Purpose
This document acts as a best practice resource for staff when collecting a blood sample through a central venous catheter.

Policy Statement
At Covenant Health facilities, health care professionals (see definition) who have successfully completed the “Central Venous Catheter (CVC) Blood Collection Learning Module” exam and performance criteria checklist may withdraw blood samples from short term and long term Central Venous Catheters, Peripherally Inserted Central Catheters (PICCs), and Implanted Vascular Access Devices (IVAD). To maintain competency, the learning module and exam must be reviewed annually.

Applicability
This policy and procedure applies to all Covenant Health facilities, staff, physicians, students and any other persons acting on behalf of Covenant Health.

Education Requirements
If theory and practicum have been completed at an educational institution, or another hospital, a letter or certificate will be accepted as proof of completion. At least one successful withdrawal of blood from a CVC must be demonstrated prior to performing the skill independently. Additional demonstrations may be required at the discretion of the clinical nurse educator.

Responsibility
It is the staff members’ responsibility to identify and communicate when they are no longer qualified to independently withdraw blood from CVCs. If this skill is a unit expectation, notify the unit supervisor or clinical nurse educator so that future education can be provided.

NOTE: The staff member is always constrained by their own level of expertise.

Principles
CVCs should not be routinely accessed for blood collection. In most cases it is preferable to obtain blood samples from a peripheral vein. If it is known that a venipuncture for blood specimen collection is difficult or not possible, a CVC may be used. Practitioners need to be aware that some CVC blood results (eg. drug levels, electrolytes, coagulation studies*) may be altered depending on the intravenous infusion or locking solution infused in the CVC. Careful attention to the technique of obtaining blood from the CVC must be observed. If laboratory values appear inaccurate, redraw a blood sample from a peripheral vein. Requisitions and tubes should be labeled “line draw”, which will assist to informing clinicians to use caution when interpreting results.

*Coagulation studies are PT, PTT, INR, D-Dimer and Heparin (aka Anti-Xa level), or any other test drawn into a blue top tube.

Practitioners should always evaluate the risk vs. benefit of performing blood sampling by venipuncture vs. CVC.
Risks of CVC blood sampling:
- Increased risk of central line-associated blood stream infection (CLABSI)
- Increased risk of catheter occlusion
- Inaccurate specimen results of coagulation studies/drug levels/electrolytes if these substances have been in contact within the CVC lumen.
- Anemia associates with frequent sampling due to the discard amount of blood required

Benefits of CVC sampling:
- Avoidance of venipuncture pain and anxiety
- Reliable blood sampling for patients with difficult venous access.

Procedure
See Attached

Definitions
For the purpose of this policy and procedure:

Health care professional means an individual who is a member of a regulated health discipline, as defined by the Health Disciplines Act or the Health Professions Act, and who practices within scope or role.

Scrub the hub: Each time the injection cap is entered it must be cleaned with an alcohol or chlorhexidine/alcohol wipe. Scrub the injection cap for a minimum of 15 seconds using friction and allow the solution to dry.

Related Documents
See “Resources” associated with this policy at http://www.compassionnet.ca/Policies.asp
Hold down the Ctrl F keys and search for ‘Blood Collection’

References


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Halm, Margo A, Gleaves, Melissa. Obtaining blood samples from peripheral intravenous catheters:
Best practice? American Journal of Critical Care, 2009, 18, 474-478


Sherertz R., Karchmer T., Ohl C., Palavecino E., Bischoff W. Blood Cultures drawn through valved catheter hubs have a 10-20% positivity rate with the majority being false positives. Paper presented at :Fifth Decennial International Conference on Healthcare-Associated Infections, 2010; Atlanta.

Strasezewski, Shannon, M. Sanchez, Leon, Mcgillicuddy, Daniel et al. Use of separate venipunctures for IV access and laboratory studies decreases hemolysis rates. Internal Emergency Medicine, 2011, 6: 357-359

Target BSI.com Webinar. Show me the evidence – should blood cultures be obtained through an intravascular catheter? Frequently asked questions.2012 Answers prepared by Mark E. Rupp MD, and Kathleen Meehan Arias, MS, CIC.

Revisions

March 6, 2013
PROCEDURE:

Background Information:

Importance of Accurate Specimen Collection
Poor collection practices can lead to:
- Inaccurate results and inappropriate treatment
- Repeated specimen collections and retesting

Errors occur 68% of the time in the pre-analytical phase (blood specimen collection) and 26% of these errors have a significant effect on patient outcomes.

