

Buttonhole Cannulation of AV Fistulas

(APPROVED December 8, 2009)

Vascular Access Guideline



BC Renal Agency
An agency of the Provincial Health Services Authority

Table of Contents

1.0	SCOPE	1
2.0	RECOMMENDATIONS, RATIONALE, & EVIDENCE	3
3.0	PROCEDURE	6
4.0	REFERENCES.....	13
5.0	SPONSORS	14
6.0	EFFECTIVE DATE.....	14

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)**. The buttonhole cannulation method (also known as the “constant-site” method) is not used for AV grafts (AVGs). The guideline applies to *adults* only.

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 (BH) 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 and CINAHL databases were searched to May 2009.
- KDOQI 2006 Guidelines – excerpts on BH method of cannulation.
- Search words: buttonhole, cannulation, hemodialysis.
- See reference section for specific articles reviewed.

The findings from the review included:

- No systematic reviews, no random controlled trials, and limited numbers of publications on the BH method of cannulation.
- Most articles focusing on the “how to” rather than “whether to” or “whom to” use the BH method.

Benefits identified consistently in the literature:

- Easier for patients to self-cannulate (KDOQI, 2006); increased patient satisfaction.
- Can safely repeatedly cannulate fistulae with limited space because of tortuosity or short length.
- Less painful cannulation and less need for analgesia (KDOQI, 2006); less stress for patient and caregiver.

Benefits identified less consistently in the literature:

- May help preserve the integrity of the outflow vein (KDOQI, 2006).
- Fewer infiltrations (KDOQI, 2006).
- Fewer missed needles and hematomas.
- Less aneurysmal development; reduction of existing aneurysms.
- Less time required for identifying appropriate needle sites.
- Shorter bleeding time post dialysis.

Drawbacks identified consistently in the literature:

- Increased risk of infection through the needle sites (especially if cleaning is not done properly).
- If the track is being established using the sharp needle method, this requires the same person (or at most two persons) to cannulate the fistula until the track is established (usually 8 – 18 cannulations); this has scheduling implications if staff do the cannulation rather than the patient.
- Can only be used with fistulae (not with grafts).

Conclusion: There is a role for the BH method for cannulating AVFs in patients with (a) the desire and capacity to self-cannulate and/or have care giver cannulate; and (b) AVFs in which the rope ladder technique has not been successful (see recommendation 2 for specifics).

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.

Recommendation 2: Generally speaking, BH tracks are appropriate for patients who self-cannulate or have a care giver cannulate and for select patients in which the rope ladder technique has not been successful.

Indications for considering the BH method:

1. Self/caregiver cannulator now or planned in the future (BH is the preferred method of cannulation for these patients)
2. Rope ladder method has not been successful:
 - Limited cannulation sites
 - Short fistula segment (<5 cm/2 inches)
 - Frequent infiltrations
 - Aneurysm formations
 - Significant pain with standard needling

Risk factors for unsuccessful buttonholes (relative contraindications¹):

- Thin subcutaneous tissue
- Signs of active infection, hematoma, swelling, skin breakdown and/or cyanosis in the fistula limb
- Poorly functioning fistula

Note: If combination fistula/graft, BH method may be used but stay away from the graft area.

¹ Patients with heart disease (e.g., mechanical heart valve, previous rheumatic heart disease, previous endocarditis), prosthetic materials (e.g., pacemakers) and/or immune suppressed (e.g., patients with lupus, on prednisone, or failed transplants) were discussed. It was agreed that these cases would be reviewed individually and that these characteristics would not necessarily be contraindications for the use of the BH method.

Recommendation 3: BH tracks may be established on new or existing mature, well functioning fistulas.

Points to consider when establishing BH tracks:

- If creating a BH for a self-cannulator, choose sites easy for the patient to cannulate. If possible, have patients cannulate their own sites.
- 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.
- 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 centimeters from the antecubital fossa/elbow crease with the arm bent at a 90 degree angle.
 - Forearm BH sites: measure in centimeters from the bent wrist.
 - Photograph of the BH sites is recommended for the Kardex/patient record.

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

General:

- If possible, encourage patients/care givers to establish the BH track.
- 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 designated 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 and in the same direction as the BH track.
 - 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 sharps in the BH track and avoid needling into the BH track.

Self/caregiver characteristics:

- 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 care giver willing to cannulate.
- Lower arm fistulas on the non-dominant arm are easiest to self-cannulate.
- Good hand dexterity (able to hold the needle and not shaky).
- Good sensation in fingers.

