

Self-Cannulation of Buttonholes on AV Fistulas



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1.0 SCOPE

This guideline makes recommendations on the use of and procedures for establishing and maintaining tunnel tracks for **buttonhole (BH) cannulation of AV fistulas (AVFs)**.

This guideline applies to:

- Self-cannulating patients (regardless of location of hemodialysis); and
- Adults (over the age of 18 years).

Buttonhole or constant-site cannulation is a cannulation method in which the AV fistula is cannulated in the exact same spot, at the same angle and at the same depth of penetration every time. With time and repeated cannulations, a scar tissue tunnel track develops, enabling the subsequent use of blunt needles for cannulation and dialysis.

Establishment of a buttonhole track is typically performed using the sharps method (a series of successive sharp needle cannulations) or the angiocath method (leaving two angiocaths in situ for 10 days to establish a scar track that will permit subsequent blunt needle cannulations). This guideline limits discussion to the use of the sharps method as this method is most commonly used and is referenced in most of the literature. The angiocath method is newer and there is less literature to support its use. Blunt needles are used once the track has been established using sharp needles.

2.0 SUMMARY OF THE LITERATURE

In the development of this guideline, a review of the literature was undertaken.

- MEDLINE databases were searched to May 2012.
- KDOQI 2006 Guidelines – excerpts on BH technique of cannulation.
- Canadian Society of Nephrology Guidelines by the Canadian Intensive HD Working Group (in preparation).
- Clinical Educators Network Guidelines for the Management of VA in HD Patients (in preparation).
- See reference section for specific articles reviewed.

The findings from the review included:

- Systematic review by the Canadian Intensive HD Working Group.
- Three randomized control trials comparing BH technique with rope ladder technique.

Benefits of BH cannulation identified in the literature:

- Reduction of cannulation discomfort.
- Increased ease of cannulation.
- Reduction of hematomas.
- Reduction of access interventions.
- Reduction of aneurysm formation.

Drawbacks identified consistently in the literature:

- Increased risk of infection.

Factors that reduced the risk of infection (mostly drawn from article by Ball, 2010):

- Creation and cannulation of the BH track by one cannulator only. Because of this, nurse cannulation of established BH tracks is not recommended.
- Keeping tunnel as close to the diameter of the needle as possible (to reduce the amount of manipulation down the tunnel which can cause a break in the epithelium lining).
- Using a tourniquet to “plump up” the vessel to enable a complete assessment and facilitate correct angle of insertion of needles.
- Stretching skin taut from side-to-side to keep the vein stable and minimize needle movement.
- Using a rigorous technique for skin cleaning prior to inserting needle: washing access just prior to sitting down in the dialysis chair; clean sites before scab removal and after scab removal with adherence to contact and drying time for cleansing solution.
- Ensure scab is removed completely.

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- Using only blunt needles in an established BH track (sharp needles cause scarring of the tunnel and blood vessel wall).
- Keeping 2 mm of needle exposed to prevent the hub from contracting the patient’s skin (to prevent “hubbing”; Ball, 2010).
- Using an antimicrobial cream prophylactically after withdrawal of needles (Marticorena et al, 2006 and Nesrallah, 2010).

Conclusion:

- There is a role for the BH technique for cannulating AVFs in patients with the desire and capacity to self-cannulate and/or have a caregiver cannulate.
- Nurse cannulation of established BH tracks is not recommended.

3.0 RECOMMENDATIONS

Recommendation 1: A nephrologist’s order and confirmation from a vascular access or home hemodialysis nurse is required prior to establishing a BH track.

Relative contraindications for using the BH technique:

1. Valvular heart disease
 - a. Mechanical heart valve
 - b. Rheumatic heart disease
 - c. History of previous endocarditis
2. Other prosthetic intravascular material which could cause serious problems if infected (i.e. permanent pacemaker, aortic graft material).
3. Immune suppression
 - a. Systemic Lupus
 - b. Patients on prednisone
 - c. Failed transplants

Vascular access patch graft material is not a contraindication due to the superficial location and relative ease of access for removal if necessary.

Risk factors for unsuccessful buttonholes:

- Thin subcutaneous tissue
- Poorly functioning fistula

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Recommendation 2: BH technique is appropriate for patients who are capable of self-cannulation and, upon assessment by the nephrologist, VA nurse and/or home hemodialysis educator, are deemed competent to manage the responsibility of BH cannulation. If these criteria cannot be met, rope ladder technique is recommended.

Some studies show a higher risk of infection with the BH technique than the rope ladder technique, especially if the appropriate BH technique is not followed consistently. This risk was first identified in the literature in 2006 (Marticorena et al, 2006). Studies published since then have identified both a similar or higher risk when compared to the rope ladder technique (none have identified a lower risk).

