superficial Veins of Neck

Figure 3. Superficial Venous Drainage of Upper Limb

Figure 4. Veins of Axilla

Figure 5. Deep Veins of Lower Limb
