

Cannulation Techniques

Cannulation Techniques

- Site-Rotation
 - Also known as:
 - Rope ladder
 - Rotating sites
- Buttonhole
 - Also known as:
 - Constant-site
 - Same-site

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Important Tips

- Take your time
- Cannulation is achieved in a gentle, fluid motion
- Determine the depth of the access during your assessment—this will determine the angle of entry into the fistula

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Tourniquet Use

- The proper use of a tourniquet is required for all AVF cannulation procedures
- This includes large AV fistulae that appear dilated without a tourniquet. Tourniquet use ensures uniform dilatation of the vessel prior to needle insertion
- Apply the tourniquet tight enough to enlarge or engorge the vessel, but not tight enough to cause pain or loss of blood flow to the limb

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Site-Rotation Technique

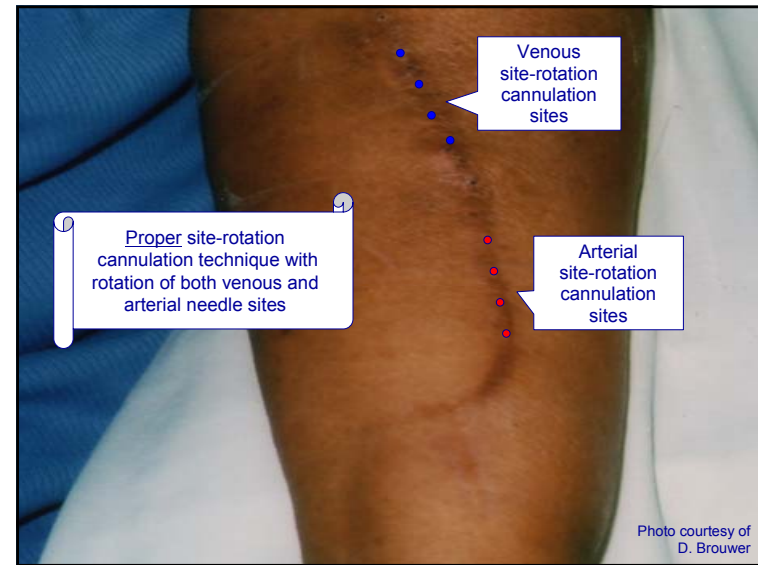
- Cannulation sites are rotated up and down the AVF to use its entire length
- Classic technique used in most dialysis centers

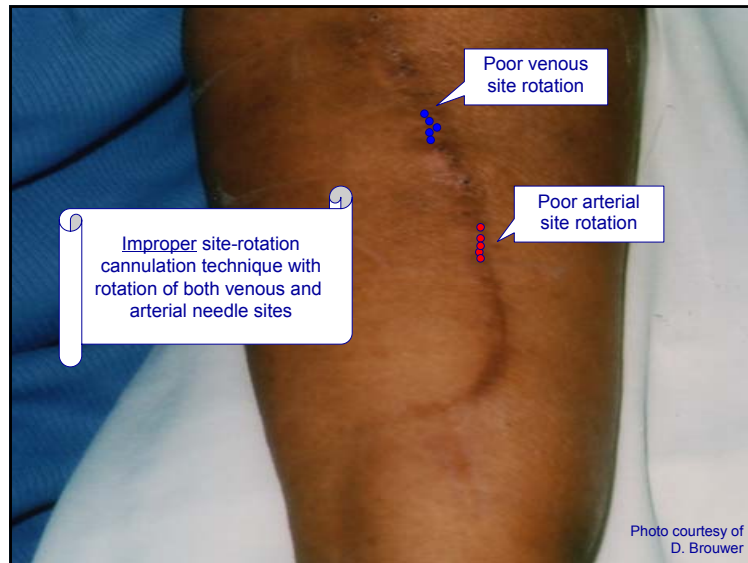
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Locating the Cannulation Site