Buttonhole Cannulation of AV Fistulas

- Good eyesight.
- Good personal hygiene.
- Mental capacity to be successful at self/care giver cannulation.
- Received specific education on establishing a BH track.

Nurse characteristics:

- Advanced cannulator as designated by the VA Nurse or an advanced cannulator.
- Received specific education on establishing a BH track.
- Available for each cannulation until track is established (8 – 18 cannulations).

Recommendation 5: Once a BH track is established, the track may be cannulated by the patient or care giver (recommended) and/or 1 - 2 different nurse cannulators (fewer is better). Nurse cannulators must have received an orientation to buttonhole cannulation.

Limiting the number of cannulators reduces the potential for destroying the BH track (as different cannulators use different angles) and complications.

If the first cannulation attempt by a patient's designated cannulator is unsuccessful:

- The patient's designated cannulator should seek assistance from another cannulator designated for that patient.
- If another cannulator designated 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 and in the same direction as the BH track.
 - 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 sharps in the BH track and avoid needling into the BH track.
- At the next dialysis session, repeat the above. If not successful after 3 sessions, consider establishing a new set of buttonhole tracks.

If neither of the two BH cannulators designated for a specific patient are available for a specific HD run, cannulate as described above (using conventional sharp needles placed a MINIMUM of 1 inch (2.5 cm) away from the BH).

Recommendation 6: In the event of a BH site is infected:

- If the BH infection is localized to the puncture site and there are no signs of systemic infection, DO NOT use the BH site 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 site 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 www.bcrenalagency.ca/default.htm.

Recommendation 7: Once the first set of BH tracks is well established, a second set may be developed to serve as a back-up. In such cases, the cannulation of each set should be alternated with each dialysis treatment.

4.0 Procedure

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

- a. Establishing a BH track using the sharps method
- b. Cannulating an established BH track
- c. Trouble-shooting BH tracks

4(a) Establishing a Buttonhole Track Using the Sharps Method

First Cannulation

1. Consult a physician and vascular access (VA) or home hemodialysis nurse to confirm that the access is ready to cannulate and the patient meets the criteria for establishment of a buttonhole track.
2. If patient is on heparin, contact physician to reassess heparin orders and heparin stop times. Reassess regularly during initial cannulations.
3. Instruct the patient to wash their access with anti-bacterial soap or scrub and water using friction; patient may apply Emla or other topical anaesthetic cream to needle sites for analgesia for the first needle insertion (it is not recommended and should not be required for subsequent insertions).
4. Select appropriate arterial and venous sites for cannulation. If available, use bedside ultrasound. For specifics, see recommendation 3.

- Using clean gloves, cleanse each needle site with a cleansing solution using a circular motion inside to outside. Contact time for the cleansing solution should total at least 40 seconds. Allow to air dry (see below for drying times).

Preferred cleansing solutions in order of preference are:

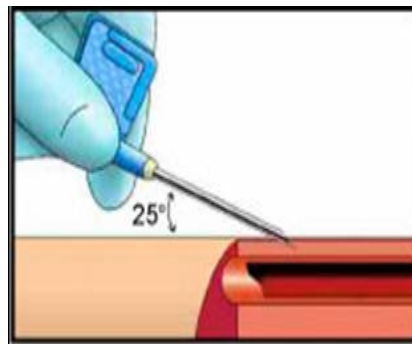
- Chlorhexidine 2%² with alcohol 4%, 70% or no alcohol (aqueous): 3 minutes drying time (longer if no alcohol used).
 - Sodium hypochlorite 0.11% (ExSept Plus®) or Amuchina 10%: 2 minutes drying time.
 - Povidone iodine 10% (Betadine®): 2 minutes drying time.
- Cannulate sites as for normal dialysis using a tourniquet and appropriate needles (15 or 16 gauge and 0.75 in, 1 in or 1.25 in long). The angle will usually be at about 25 degrees but may vary depending upon the depth of the fistula. Self-cannulators may require a steeper angle.
 - ▶ Key point: Create a cut-out of the angle of insertion using a cardboard cut-out. This cut-out can be used to ensure the angle of insertion is consistent each entry.



- Maintain this angle until you enter the vessel. When you see flashback (indicating the needle is in the access), lower the angle of insertion and continue to advance the needle into the AVF until it is appropriately placed within the vessel. Aspirate to confirm patency.
- Match needle gauge to blood pump speed and proceed with dialysis.



