

## Definitions of Cannulation Techniques used for Arteriovenous Fistulae and Grafts for Haemodialysis

### **Rope Ladder (aka Different Site Cannulation)**

Rope ladder is cannulation technique used on arteriovenous fistulae (AVF) and arteriovenous grafts (AVG). This involves cannulation of the vein / graft that moves progressively up the vein / graft in a systematic manner at each cannulation, to ensure uniform use of the vein / graft. Each cannulation should be inserted 0.5-1cm above the previous cannulation site, for both arterial and venous cannulation sites. Once the top of the cannulation segment of the vein / graft is reached, cannulation should start at the bottom of the vein / graft again.

To do this requires a straight segment of vein / graft of at least 8cm that will allow cannulation along the full segment of that vein / graft. If the arterial and venous cannulation sites are on the same segment of vein / graft, the cannulation sites should be continuous with the 2 cannulation areas meeting at the middle point on the vein / graft. If separate segments are used for arterial and venous cannulation sites, then each site should have at least 8cm of vein / graft that is used fully.



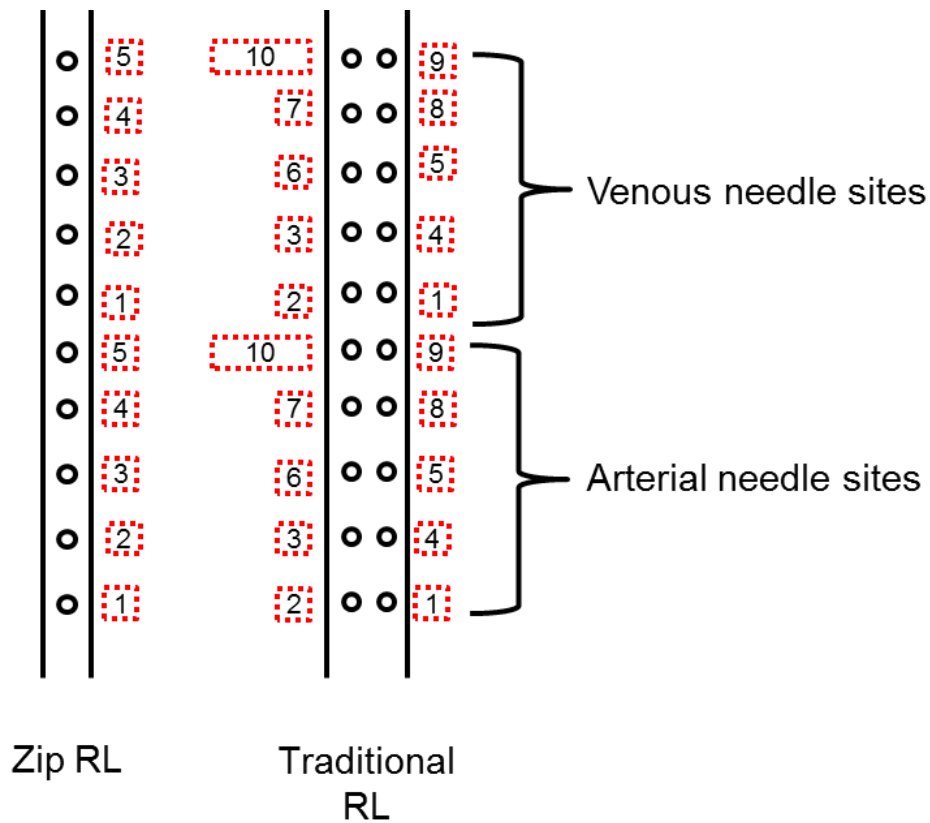
The image above shows an AVF that has undergone rope ladder cannulation. You will see cannulation site scars along the whole length of the cannulation segment.

### **Rope Ladder – Central / ‘Zip’**

If the diameter of the vessel is less than 9mm, the cannulation site for rope ladder should sit centrally above the vein / graft. Each time, the cannulation site sits above the previous cannulation site, in the centre of the vein / graft, until the top of the cannulatable segment is reached.

### Rope Ladder – Side to side / Traditional

If the diameter of the vein / graft is 9mm or more, then rope ladder cannulation sites can move side to side on the vessel, as the diameter will allow this. The cannulation sites should still progress up the vein / graft in a systematic manner, but the next cannulation sites may be to the side of the previous, with future sites then progressing up the vein / graft. Care needs to be taken when using this technique that it does not degrade into area puncture.



### **Buttonhole** (aka same site / constant site cannulation)

Buttonhole is a cannulation technique used on AVF. This involves cannulating each cannulation site on the vein in exactly the same manner during each cannulation i.e entering the skin and vein at the same point, using the same angle, depth and direction of cannulation. Defining features of buttonhole cannulation practice include removal of the scab from the previous cannulation, entering the skin in exactly the same spot, the needle sliding down a single collagen track leading to a single entry point into the vein. The single collagen track is normally developed using a sharp needle in the track development phase and is then converted to a blunt / dull needle once the track is developed.

If multiple tracks are formed at a cannulation site, then this is not classed as buttonhole cannulation, even if the same hole in the skin is used for each cannulation. If multiple tracks are formed on a site, the site must be abandoned due to the increased infection (Ball, 2015) and haemorrhage risk. If multiple entry points are formed on the vein, then this becomes area puncture cannulation, despite entering the same hole in the skin.

Normally buttonhole cannulation is expected to involve 1 arterial needle site and 1 venous needle site. However, it can involve more than 2 cannulations sites, with 3-4 sites. This allows resting of the site for some sessions, particularly when patients dialyse more frequently than 3 times a week.



The image below shows an AVF that has undergone buttonhole cannulation.

### Area Puncture (aka cluster)

Area puncture involves arterial and venous cannulation sites, with each cannulation site covering a maximum of a 5cm segment of vein / graft. However, if both cannulation sites are on a single segment of vein, if they cover less than 8cm between them then this should be considered area puncture. Area puncture often involves moving side to side with cannulation sites, thus puncturing the sides of the vein / graft as well as the central section.

Area puncture is not recommended and should be used with extreme caution as it leads to an increase of aneurysm formation (Kronung, 1984), is associated with a shorter AVF / AVG life span (Parisotto et al, 2014) and associated with a higher risk of haemorrhage (BRS VA SIG, 2016). The risk of stenosis forming adjacent to and in between aneurysms from area puncture cannulation is high. Patients often worry about the appearance of an aneurysmal fistula vein and this can be a barrier to AVF use (Quinn et al, 2008).



The image above shows an AVF that has undergone area puncture cannulation. You will see that both cannulation sites have multiple scars from cannulation over a short segment of vein.

## References

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