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Background

AHS suggests a limit of four attempts at traditional peripheral vascular access,\(^1\) however there are limited current options at many sites for these patients. Between 10 and 25 percent of patients present to the emergency department (ED) with difficult to cannulate veins.\(^2,3\) In these patients ultrasound guided catheter placement has been shown to decrease the number of intravenous (IV) attempts,\(^4\) decrease time to successful IV placement,\(^5,6,7\) improve patient satisfaction,\(^8\) and in adult patients decrease central line use.\(^9,10\) Emergency nurses have been shown to successfully employ ultrasound-guided peripheral vascular access.\(^9,11,12\) Nursing clinical practice guidelines place a high recommendation for this practice.\(^13\) This education resource supports that practice.

ED nurses are experts at placing IV’s using traditional techniques and this skill is gained over years of practice and is invaluable to patient care. In some cases however we have to ‘make do’ with a suboptimal placement, either a smaller gauge cannula or a site that is not ideal (e.g. a point of flexion). Ultrasound is a tool that provides expert nurses a greater range of vein choices so as to place the best IV in the best location.

Similar to traditional IV placement technique, the physical skill of ultrasound guided IV is relatively simple, this resource focuses on the tips and tricks to improve success as well as how to apply or fit this new skill into routine clinical practice.

Ultrasound-guided peripheral intravenous catheter placement

Scope: Registered Nurses (RN) and Advanced care Paramedics (referred to as qualified health care professional (HCP))

A patient specific provider order for ultrasound use is not required; however inform the attending physician if the patient is to have limited IV options that might effect a planned PICC, or central line placement.

Definition

Ultrasound-guided peripheral intravenous catheter (UGIVC) placement is when ultrasound is used to assist a qualified health care provider with IV cannulation from skin puncture through venipuncture via direct visualization on an ultrasound machine in real time. UGIVC placement fills a gap in patient care when peripheral IV access is assessed to be difficult with traditional peripheral IV access methods of vein visualization and/or palpation, intraosseous access, and central venous access.

Purpose

The purpose of this education package is to describe the process, education, and training required to ensure minimum safe practice with UGIVC placement within those sites whose patient care managers (PCM) approve its use and where a qualified health care provider has completed the competency requirements to utilize the skill.
Learning Plan

It is the duty and responsibility of all health care providers is to self-identify learning needs and undertake appropriate measures to ensure continual competency, as determined by their regulatory body and specific work setting.

Target Audience: UGIVC procedure is restricted to qualified health care providers who demonstrate competency after didactic and clinical education and training.

Insertion of an UGIVC by a qualified health care provider can be performed when:

- Skill performance is deemed appropriate by site operational leadership
- The work setting has opportunities to maintain competency in UGIVC insertion

Competency training: Insertion of an UGIVC is a restricted activity for Registered Nurses (RNs). This competency requires:

1. Complete this training module and its associated learning activities
2. Complete the online self-assessment with a pass mark of 100%. (or 80% via closed book copy)
3. HCP should consult with a CNE to resolve any knowledge deficiencies.

Procedure for attaining ultrasound-guided competency

1. Review the learning package to support knowledge competency.
2. Completion of examination
3. Upon successful completion of the exam, the HCP will arrange to attend a training session with a CNE or designate facilitator*. The goal is vein identification/selection and assessment and IV insertion technique on a simulated gel model.
4. Three successful UGIVC insertions proctored by a mentor** within three months. If not completed within this time period, the health care provider should demonstrate insertion technique on a gel model with a facilitator prior to patient placement.
5. After three successful proctored placements, the HCP provider may place UGIVC independently.
6. Annual competency revalidation will be required to maintain this competency. (Note: ongoing competence of 12 successful placements a year is required in lieu of annual assessment and recertification and will be self-reported by the qualified HCP)

* this designate is defined as a qualified HCP who has technical competency as well deemed competent at teaching the procedure as assessed by the site CNE.
** A mentor has a minimum number of successful starts to support the learner while also ensuring best patient care. There is no fixed number of successful starts, but a minimum suggested number is 20. Prior to this number there remains significant personal skill development of the mentor. The site CNE/manager will designate who can mentor others in this skill, as other non-clinical factors can play a part in this decision (e.g. interpersonal communication). See role of mentor below for further information.