Step 1

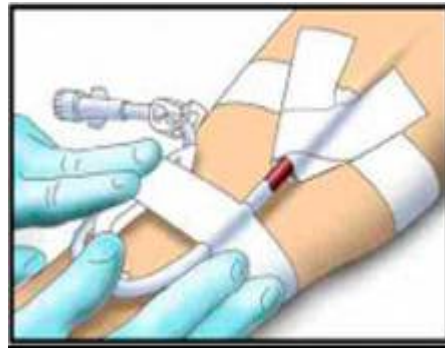


Step 2

² Note: Recommendations in this document re the use of chlorhexidine are for children > 2 years of age; the literature makes no recommendations for infants < 2 years of age (unresolved issue; MMWR, 2002, p. 14).



Step 3



Step 4

Photographs provided courtesy of Medisystems, a NxStage Company.

First Needle Removal

9. After dialysis, remove the fistula needles in the same direction they were inserted. Apply mild, localized, direct pressure for 10 – 15 minutes to the needle exit sites of both the skin and vessel wall, using a two digit technique. Do NOT use a clotting agent.
 - One finger at the vein site (internal)
 - One finger at the skin exit site (external)
10. Cover the exit site with a sterile 2x2 gauze (note: antibiotic ointment is not recommended routinely). Tape in place with paper tape. Instruct the patient to remove the gauze after 4 - 6 hours.

Cannulation #2 and until track is established:

11. Instruct the patient to wash their access with anti-bacterial soap or scrub and water using friction.
12. Don clean gloves. Cleanse each needle site with a cleansing solution and gauze/swab using a circular motion inside to outside.
13. Gently lift the scab off with the gauze/swab (during cleansing, if possible). If the scab does not come off easily, soften with a warm, wet compress or chlorhexidine/alcohol swab (do not “over soak” the scab or it will become “mushy” and hard to remove) and remove using clean forceps, tweezers or a blunt needle.
 - ▶ Key point: To prevent infection, remove the entire scab. The scabs are very small. You can tell when the scab is off because the tunnel track looks shiny and wet. There may be a slight amount of superficial bleeding.
14. After removing the scabs, cleanse each needle site again. Contact time for the cleansing solution should be at least 40 seconds. Allow to air dry.

- ▶ Key point: Buttonhole sites and infection:
 - If the BH infection is localized to the puncture site and there are no signs of systemic infection, DO NOT use the BH site 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 site 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.

15. For cannulations #2 - #6, cannulate as for normal dialysis using a tourniquet and the same size sharp needles as used for the initial cannulation. Insert needles at the same angle each time.

- ▶ Key point: Utilize the cardboard cut-out of the angle of insertion created during the initial cannulation to ensure the angle is consistent each entry.



16. When you see flashback (indicating the needle is in the access), lower the angle of insertion and continue to advance the needle into the AVF until it is appropriately placed within the vessel. Aspirate to confirm patency.

17. Match needle gauge to blood pump speed and proceed with dialysis.

18. Remove needles using the procedure identified under “first needle removal.”

19. Try using blunt needles once the:

- BH site looks well-healed;
- BH site has a round hole; and
- Resistance in the track is decreasing with each use

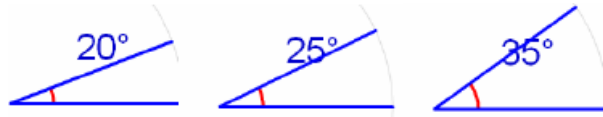
20. If unsuccessful with blunt needles, return to using sharp needles taking care to advance the needle slowly along the developing scar track. At each subsequent dialysis treatment, try again with a blunt needle.

- ▶ Key point: Move to the use of blunt needles as soon as possible (blunt less likely to go through the established track; sharp needles may cut adjacent tissues, enlarge the track and cause bleeding along the track). For most patients, it takes between 8 and 18 cannulations using a sharp needle to create a scar tissue tunnel track. Arterial and venous sites may not develop at the same rate.