- Look for straight areas of at least 1" for each cannulation site
- If you try to "straighten out" by *pulling* on the vessel to cannulate, the vessel will retract into its original position when released and lead to an infiltration
- Avoid aneurysms and flat or thinned-out areas
- Stay 1.5" away from the anastomosis
- Keep the needles at least 1.5" apart
- Each treatment requires 2 new sites

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“One-site-itis”

- “One-site-itis” occurs when you stick the needle in the same general area, session after session
- Causes aneurysm and stenosis formation

Practice of repeatedly puncturing same area, AKA “one-site-itis”

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AVF Aneurysm

- Caused by sticking needles in the same general area
- Aneurysm can also result from stenosis beyond the aneurysm, causing elevated back pressure

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Needle Insertion

- Watch the orientation of the needle bevel, and avoid turning your wrist
 - If the bevel enters sideways, this can cause cutting of the vessel and/or a sidewall infiltration
- Use only a back-eye needle for the arterial needle
 - The venous needle can be back-eye or non-back-eye

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Three-Point Technique

- Use of tourniquet should be mandatory
- Stabilize vessel
- Pull skin taut toward the cannulator to allow easier needle insertion (compresses nerve endings, blocking pain sensation to the brain for about 20 seconds)



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"L" Technique

Hold thumb and index finger as an "L"



Thumb holds skin taut over fistula

Index finger stabilizes and engorges fistula



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Photos courtesy of J. Holland

Cannulation Technique

- Fistula needle/wings are the extension of your hands and fingers
- Slowly advance the needle
- Watch for blood flashback once the needle enters the vessel
- Level out the needle angle and slowly advance needle up the center of the vein
- Do not flip the needle
- Tape the wings to stabilize the needle
- Check for good flow
- Finally, chevron the tape to prevent needle from dislodging

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Angles of Entry

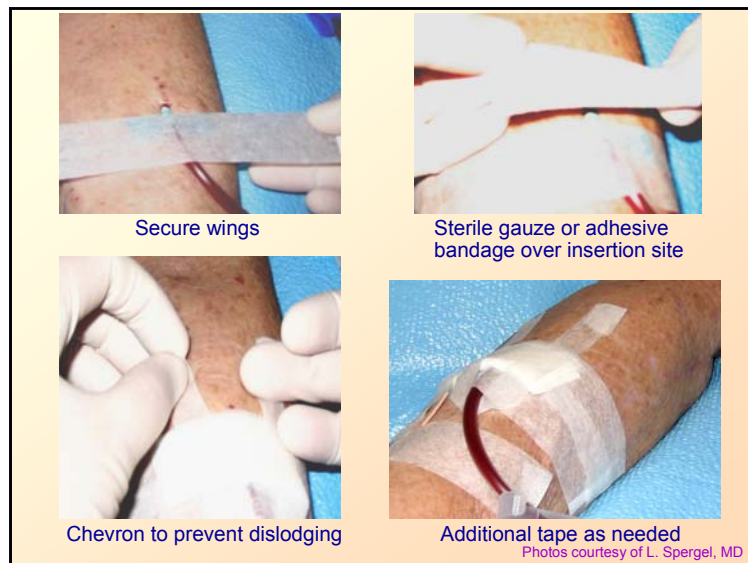
Rule of Thumb:

- 20–35° angles for fistulae
- 45° for grafts

Reality:

- Not every access fits the rule of thumb; some AV fistulae are very shallow and a lesser angle can be used
- You will need to carefully assess the depth of the access and adjust the angle of cannulation accordingly

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Flipping Needles

- Historically, we flipped all needles because we did not have back-eye needles
 - Causes enlargement of the entrance hole, which allows blood to seep out around the needle during dialysis
 - Can cause coring of the access, requiring surgical closure of the hole
- If cannulation technique is correct, there is rarely a need to flip needle

