01.18 - Intravascular Devices and Infusion Systems

Purpose

To provide infection control guidelines for the proper placement and management of intravascular devices and infusion systems

Audience

All employees of UTMB hospitals, clinics, outpatient surgical center, contract workers, volunteers, and students.

Hand Hygiene

- Observe proper hand-hygiene procedures either by washing hands with conventional antiseptic-containing soap and water or with waterless alcohol-based hand rubs. Observe hand hygiene before and after palpating catheter insertion sites, as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter. Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained.
- Use of gloves does not obviate the need for hand hygiene.

Documentation

- Record the operator, date, and time of catheter insertion and removal, and dressing changes on a standardized form.

Surveillance

- Monitor the catheter sites visually or by palpation through the intact dressing on a regular basis, depending on the clinical situation of individual patients. If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local infection or bloodstream infection (BSI), the dressing should be removed to allow thorough examination of the site.

Aseptic Technique During Catheter Insertion and Care

- Maintain aseptic technique for the insertion and care of intravascular catheters.
- Wear clean or sterile gloves when inserting an intravascular catheter. Wearing clean gloves rather than sterile gloves is acceptable for the insertion of peripheral intravascular catheters if the access site is not touched after the application of skin antiseptics. Sterile gloves must be worn for the insertion of arterial and central venous catheters.
- Wear clean or sterile gloves when changing dressings on intravascular catheters.

Catheter Insertion

- Do not routinely use arterial or venous cut-down procedures as a method to insert catheters.

Catheter-site Care

- Cutaneous antisepsis
  - Disinfect clean skin with ChloraPrep (2% chlorhexidine/70% isopropyl alcohol) antiseptic before catheter insertion and during dressing changes.
  - Allow the antiseptic to remain on the insertion site to air dry before catheter insertion.
  - Do not apply organic solvents (e.g., acetone and ether) to the skin before insertion of catheters or during dressing changes.

Catheter-site Dressing Regimens

- Use transparent, semipermeable dressings or gauze dressings to cover central venous catheter sites. Replace dressings every 7 days for transparent dressings and every 48 hours for gauze dressings.
- Replace transparent semipermeable or gauze catheter-site dressings if they become damp, loosened, or visibly soiled.
- If the patient is diaphoretic, or if the site is bleeding or oozing, a gauze dressing is preferable to a transparent, semi-permeable dressing.
- Tunneled central venous catheter (CVC) sites that are well healed do not require dressings.
- Do not use topical antibiotic ointment or creams on insertion sites because of their potential to promote fungal infections and antimicrobial resistance.
- Do not submerge the catheter under water. Showering may be permitted if precautions can be taken to reduce the likelihood of introducing organisms into the catheter site (e.g., if the catheter and connecting device are protected with an impermeable cover during the shower.

Selection and Replacement of Intravascular Devices

- Select the catheter, insertion technique, and insertion site with the lowest risk for complications (infectious and noninfectious) for the anticipated type and duration of IV therapy.
- Promptly remove any intravascular catheter that is no longer essential.
- Do not routinely replace central venous or arterial catheters solely for the purposes of reducing the incidence of infection.
- Replace peripheral venous catheters in adults every 72-96 hours to reduce the risk of infection and phlebitis. Leave peripheral venous catheters in place in children until IV therapy is completed, unless complications (e.g., infection, phlebitis and infiltration) occur.

- When adherence to aseptic technique cannot be ensured (i.e., when catheters are inserted during a medical emergency), replace all catheters as soon as possible and after no longer than 48 hours.
- Use clinical judgment to determine when to replace a catheter that could be a source of infection (e.g., do not routinely replace catheters in patients whose only indication of infection is fever). Do not routinely replace venous catheters in patients who are bacteremic or fungemic if the source of infection is unlikely to be the catheter.
- Replace any short-term CVC if purulence is observed at the insertion site, which indicates infection.
- Replace all CVCs if the patient is hemodynamically unstable and catheter-related bloodstream infection (CRBSI) is suspected.
- Do not use guidewire techniques to replace catheters in patients suspected of having catheter-related infection.