Objectives

i. Knowledge

Upon completion of this learning package the HCP will be able to:

1. Discuss the infection prevention and control practices (i.e. PPE, hand washing, probe and site cleaning) when performing UGIVC.
2. Identify the indications and contradictions for UGIVC.
3. Describe the anatomy, physiology, and landmarks of commonly used veins.
4. Describe the principles of the ultrasound technology including ultrasound probe (referred to as ‘probe’ in this document) selection.
5. Identify the possible complications related to UGIVC.
6. Describe the aftercare of the intravenous catheter including securing/stabilization of the device.
7. Identify the role of the nurse with ultrasound training in supporting other staff gaining traditional IV placement experience

ii. Skill

Demonstrates the following skills:

1. Prepare the probe, equipment, environment, and patient.
2. Select the appropriate insertion site and catheter size and length.
3. Prepare the insertion site.
4. Insert and secure the intravenous catheter that has been placed by ultrasound guidance.
5. Confirm location of intravenous catheter in the vein.

NOTE: See Appendix A for clinical performance criteria and skills checklist
Clinical Indications

Consider placement of an UGIVC for patients who require IV access to administer medications, IV fluids, and/or blood products that do not require immediate central venous or IO access and who meet one of the following criteria:

1) Patient is known or suspected to be a difficult IV access without visible or palpable peripheral vessels.

2) Does not have an optimal site for IV placement that is easy to cannulate by traditional placement technique (e.g. avoiding an area of flexion for planned long term use of an IV, or allowing an optimally sized IV catheter to be placed in larger vein than what would have not been possible (or easy) with direct IV placement)

i.e. Ultrasound should be considered for a patient whose veins are “not easy or not optimal” to cannulate.

The Provincial Clinical Care Topic Vascular Access Device Infusion Therapy recommends that IV attempts should be limited to a maximum of four. To best meet this recommendation, patients who are assessed as having moderately difficult to cannulate veins by traditional technique should be considered for early assessment by a HCP with UGIVC competency wherever possible.

A recent study with experienced ED nurses and techs found that in adult patients predicted to be moderately difficult prior to IV attempt, the use of U/S improved IV success (71% to >75% respectively) with far more benefit for predicted harder difficulty. In pediatrics a recent RCT found significant time savings (14 minutes vs 28 minutes) improved first pass success (85% vs 45%), and improved dwell time of the IV 7 days vs 2 days with ultrasound use in patients predicted to be difficult access by the DIVA assessment scale (information on next page).

NOTE:
Ultrasound guided peripheral IV has a learning curve like traditional IV placement. Upon successful completion of this learning module, providers will have the minimal training and experience to safely start utilizing ultrasonography to assist in IV placement. Local data from our QI registry has found that practitioners with 10 to 20 starts achieve around 75% first pass success and higher success with greater than 30 starts. It’s key to focus on a learning plan similar to traditional IV placement techniques to improve competence and confidence. Take every opportunity you can when learning to utilize ultrasound when clinically indicated and your other clinical priorities allow. The time of the procedure will reduce significantly to less than what it takes utilizing traditional technique on patients with difficult to cannulate veins.
There are two scoring systems that help you understand the chances of first pass success using traditional IV technique in pediatrics and adults patients respectively.

**DIVA Scoring Tool\(^{16}\) predictor of IV difficulty in pediatrics**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>0 Points</th>
<th>1 Points</th>
<th>2 Points</th>
</tr>
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<tbody>
<tr>
<td>Visible Vein</td>
<td>Visible</td>
<td>-</td>
<td>Not Visible</td>
</tr>
<tr>
<td>Palpable Vein</td>
<td>Palpable</td>
<td>-</td>
<td>Not palpable</td>
</tr>
<tr>
<td>Age</td>
<td>≥ 36 months</td>
<td>12-35 months</td>
<td>&lt;12 months</td>
</tr>
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If DIVA 3 or greater (e.g. age less than 12 months and non-visible veins) predicted first pass success with traditional IV placement is less than 50%, so ultrasound guided IV should be initially considered or an experienced clinician consulted to make an attempt following best practices.\(^{15}\) Always consider techniques to enhance vein dilation/visualization per routine practice\(^{1}\) such as hot packs, vein viewer, or trans-illumination.