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Preparing for Cannulation

- Prep skin prior to cannulation
- Stabilize the skin and the AVF

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Insertion of Needle

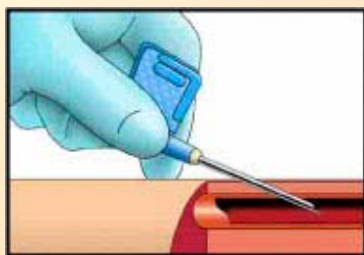
- Use an approximately 20–35° angle of insertion depending on the depth of the access
- The angle is from the skin to the needle hub
- First, enter the skin and tissue above the AVF vessel, then the vessel

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Advancing the Needle

- Once the AVF vessel is entered, the blood flashback is visible in the needle tubing
- Level out and advance the needle with very minimal pressure



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Placement Is Crucial

- Do not “flip” or rotate the bevel of the needle 180°
 - Flipping can lead to stretching of the needle-insertion site and cause oozing during the dialysis treatment



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Needle Removal

- Apply gauze dressing without pressure
- Remove needle at insertion angle
- Apply pressure with 2 fingers
- Do not use excessive pressure
- Hold for 10–12 minutes, no peeking
- **Use stethoscope to check for bruit after applying dressing to stick site**

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Use a stethoscope to check for bruit



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Photo courtesy of J. Holland

Needle Removal (cont'd)

- Apply adhesive bandages
- Dispose of needles in biohazard sharps container per guidelines specified in the Occupational Safety and Health Act (OSHA)

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Post-Treatment Hemostasis

- Pull needle completely from the vein before pushing down on the needle site
- Hold direct pressure for 10 minutes without “peeking”—no exceptions
- Do not use clamps unless absolutely necessary!

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Clamps vs Holding Sites

- Patients and/or family should be taught to hold sites properly; otherwise, staff should hold sites
- Compression of the sites in the presence of hypotension can cause the access to clot
- Clamps should not be used routinely; however, if clamps must be used:
 - Use only 1 at a time
 - Be sure they are adjustable
 - Check for thrill above the clamp to ensure vessel is not occluded
 - Clamps should never be left on longer than 20 minutes (bleeding longer than 20 min needs to be investigated)

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Summary

- Site-rotation or rope-ladder cannulation technique allows for improved needle site selection and use of the entire AVF for cannulation
- Proper site selection helps to ensure a successful cannulation
- Follow proper infection-control measures and your unit-specific cannulation policies and procedures

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Summary (cont'd)

- AVF cannulation uses a lesser angle of insertion compared with graft cannulation
- Watch for blood flashback, then lower the angle and advance needle up the center of the vessel
- Use of back-eye needles eliminates the need to flip, or rotate, the needle bevel 180°

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Summary (cont'd)

- Always use a tourniquet for AVF cannulation
- If using optional “wet-stick” method, check needle placement with a normal saline flush to ensure proper placement prior to initiation of the hemodialysis treatment
- Review and follow your unit-specific cannulation procedures for AVF and AVG cannulation procedures

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Cannulation Techniques

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History of the Buttonhole Technique

- Dr. Twardowski developed the technique in Poland more than 25 years ago
- Dialysis supplies, including AV fistula needles, were very limited
- AV fistula needles were reused for multiple cannulations
- The needles became dull after repeated use and would not cut the skin
- The “dull” needles would enter smoothly if the exact same cannulation site was used (same skin entry, same angle of entry, and same vessel entry depth)
- Buttonhole technique was used to successfully solve the dull needle challenge

Twardowski Z. *Dialysis & Transplantation*. 1995;24:559.
Peterson P. *Nephrol Nurs J*. 2002;29:195.
Lewis C. *Nephrol Nurs J*. 2005;32:225.