Common Sample quality problems
- Hemolysis account for 48-60% of specimen rejection
  o Collection from IV and poor technique with syringe transfer into specimen tube
- Mislabelling &/or misidentification account for 31% specimen rejections
- Short draws account for 12-15% of specimen errors
  o Syringe transfer to specimen tube may result in over or under-fill if injected by hand.
  o Under-fill / overfill results in a report of elevated/decrease blood levels
- Failure to properly invert (mix) tubes can skew blood to additive ratio and results in erroneous results.

Importance of Specimen Collection for the health care provider
- Exposure to blood-borne pathogens (Hepatitis/HIV)
- Unnecessary repeated specimen collection and patient dissatisfaction.

1.0 PROCEDURE FOR DRAWING BLOOD SAMPLES

NOTE: In general, specimens for therapeutic drug monitoring, electrolyte and coagulation studies should not be obtained from a catheter or lumen previously used for a drug or electrolyte infusion, even if the catheter has been flushed. If the CVC has been locked with heparin or sodium citrate, coagulation studies are known to be inaccurate. If reported values appear inaccurate, redraw the specimen from a peripheral vein.

Label specimen and requisition with “line draw” sticker.

See Section 2 for drawing blood cultures.

1.1 Discard volume is a minimum of 2 x the dead space volume of the line (usually 3 mL). Except in the case of coagulation studies, in which case the discard is 6 x the dead space volume (6 mL minimum)
1.1.1 Pediatric patients the usually discard is 0.2 mL.

1.2 Collect blood sample with minimal delay following discard.

1.3 All Infusions must be held for 1-3 minutes prior to drawing CVC blood specimens.

1.4 Use the syringe method for Bard Solo PICC catheters.

1.4 **Vacutainer Method**

**Equipment:**
- protective gloves
- multisample luer adapter / BD Vacutainer Luer-Lok Access Device (needleless) (BD # 364902)
- vacutainer holder
- blood tubes for specimens ordered
- one tube for discard the same colour as the first draw or use a designated BD discard tube to reduce the risk of inaccurate results
- chlorhexidine/alcohol swabs
- three or more 10 mL normal saline pre-filled syringes for flushing catheter lumen(s). Note: if obtaining blood drug levels, you will need two more normal saline syringes.
- small sharps container
- pre-filled heparin syringe (10 U/mL) if applicable
- one injection cap
- syringe
- line draw stickers for requisition and each tube sent to lab. ([www.marketlab.com](http://www.marketlab.com) has "line draw" stickers available for purchase. $23.30/1000 1.625W X 0.375H. It is item #ML9103.)

1.4.1 Check patient care orders for lab tests required. Ensure the order of draw, number of times specimen tube needs inversion, and the technical factors (eg. patient fasting, specimen on ice, timeliness of dispatch to laboratory) are known and followed prior to obtaining specimen.

1.4.2 Perform hand hygiene. Assemble equipment. Label discard tube if using.

1.4.3 Identify patient using two identifiers and explain procedure.

1.4.4 If continuous infusion of IV fluids in any lumen STOP all IV solutions for 1-3 minutes prior to draw.

1.4.5 Perform hand hygiene.

1.4.6 Apply protective gloves.
1.4.7 Multi-lumen Catheters – Staggered Lumens- Blood is to be drawn from the proximal lumen if possible*. For other multi-lumen catheters the largest lumen should be used. If obtaining drug levels, the sample should be drawn from a lumen not being used for administration:

   a) Lumen without continuous infusion
   b) Lumen with continuous infusion
      • Remove tubing from injection cap. Protect distal end of tubing from contamination by applying sterile end.

* If proximal lumen is already in use, any unused lumen may be used. If blood is routinely drawn from the CVC, identify a lumen only for blood specimen collection.

1.4.8 Open slide clamp on lumen if applicable.

1.4.9 Scrub the hub for a minimum of 30 seconds and allow to dry thoroughly.

1.4.10 Enter lumen and flush lumen with 10 mL of normal saline.

   If you are obtaining blood drug levels, flush with 30 mL NS prior to withdrawing discard.

   You may withdraw the discard with the same syringe at this time or withdraw the discard with a vacutainer (see next steps below). Ensure discard is actually discarded and not used for the blood specimen. Mark tube as discard to prevent sending the wrong specimen or use a designated discard tube by manufacturer.

   • Discard is a minimum of 2 x the dead space volume of the line (3 mL). Except in the case of coagulation studies when 6 x the dead space volume is taken (6 mL minimum).
   • Pediatric patients the usually discard is 0.2 mL.