Of interest, QI feedback from a local ultrasound user was that for their first nine months experience of placing UGIVC on pediatric patients: their patients had over 4 traditional attempts, compared to the subsequent nine months with only two traditional attempts. This was attributed to their colleagues becoming aware of the provider and the option of ultrasound.

**Modified DIVA to predict adult difficult access and first pass success.\(^{17}\)**

Each aspect below scores one point and points are totaled up.

- Known history of a difficult IV access
- Expect a failed first attempt or difficult IV access
- Not able to palpate a vein
- Not able to visualize a vein
- Largest vein diameter <3 millimeters

<table>
<thead>
<tr>
<th>Score</th>
<th>Predicted first pass success with traditional technique</th>
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<tbody>
<tr>
<td>0</td>
<td>98%</td>
</tr>
<tr>
<td>1</td>
<td>90%</td>
</tr>
<tr>
<td>2</td>
<td>69%</td>
</tr>
<tr>
<td>3</td>
<td>55%</td>
</tr>
<tr>
<td>4</td>
<td>14%</td>
</tr>
<tr>
<td>5</td>
<td>2%</td>
</tr>
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A score of 2 is considered moderate and this predicted first pass success percentage is lower than that of ultrasound use.

A suggested ED clinical pathway for pediatric patients is provided in **Appendix A** for individual and site consideration. The aim is to gain IV access of an appropriate gauge and location in the minimal number of attempts.
Videos

These videos will demonstrate ultrasound use for vascular imaging and IV placement. They don’t demonstrate completely the technique we teach but will provide good background. (used with permission)

Placement technique demonstrating sterile technique. (Note: video comment on use of 1” IV catheter for vessel 0.5cm deep: better practice would be using a 1.75” catheter, also not demonstrated is assessing tip placement and length of cannula intra-lumen)
https://www.youtube.com/watch?v=aacYrpjF0Kc

Peripheral Venous Access Under Ultrasound Guidance - Part 1 - SonoSite, Inc
https://youtu.be/IREUPXcPkJ8

Peripheral Venous Access Under Ultrasound Guidance - Part 2 - SonoSite, Inc
https://www.youtube.com/watch?v=riizCYcXhRU&feature=youtu.be

Ultrasound guided dynamic needle tip positioning in peripheral artery and vein cannulation as well as how to save a posterior wall puncture. NOTE - no sound on video.
https://www.youtube.com/watch?v=QAJ5rbJua7U&t=3s

Supplies

The only separate supplies from a standard IV start are:

- A longer intravenous catheter (e.g. 4.5cm and 6.4cm)
- Ultrasound gel**
- Gauze or a cloth to wipe away the extra gel prior to site cleaning
- Chlorohexidine swabs work better than the square swaps but both work
- Bedside table to support arm bracing

**NOTE: A technique that starting to be utilized using a chlorohexidine swab in place of the gel. The site is cleaned with the swab and the probe is placed on the still wet solution taking care not to touch the sterilized insertion point. This technique is best utilized by non-novice providers who can place the IV relatively quickly.
Contraindications

- All contraindications of routine IV placement relate to UGIVC such as traumatic injuries/burns to limb
- Infections in the limb
- Presence of arteriovenous fistulas
- Deep vein thrombosis in the limb
- Deep veins where the catheter used will result in less than a third of the catheter being situated in the vein. (e.g. a vein deeper than 1.5 cm when using a 4.6cm long catheter)
- Post mastectomy

Complications

All complications associated with traditional IV placement can affect UGIVC (e.g. local infiltration, cellulitis, and thrombophlebitis). Additional complications that apply to ultrasound guided IV placements include the following (mitigating techniques included):

- Arterial puncture has been documented to occur approximately 2% of the time when attempting to cannulate veins close to the brachial complex which is similar or slightly less than traditional landmark techniques in this area (only consider vein cannulation in the brachial complex when sufficient procedural skill with tip tracking has been developed)

- Larger hematoma formation may be decreased or avoided with the application of firm pressure of at least 2 minutes after an unsuccessful cannulation attempt. (In these cases pressure should be placed over the site of the vein cannulation and not just the skin puncture site)