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Buttonhole Technique

- Procedure: Method in which an individual cannulates the AV fistula in the exact same spot, at the same angle and depth of penetration every time
- A scar tissue tunnel track develops, allowing for the use of a buttonhole (blunt) fistula needle

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Advantages

- May prolong AVF lifespan
- Reduces pain, bleeding, infiltration, infection
- Virtually eliminates missed cannulations
- Promotes self-care and self-dialysis
- Use blunt needles, which require no safety device

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Disadvantages

- Requires same cannulator, same angle, same location
- Concerns of “one-site-itis”
- Difficult with fistula covered by:
 - Heavily scarred skin
 - Large amount of subcutaneous tissue

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Who Is a Good Candidate?

- Any patient with a native AVF
- Any potential self- or home-dialysis patient
- When there is a limited area for cannulation sites
- When preservation of the access is of critical concern because it is the patient's last viable access option

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Advantages

- May prolong the AVF lifespan
- Reduced pain, no need for anesthetics
- Reduced bleeding, infiltrations, and infection
- Missed sticks are virtually eliminated
- Promotes self- and home dialysis
- No safety device required on the needle

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Disadvantages/Barriers

- Limited to use with native AVF only
- Overcoming staff and patient concerns of “one-site-itis”
- Requires the same cannulator, same angle, and same location until the track/tunnel has developed
- Difficult to use with a heavily scarred access or upper-arm AVF with large amount of subcutaneous tissue overlying the vessel

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Major Technique Differences With Buttonhole

- Must use the same exact track and angle of entry as the original cannulator of the track/tunnel
- Scab removal is required before prepping the skin
- Strict aseptic technique and infection-prevention measures are crucial to the success of the buttonhole method

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Selecting Buttonhole Sites

- Perform a complete physical exam of the access
- Record arterial and venous pressures at various cannulation sites
- Look for straight sections of the fistula
- Consider who will be performing the cannulations
- Consider direction of the blood flow and direction of the needles
- Stay away from aneurysm areas
- Consider selecting and preparing additional sites for possible need for additional buttonhole sites

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Select Sites Carefully

- Straight areas without aneurysms
- Minimum of 1" to 1.5" between needle tips
- Consider direction of blood flow
- Establish site for arterial and venous needle

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Establishing Buttonhole Sites

- One person should do all of the buttonhole cannulations with a sharp needle until the scar tissue tunnel track is well formed
- Using aseptic technique, cannulate the same exact spot each time, using the same angle and depth of penetration
- Establish 1 site for arterial and 1 site for venous access

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Establishing Buttonhole Sites (cont'd)

- Once buttonhole sites are well established and defined, it is recommended that an alternate set of sites be developed
- Typically, it takes 6–10 cannulations using sharp fistula needles to establish a buttonhole site
- For diabetic patients and others with slower wound healing, it may take 12 cannulations or more to develop the buttonhole track
- Some patients may take longer to develop the tunnel/track, requiring longer use of a sharp needle

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AVF Buttonhole Technique



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Establishing Buttonhole Sites

- Perform a complete physical assessment of the AV fistula and document the findings
- Select cannulation sites carefully
 - Consider straight areas, needle orientation, and ability of the patient to self-cannulate
 - Sites should be selected in an area without aneurysms and with a minimum of 2" between the tips of the needles
- Remove any scabs over the cannulation sites
- Disinfect the cannulation sites per facility protocol
- Using a sharp AV fistula needle, grasp the needle wings
- Align the needle cannula, with the bevel facing up, over the cannulation site, and pull the skin taut

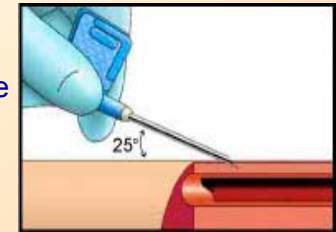


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Establishing Buttonhole Sites (cont'd)

- Cannulate the site at a 20–35° angle
- Self-cannulators may require a steeper angle
- It is important to cannulate the developing buttonhole site in the exact same place, using the same insertion angle and depth of penetration each time
 - This requires that a single cannulator perform all cannulations until the site is well established