Patient/caregiver characteristics for self/caregiver cannulation:

- Currently on or is a candidate for home hemodialysis (may also be an in-centre and/or community dialysis patient if the remaining characteristics apply).
- Wants to self-cannulate and/or has a caregiver willing to cannulate.
- Good hand dexterity (able to hold the needle and not shaky).
- Good sensation in fingers.
- Good eyesight.
- Good personal hygiene.
- Mental capacity to be successful at self/caregiver cannulation.
- Received specific education on self-cannulation.
- Lower arm fistula on the non-dominant arm is the easiest to self-cannulate.

Decision criteria for use of rope ladder vs. buttonhole technique:

Rope Ladder

- Capacity to understand the concept of rope ladder and assess and track rotation of sites.
- Willingness to undertake rope ladder technique.
- Risks of rope ladder technique reviewed with the patient.
- Fistula easy to cannulate.
- Easily palpable vein.
- Large area of straight vein available for cannulation.

Buttonhole

- Willingness to undertake BH technique.
- Risks of BH technique reviewed with the patient (there is a slightly higher risk of infection with the type of needling, although the risk is still small).
- Fistula has short, limited space for cannulation.
- Deemed to be appropriate for the BH method of cannulation by nephrologist, VA nurse and/or home hemodialysis educator.

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Recommendation 3: BH tracks may be established on new or mature, well functioning fistulas; however, mature fistulas are preferred.

Points to consider when establishing BH tracks:

- Choose sites easy for the patient to cannulate.
- When choosing sites, try to choose straight, relatively unused sections of the access. If possible, allow at least 2 inches between the tips of the needles. Start near the AV incision to leave room for future BH sites.
- Avoid compromised areas such as aneurysms or areas without sufficient subcutaneous tissue to enable a tunnel track to develop.
- Create buttonhole sites at the centre of the vessel, not on the sides.
- If available, use bedside ultrasound to map BH sites.
- Measure and document BH site locations and needles used. BH site locations:
 - Upper arm BH sites: measure in centimetres from the antecubital fossa/elbow crease with the arm bent at a 90 degree angle.
 - Forearm BH sites: measure in centimetres from the bent wrist.
- Photograph of the BH sites and angle of cannulation is recommended for the Kardex/patient record.

Recommendation 4: BH tracks may be established by patients/caregivers or by a designated nurse who is a home HD nurse and/or an advanced cannulator (advanced cannulators are designated by the vascular access nurse).

General:

- If possible, encourage patients/caregivers to establish the BH track. If a nurse is initially required to establish the track, work toward transferring the function to the patient/caregiver as soon as possible.
- Same cannulator should cannulate the access until the track is established (usually takes 8 – 18 cannulations; upper arm fistulas with higher flows and/or patients with diabetes or deeper vessels may require more cannulations to establish the track).

If the patient/caregiver is unable to self-cannulate and/or the nurse cannulator for that patient is not available and/or not successful:

- Cannulate the track using conventional sharp needles placed antegrade and a MINIMUM of 1 inch (2.5 cm) away from the BH site.
- If there is insufficient space to place two conventional sharp needles (i.e. BH sites are last resort), place one between the buttonhole sites and dialyze with a single needle.
- DO NOT use sharp needle in the BH track.

Recommendation 5: Once a BH track is established, the track is cannulated by the patient/caregiver using a blunt needle. Sharp needles may only be used after consultation with nephrologist. Nurse cannulation of established BH tracks is not recommended.

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Recommendation 6: Reduce the risk of infection by teaching patients/families rigorous cleansing of the arm/site prior to needling, appropriate needling techniques and applying an antimicrobial cream after withdrawal of the needles.

There is a slightly higher risk of infection with buttonhole cannulation than rope ladder cannulation, although the risk is still small. The literature review in section 2.0 identified several ways to reduce the risk.

Rigorous cleansing of the arm/site and using the appropriate needling technique have been recommended in the literature for several years. The prophylactic application of an antimicrobial cream after withdrawal of the needles is a relatively new recommendation for BH sites. Recent studies in the literature that applied antimicrobial creams to the exit sites have noted a reduction in exit site infections (Marticorena et al, 2006 & 2009; Nesrallah et al, 2010). This recommendation has been incorporated into the VA guideline developed by the Canadian Society of Nephrology Guidelines by the Canadian Intensive HD Working Group (in preparation) and the Clinical Educators Network (in preparation).

In BC, it is recommended that one of the following be applied: (1) Curity AMD Band-Aid impregnated with 0.2% polyhexamethylene biguanide (PHMB); or (2) Mupirocin antibiotic cream (apply with a sterile cotton swab or gauze).