- Risk of extravasation is increased compared to non-ultrasound guided IV placement.\textsuperscript{18} (ensure greater than two thirds of catheter is in the vein: visualized on longitudinal view)\textsuperscript{19}

- Traditionally risk of complication increases as vessel depth increases with vessels deeper than >1.6cm not previously recommended. This was based on studies that utilized 1.88” (4.5cm) long catheters. Newer research found that 100% of catheters failed within 15 hours if <30% of the catheter was in the vein compared to 0% failure for >65% of the catheter in the vein. Consider this finding for all depths of veins to ensure appropriate catheter length is chosen for the target vein.\textsuperscript{19} (Utilize longer catheters (such as 2.5” or 6.3cm) whether possible for veins 1cm and deeper. Also utilize a steep angle of catheter insertion till just before vein cannulation to facilitate threading)

- Nerve damage when attempting veins in close proximity to nerve bundle. (preferentially avoid veins in proximity to nerves such as the ulnar nerve on the medial aspect of the arm close to the elbow, and radial nerve on the lateral aspect of the wrist.)
Figure 1 above: Basilic vein (BV) anteriorly and ulnar nerve posteriorly, probe in transverse orientation, proximal to elbow, oriented medially.

Figure 2. Relationship of Brachial artery (Br A), Brachial vein (Br V), Median nerve, and Basilic vein (B V). Probe is oriented in transverse, proximal to the elbow, marker (M) pointed laterally. Note: there are usually PAIRED brachial veins that run with the brachial artery, but only one of them is visible in this image.

- Increased success is seen with larger vessels. Some studies reported a low success if the vessel is <3mm diameter, though in our experience these can be successfully cannulated with a high first pass success.
Clinical Tip:

When high risk medications are infusing, increase vigilance through site assessment and patient teaching is required.

Confirm that sufficient catheter length is in the vein (i.e. greater than 65%)\textsuperscript{19}

 Probe selection

The high-frequency linear array probe should be used, as it provides higher resolution of the superficial areas of soft tissue. Two examples of high frequency probes are shown below (those not marked by the “X”)

Clinical Tip

Probe is very fragile and significant care should be taken not to drop it. Either hang the probe in its cradle or hold onto it, don’t leave it lying on the bed. Also protect the probe cable from damage from being caught in the wheels.
Vein selection

The same veins of the arms as described in the vascular access clinical care topic can be utilized to cannulate via ultrasound guidance, as are the same veins or areas to avoid.\textsuperscript{1} The goal is to cannulate the largest most distal vessel that can be visualized with the least surrounding structures (e.g. artery, nerve bundle). In general order of choice to cannulate (baring any contraindications)

**First cannulation choice**: forearm veins on both arms such as the cephalic, basilic and median veins. Ideally avoid veins on the lateral aspect of the wrist as the radial nerve runs in close proximity. Also ideally avoid approximately 10cm distal to the antecubital fossa (AC) since cannulating here will result in the catheter tip ending up dwelling in the AC which will occlude with arm flexion.

**Second cannulation choice** is the cephalic vein on the lateral aspect of the upper arm. The vessel is generally straight with no associated nerve or artery.

**Third cannulation choice**: basilic vein on the medial aspect of the upper arm. To avoid the ulnar nerve that is present around the elbow, start most distal just proximal to the bifurcation with the median and basilic veins.

**Forth cannulation choice** is the brachial vein. Care is required to maintain tip visualization throughout insertion due to the brachial nerve and artery being in close proximity.

Patient factors and provider positioning can play a role in the above selection of veins.
Patient factors

**Mobile tissue**: mobile and soft subcutaneous tissue often found around the brachial and basilic veins can lead to mobile veins that have significant vertical movement with light ultrasound probe pressure. *This is commonly seen with geriatric patients, particularly women.* To assess for mobile tissue, remove pressure from the probe and slowly lift the probe off the surface of the skin and assess for vertical movement of the vein. If there is excessive movement, perhaps >5mm, then this makes for more challenging placement. The problem with mobile tissue is that, when cannulating the vein, when the catheter just enters the lumen if pressure is removed from the probe the vein would pull or drop away from the catheter and the site would blow. It is also important to measure/estimate the true depth of the vein when pressure is off the probe to use the appropriate length IV. Trouble-shooting for placement includes using a second provider to maintain skin tension on the underneath of the arm while keeping clear of the IV placement site. This can be utilized in both pediatrics and adult patients.