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Establishing Buttonhole Sites (cont'd)

- A flashback of blood indicates the needle is in the access
- Lower the angle of insertion
- Continue to advance the needle into the AV fistula until it is appropriately positioned within the vessel

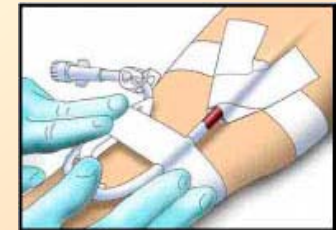


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Establishing Buttonhole Sites (cont'd)

- Securely tape the AV fistula needle, and proceed with dialysis treatment per facility protocol



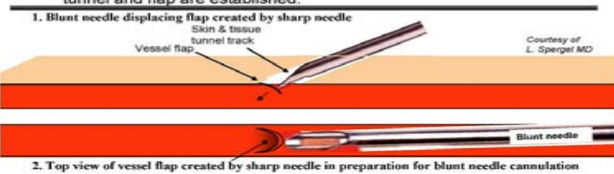
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Skin/Tissue Tunnel Track + Vessel Flap = Buttonhole Site

Skin / tissue buttonhole tunnel track forms like the scar tissue track from a pierced earring.

Vessel flap is created by repeated punctures with the sharp needle at the same site. Vessel flap will then be displaced by the blunt buttonhole needle at each cannulation after the tunnel and flap are established.



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Two Buttonhole Sites



Buttonhole sites

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Changing to Blunt Needles

- Change to blunt needles once the track is formed
 - Blunt needles prevent continued cutting of the buttonhole track and new entry site of the AVF vessel
 - Blunt needles prevent infiltrations, bleeding from around the needle sites, and resistance to the needle insertion into the track and vessel

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Needles—Sharp and Blunt



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When to Switch to Blunt Needles

- This will be specific to each patient, but ask yourself these basic questions:
 - Can you visualize a round hole?
 - Does it look well healed?
 - Has there been decreasing resistance with the sharp needle?
- Do not use excessive force when changing to blunt needles
- You may need to rotate the needle back and forth with gentle pressure while advancing down the track

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A Developing Buttonhole

- A ridge is starting to develop
- A hole is starting to develop
- This site is not yet ready for a blunt needle



Day 5 with Buttonhole

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Changing to Blunt Needles

- Do not use excessive force
- Use same gauge for sharp and blunt needles
- Ensure appropriate needle gauge ordered by physician
- Initiate cannulation log sheet for each needle

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Changing to Blunt Needles (cont'd)

- Ensure that appropriate needle gauge for the blood pump speed is ordered by the physician
- Sharp-needle and blunt-needle gauges must be the same
- Initiate a cannulation log sheet for each needle (recommendation)

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Cannulating Established Sites

- Use an anti-stick blunt-bevel needle
- Anyone familiar with buttonhole technique can cannulate an established site
- Perform physical assessment of the access
- Wash the access with antibacterial soap

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Scab Removal: A Patient's Perspective

- Scabs will form at buttonhole cannulation sites
- Scabs must be removed to prevent infection!
- The scab looks like a mushroom, with a cap and stem
- Using a clean technique to moisten scabs makes them easier to remove
- Soften scab *before* leaving home by applying lotion or an alcohol wipe
- Often, scabs come off when scrubbing the site
- Stretch skin in all 4 directions around scab to loosen an edge
- Remove scab with a gauze square or tweezers using aseptic technique, carefully removing scab without harming the surrounding tissue

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Do's & Don'ts of Scab Removal

