Goal

Review the principles of Buttonhole (BH) cannulation of arteriovenous fistulas (AVF).

Objectives

1. Describe what BH cannulation is.
2. Discuss the important principles of BH cannulation.
3. Provide some tips and troubleshooting for BH cannulation.

Introduction

BH cannulation of the AVF for haemodialysis treatment has been practised for over 30 years in Europe and Japan and approximately 25 years in Seattle, Washington (Ball, 2006). There are differing reasons for using this technique, including patient preference for self-cannulation and where patients with short fistulas have limited room for rope ladder cannulation. BH has also been used effectively for difficult fistulas in rural/remote locations where fistula problems can require multiple, expensive and time-consuming travel to metropolitan/tertiary centres for management.

Whatever the reasons for its use, this method of cannulation has proved to be successful from the perspective of patients and nurses (Hartig & Smyth, 2009). Meticulous management and due care with technique will minimise any risk of associated infection with buttonholes.

What is BH cannulation?

Buttonholing is the insertion of a needle into a fistula, for haemodialysis treatment, at exactly the same site, angle and depth every cannulation. This encourages a track to form, likened to an earring hole of a pierced ear (Ball, 2005). There is one neat entry point (doorway) into the fistula at the end of the tunnel. Originally it was thought that ‘flaps’ were formed in the wall of the fistula into the circulation. Now the belief is that a puckered or pursed-like opening is formed through which the dull needle is inserted.

Dull needles are used following the track formation, thereby reducing the risk of damage to the track caused by sharp needles. It is extremely important that all persons cannulating the fistula post BH development follow through the entire process the same way to avoid problems such as stretching or coning of the track.

BH cannulation requirements

- Careful access assessment (every session).
- Thorough skin preparation and scab removal.
- Fistula stabilisation during cannulation.
- Secure taping of needles.
- Care with needle removal and achievement of haemostasis at the end point.

These are all equally important for the success of the BH method. At no stage are any short cuts to the above acceptable and ongoing education for staff and patients is a significant requirement to maintain good BH technique (Doss et al., 2008).

Principles of BH cannulation

Education

Nursing staff, nephrologist, the patient and family all need to have an understanding of what BH is and why this is appropriate for the patient. One staff member should be identified as the primary establisher for the BH. As with any access cannulation, the BH method requires the dialysis nurse to attain a high level of skill, with frequent monitoring, evaluation and education of technique to enable the highest quality of care (van Loon et al., 2010).

Site selection

Comprehensive fistula assessment using “Look, Listen and Feel”, with the application of a tourniquet is the first step to good BH site placement. Identification of straight sections of the fistula free from any aneurysms is important in the planning phase. Consideration needs to be given to the ability/ease of access to the sites for the cannulator (patient/nurse/carer). The ability to replicate exactly the same arm position is also important for each cannulation session, so the initial position needs to be one of comfort for both

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Buttonhole cannulation principles

patient and cannulator.

Skin preparation
In 1988 Kaplowitz et al. noted that Staphylococcus aureus carriage in the nose and on the skin has been shown to be more common in patients receiving chronic haemodialysis than in the general population. For this reason, meticulous skin preparation prior to any cannulation is of critical importance (Marticorena, 2006). In 2008, Doss et al. indicated that after BHs are established, it is easy for cannulators to become lax and use inadequate skin preparation. As a result, bacteraemia can occur with severe clinical sequelae – outcomes that are not commonly expected with conventional cannulation under stringent hygiene conditions.

Patients should always wash their fistula with soap and water just prior to sitting in their chair. Preferably a chlorhexidine/alcohol preparation should then be used to clean the fistula in a circular rather than paintbrush, side-to-side motion. The chlorhexidine/alcohol preparation offers a long-lasting, antimicrobial effect for some hours after application. It is important to follow the recommended contact time for whatever cleaner is used and know the point at which the preparation becomes effective, for example, only once dried (Ball, 2006). In 2008, Doss et al. indicated that after BHs are established, it is easy for cannulators to become lax and use inadequate skin preparation. As a result, bacteraemia can occur with severe clinical sequelae – outcomes that are not commonly expected with conventional cannulation under stringent hygiene conditions.

Scab removal
Following adequate skin preparation, the scabs should be removed using a blunt-ended (for example, drawing up) needle, forceps or alcoholic chlorhexidine-soaked gauze. Some of the BH needles available have a scab removal device built into their needle cap. It is hoped that the Nipro BH needle with this cap will eventually become standard in Australia. Scabs are all different and, therefore, a variety of methods for their removal may need to be explored. The universally important message is thorough scab removal without damage to the surrounding tissue. Injury to the surrounding tissue or BH edges presents an opportunity for infection.

Patients should be advised not to remove their scabs with their fingernails. There is research which suggests that microbes remain in the base of nail bed even after hand washing (Ball, 2006). Following complete scab removal, a second skin preparation is of vital importance to kill off any bacteria present following scab disturbance.

Cannulation
Prior to needle insertion the arm position, as previously mentioned, should be checked for comfort and ease of reach for the cannulator. Ball (2005) recommends that a tourniquet be applied as proximal to the fistula as possible, that is in the axillary region. Application should be firm NOT tight so as to displace pressure along the whole fistula. A tourniquet firms the access, allowing the cannulator to better feel and see the fistula. This also gives maximum 'plumpness' and roundness to the access, making insertion of the needle into the centre of the vessel more achievable. Tourniquet use should continue for every cannulation even once the BH is established.