1.4.11 Insert the Vacutainer Luer-Lok access device onto injection cap.

1.4.12 Obtain a discard volume. Use the same colour of tube for discard as the first tube drawn for analysis. Label with "Discard" and discard this tube in the sharps container when collection completed. Collect blood sample with minimal delay following discard.

1.4.13 Collect blood samples in the order identified by Laboratory Services. Gently invert (mix) specimen tubes the number of times identified by the lab.

   RECOMMENDED ORDER OF DRAW is available through regional laboratory services.
NURSING ALERT: If unable to withdraw blood from CVC

- Check to ensure slide clamp is open.
- Reposition the patient (example; change to supine from semi-fowlers; turn patient’s head away from insertion site; raise patient’s arms above his body).
- Have the patient cough, exhale, or perform Valsalva manoeuvre.
- Try using a syringe rather than a vacutainer.
- Gently flush the catheter with 5 mL of normal saline and attempt another collection.
- Use pediatric collection tubes or syringe method.
- If still unable to withdraw blood from CVC, patency should be restored for withdrawal occlusion. See site policy for occlusion management of central lines (NOTE: corporate policy #VII-B-335, Occlusion Management of Central Venous Catheters in Adult Patients in development).

1.4.14 Remove vacutainer from injection cap. NOTE: Ensure injection cap remains well secured to lumen of CVC.

1.4.15 **Scrub the hub** for a minimum of 30 seconds and allow to dry thoroughly.

1.4.16 Flush each lumen post blood draw with a minimum of 20 mL of normal saline utilizing positive pulsating pressure. Remove syringe. If blood residue is visible in injection cap, replace cap with new sterile cap.

1.4.17 a) Lumen without continuous infusion
    - **Scrub the hub**
    - flush all lumens that are not in use with 10 mL normal saline;
    - lock all lumens with appropriate locking solution;
    - close slide clamp as appropriate.

b) Lumen with continuous infusion
    - **Scrub the hub**
    - reconnect tubing to lumen using aseptic technique;
    - ensure slide clamps open on lumen and reset flow rates for infusates.

1.4.18 Dispose of blood contaminated equipment and discarded blood sample in sharps container.

1.4.19 Apply labels to specimen tubes of blood at bedside. (Refer to attachment – “Best / Worst Dressed Tubes” for tips on correct placement of identification labels on specimen tubes.) Label tube and requisition as “line draw”.

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1.4.20 Place specimen tubes of blood in biohazard bag. Complete requisition. (www.marketlab.com has "line draw" stickers available for purchase. $23.30/1000 1.625W X 0.375H. It is item #ML9103.)

1.4.21 Remove gloves and perform hand hygiene.

1.4.22 Document procedure in chart and record lock solution on Medication Administration Record (MAR).

1.5 **Syringe Method**

**NOTE:** Hemolysis can be caused by using force during aspiration and injecting or the force that is created by the use of a large barrel syringe. Excessive suctioning and forceful plunger depression during blood collection or transfer creates shear forces and breakage of red blood cells. Use gentle aspiration for obtaining the specimen and, when transferring blood into the specimen tube, allow the vacuum in the tube to fill it. Injecting the blood into the specimen tube also causes under and over fill.

**Equipment:**
- protective gloves
- syringes for the volume of blood to be withdrawn (use 3ml to 10 mL barrel syringes to reduce risk of hemolysis)
- vacutainer blood transfer device (BD # 364880)
- blood tubes for specimens ordered
- chlorhexidine/alcohol swabs
- three or more 10 mL normal saline pre-filled syringes for flushing catheter lumen(s).
  Note: if obtaining blood drug levels, you will need two more normal saline syringes.
- small sharps container
- pre-filled heparin syringe (10 U/mL if applicable)
- injection caps
- “line draw” stickers for each specimen tube and requisition.

1.5.1 Follow steps #1 through #10 in Section 1.4.

1.5.2 Attach a second syringe into the injection cap and withdraw blood for specimens required. Calculate the amount of blood required by looking on the tube for the volume.
NURSING ALERT: If unable to withdraw blood from CVC

- Check to ensure slide clamp is open.
- Reposition the patient (example; change to supine from semi-fowlers; turn patient’s head away from insertion site; raise patient’s arms above his body).
- Have the patient cough, exhale, or perform Valsalva manoeuvre.
- Try aspiration by using a smaller syringe.
- Gently flush the catheter with 5 mL of normal saline and attempt another collection.
- If still unable to withdraw blood from CVC, patency should be restored for withdrawal occlusion. See site policy for occlusion management of central lines (NOTE: corporate policy #VII-B-335, Occlusion Management of Central Venous Catheters in Adult Patients in development).