- Don't flip the scab off with the needle you will use for cannulation—this contaminates the needle
- Don't use a sterile needle—you could cut the patient's skin and you would also need a sharps container nearby
- Don't allow patients to pick at their scabs
- Do use aseptic tweezers, or
 - Soak two 2" x 2"s with sterile saline and apply over the scabs; or
 - Moisten 2" x 2"s with alcohol-based gel; or
 - Have patient tape an alcohol square over sites prior to dialysis
 - Have patient apply moist, warm washcloth to scab site prior to arriving at dialysis to facilitate scab removal

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Cannulating Established Sites

- Disinfect the site for cannulation per unit protocol
- Carefully insert needle into the established site
- Advance the needle along the scar tissue tunnel track
 - If mild-to-moderate resistance is met, rotate the needle as you advance using gentle pressure
- A flashback of blood in the tubing will indicate when needle is in the access

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Cannulating Established Sites

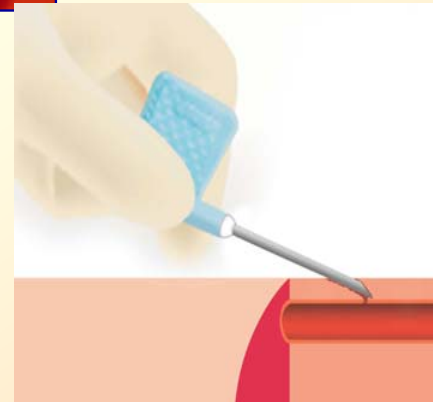
(cont'd)

- Lower the angle of insertion
- Continue to advance the needle until it is appropriately positioned within the vessel
- Securely tape the needle and proceed with dialysis treatment
- After treatment, follow OSHA guidelines—dispose of the buttonhole needles in an approved biohazard sharps container

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Sharps disposal containers with needle removal features. Available at: <http://www.osha.gov>. Accessed April 28, 2006.

Buttonhole: Wrong Angle of Insertion



- Needle inserted into the buttonhole tunnel track, but the angle is not aligned with the vessel flap
- The needle can bounce on the vein and not displace the vessel flap

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Buttonhole: Adjusted Angle of Insertion



- Adjust angle to find the flap
- Lift up and down on the needle to readjust the angle until the needle drops into the vessel flap
- Causes: moving needle from angle used to enter the skin, arm positioning not in routine place, or patient weight gain or loss

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Helpful Hints...

- It may be possible to speed the development of buttonhole sites by cannulating the sites every day
- It is helpful to switch over to blunt needles as soon as possible
 - Long-term use of sharp needles will cut adjacent tissues, enlarge the hole, and cause bleeding along the needle path

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More Helpful Hints...

- If it is impossible to have only 1 cannulator, additional buttonhole sites can be developed at the same time using a second cannulator
- If your patient is hospitalized and the acute hospital renal team does not know how to access a buttonhole, they can:
 - Rotate sites using standard sharp needles as long as they stay $\frac{3}{4}$ " away from the buttonhole tracks, or
 - Have the patient self-cannulate (if the patient has been trained)

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Still More Helpful Hints...

- Plan outreach to the acute team and educate regarding buttonhole technique
- Continue access monitoring and surveillance, even if patient is dialyzing at home
- Inform patients that laminated procedure cards and videos are available

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Troubleshooting the Buttonhole

- Bleeding can occur around the needles during dialysis if:
 - You are using sharp needles and have cut the track
 - The track has stretched because of trying to direct the needle instead of following the track
 - You have made a new track and torn tissue

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Troubleshooting the Buttonhole (cont'd)

- If, after the weekend, you have trouble with blunt needles, switch to sharp needles for that day, being careful not to cut the track
- If a site is not progressing, it is acceptable to abandon that site and find another site

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Troubleshooting the Buttonhole (cont'd)

Difficulty re-entering the fistula vein:

- Can occur when transitioning from sharp to blunt needles
- The blunt needle “bounces” on the vessel and will not enter the vessel
- Corrective action: Change the needle angle slightly until the vessel flap is located and needle drops into the vessel
- If it persists, return to sharp needle for a few sessions and then try blunt needle again