4(b) Cannulating an Established Buttonhole Track

21. Instruct the patient to wash their access with anti-bacterial soap or scrub and water using friction.
22. Don clean gloves. Cleanse each needle site with a cleansing solution using a circular motion inside to outside.
23. Gently lift the scab off with the gauze/swab (during cleansing, if possible). If the scab does not come off easily, soften with a warm, wet compress or chlorhexidine/alcohol swab (do not “over soak” the scab or it will become “mushy” and hard to remove) and remove using clean forceps, tweezers or a blunt needle.
 - ▶ Key point: To prevent infection, remove the entire scab. The scabs are very small. You can tell when the scab is off because the tunnel track looks shiny and wet. There may be a slight amount of superficial bleeding.
24. After removing the scabs, cleanse each needle site again. Contact time for the cleansing solution should be at least 40 seconds. Allow to air dry.
 - ▶ Key point: If the BH site has signs of infection, notify the nephrologist and initiate the protocol outlined in the BCPRA guideline for *Prevention, Treatment and Monitoring of VA Related Infection in HD Patients* (obtain culture from exit site; if local signs of infection are accompanied by a fever >38°C +/- chills +/- hypotension, also obtain 2 sets of blood cultures 5 minutes apart). DO NOT use the BH site. Use conventional sharp needles and place antegrade and a MINIMUM of 1 inch (2.5 cm) away from the BH and in the same direction as the BH track. Avoid needling into the BH track. Continue cannulating this way until signs of infection are no longer present.
25. Cannulate as for normal dialysis using a tourniquet except use a blunt (buttonhole) needle instead of a sharp needle. If mild to moderate resistance is met when attempting to insert the needle, rotate the needle as you advance it, using gentle pressure. If resistance continues to be felt, gently pull the needle back but not out of the tunnel, wait x 20 seconds and try to advance the needle again.

- ▶ Key points:
 - Hold the needle behind the butterfly; this will allow it to find the established track, lessening the chance of injury to the track. After reaching the vessel wall (the needle may stop when it reaches the vessel wall), advance the needle slowly, grasping the butterfly if you require more control.
 - Utilize the cardboard cut-out of the angle of insertion created during the initial cannulation to ensure the angle is consistent each entry.



26. If unsuccessful in using blunt needles, seek out the assistance of another cannulator designated for that patient.

If another cannulator designated 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 and in the same direction as the BH track.
- 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 sharps in the BH track and avoid needling into the BH track.

At the next dialysis session, repeat the above. If not successful after 3 sessions, consider establishing a new set of buttonhole tracks.

Needle Removal

27. After dialysis, remove the fistula needles in the direction they were inserted. Apply mild, localized, direct pressure for 10 – 15 minutes to the needle exit sites of both the skin and vessel wall, using a two digit technique. Do NOT use a clotting agent.
- One finger at the vein puncture site (internal)
 - One finger at the skin exit site (external)
28. Cover the exit site with a sterile 2x2 gauze (note: antibiotic ointment is not recommended routinely). Tape in place with paper tape. Instruct patient to remove gauze after 4 - 6 hours.

4(c) Tips/Trouble-Shooting BH Tracks

Problem	Description/Cause	Tip
Fluid overload	Causes tissues to swell and may narrow the BH track.	<ul style="list-style-type: none"> • Gently rotate the needle slightly, side to side. • Flush the needle tubing with saline, allowing it to drip off the end of the needle.
Needle won't go in	Drinking extra fluids may cause fluids to stay in the track and cause the track to stretch and/or the flap to move out of position	<ul style="list-style-type: none"> • Insert needle into the vessel, then gently lift up or lower the needle and try to insert.
Unstable BH site	Excess upper arm tissue or skin	<ul style="list-style-type: none"> • Place cushion under access arm as far up in the axilla area as possible (better visualization and raises and stabilizes arm for cannulation).
Difficulty getting blunt needles into the fistula ("trampoline" effect)	Fistula is thick walled; and/or Blunt needles not pointed enough	<ul style="list-style-type: none"> • Use touch cannulation technique. • Allow needle to direct the needle down the BH, and not the cannulator. • Hold tubing with the thumb and forefinger just behind the wings.
Oozing and large scabs		<ul style="list-style-type: none"> • Use single cannulator (prevents cone-shaped tunnels and large scabs).
Excessive bleeding		<ul style="list-style-type: none"> • Check for stenosis, track being cut or damage to vessel wall flap. • Do not use sharp needles. • Do not flip needles. • Evaluate anticoagulation.
Infection	Dialysis patients are highly susceptible to infection (immunocompromised, frequently hospitalized)	<p>Proper skin cleaning:</p> <ul style="list-style-type: none"> • Patient to wash arm immediately prior to cannulation • Cleanse needle sites prior to and after scab removal (circular, outward motion) <p>Proper scab removal:</p> <p>DO: use aseptic tweezers or a blunt needle; stretch skin around scab in opposite directions.</p> <p>DON'T: flip the scab off with the needle you will use for cannulation; let patients pick off their scabs; stick through scabs.</p>

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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.

Developed by a Vascular Access Working Group of multidisciplinary care providers from across BC and Alberta (Southern Alberta Renal Program), 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 BCRA as a provincial guideline.

7.0 Effective Date

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