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

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IMPORTANT INFORMATION

This BCPRA 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 BCPRA provincial guidelines/resources, refer to http://bit.ly/28SFr4n.
1.0 Scope

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

1. Mapping of 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:

- 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.

2.0 Recommendations, Rationale, & Evidence

Recommendation 1: Consider using ultrasound to support cannulation in the following situations:

1. Assessment and mapping of vessels prior to cannulation (check vein depth, diameter & length) (RNs and LPNs with appropriate training).
   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 RN cannulators with appropriate training and significant experience in using ultrasound in the situations listed above).

Portable ultrasound has become standard of practice in several HD units in Canada and worldwide for: (1) assessment and mapping 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). This has likely been driven by the availability of lighter, more portable equipment.

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).

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.
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(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).

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, patches, 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 “map” 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 > 0.6 cm; vein may roll upon palpation)
  - Vein narrow (vein diameter of < 0.6 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
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- 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 2: Registered Nurses (RNs) and Licensed Practical Nurses (LPNs), with appropriate training, may utilize ultrasound to support the cannulation of AVFs and AVGs.

The College of Registered Nurses of BC (CRNBC) regulations allow RNs to apply ultrasound without an order:
- Regulation 6 (1) (i) allows RNs to apply ultrasound without an order for the purposes of blood flow monitoring. For the purposes of this guideline, this has been interpreted to include: transonic monitoring, fistula/graft assessment and needle tip confirmation. Real-time ultrasound guidance during cannulation is not included for LPNs because the focus of LPN care is on stable, predictable and uncomplicated patients/accesses.
- The source document is available at: www.clnbc.org/Documents/Practice-Support-Documents/Scope-of-Practice-ONLINE.aspx

Recommendation 3: Training on the use of ultrasound to support cannulation needs to include both theory and hands-on practice.

RNs and LPNs can use ultrasound to support cannulation in two ways:

1. Assessment and mapping of vessels prior to cannulation (check vein depth, diameter & length). (RNs and LPNs)
2. Real-time ultrasound to guide cannulation and assess problems in the vessel. (advanced RN cannulators with significant experience in using ultrasound)

Competencies for assessment and mapping of vessels prior to cannulation include knowing/demonstrating:
- Indications for use of ultrasound
- Basic principles of ultrasound
- How to operate the ultrasound device
- How to visualize the vessel
- How to disinfect probes

Additional competencies for using ultrasound in real-time to guide cannulation and assess problems in the vessel include knowing/demonstrating:
- How to utilize ultrasound to guide cannulation.
- Understanding of ultrasound images & abnormalities (e.g., stenosis, aneurysms, calcification, etc)
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 mapping of an access prior to cannulation (skilled cannulators)**

   BCPRA PPT: Ultrasound to Support Cannulation: [https://tinyurl.com/yaqgo8yz](https://tinyurl.com/yaqgo8yz)

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

   Ontario Renal Network: Cannulation Training Video (ultrasound portion starts at 12:24/20.44 minutes into the video) [https://tinyurl.com/yc26hfsn](https://tinyurl.com/yc26hfsn)

   Article by Kamata (2016), including 2 additional video files
   - Videos:
     - Scroll to the bottom of the page, click on the blue type “Additional file 1” (Ultrasound-guided deep peripheral vein cannulation). Wait for it to download - it is a large file and takes a while.
     - Scroll to the bottom of the page, click on the blue type “Additional file 2” (Control of a needle tip within the lumen of a vessel).

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

3.0 **Assessment of Problems in Vessel (Advanced Cannulators)**

BCPRA Cannulation for the Skilled Cannulator: [https://tinyurl.com/ybspllr2](https://tinyurl.com/ybspllr2)

BCPRA Cannulation Workshop: [www.bcrenalagency.ca/resource-gallery/Documents/VA%20Workshop%20FINAL%202015%20sV2.pdf](http://www.bcrenalagency.ca/resource-gallery/Documents/VA%20Workshop%20FINAL%202015%20sV2.pdf)

Article by Schoch (2016): [https://tinyurl.com/y7bm548e](https://tinyurl.com/y7bm548e)

4.0 **References**


5.0 Sponsors

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