**Mobile and calcified vessels**: these are sometimes hard to identify until placing the cannula. In older patients there is often less subcutaneous tissue to ‘anchor’ the vein, and the vein might be calcified. Trouble-shooting placements with this include using a second provider to maintain skin tension, cannulating just above a bifurcation that might provide some additional vein traction, and using a dynamic vein cannulation technique where the catheter tip is advanced to just above the vein and then the angle of the catheter is lowered and a dynamic forward movement is made like in a traditional placement with the aim of cleanly penetrating the lumen. To assist with catheter advancement it helps to continue to tip track the catheter up the lumen until significant length is in the vein prior to separating cannula from needle.

**Pediatric patient placement factors**

As discussed above pediatric patients predicted to be difficult traditional IV placement should be considered for an UGIVC. A location that is particularly useful to look is the forearm. This area can be braced during placement as well as well secured afterwards. Tips a tricks that can be employed include

- Using ultrasound just to confirm location and presence of vein, then using traditional technique
- When using small IV gauges on infants the pressure of advancing the IV collapses the vein. Use an ‘advance then stop method’ to allow for the vein to return to flow
- Utilizing at least one other provider to stabilize the arm. (often two is required)
- Use local analgesic (e.g. maxilene) and all conventional distraction methods whenever possible
- Using a technique where once the cannula is under the skin it is advanced with a light touch which allows the cannula it to move with patient movement.
- When cannulating the vein a modified technique can be attempted where a flat angle is used and the needle advanced like traditional technique rather than tip tracked up the vessel a long way (useful when there is lots of patient movement)
- IV choice consideration is similar to adults regarding catheter length in vein. Longer 22g (4.5cm) and 24g (1.25cm)IV are particularly useful.
Provider factors

Provider positioning affects how steady and clear an image can be generated, as well as how steadily the catheter can be placed. After appropriate vein selection this is perhaps the most important step to support successful cannulation. Ideally, both arms/hands can be braced or rested during placement. For the hand holding the ultrasound probe, the 5th and possibly the 4th digits can be used to stabilize the hand against the patient’s skin. Ideally this arm’s elbow is also braced. For the dominant hand inserting the catheter, the 4th and 5th digits can again be resting against the patient or other item to stabilize. An area where this is a challenge is when a patient is not able to rotate their arm outward enough and attempting to cannulate veins of the inner (lateral) arm such as basilic and upper brachial veins.

Ultrasound screen position should be in-line with the placement site and the provider’s arms, so that they can look directly at the screen and not off to one side. This might result in the best location for the machine to be across the bed.

Patient and provider positioning

The use of a table and a chair, or having the bed at the correct height is key. If required an assistant is useful to help stabilize the arm in cases where patient movement is expected, or if significant mobile soft tissue that needs to be displaced.

Note:

- Table to brace both probe arm (key to rest the elbow) as well as IV hand
- Bracing probe hand against patient skin to anchor probe
- Hand/finger position on IV: held towards the back to assist with fine tip control
- Second provider assistance with triceps tension (if mobile tissue).
Short-axis (Transverse) probe technique:

- Clean probe with disinfectant.
- Set up patient, equipment and provider to optimize success
- Hold probe in the non-dominant hand
- Place probe (with ultrasound gel on it) transversely across the area of interest.
- Ultrasound display & probe marker on the left side of the screen. (Left/right movements on display correspond to left/right movements of catheter).
- Examine the arm with the ultrasound, attempting to find the most suitable vein for IV access. Select vein choice based on best choice noted above
- Assess vein depth and presence of mobile tissue by lifting up on the probe. If mobile tissue consider using an assistant to support
- Once target vessel identified, center and enlarge it on the screen display.
- Compress the vessel with the probe to distinguish artery from vein. Two indicators are used to differentiate between a vein and an artery.
  1) Vein will collapse more readily than an artery.
  2) The artery will be pulsatile (compress vessel approx. ½ way to visualize best)
- Wipe away the gel from the area to cannulate
- Cleanse the skin area per standard procedure, once clean use an aseptic no-touch technique (ensure the probe is not moved back over the sterile site)
- With the target vessel centered on ultrasound display, the point of catheter entry is in front of the probe in the middle. (to ensure that the IV will not be placed too deep prior to coming into the view of the ultrasound screen)
- Hold catheter towards back in a pen like hold, Insert catheter at a steeper angle than traditional IV placement (30 - 45 degrees depending on target vein depth)
- Once catheter under the skin, pause and adjust probe to visualize needle tip.
- As the catheter is advanced slide the probe incrementally up the arm each time the tip of the catheter is visualized until the vessel is entered. (tenting of the vessel or ring sign is often seen prior to the catheter entering the vessel)
- Once the catheter tip is in the vessel **flatten the catheter angle to the skin and advance the catheter in the vein another approximately 1cm prior to separating the needle from the catheter** and advancing the catheter as usual. Keep tracking the needle tip within the vein to prevent damage to the posterior or lateral walls of the vein.
- Procedures for securing the UGIVC, disposing of sharps, and drawing blood-work are performed in the same manner as for non UGIVC.
- Once IV secured, confirm ultrasound guided catheter tip (See section below)

NOTE: Short-axis (transverse) technique has been found to be easier for both novice and expert sonographers, with improved first pass success, quicker access, and decreased complication rates compared with the long-axis (Longitudinal) technique.20
Conformation of IV placement

Best practice is to confirm IV catheter placement. UGIVC have a higher reported failure rate than traditional IVs and can be harder to assess placement via traditional methods. Conformation steps should include assessing for catheter tip in the vessel as well as assessing approximate length of catheter in the vein as follows:

- Visualization of cannula within the lumen of the vein
  - on transverse orientation: ‘bull's eye’ or ‘vanishing target’ sign as the probe is slid away from the IV hub.
  - on longitudinal orientation: catheter seen lying within lumen (See pictures next page)

- Observing fluid flowing within the lumen of the vein (either via an NS flush or via ongoing IV fluid infusing). See link http://blog.5minsono.com/diva3/ for videos of how successful intra-lumen flush and interstitial IV flush appears on ultrasound. Can also been seen as “blinking” of the vessel when the IV flush is pulsed.

Confirming adequate catheter length in the vein

If there is less than 30% of the catheter in the vein it was found that 100% of catheters failed within 15 hours. If there was more than 65% of the catheter in the vein none failed. In-between the extremes there is an increasing longevity with more catheter length in the vein. It is not required to physically measure the catheter length and calculate this percentage. But visualization will provide you with an accurate assessment as demonstrated below.

See over for examples of inadequate and adequate catheter length in the vein.
Example of inadequate catheter length intra-lumen.

Example of adequate catheter length intra-lumen

If there is not adequate catheter length identified intra-lumen consider the planned use of IV and whether it can be safely used e.g. the site might be adequate for immediate blood draws and IV fluid resuscitation but inadequate for CT contrast or medication infusions that are vesicant. If the site is used, careful taping the site so that traction is maintain proximally, as well as minimizing arm movement might prolong the IV. Consultation with the physician to support this decision making around the IV and its use would be reasonable.
Considerations and Safety Precautions

- **Extended time may be required to place an ultrasound-guided IV**
  - The time to place an UGIVC will decrease with experience and practice.
  - At one local site their initial experience of the length of time the nurse left their assignment to place an ultrasound guided IV was: Did not leave 14%, 0-5 minutes 6%; 6-10 minutes 35%, 11-20 minutes 35%; >20 minutes 9%

  ```
  Best practice is if asked to place an IV outside of your clinical area please ensure the charge nurse or team lead is aware so the department can be best managed.
  ```

- **Losing track of needle tip**
  - The needle is seen only as a small bright white ovoid structure, making it difficult to determine which part of the needle is being visualized.
  - Make small transducer adjustments up or down the vein to bring the needle tip into view. Maintaining visualization of the needle tip will reduce the chance of over-insertion and penetrating the posterior vessel wall.
  - Gently move the catheter from side to side to help re-identify the tip
  - Ensure that the gain is correctly set (dark enough) to highlight the catheter
  - Angle the probe away from provider to create a 90 degrees angle with the catheter to increase the brightness of the catheter

- **Not identifying surrounding structures**
  - Misidentifying an artery for a vein or not identifying a nerve bundle.