Replacement of Administration Sets and Intravenous Fluids

Administration Sets

- Replace administration sets, including secondary sets and add-on devices, **at 96-hour intervals.**
- Replace tubing used to administer blood, blood products or lipid emulsions (those combined with amino acids and glucose in a 3-in-1 admixture or infused separately) within 24 hours of initiating the infusion. If the solution contains only dextrose and amino acids, the administration set does not need to be replaced more frequently than at **96-hour intervals**.
- Replace tubing used to administer propofol infusions every 6 or 12 hours, when the vial is changed, per the manufacturer's recommendation.

Needleless Intravascular Devices

- Change the needleless connectors no more frequently than every 72 hours or according to manufacturers' recommendations for the purpose of reducing infection rates.
- Ensure that all components of the system are compatible to minimize leaks and breaks in the system.
- Minimize contamination risk by scrubbing the access port with 70% alcohol, letting the alcohol dry, and then accessing the port only with sterile devices.
- Use a needleless system to access IV tubing.
- When needleless systems are used, a split septum valve may be preferred over some mechanical valves due to increased risk of infection with the mechanical valves.

IV Injection Ports

- Clean injection ports with 70% alcohol, and let the alcohol dry before accessing the system.
- Cap all stopcocks when not in use.

Preparation and Quality Control of Intravenous Admixtures

- Admix all routine parenteral fluids in the pharmacy in a laminar-flow hood using aseptic technique.
- Do not use any container of parenteral fluid that has visible turbidity, leaks, cracks, or particulate matter or if the manufacturer's expiration date has passed.
- Use single-dose vials for parenteral additives or medications when possible.
- Do not combine the leftover content of single-use vials for later use.
- If multidose vials are used
  - Refrigerate multidose vials after they are opened, if recommended by the manufacturer.
  - Cleanse the access diaphragm of multidose vials with 70% alcohol and let the alcohol dry before inserting a device into the vial.
  - Use a sterile device to access a multidose vial and avoid touch contamination of the device before penetrating the access diaphragm.
  - Discard a multidose vial if sterility is compromised.
  - All multidose vials should be dated when first used and thereafter not used beyond the manufacturer’s stated expiration period.

In-line filters

- Do not use in-line filters routinely for infection-control purposes.

IV-Therapy Personnel

- Designate trained personnel for the insertion and maintenance of intravascular devices.

Prophylactic Antimicrobials

- Do not administer systemic antimicrobial prophylaxis routinely before insertion or during use of an intravascular catheter to prevent catheter colonization or CRBSI.

Peripheral Venous Catheters, Including Midline Catheters, in Adult and Pediatric Patients

Selection of Peripheral Catheter

- Select catheters on the basis of the intended purpose and duration of use, known complications (e.g., phlebitis and infiltration), and experience of individual catheter operators.
- Avoid the use of steel needles for the administration of fluids and medications that might cause tissue necrosis if extravasation occurs.
- Use a midline catheter or PICC, instead of a short peripheral catheter, when the duration of IV therapy will likely exceed 6 days.

Selection of Catheter-insertion Site

- In adults, use an upper- instead of a lower-extremity site for catheter insertion. Replace a catheter inserted in a lower-extremity site to an upper-extremity site as soon as possible.
- In pediatric patients, the upper- or lower-extremities or the scalp can be used as the catheter insertion site.
- Replacement of catheter
  - Evaluate the catheter insertion site daily, by palpation through the dressing to discern tenderness and by inspection if local tenderness or other signs of possible catheter-related bloodstream infection (CRBSI) are suspected.
  - Remove peripheral venous catheters if the patient develops signs of phlebitis (e.g., warmth, tenderness, erythema, and palpable venous cord), or infection, or if the catheter is malfunctioning.
  - In adults, replace short, peripheral venous catheters no more frequently than every 72-96 hours to reduce the risk for phlebitis. If sites for venous access are limited and no evidence of phlebitis or infection is present, peripheral venous catheters can be left in place for longer periods, although the patient and the insertion sites should be closely monitored.
  - Do not routinely replace midline catheters to reduce the risk for infection.
  - In pediatric patients, leave peripheral venous catheters in place until IV therapy is completed, unless a complication (e.g., infection, phlebitis or infiltration) occurs.

