

Compass™ Vascular Access: Frequently Asked Questions

Q1. Can't I tell I'm in an artery because I'll get bright red pulsatile flow when I disconnect the syringe?

A1. Using blood color and flow to identify arterial placement of the finder needle results in an inadvertent arterial cannulation rate of between 0.1-1.0%¹⁻⁶, or between 1-10 arterial cannulations every year at a large hospital. The American Society of Anesthesiologists has included the following statement in their 2010 Practice Guidelines for Central Venous Access (Draft), "*Blood color or absence of pulsatile flow should not be relied upon for confirming that the catheter or thin-wall needle resides in the vein.*"

Q2: Hasn't ultrasound solved this problem?

A2. Clinical evidence has not shown a benefit for ultrasound use in central lines placed in the subclavian vein⁷. Ultrasound clearly reduces complications for central lines placed in the IJ⁸. However, while it may be possible to visualize the tip of the needle with ultrasound⁹, it is difficult to distinguish the shaft of the needle from the tip. Confusion between the tip and the shaft of the needle in the ultrasound image can lead to inadvertent arterial cannulation when the needle passes through the intended vein and into the underlying artery. A recent series reported by Blaivas¹⁰ presented six inadvertent arterial cannulations during dynamic ultrasound that all occurred at a single institution. The author presented the data, in part, because, "few reports of accidental arterial cannulation are present in the literature, and the casual reviewer may assume that serious complications no longer arise when ultrasound is used." The table summarizes each of these six cases, including an analysis of the error based on a video review of the ultrasound-guided arterial cannulation.

Age	Mechanism of injury	Outcome
67	Needle went through IJ into carotid artery	Patient Died
75	Needle went though femoral vein into femoral artery	Vascular surgery for AV fistula
48	Needle went though IJ and entered carotid artery sitting underneath the IJ	Surgery for tear and focal dissection of carotid artery
67	Guidewire traveled through IJ and its posterior wall and into carotid artery	Hematoma with respiratory distress requiring emergent intubation.
69	Needle penetrated the carotid artery which was very close to the IJ	Emergency carotid artery repair; Patient died of complications
14	Needle penetrated rear wall of IJ and entered carotid artery	Central line removed and bleeding eventually stopped

Other case reports of arterial cannulation during attempted cannulation of the internal jugular vein under ultrasound guidance have described similar errors (passage of the introducer needle though a vein and into the underlying artery)¹¹⁻¹³.

A recent survey of anesthesiologists revealed that only 15% always or almost always use ultrasound¹⁴. Ultrasound use requires training, expensive capital equipment, and adds additional complexity and time to the procedure. For those centers where ultrasound is not routinely used, the Compass offers a simple, low cost method to continuously monitor pressure during central line procedures.

Q3. What evidence is there that the Compass is going to prevent arterial cannulations?

A3. In 2009 Ezaru et al. published a retrospective analysis of 9,348 central venous catheter placements over a 15 year period in a single institution requiring mandatory use of tube manometry to verify venous access¹. There were no cases of arterial cannulation. During the final year of the study 511 catheters were placed. Arterial puncture (defined as placement of an 18 gauge introducer needle into an artery) occurred in 28 patients (5%). Arterial puncture was correctly recognized from color and pulsatility in 24 cases, without manometry, but in 4 cases (0.8%), the arterial placement was only recognized with manometry.

25 years earlier, Jobses et al. performed a prospective trial of 1,284 attempts at internal jugular venous access in which they measured a pressure waveform from the vessel before inserting the guidewire¹⁵. Prior to measuring the pressure waveform a clinical assessment was made as to whether the needle was in an artery or vein, based on the usual criteria of color and pulsatility. There were 51 arterial punctures, 10 of which were incorrectly identified as being venous based on color and pulsatility, but were determined to be arterial from the pressure waveform. Thus, 10 inadvertent arterial cannulations (representing a 0.78% error rate) were avoided by pressure waveform monitoring.

Q4. Is this a big problem -- can't I just pull out the catheter and apply pressure?

A4. The American Society of Anesthesiologists included the following statement in their 2010 Practice Guidelines for Central Venous Access (Draft), "Case reports of adult patients with arterial puncture by a large bore catheter/vessel dilator during attempted central venous catheterization report severe complications (e.g., cerebral infarction, arteriovenous fistula, hemothorax) following immediate catheter removal; no such complications were reported for adult patients whose catheters were left in place before surgical consultation and repair^{16,17}. The consultants and ASA members agree that, when unintended cannulation of an arterial vessel with a large bore catheter occurs, the catheter should be left in place and *a general or vascular surgeon should be consulted.*"

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