- **Not using a long IV catheter for deeper veins.**
  - If the IV catheter is too short, it can become displaced out of the vein and infiltrate when the patient moves the extremity.

- **Not placing the catheter at a steep enough angle**
  - Leads to running out of catheter length

- Applying too much pressure on the transducer will collapse the vein

- Delayed blood flash can occur with longer IV catheters – if you wait for blood flash to assess whether you are in the vein rather than keeping constant tract of the catheter tip you risk posterior vessel wall damage

- Poor / patchy images are often due to lack of gel. If adequate gel is used, ensure the gain is correctly set to optimize the image on the screen display.
Local Edmonton feedback and learnings

<table>
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<tr>
<th>IV attempts at three sites in the Edmonton zone</th>
<th>Adult</th>
<th>Pediatric</th>
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<tbody>
<tr>
<td><strong>Site A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean IV attempts prior to U/S attempt [SD] (min– max)</td>
<td>4.2 [2.5] (0-12)</td>
<td>2.8 [2.6] (0-12)</td>
</tr>
<tr>
<td><strong>Site B</strong></td>
<td></td>
<td></td>
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<tr>
<td>Mean IV attempts prior to U/S attempt [SD] (min – max)</td>
<td>3.4 [2.1] (0-12)</td>
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<tr>
<td><strong>Site C</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean IV attempts prior to U/S attempt [SD] (min – max)</td>
<td>4.77 [2.9] (0-15)</td>
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</table>

**Learning points**
There is an opportunity to decrease total number of attempts prior to ultrasound use. In the cases of the pediatric starts, comparing the first 9 months to the second 9 months IV attempts prior to UGIVC attempt decrease from approximately 4 to 2. Ideally, clinicians will utilize ultrasound early if the patient is predicted to be a difficult IV start. A recent study with experienced ED nurses and techs found that in patients predicted to be moderately difficult prior to IV attempt, the use of U/S improved IV success (71% to >75% respectively). With the following caveats to emphasis:

**Immediate IV placement:**
For patients that require immediate IV placement, ultrasound is not always the best option. So as not to delay care, consider placing a smaller IV and then use ultrasound to gain larger more appropriate longer term access, or simply use traditional technique (e.g. landmark) to place an appropriate sized IV in an acceptable number of attempts. If the patient is a difficult start and appropriate IV access cannot be gained in reasonable number of attempts (e.g. greater than 4) inform the physician so they can decide upon the best access strategy to employ (e.g. further direct IV attempts, IO use, EJ, central line, or ultrasound guided).

**Use in resuscitation:** When a practitioner has gained sufficient procedural skill, ultrasound can play a role in resuscitations (not likely cardiac arrest where an IO is indicated); however, overall team/physician consideration should be given to the indications for an immediate IO or central line when indicated. Be aware that ultrasound use has been attempted when IO or central line was a better option and this should not occur. Always ensure clear communication occurs with the team leader to ensure the right method is employed at the right time. Feedback from USGIV-trained nurses is that after approximately thirty successful starts the technique is faster with a higher rate of success. Furthermore, it has been successfully used to gain access in resuscitations, in a timely manner. Also reported is that the time pressure of this situation is not a good learning environment and can cause increase failure rate

**Role of ultrasound-trained practitioners in mentoring new staff with traditional IV placement technique.**
There is a concern that new staff not gaining expert traditional IV skills: To support new ED staff to become expert at traditional IV placement, when an ultrasound trained nurse is asked to place an ultrasound guided IV by that staff member, ensure that the patient has been assessed for suitable veins to cannulate via traditional technique and where appropriate support the junior ED staff in attempting these veins while ensuring best patient care.