Catheter and Catheter-site Care

Do not routinely apply prophylactic topical antimicrobial or antiseptic ointment or cream to the insertion site of peripheral venous catheters.

Central Venous Catheters, Including PICCs, Hemodialysis, and Pulmonary Artery Catheters, in Adult and Pediatric Patients

General Principles

- An observer will monitor the insertion using a checklist to verify appropriate insertion technique. (See Appendix for checklist.)
- Use a CVC with the minimum number of ports or lumens essential for the management of the patient.
- Designate personnel who have been trained and exhibit competency in the insertion of catheters to supervise trainees who perform catheter insertion.
- Use totally implantable access devices for patients who require long-term, intermittent vascular access. For patients requiring frequent or continuous access, a PICC or tunneled CVC is preferable.
- Use a cuffed CVC for dialysis if the period of temporary access is anticipated to be prolonged (e.g., >3 weeks).
- Use a fistula or graft instead of a CVC for permanent access for dialysis.

- Do not use hemodialysis catheters for blood drawing or applications other than hemodialysis except during dialysis or under emergency circumstances.

Selection of Catheter Insertion Site

- Weigh the risk and benefits of placing a device at a recommended site to reduce infectious complications against the risk for mechanical complications (e.g., pneumothorax, subclavian artery puncture, subclavian vein laceration, subclavian vein stenosis, hemothorax, thrombosis, air embolism, and catheter misplacement).
- Use a subclavian site (rather than a jugular or a femoral site) in adult patients to minimize infection risk for nontunneled CVC placement.
- Place catheters used for hemodialysis and pheresis in a jugular or femoral vein rather than in a subclavian vein to avoid venous stenosis.

Maximal Sterile Barrier Precautions during Catheter Insertion

- Perform hand hygiene procedures, either by washing hands with conventional antiseptic containing soap and water or with waterless alcohol-based handrubs.
- Use sterile technique including the use of a cap, mask, sterile gown, sterile gloves, and a large fenestrated sterile drape, for the insertion of CVCs (including PICCs) or guidewire exchange.
- Use ChloraPrep to prep the insertion site. Let the ChloraPrep air dry before inserting the catheter.
- After catheter insertion in adults only (not pediatrics), apply a chlorhexidine impregnated sponge dressing to the insertion site followed by placement of a transparent or gauze dressing. Replace the chlorhexidine impregnated sponge dressing every 7 days or at any time if it becomes soaked with blood.
- Use a sterile sleeve to protect pulmonary artery catheters during insertion.

Replacement of Catheter

- Do not routinely replace CVCs, PICCs, hemodialysis catheters, or pulmonary artery catheters to prevent catheter-related infections.
- Do not remove CVCs or PICCs on the basis of fever alone. Use clinical judgment regarding the appropriateness of removing the catheter if infection is evidenced elsewhere or if a noninfectious cause of fever is suspected.
- When catheters are removed, do not routinely culture the tips.
- Guidewire exchange
  - Do not use guidewire exchanges routinely for nontunneled catheters to prevent infection.
  - Use a guidewire exchange to replace a malfunctioning nontunneled catheter if no evidence of infection is present.
  - Use a new set of sterile gloves before handling the new catheter when guidewire exchanges are performed.

Catheter and Catheter-site Care

- General measures
  - Use ultrasound guidance to place central venous catheters to reduce the number of cannulation attempts and mechanical complications. Ultrasound guidance should only be used by those fully trained in its use.
- Antibiotic lock solutions
  - Use prophylactic antimicrobial lock solution in patients with long-term catheters who have a history of multiple CRBSI despite optimal maximal adherence to aseptic techniques.
  - Do not routinely use anticoagulant therapy to reduce the risk of catheter-related infection in general patient populations
- Catheter-site dressing regimens
  - Replace the catheter-site dressing when it becomes damp, loosened, or soiled or when inspection of the site is necessary.
  - Replace dressings used on short-term CVC sites weekly for transparent dressings, except in those pediatric patients in which the risk for dislodging the catheter outweighs the benefit of changing the dressing.
  - Replace dressings used on short term CVC sites every 2 days if a gauze dressing is required.
  - Replace dressings used on tunneled or implanted CVC sites weekly, until the insertion site has healed.
- Ensure that catheter-site care is compatible with the catheter material.
- Use a sterile sleeve for all pulmonary artery catheters.