1.5.3 Transfer blood sample immediately to specimen tubes by using a syringe transfer device and allow tubes to fill. Do not inject blood as this causes hemolysis and over fills the tube.

1.5.4 Allow tubes to fill with blood. Gently invert (mix) specimen tubes the number of times identified by the lab.

1.5.5 Continue with steps #1.4.15 through to #1.4.22.

2. Collection of Blood Cultures from CVC

Collection of blood cultures from CVC is a two-person procedure.

2.1 Blood cultures are taken from the CVC only if the CVC is suspected as the source of infection. Consider removal of short term CVC and send 5-7 cm of catheter tip for culture.

2.1.1 Blood cultures should not be taken from CVC if the source of infection is thought to be non-CVC related (eg. pneumonia, wound infection, urinary tract infection). If a clear source of infection is not evident and the sepsis is believed to be possibly related to the CVC, draw blood from both a peripheral venipuncture and from each lumen of the CVC.

If no peripheral venipuncture site is available, take at least two specimens (20 mL each) from CVC. Use two lumens if possible.

2.1.2 Collect culture specimens from a peripheral venipuncture and the CVC lumens simultaneously (within 15 minutes) so that a differential time to positivity (DTP)* can be determined. Clearly document the site from where the blood was obtained and time of the draw (eg. CVC purple lumen 0900h; right arm venipuncture 0845h).
* DTP: If the CVC culture grows more than or 2 hours before the peripheral culture, the CVC is considered the source of CLABSI

2.1.3 Prior to obtaining the blood cultures, replace the used injection cap on each CVC lumen with a new sterile injection cap to prevent false positive results. Injection caps are known to grow biofilm and have been implicated to false positive results.

2.1.4 Do not flush or obtain a discard unless the lumen contains an antibiotic. If the catheter is the source of infection, there will be a higher concentration of bacteria in the initial blood that is drawn through the catheter.

2.1.5 Blood Cultures should be obtained prior to initiation to antibiotic treatment if possible. If the patients are on antibiotic therapy, take blood cultures immediately before the next dose of antibiotic (adult patients).

2.1.6 When initially evaluating if CVC is the source of infection:

- **Adults:** A full 10 mL for anaerobic and 10 mL for aerobic = 20 mL of blood is regarded as the minimum volume for adult patients. When DTP is drawn from a CVAD and peripheral vein, 20 mL is required from the peripheral site and 20 mL from each CVC lumen as both aerobic and anaerobic cultures are drawn from each site /lumen. Aerobic is drawn first, then anaerobic. Follow-up blood cultures are drawn from a peripheral venipuncture only.
- **Neonates:** One or two milliliters. Refer to Stollery procedure.

2.1.7 Ensure the top of the blood culture bottles are scrubbed / disinfected with chlorhexidine 2% with alcohol 70% swab for 15 seconds. The tops on the bottles are dust caps only; therefore the top of the bottle is not sterile.

2.1.8 Use the syringe method to draw blood cultures because with the vacutainer method the broth within the specimen bottles can flow into the patients' bloodstream. This is a two-person procedure; one to draw the specimen and one to transfer blood into the culture bottle using a transfer device.

2.1.9 If a catheter related blood stream infection needs to be confirmed, culture tip when catheter is removed. Use sterile technique and cut 5-7 cm of the tip for culture.

**Procedure: Collection of Blood Cultures from CVC**

2.1.10 Collect equipment as per syringe method. You will require additional chlorhexidine/ alcohol swabs and new sterile injection cap(s).
2.1.11 Cleanse around the injection cap and catheter hub with chlorhexidine swab for 15 seconds and let the area dry. **Remove old injection cap and replace with new injection cap for each lumen to be cultured.**

2.1.12 Cleanse the top of the blood culture bottles for 15 seconds with chlorhexidine-alcohol swabs. Allow to dry completely. This is a two-person procedure; one to draw the specimen and one to aseptically transfer blood into the culture bottle using a transfer device.

2.1.13 **Scrub the hub.** Using an empty 10 mL syringe, withdraw 10 mL for the first culture bottle (do not flush first unless antibiotic indwelling in lumen of catheter). Hand the blood filled syringe to the second person for transfer to the culture bottle. Repeat this sequence, beginning with **scrub the hub** for the remaining culture bottles.

2.1.14 Continue with steps #1.4.15 through to #1.4.22

2.1.15 Ensure all culture bottles are labelled with the date, time and CVC lumen used (eg. Jan 5, 2013, 1030h, CVC purple lumen; CVC distal lumen.)
Worst Dressed Tubes

Best Dressed Tube

Get it Straight
Reduce the Wait