Cannulation at the chosen site at the appropriate angle and depth, as indicated with the initial assessment, should be achieved smoothly and fluently. Care should be taken not to push the needle into the fistula too deeply. The hub of the needle should not be pushing into the tissue surrounding the fistula. Ideally 1 mm of stainless steel of the needle should remain visible when taping. This will prevent 'hubbing' where the BH opening is wider than the needle as a result of stretching from the hub (Ball & Mott, 2010). Needles should be taped securely so there is no movement within the fistula and track.

Sharp needles are only used during the track establishment phase. The time taken to establish a track varies between patients and is somewhere between six and 12 cannulations. There are changes with the BH which help indicate that a BH is ready for a dull needle. The BH shape at the opening on the skin changes from a 'v' to a 'u' shape and finally a round hole. The arterial opening may develop a pouty appearance and the venous site a dimpled appearance. Finally, there is a change in resistance to the needle insertion and the needle glides in easily. At this point often the needle feels as if it is being drawn into the tunnel with very little effort required to enter the blood vessel (Ball, 2006).

Once a track is established never return to using a sharp needle. Some extra patience, persistence and troubleshooting may be all that is required when difficulty is encountered. However, if for some reason the BH cannulation is not successful, then insertion of a sharp needle at least 20 mm away from the BH will facilitate access for the treatment (Ball, 2010).

Needle removal
Needles should be removed one at a time and the site held until haemostasis is achieved before the next needle is removed. Always remember that there are two puncture sites per needle which need to be held. There is the hole in the skin at the beginning of the tunnel and
a second at the entry to the blood vessel itself. Due to the angle of cannulation these holes are not directly above and below each other and, therefore, require two fingers to hold the sites correctly (Ball, 2005). Clamps are not recommended for holding sites post-treatment. BH sites can be covered post-treatment as per unit policy.

**BioHole™ pegs**

Some units have had great success with the use of the Nipro® BioHole™ BH device. These are small (5 mm) polycarbonate, single-use pegs, which are inserted into the track left by the cannulation needle. This sterile peg is inserted following haemostasis and sits in the track keeping it patent. The peg does not enter the fistula/bloodstream. Following insertion, the peg is covered with a band aid and a waterproof, adhesive dressing which stays in place until the next cannulation. With some fistulas pegs may be required as few as three sessions before being able to insert a dull needle into the fistula. As soon as the dull needle can be inserted, peg use can be ceased. These pegs can significantly reduce the time required to establish a BH. They, therefore, also decrease the time required for a single cannulator while the BH is being established (Marticorena et al., 2011)

**Tips**

Additional third and fourth BH sites can be established if there is room. This allows for rotation of sites each treatment session and the resting of a site if necessary. It is important, however, to regularly use all the sites to keep them patent and visually apparent to avoid accidental damage with a sharp needle.

Photos and diagrams of the fistula/BH and the angle and direction of needle insertion can be valuable as a reference for all staff and particularly if the patient is required to dialyse at a different facility.

Adequate information should be sent and given to the patient to take on holidays to explain their unique BHs. If the treating unit is not familiar with or able to manage BH access, a request should be made to use a sharp needle for cannulation away from the established BH sites.

**Troubleshooting**

Misalignment causing difficulty with cannulation may be due to not following the originator’s angle of entry. Other reasons can be not stabilising fistula, not using a tourniquet and not holding skin taut. The patient may also have excess fluid overload, causing stretching of the vessel and difficulty lining the vessel wall entrance with the tunnel (Ball, 2010).

Firstly, check the arm is at the same angle and position as when cannulation is normally undertaken, for example, the hand with the thumb up. Check if there is an arm rest or larger pillow than usual under the arm. Realigning the tunnel and opening can be achieved by inserting the dull needle down the tunnel to the point at which resistance is felt. Then gently lift the tunnel slightly until the opening is found or push down slightly until found.

**Conclusion**

BH cannulation is not a new method for haemodialysis access, but with a better understanding of the principles behind this any associated risks can be significantly reduced. For this reason, it is of paramount importance that there is ongoing education of staff and patients regarding the principles of this technique. Comprehensive fistula assessment, skin preparation, attention to scab removal and using a tourniquet constitute the key activities required to achieve successful buttonholing.

**Learning outcome questions and activities**

**Questions**

Q1. In choosing/planning BH sites what should be taken into consideration?

Q2. What skin preparation steps are necessary before accessing a BH?

Q3. Discuss ways in which BH scabs can be removed.

Q4. You are having difficulty accessing an established BH.

a. Why might this be occurring?

**Take away points**

**Always**

- Wash fistula before sitting in chair.
- Assess access – “Look Listen & Feel”.
- Adequate skin preparation.
- Completely remove scabs.
- Align arm, fistula and BHs.
- Use a tourniquet.
- Hold site with two fingers post-needle removal.
- Educate, educate and educate staff and patient.

**Never**

- Cannulate through a scab.
- Pick scabs with fingernails or cannulation needle.
- Overtighten tourniquet.
- Flip needles over once inserted (risk coring the fistula wall).
- Use sharp needle in an established BH track.
- Use clamps on fistula.
b. How are you going to manage this problem?
c. If required to use a sharp needle, where will you cannulate?

Q5. When should you use a tourniquet?

Activities
A1. Find your unit’s policy on fistula assessment and access washing/preparation; is this policy always adhered to?
A2. Check your unit’s policy on AVF cannulation; is there any reference to or recommendation for BH cannulation? If not, find out why not.
A3. Observe all the patients in your care and identify who you think could benefit from BH access. Discuss findings with your vascular access nurse or your unit manager, giving your reasons why you feel BH for the patient/s would be advantageous.

References