Additional Recommendations for Insertion of Arterial Catheters and Pressure Monitoring Devices for Adult and Pediatric Patients

Insertion of Arterial Catheters

- Insertion of radial arterial catheters
  - An observer will monitor the insertion using a checklist to verify appropriate insertion technique. (See Appendix for checklist.)
  - Wash hands with an antimicrobial soap or apply an alcohol hand rub.
  - Don a cap, mask, sterile gown, sterile gloves and use a small sterile fenestrated drape. As an option, a small sterile non-fenestrated drape, to open supplies onto a sterile field, may be added.
  - Use ChloraPrep to prep the insertion site. Let the ChloraPrep air dry before inserting the catheter.
  - In adults (not pediatrics), apply a chlorhexidine impregnated sponge dressing to the insertion site. Replace the chlorhexidine impregnated sponge dressing every 7 days or at any time if it becomes soaked with blood. Fix the catheter to the skin with a sterile adhesive product before applying the dressing.

  - Either gauze and tape or a polyurethane dressing can be used.
  - If gauze and tape is used, it must be changed every 48 hours.
  - If polyurethane is used, it must be changed every 7 days. However; if the site begins to ooze blood, the dressing must be changed to a gauze and tape dressing which must be changed every 48 hours.
- During femoral artery catheter insertion, maximal sterile barrier precautions will also be used.
  - In adults (not pediatrics), apply a chlorhexidine impregnated sponge dressing to the insertion site followed by a dressing.
  - The chlorhexidine impregnated sponge is changed every 7 days (or at any time if it becomes soaked with blood).
  - Either gauze and tape or a polyurethane dressing can be used.
  - If gauze and tape is used, it must be changed every 48 hours.
  - If polyurethane is used, it must be changed every 7 days. However; if the site begins to ooze blood, the dressing must be changed to a gauze and tape dressing which must be changed every 48 hours.

Replacement of Catheter and Pressure Monitoring System

- Replace arterial catheters only when there is a clinical indication.
- Remove the arterial catheter as soon as it is no longer needed.
- Replace transducers at 96-hour intervals. Replace other components of the system (including the tubing, continuous-flush device, and flush solution) at the time the transducer is replaced.

Care of Pressure Monitoring Systems

- General Measures
  - Keep all components of the pressure monitoring system (including calibration devices and flush solution) sterile.
  - Minimize the number of manipulations of and entries into the pressure monitoring system. Use a closed-flush system (i.e., continuous flush), rather than an open system (i.e., one that requires a syringe and stopcock), to maintain the patency of the pressure monitoring catheters.
  - When the pressure monitoring system is accessed through a diaphragm rather than a stopcock, scrub the diaphragm with alcohol and let it dry before accessing the system.
  - Do not administer dextrose-containing solutions or parenteral nutrition fluids through the pressure monitoring circuit.

Recommendations for Umbilical Catheters

Replacement of Catheters

- Remove and do not replace umbilical artery catheters if any signs of catheter-related bloodstream infection, vascular insufficiency, or thrombosis

are present.

- Remove and do not replace umbilical venous catheters if any signs of catheter-related bloodstream infection or thrombosis are present.
- Replace umbilical venous catheters only if the catheter malfunctions.

Catheter-site Care

- Cleanse the umbilical insertion site with an antiseptic before catheter insertion. Avoid tincture of iodine because of the potential effect on the neonatal thyroid. Other iodine-containing products (e.g., povidone-iodine) can be used.
- Do not use topical antibiotic ointment or creams on umbilical catheter insertion sites because of the potential to promote fungal infections and antimicrobial resistance.
- Add low doses of heparin (0.25-1.0 U/ml) to the fluid infused through umbilical arterial catheters.
- Remove umbilical catheters as soon as possible when no longer needed or when any sign of vascular insufficiency to the lower extremities is observed. Optimally, umbilical artery catheters should not be left in place >5 days.
- Umbilical venous catheters should be removed as soon as possible when no longer needed but can be used up to 14 days if managed aseptically.
- An umbilical catheter may be replaced if it is malfunctioning, and there is no other indication for catheter removal, and the total duration of catheterization has not exceeded 5 days for an umbilical artery catheter or 14 days for an umbilical venous catheter.

