



PROVINCIAL STANDARDS & GUIDELINES



Use of Portable Ultrasound to Support Cannulation of AV Fistulas and Grafts

Approved July 2017; Updated December 2019
Approved by the BC Hemodialysis Committee

Table of Contents

1.0 Scope.....	1
2.0 Recommendations, Rationale, & Evidence	1
3.0 Assessment of Problems in Vessel (Advanced Cannulators)	3
4.0 References.....	4
5.0 Sponsors.....	4

IMPORTANT INFORMATION

This BC Renal guideline/resource was developed to support equitable, best practice care for patients with chronic kidney disease living in BC. The guideline/resource promotes standardized practices and is intended to assist renal programs in providing care that is reflected in quality patient outcome measurements. Based on the best information available at the time of publication, this guideline/resource relies on evidence and avoids opinion-based statements where possible; refer to www.bcrenalagency.ca for the most recent version.

For information about the use and referencing of BC Renal guidelines/resources, refer to <http://bit.ly/28SFr4n>.



BC Renal
Phone: 604-875-7340
Email: bcpra@bcpra.ca
Web: BCRenalAgency.ca

 [Facebook.com/BCRenalAgency](https://www.facebook.com/BCRenalAgency)
 [@BCRenalAgency](https://twitter.com/BCRenalAgency)
 [Youtube.com/BCRenalAgency](https://www.youtube.com/BCRenalAgency)

1.0 Scope

This guideline makes recommendations about the use of portable ultrasound for:

1. Scanning an arteriovenous fistula (AVF) and arteriovenous graft (AVG) prior to cannulation;
2. Real-time cannulation guidance of an AVF and AVG and assessment of potential problems in the vessel.

This guideline applies to adult patients on hemodialysis.

Related Guidelines (BC, Canada, or International):

- BC Renal:
 - Buttonhole Cannulation of AV Fistulas.
 - Cannulation of AV Fistulas and Grafts using Rope Ladder Technique.
- Canadian Association of Nephrology Nurses and Technologists (CANNT). Nursing Recommendations for the Management of Vascular Access in Adult HD Patients, 2015 Update. www.cannt.ca/en/standards-of-practice/vascular-access-guidelines (available for purchase).
- National Kidney Foundation. KDOQI Clinical Practice Guideline for Vascular Access: 2018. AJKD Submission draft April 2019.

2.0 Recommendations, Rationale, & Evidence

Recommendation 1: Every hemodialysis unit has access to a portable ultrasound machine.

Portable ultrasound has become standard of practice in several HD units in Canada and worldwide for: (1) assessment and scanning of vessels prior to cannulation (competency expected of skilled cannulators in BC); and (2) real-time cannulation guidance of an AVF or AVG and assessment of potential problems in the vessel (competency

expected of advanced cannulators in BC) (Schoch, 2015).

Portable ultrasound has been used in peripheral intravenous cannulation in the non-renal population for a long time. Two systematic reviews and meta-analyses concluded that ultrasound-guided peripheral intravenous cannulation increases the likelihood of successful cannulation compared with the standard technique in patients known to have a difficult access (Stoltz, 2015; Egan, 2012). One of the review studies also noted that there was no difference in time between the two techniques (Stoltz, 2015).

Recommendation 2: Use ultrasound to support cannulation in the following priority situations:

1. Assessment and scanning of vessels **prior to** cannulation (check vein depth, diameter, direction & length) (Nurses who have received orientation on the use of the ultrasound machine).
 - a) New AVFs and AVGs;
 - b) Complicated AVFs and AVGs (see below for specifics);
 - c) AVFs and AVGs with a history of multiple attempts; and
 - d) Established or new AVFs in which a buttonhole track is being established.
2. **Real-time** ultrasound to guide cannulation and assess problems in the vessel (advanced cannulators who have received appropriate training and have significant experience in using ultrasound in the situations listed above).

While no renal-specific, evidence-based guidelines regarding the use of portable ultrasound for assessment and cannulation exists, units that have implemented portable ultrasound report an improvement in vascular access-related outcomes (Marticorena, 2015; Harwood, 2015). The CANNT guidelines recommend the use of portable ultrasound to determine optimal cannulation sites and assess needle position when ultrasound is available (CANNT,

2015 update). KDOQI recommends ultrasound in select patients as needed (not all patients) to help determine proper needle placement and direction of flow (if the ultrasound machine is capable of the latter) to prevent cannulation complications (KDOQI, 2018, draft).

