

Use of point of care (POC) handheld ultrasound (US) for vascular access in haemodialysis

Ultrasound use has become the standard of care in many haemodialysis units around the world, however its use in guided cannulation in haemodialysis is limited to cannulation of new or complicated accesses. Due to the development of lighter, more portable POC equipment, clinicians are enabled to perform more complex assessments right at the bedside¹.

In 2018 the British Renal Society VASCULAR ACCESS special interest group, together with VASBI published **Recommendation K: Use of Nurse-Led Ultrasound to Assist with Needling** as part of their Clinical Practice Recommendations for Needling of Arteriovenous Fistulae and Grafts for Haemodialysis².

The Recommendations recognise that use of ultrasound technology can make needling of difficult AV access more successful and less traumatic for patients and suggest that each unit should consider investment in this technology and training for nursing staff, to implement this practice to support needling of difficult AV access³.

The objectives of US imaging detailed in the Clinical Practice Recommendations are:

- assessing the maturity of an AVF i.e. newly formed AVF and assist with first cannulation⁴
- assessing the AVF/AVG prior to needling, especially if it's difficult to palpate or to cannulate⁵
- real-time visualisation of the AVF/AVG concurrently with needling and allowing assessment of the vessel's response to needle insertion.

Intraluminal needles positioning during Haemodialysis⁶

Ultrasound evaluations of intraluminal needle position were performed in patients who underwent successful cannulations (i.e., one arterial needle and one venous needle) without ultrasound guidance (blind cannulation) and who had achieved the prescribed pump speed without interruption.

This study showed that the assumption of needle placement in the centre of the vessel lumen with blind cannulation was correct only **9.3% of the time**. These results have important implications related to mechanical and haemodynamic trauma to the inner lining of the access wall.

The unexpected findings of two cases of severe needle engagement (needle tip piercing through the access wall), in which patients had no discomfort and the dialysis machine venous pressures were within parameters, caused much surprise and a new concern. One can wonder how many times "back-walling" occurs during blind cannulation or needle repositioning and goes unnoticed.

Proper needle placement (centre) lessens the high wall shear stress which is associated with intimal hyperplasia and stenosis⁷.

Important findings in Haemodialysis Vascular Access Cannulation

Renal nurses play an integral role in the use of POC ultrasound in haemodialysis. For many years, renal nurses have been cannulating 'blind', leading to missed cannulation and infiltration of the vessels, particularly in new AVFs. Van Loon et al. (2009) reported that in the first six months of an AVF's life there is a 31% chance of missed cannulation, 33% chance of requiring single-needle dialysis and 22% chance of reverting to the use of CVC for dialysis.

They concluded that the cannulation-related adverse events were eventually associated with vascular access failure. The use of ultrasound as part of POC vascular access assessment and cannulation should assist in decreasing these statistics⁸.

International evidence-based recommendations also suggest that ultrasound-guided cannulation should be the method of choice for any type of vascular cannulation due to the higher efficacy and safety of this method⁹

Advantages of POC ultrasound in Haemodialysis Vascular Access ¹⁰
Used as an adjunct to current clinical assessment
Avoid infiltration of the vessel by allowing staff to choose optimal cannulation sites and visualise insertion

Advantages of POC ultrasound in Haemodialysis Vascular Access¹⁰
Identify problems such as deep vessels, areas of previous infiltration, stenosis or thrombosis to avoid during cannulation
Aids in creating an AVF or AVG ‘map’ for subsequent cannulators
Images can be saved and uploaded to patient electronic records or shared among the medical team for case-based discussion.
Decreases the number of patients requiring Doppler ultrasound in the imaging department
Decreases the amount of needle sticks (cannulations) for the patient
Decreases cost if CVC, single-needle, subsequent dialysis sessions and radiology visits are decreased or eliminated
Identify anomalies like the presence of valves
Avoids ‘Backwalling’ or coring of the vessel
Allows early identification of pseudoaneurysms, true aneurysms, thrombus and haematomas

Conclusions:

In striving to achieve the targets set by the Renal Association Clinical Practice Guideline on Vascular Access for Haemodialysis¹¹ i.e. **60% of all incident haemodialysis with established end stage kidney disease commencing planned haemodialysis should receive dialysis via a functioning arteriovenous fistula or graft. 80% of all prevalent long term dialysis patients should receive treatment via a definitive access: AVF or AVG or Tenckhoff catheter,** many aspects of clinical practices should be considered.

US imaging is one such practice that has allowed prompt cannulation of developing AV fistulae and successful cannulation of problematic AV fistulae in units like Derby Hospital⁵

US imaging can be used to assist senior haemodialysis nurses in the assessment of AVF. This is most often used to assess newly formed AVF and assist with first cannulation or following problematic cannulation. Both nurses and patients felt this was beneficial practice that helped with cannulation of AVF⁴

Use of Point Of Care ultrasound visualisation in line with the 2018 the British Renal Society VASCULAR ACCESS special interest group & VASBI needling recommendations may assist centres in their fistula & Graft preservation strategies.

The ability of the patient to have knowledge and understand of their own fistula is a key point in **Recommendation M²** and visualising their fistula using the familiarity of smart phones/ tablets during a conversation with the scanning nurse is a practical way to achieve this.

To help haemodialysis centres to implementing the Nurse-led Ultrasound BRS clinical practice recommendations and introduce ultrasound-guided procedures / protocols, **xtra-med** can assist with further education & training.

To organise a demonstration in your unit with our new hand-held ultrasound visualisation device and experience its benefits, as well for any other questions please contact **xtra-med** at:

info@xtra-med.com; Office: 01663 733522; Mobile 07717 660 461; www.xtra-med.com

1, 8, 9,10 Schoch M.L, Du Toit D., Marticorena R.M., Sinclair P.M. (2015) Utilising point of care ultrasound for vascular access in haemodialysis.
 2. Clinical Practice Recommendations for Needling of Arteriovenous Fistulae and Grafts for Haemodialysis (2018)
 3. Recommendation K: Use of Nurse-Led Ultrasound to Assist with Needling (2018)
 4. Fielding C, Berino L, Fluck R, Owen P, John S, Chesterton L A UK (Kidney Week 2016) Service Evaluation of Nurse-Led Ultrasound Assessment of Arterio-Venous Fistulae and Grafts for Haemodialysis
 5. Fielding C.A., Owen P., Chesteron L., Fluck R.J. and Pitt H. UK (Kidney Week 2014) Development of a Training Package to Assist Senior Haemodialysis Nursing Staff to Utilise Ultrasound Images to Assess Arterio-Venous Fistulae
 6. Marticorena, R.M.; Kumar L.; Bachynski, Jovina Concepcion; Dacouris N; Smith I; Donnel (2018) Ultrasound evaluation of intraluminal needle position during hemodialysis: Incidental findings of cannulation complications;
 7. David Fulker, Anne Simmons, Tracie Barber (Journal of Biomechanical Engineering – Jan 2017 Vol.139 – Computational Model of the Arterial and Venous Needle During Hemodialysis
 11. Clinical Practice Guidelines: Vascular Access for Haemodialysis. UK Renal Association 6th Edition