References:

1. Centers for Disease Control and Prevention. Guidelines for the Prevention of Intravascular Catheter-Related Infections. MMWR 2011.
2. Rupp ME, Hewlett AL. Healthcare-associated infections related to use of intravascular devices inserted for short-term vascular access. In: Mayhall CG, ed. Hospital epidemiology and infection control, 4th Ed. Philadelphia: Lippincott Williams and Wilkins, 2012.
3. Rijnders BJA, Van Wijngaerden E, Wilmer A, Peetermans WE. Use of full sterile barrier precautions during insertion of arterial catheters: a randomized trial. Clin Infect Dis 2003; 36: 743-748.
4. Marschall J, Mermel LA, Classen D, Arias KM, Podgorny K, Anderson DJ, et.al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals. Infect Control Hosp Epidemiol 2008;29:S22-S30.

Appendix

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Central Intravenous Catheter and Arterial Catheter Insertion Practices Monitoring Form

Data Collected by: _____ Date of Insertion ____ / ____ / _____

Patient Initials _____ UH# _____ Procedure Start Time:_____

Male____ Female____ DOB ____ / ____ / _____ Procedure End Time: _____

Event type: CVC____ PAC____ PICC____ Location of Pt: **MICU**_____ **SICU**_____ **BICU**_____ **TDCU**_____**NCCU**_____

Site of insertion: subclavian ____ internal jugular ____ arm (PICC) ____ femoral ____ radial artery _____

Operator's Name (central line inserter): _____

Operator's Occupation: Attending ____ Intern/Resident ____ Fellow ____ PA ____

Nurse ____ Medical Student ____ Other _____ (Please specify)

Reason for inserting: New indication ____Suspected central line infection____ Other (explain)_____

Replace (rewire) malfunctioning central line ____

Replace (rewire) central line in preparation for discharge from the ICU____

Insertion practices:

Mask donned	☐ Yes	☐ No	☐ Yes, after intervention
Cap donned	☐ Yes	☐ No	☐ Yes, after intervention
Eye shield donned	☐ Yes	☐ No	☐ Yes, after intervention
Performed hand hygiene	☐ Yes	☐ No	☐ Yes, after intervention
Touched any surface or object after hand hygiene and before donning sterile gown and gloves	☐ Yes	☐ No	☐ No, after intervention
Sterile gloves	☐ Yes	☐ No	☐ Yes, after intervention
Sterile gown	☐ Yes	☐ No	☐ Yes, after intervention
Gloves pulled up over cuffs of gown	☐ Yes	☐ No	☐ Yes, after intervention
Touched gown and/or gloves to nonsterile surface prior to setting up the sterile field	☐ Yes	☐ No	☐ No, after intervention
Skin preparation with 2% chlorhexidine	☐ Yes	☐ No	☐ Yes, after intervention
Was chlorhexidine prep completely dry *before* first skin puncture or start of rewire procedure	☐ Yes	☐ No	☐ Yes, after intervention
Sterile full body fenestrated drape used (small fenestrated drape for radial artery catheter insertion)	☐ Yes	☐ No	☐ Yes, after intervention
Placed sterile fenestrated full body drape or sterile small fenestrated drape over insertion site without contaminating the drape during placement	☐ Yes	☐ No	☐ Yes, after intervention

Number of skin punctures (circle one) 1 2 3 ≥4 ☐ N/A for rewire

List any other breaks in technique that occur _____

before insertion of the catheter _____

(This section to be answered only if your are replacing a line)

For catheter exchange, managed wire without contamination	☐ Yes	☐ No	☐ Yes, after intervention
For catheter exchange, new sterile gloves donned prior to insertion of new catheter	☐ Yes	☐ No	☐ Yes, after intervention