Central Line Placement: Is it venous or arterial?

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Introduction

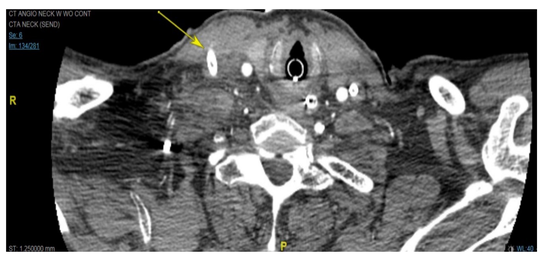
- Abdominal aortic aneurysms cause 1-3% of all deaths in men aged 65-85 years in developed countries
- Rupture of AAA requires timely repair in order to increase the likelihood of survival
- Central venous access indicated in situations that require rapid transfusion of blood products and/or hemodynamic monitoring
- A sheath introducer is typically the catheter of choice in an unstable trauma patient
- Sites of placement include the internal jugular vein, subclavian vein, and femoral vein
- Most common complication during central line placement is an arterial puncture
- In a study comparing prevalence of complications of central line placements with or without ultrasound guidance, 95% of recorded complications were arterial puncture with a higher prevalence when placed without ultrasonographic guidance

Case Presentation

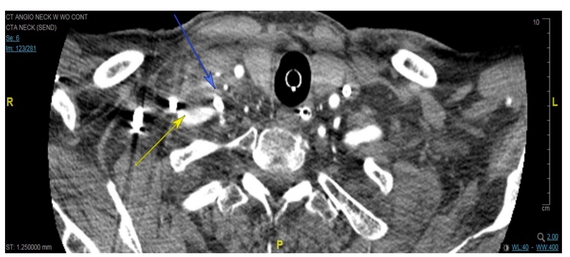
- A 67-year-old male with a history of uncontrolled hypertension presented with complaints of flank pain for 2 hours
- CT of the abdomen revealed an infrarenal 9 cm AAA with surrounding retroperitoneal hemorrhage of varying density, suggesting varying age
- Upon initial evaluation, patient was AAOx3, in mild distress, with elevated blood pressure that was treated with a nicardipine drip
- Patient was brought to the operating room for an open repair by vascular surgery
- Prior to induction, two large bore peripheral IVs and a left radial arterial line was placed
- Following rapid sequence induction with etomidate and succinylcholine, a 9 French introducer was placed in the right internal jugular vein
- Ultrasound showed the wire in a patent vessel but when scanning distally, the wire dove down into the tissue and there was an inability to trace it into the subclavian vein
- Skin was dilated and the Cordis was advanced and secured but once connected, blood was noted to be backing up, prompting suspicion of arterial cannulation

Results

- Blood gas values were consistent with that of arterial blood
- Intraluminal pressure was measured with a transducer, revealing arterial pressure and waveform
- Immediately following confirmation of misplacement, a left internal jugular cordis was placed with blood gas confirmation of venous access
- Surgeon was then notified and both vascular surgery and interventional radiology were consulted
- Following surgical stabilization of AAA, the patient was taken for a CT angiography
- As the patient had previously received contrast for AAA evaluation, a fluid bolus was provided for renal protection



- Cordis entering tissue (yellow arrow)



Cordis entering right subclavian artery (blue arrow), subclavian artery (yellow arrow)

Discussion

- During inadvertent arterial cannulation, early recognition is key
- It is crucial that the catheter is not removed, all medications through the line should be discontinued, vascular surgery should be consulted, and imaging should be acquired as soon as possible
- In order to prevent thrombosis, normal saline infused with 2K units of heparin at a rate of 20ml/hr should be run through the arterial line
- Incidence of arterial injury is ~3.7-12% of all central venous access procedures
- Use of ultrasound greatly decreases the incidence of this injury as it allows constant visualization of the needle (or needle tip) while advancing in order to avoid accidental arterial puncture
- Ultrasound is user-dependent and long-axis cannulation of the presumed venous vessel can avoid losing sight of the needle tip
- Some studies have shown that location of vein and its anatomic relation to the artery is actually best accomplished with a combination of both a short-axis and long-axis view of vessels
- Color Doppler imaging and flow measurements can help differentiate between venous and arterial vessels
- Application of pulse wave Doppler when viewing the guidewire will further confirm cannulation of a venous vessel
- However, not entirely a fail-safe technique as there have been documented cases in which confirmation of the guidewire was insufficient to exclude arterial cannulation
- Use of an 18-gauge finder needle and catheter prior to threading the wire can allow for column manometry to be connected
- If blood rises and continues to rise, then it is likely arterial but if the blood rises then falls, it is likely of venous origin
- Present data demonstrates holding pressure after removal of a catheter > 7 Fr is considered poor management with significantly higher morbidity when compared to surgical or vascular management
- Thus, arterial injuries are best managed by leaving the catheter in place with a percutaneous closure device, balloon tamponade, and/or stent placement and repair by vascular surgery
- In emergency situations where large-bore line access is necessary, it is important to utilize a method to confirm venous line placement prior to use via the right brachial artery

References

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