**Lack of pediatric IV placement at non-specialist sites:** Consider UGIVC for pediatric use
Additional online resources:

The additional optional videos cover anatomy refreshment and techniques for UGIVC placement (note Firefox might be required to view)

http://blog.5minsono.com/diva1/
http://blog.5minsono.com/diva2
http://blog.5minsono.com/diva3/
https://www.youtube.com/watch?v=d8VFgb9Edfw
https://docs.google.com/file/d/0B4rBvv7dCN7ZWMvV4WVBtZ2Iya3c/edit?pli=1
References


14. Melissa L. McCarthy, ScD*; Hamid Shokoohi, MD, MPH; Keith S. Boniface, MD, RDMS; Russell Eggeleton, EMT-B E, Andrew Lowey, BS, EMT-P; Kelvin Lim, BS; Robert Shesser, MD; Ximin Li, MS; Scott L. Zeger P. Ultrasonography Versus Landmark for Peripheral Intravenous. Ann Emerg Med. 2016;Volume 68(no 1).


## Procedural performance criteria checklist

<table>
<thead>
<tr>
<th></th>
<th>Name:</th>
<th>Successful</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1.</td>
<td>Follows routine practice for gathering equipment, introducing self, identifying patient, and taking universal precautions</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Identifies indications for using ultrasound for IV catheter placement</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Uses an approved antiseptic to clean the probe (before and after procedure)</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Utilizes tourniquet or blood pressure cuff on venipuncture mode as required</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Adjust gain and depth of ultrasound view as appropriate</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Optimizes patient, provider, and equipment throughout (inc. protects probe)</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Identifies best vein for cannulation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Confirms vein rather than artery by compression and no pulsatile movement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Confirms vein depth of vein and appropriate catheter selected</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Confirms vein course is sufficiently linear to insert the IV catheter.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Wipe away Gel with gauze. Cleanse site per standard procedure</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Once skin clean use an aseptic non-touch technique</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ensure probe is not moved back over the sterile site)</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>In short access (transverse) orientation, center vessel in middle of screen.</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Inserts catheter at 30 to 45 degree angle in line with center probe marker</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Identify and then track needle tip as its advanced into the vein by sliding the probe to keep IV tip in view (dynamic tip tracking)</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Track needle tip intra-lumen for appropriate length prior to separating and advancing catheter fully into vein</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Secure IV catheter per routine traditional practice</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Confirm IV tip and length of IV catheter in vein adequate (&gt;65% of catheter) including with a visualized intra-lumen saline flush</td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>Completes remaining procedure per traditional practice (inc. documentation)</td>
<td></td>
</tr>
</tbody>
</table>

First successful: Date: ___________ Facilitator (Print/sign): ___________
Second successful: Date: ___________ Facilitator (Print/sign): ___________
Third successful: Date: ___________ Facilitator (Print/sign): ___________
Appendix A

Suggested ED clinical pathway for pediatric vascular access
Aim: IV access (right gauge/right location) with minimal attempts

Peripheral IV Access Required

Routine

Pain Control
Assess for DIVA
Optimize technique

DIVA score ≥ 3
Consider optimal IV location

Not difficult

Initial clinician: 2 attempts
Additional provider 1 attempt

Difficult or not optimal

USGIV

Notify physician
Two additional USGIV attempts
Consider senior USGIV clinician
Discuss and document plan
(could include additional IV attempts)

Immediate

Two traditional attempts
Consider immediate IO access
Consider simultaneous USGIV attempts

Access escalation

Physician to consider IO/central line
Consider USGIV if not attempted

Optimize technique

Warming (safe wet tamp warmth)
Assess all possible sites
Use assistant(s) to ergonomically stabilize joint/limb/body
Consider vein viewer

DIVA Scoring Tool

<table>
<thead>
<tr>
<th>Predictor</th>
<th>0 Points</th>
<th>1 Point</th>
<th>2 Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visible vein</td>
<td>Visible</td>
<td>-</td>
<td>Not Visible</td>
</tr>
<tr>
<td>Palpable vein</td>
<td>Palpable</td>
<td>-</td>
<td>Not palpable</td>
</tr>
<tr>
<td>Age</td>
<td>≥5 years</td>
<td>1-3 years</td>
<td>&lt;1 year</td>
</tr>
</tbody>
</table>

PAIN CONTROL
All patients (Except Emergent IV)
Distraction/Child Life
Sucrose
Topical Local anesthetic