Recommendation 7: In the event a BH site becomes infected:

- If the BH infection is localized to the puncture site and there are no signs of systemic infection/deep infection, DO NOT use the BH sites and follow the protocol for VA related local Infections in the BCPRA guideline *Prevention, Treatment and Monitoring of VA Related Infection in HD Patients* (includes a culture of the local site and 2 – 3 week course of topical and/or oral antibiotics). An attempt could be made at needling the original BH site once the course of antibiotics is complete.
- If an abscess has developed, the entire AVF has become infected and/or the patient demonstrates clinical signs of bacteremia, DO NOT use the BH sites and follow the protocol for VA related bacteremia in the BCPRA guideline for *Prevention, Treatment and Monitoring of VA Related Infection in HD Patients* (includes a culture of the local site, 2 sets of blood cultures drawn 5 minutes apart and a 6 week course of IV antibiotics). Establish a new BH site once the course of antibiotics is complete.
- Document the infection in PROMIS.

For specifics, refer to the *Prevention, Treatment, & Monitoring of VA Related Infection in HD Patients* at bcrenalagency.ca.

4.0 PROCEDURE

The next section describes 2 procedures and tips/troubleshooting for BH cannulation:

- Establishing a BH track using the sharps method
- Cannulating an established BH track
- Troubleshooting BH tracks

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4(a) Establishing a Buttonhole Track Using the Sharp Needle Method

First Cannulation (prefer this be done by patient/caregiver but may be done by advanced cannulator and/or home HD nurse)

1. Consult a physician and vascular access (VA) or home HD nurse to confirm that the access is ready to cannulate and the patient meets the criteria for establishment of a buttonhole track.
2. Assess access for signs of infection (redness, swelling, tenderness or drainage) and that it is working by feeling a thrill (pulsation or vibration).
3. Instruct the patient to wash their hands and access with antibacterial soap or scrub and water using friction; patient may apply Emla or other topical anaesthetic cream to needle sites for analgesia during the establishment of the BH tracks; Emla cream is discouraged and should not be required once the BH tracks are established.
4. Select appropriate arterial and venous sites for cannulation (see recommendation 3). If available, use bedside ultrasound.
5. Cleanse each needle site with a cleansing solution using a back and forth rubbing motion. Allow to dry.

Preferred cleansing solutions in order of preference on allergic reaction basis are:

	Solution	Contact Time¹	Cannulation
1	Chlorhexidine 2% with alcohol 70%	30 seconds	When dry
2	Chlorhexidine 2% with alcohol 4% (aqueous)	2 minutes	When dry
3	Sodium hypochlorite 0.11% (ExSept Plus® or Amuchina 10%)	2 minutes	When dry
4	Povidone iodine 10% (Betadine®)	3-5 minutes	When dry
5	Chlorhexidine 2% with no alcohol	3 minutes	When dry

Note: contact time is based on manufacturer’s recommendations.

6. Apply tourniquet 4 inches higher than the venous (top) needle site.
7. Put on clean gloves.

¹ Contact times were pulled from a variety of sources including:

- Manufacturer’s instructions (where indicated)
- Safer HealthCare Now (June 2012). Prevent Central Line Infections: Getting Started Kit. <http://bit.ly/14aynbt>
- Debraun, B. (2008). Evaluation of the antimicrobial properties of an alcohol-free 2% chlorhexidine gluconate solution. *AORN*. May, 87(5), 925-933.

² Recommendations in this document regarding the use of chlorhexidine are for children > 2 years of age; the literature makes no recommendations for infants < 2 years of age (unresolved issue; CDC, 2011, p. 13).

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8. Insert arterial needle:
 - a. Remove cap and hold needle (15 or 16 gauge, 1 in or 1.25 in long) by the plastic wings with the opening (bevel) facing up. Note: 1.25 in needle is only used for patients with deep fistulas.
 - b. Pull back on the skin with light pressure below where the needle will be placed.
 - c. Insert needle using a 25 degree angle, although this may vary depending on the depth of the fistula.
 - d. Flatten angle once you see blood pulsing (flash back). Slowly advance needle almost to the end in the same direction as the fistula. To prevent the “hubbing effect³”, leave the last 2 mm of metal part of the needle exposed (prevents the hub of the needle from touching the entrance sites).
 - e. Holding the wings of the needle, check the flow of the blood by pulling up and down on the syringe. Syringe should be in a vertical position.
 - f. Place folded gauze under the needle if required.
 - g. Tape needle securely leaving exit site covered with tape or dressing.
 - h. Clamp needle.
9. Repeat step 6 to insert the venous needle.
10. Remove tourniquet.
11. Check flows and give initial heparin dose by replacing the empty syringe with the heparin-filled syringe.
12. Proceed with dialysis.