From the perspective of the patient, no downsides have been identified in the literature to the use of portable ultrasound to support cannulation. The benefits include (Kamata, 2016; Schoch, 2015):

- Provides an additional assessment tool
- Increases the accuracy of cannulation by helping with:
 - Selecting the best cannulation site (rope ladder or buttonhole sites)
 - Determining patency, depth, shape, size and direction of vessel
 - Identifying structures in the vessel (stents, valves, etc.)
 - Visualizing the position of the needle in real-time
- Reduces the number of cannulation attempts (miscannulations) which minimizes the trauma and increases the comfort for patients
- Reduces the number of complications associated with cannulation:
 - Fewer infiltrations as cannulators can select optimal sites and visualize insertion
 - Helps to identify problems such as deep vessels, areas of previous infiltration, stenosis, thrombosis and aneurysms to avoid during cannulation
- Facilitates earlier identification of potential problems (e.g., thrombosis/clots, narrowing of vessel)
- May reduce referrals for expensive imaging for what is in essence a cannulation issue rather than a vascular access issue
- Ultrasound can be used to create an AVF or AVG “scan” for subsequent cannulators

- Images can be saved and uploaded to patient electronic records or shared among the kidney care team for case-based discussion.

Potential barriers to the use of portable ultrasound identified in the literature include (Kamata, 2016; Schoch, 2015):

- Training required to acquire and maintain skills and the costs associated with the training
- Finding the time to use the ultrasound prior to and during cannulation
- Availability and costs of portable ultrasound machines

The types of patient/accesses most likely to benefit from the use of ultrasound are likely to include: (Kamata, 2016; BCPRA Cannulation Learning Plan, 2016):

- New AVFs and AVGs.
- Complicated AVFs and AVGs which have one or more of the cannulation complications listed below:
 - Vein not easily palpable (vein deep or inconsistent depth; vein depth of $>.6$ cm; vein may roll upon palpation)
 - Vein narrow (vein diameter of $<.6$ cm)
 - Poorly defined area of straight vein available for cannulation
 - Visible dilated area or aneurysm formation that may interfere with cannulation
 - Visible collateral veins that may interfere with cannulation
 - Access limb has signs of edema, bruising, or local infection
 - Recent and repeated infiltrations
 - Access flow of <500 mL/min
 - Suspected thrombus
 - Patient has muscle spasms or limb tremors
 - Patient is highly anxious about needling or restless and confused
- AVFs and AVGs with a history of multiple attempts.

- Established or new AVF in which a buttonhole track is being established.

Recommendation 3: Nurses (RNs and LPNs), with appropriate training, may utilize ultrasound to support the cannulation of AVFs and AVGs.

The BC College of Nursing Professionals (BCCNP) regulations allow Registered Nurses (RNs) and Licensed Practical Nurses (LPNs) to apply ultrasound without an order:

RNs:

- Regulation 6 (1) (i) allows RNs to apply ultrasound without an order for the purposes of blood flow monitoring.
- The source document is available at: http://www.bclaws.ca/civix/document/id/complete/statreg/284_2008

LPNs:

- Regulation 10 (ii) allows LPNs to apply ultrasound without an order for the purposes of blood flow monitoring.
- The source document is available at: http://www.bclaws.ca/civix/document/id/complete/statreg/224_2015

For the purposes of this guideline, the RN and LPN regulations have been interpreted to include: **transonic monitoring, fistula/graft assessment, needle tip confirmation and real-time guidance during cannulation of a fistula/graft.**

Recommendation 4: Training on the use of ultrasound to support cannulation needs to include both theory and hands-on practice.

In order to obtain basic hand-eye coordination, theoretical sessions on ultrasound use, as well as practical sessions using phantom models are recommended prior to its use in the clinical setting with patients (Marticorena, 2015). It takes approximately 500 guided cannulations of combined

new and complex accesses to achieve an advanced level of competency (Marticorena, 2014).

Several resources are available to support the training of cannulators on the use of ultrasound to support cannulation.

- 1. Assessment and scanning of an access prior to cannulation** (Nurses who have received orientation on the use of the ultrasound machine)

BCR Powerpoint: [Ultrasound to Support Cannulation](#)

- 2. Real-time ultrasound guided cannulation (advanced cannulators)**

Ontario Renal Network Vascular Access Education Program (self-directed learning). Module 4: Cannulation. <https://my.desouzainstitute.com/external/courses/view/908>.