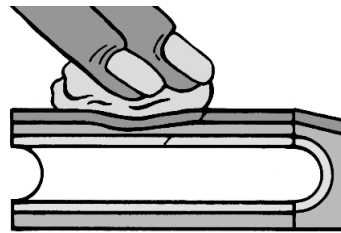
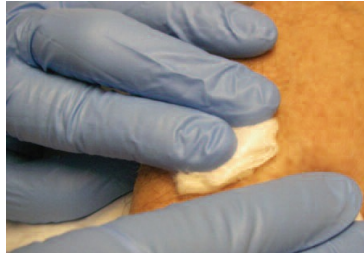
First Needle Removal

13. Wash hands with antibacterial soap using friction or hand sanitizer.
14. Clamp both needles. Place a drape under arm.
15. Put on clean gloves.
16. Hold needle while removing tape. Place gauze over the needle site without applying pressure.
17. Remove needles one at a time by grasping the needle wings and placing gauze over the puncture site. Pull needle out slowly at the same angle as the track.

³“Hubbing” is when BH sites start developing a widening and a bowl-like indentation at the entrance. This makes it difficult to remove scabs and increases the chances of infection (Ball, 2010).

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18. After the needle is out, apply mild, direct pressure for 10-15 minutes to each site, using sterile gauze and a two digit technique.
- One finger at the vein site (internal)
 - One finger at the skin exit site (external)



19. Once the site has stopped bleeding:
- Cover the exit site with a Curity AMD Band-Aid impregnated with 0.2% polyhexamethylene biguanide (PHMB) (one band-aid per site). Instruct the patient to remove the band-aids after 4 – 6 hours; or
 - Apply 2% Mupirocin cream about the size of a pea to each BH site with a sterile cotton swab (one swab per site) or sterile 2x2 gauze. Make sure the tube of Mupirocin cream does not contact the skin. Cover the exit site with a sterile 2x2 gauze and tape in place with paper tape. Instruct the patient to remove the gauze after 4–6 hours and, using a sterile gauze, wipe away excess Mupirocin cream.

Second Cannulation and Until BH Track is Established (if initial cannulation done by advanced cannulator nurse, transfer function to patient as soon as possible)

Same process as for the first cannulation except that the BH scab needs to be removed.

20. Procedure for removing BH scabs:
- Apply a disinfectant-soaked gauze or tape an alcohol wipe over buttonhole sites for 10 minutes or more until the scab softens. If patient is sensitive to disinfectant, use a normal saline-soaked gauze. Remove gauze in wiping motion.
 - If scabs are not removed with soaking, gently remove with a red blunt fill needle or SteriPick (one for each site) and discard. Do not use reusable, non-sterile tweezers or fingernails to remove the scab.
 - Cleanse each needle site again with a disinfectant-soaked gauze.

Needle Removal

21. Follow steps 13 – 20.

4(b) Cannulating an Established Buttonhole Track

22. Once BH track is well established, transition to blunt needle cannulation.
- BH site looks well-healed;
 - BH site has a round hole; and
 - Resistance in the track is decreasing with each use.

Note: Blood leakage at the BH site may also be an indication that it is time to transfer to blunt BH needles.

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23. Follow same as previously outlined steps (assess access, remove scab and insert needles except using a blunt needle).
- If mild to moderate resistance is met when attempting to insert the needle, rotate the needle as the needle is being advanced, using gentle pressure.
 - If resistance continues to be felt, gently pull the needle back but not out of the tunnel, wait for 20 seconds and try to advance the needle again.
 - If unsuccessful with the blunt needle, remove the needle and hold site with sterile gauze.
 - If bedside ultrasound is available, attempt to visualize the BH track.
 - Reposition the tourniquet, palpate the vessel, repeat cleansing procedure and try cannulating the site again using a new blunt needle.
 - If unsuccessful cannulating the BH site the second time, cannulate a new rope ladder site at least 1 in away from the BH track using a sharp needle.
 - Consult a nephrologist if difficulty cannulating with a blunt needle at more than one consecutive HD session.

Needle Removal

24. Follow steps 13 – 20.

5.0 REFERENCES

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Self-Cannulation of Buttonholes on AV Fistulas**6.0 SPONSORS**

This provincial guideline was developed to support improvements in the quality of vascular access care delivered to patients with chronic kidney disease in BC. Based on the best information available at the time it was published, the guideline relies on evidence and avoids opinion-based statements where possible. When used in conjunction with pertinent clinical data, it is a tool health authorities and health professionals can use to develop local guidelines.

The original guideline was developed by a vascular access working group of multidisciplinary care providers from across BC and Alberta (Southern Alberta Renal Program). The revisions were completed by a working group from BC. The guideline was approved by the Provincial Vascular Access Services Team and the BC Provincial Renal Agency Medical Advisory Committee. It has been adopted by BCPRA as a provincial guideline.

7.0 EFFECTIVE DATE

- Effective date: December 8, 2009; Revised: July 2013.
- This guideline is based on scientific evidence available at the time of the effective date; refer to bcrenalagency.ca for most recent version.