Kamata, T. et al article (2016). <https://rrtjournal.biomedcentral.com/articles/10.1186/s41100-016-0019-1>. Accessed Nov 5, 2019.

BCR PPT: Real-Time Ultrasound-Guided Cannulation (to be developed - future)

3.0 Assessment of Problems in Vessel (Advanced Cannulators)

BCR Cannulation for the Skilled Cannulator: <https://tinyurl.com/ybsp1lr2> Accessed Nov 5, 2019.

BCR Cannulation Workshop: www.bcrenalagency.ca/resource-gallery/Documents/VA%20Workshop%20FINAL%202015%20sV2.pdf Accessed Nov 5, 2019.

Article by Schoch (2016): <https://tinyurl.com/y7bm548e>

4.0 References

Egan G, Healy D, O'Neill H, Clarke-Moloney M, Grace PA, Walsh SR. (2013). Ultrasound guidance for difficult peripheral venous access: systematic review and meta-analysis, *Emergency Medicine Journal*, 30:7, 521-526 doi:10.1136/emered-2012-201652, <http://emj.bmj.com/content/30/7/521> (accessed Nov 18, 2016).

Harwood L, Wilson B and Oudshoorn A. (2015). Improving vascular access outcomes: attributes of AVF cannulation success; *Clinical Kidney Journal*; 10.1093/ckj/sfv158; <https://academic.oup.com/ckj/article/9/2/303/2462508>

Kamata T, Tomita M, Lehara N. (2016) Ultrasound-guided cannulation of hemodialysis access. *Renal Replacement Therapy* 2:7, DOI 10.1186/s41100-016-0019-1; <https://rrtjournal.biomedcentral.com/articles/10.1186/s41100-016-0019-1> (accessed Nov 18, 2016)

Marticorena RM, Mills L, Sutherland K, McBride N, Kumar L, Bachynski JC, Rivers C, Petershofer EJ, Hunter J, Luscombe R, Donnelly S. (2015) Development of competencies for the use of bedside ultrasound for assessment and cannulation of hemodialysis vascular access, *CANNT Journal*, 25:4, Oct-Dec 2015, p.p. 28 - 32. W (accessed Nov 18, 2016)

Marticorena, R. M., Kumar, L., Dhillon G., Tria, J., Zevart, D., Sirpal, S., Smith, I., Suneja, S., Shan, X., Kajbaf, S., Aziz Walele, A., Sachdeva, J. S., Mehta, H. K., Reen, B. S., & Donnelly, S. M. (2014). Real-Time Imaging of Vascular Access to Optimize Cannulation Practice and Education: Role of the Access Procedure Station [Abstract]. *Journal of the American Society of Nephrology*, 25, 891. www.asn-online.org/abstracts (accessed Nov 25, 2016)

Nephrology Clinical Educators Network (CEN) and Canadian Hemodialysis Access Coordinators Network (CHAC), Nursing Recommendations for the

Management of Vascular Access in Adult Hemodialysis Patients, 2015 Update. www.cannt.ca/files/CANNT-VA%20Guidelines-2015Oct16-NP.pdf (accessed Nov 18, 2016).

Schoch ML, Du Toit D, Marticorena RM, Sinclair PM. (2015) Utilising point of care ultrasound for vascular access in haemodialysis, *Renal Society of Australasia Journal*, 11:2, July 2015; www.renalsociety.org/public/6/files/documents/RSAJ/06%20schoch.pdf (accessed Nov 18, 2016)

Stoltz, L, Stoltz, U, Howe, C, Farrell, I & Srikar, A (2015). Ultrasound-guided peripheral venous access: a meta-analysis and systematic review. *J Vasc Access* 2015; 16:4: 321-26. www.vascular-access.info/article/ultrasound-guided-peripheral-venous-access--a-meta-analysis-and-systematic-review (accessed Nov 18, 2016)

5.0 Sponsors

Developed by:

- BC Renal Vascular Access Educators Group (finalized July 18, 2017; updated Dec 5, 2019)

Reviewed by:

- BC Renal Renal Educators Group (April 27, 2017; update reviewed Dec 5, 2019)

Approved by:

- BC Renal Hemodialysis Committee (Update reviewed January 15, 2020)

For information about the use and referencing of BCR provincial guidelines/resources, refer to www.bcrenalagency.ca.