

## Vascular/Procedural Cases

### Case 1:

A 60 year old male with a history of hypertension and peripheral vascular disease presents to the ED with sudden onset of severe abdominal pain. He is diaphoretic and tachycardic with a systolic blood pressure of 92mmHg. He is sent for a CTA and the following image is obtained. What is the diagnosis and next step in management?

Answer: The image is of a large abdominal aortic aneurysm. Given the patient's vital signs, it is likely that the aneurysm is leaking. The vascular surgery team should be called immediately to evaluate this unstable patient for either EVAR or open repair of the aneurysm. The patient should be volume resuscitated and transfused as needed according to serial CBC's and TEG's.

### Case 2:

A 55 year old male is admitted to the ICU status post Whipple procedure. He appears under-resuscitated upon presentation, and after two liters of crystalloid, it is apparent that he will require vasopressor management. In addition to ruling out sepsis, what is the next step in management after having obtained the following image?

Answer: The image demonstrates an easily compressible internal jugular vein that is free of clot. It is important to evaluate any vein prior to access in order to avoid difficult central line placement. The most common occurrence is inability to thread the wire secondary to obstruction by a clot. Vasopressors, when given the option, should always be run through a central line. There is some data suggesting that it is acceptable to run vasopressors for a short time peripherally, specifically phenylephrine. The problem comes when a patient requires escalation of care or multiple vasopressors. Extravasation of a vasopressor, especially norepinephrine, can lead to tissue necrosis. In this patient, the vein that has been imaged is appropriate for central line placement.

### Case 3:

Assume that the same patient from Case 2 had an occlusive thrombus in the imaged vein. Given the following ultrasound image, what would be your next step in management?

Answer: The fact that the patient has an occlusive thrombus does not change his need for vasopressor support. The image shows a compressible femoral vein. In order to determine whether a vein is patent, the vein should be compressed until the adjacent artery just begins to collapse. If it takes any more pressure to completely collapse the vein with the ultrasound probe, it is likely there is an occlusion. However, in this case, the vein is present, and a femoral line should be inserted until access can be obtained in a location less likely to become infected, such as the subclavian vein.

#### Case 4:

You are performing an ultrasound-guided central venous line. What is the structure visualized in the middle of the vein?

Answer: The structure is the tip of the needle. The needle tip should always be kept in view when attempting to cannulate a vein (or an artery in the case of an arterial line) in order to ensure the highest level of safety for the patient. This is called the bull's eye approach, as the dot indicating the needle is surrounded by the round wall of the vessel. This is accomplished by advancing the needle under the probe until it is seen. The probe is then advanced only until the needle tip is lost. After this, the needle is then advanced. By using this technique, one can always ensure the needle stays endovascularly. This is especially helpful when starting peripheral IV's or arterial lines that don't "flash" when accessed.

#### Case 5:

A 78 year old patient is hypotensive after a femoral-femoral bypass surgery for severe atherosclerotic disease. She has a history of CAD and had a left coronary bare metal stent placed 7 weeks ago. She is intubated and hypotensive on admission to the ICU. In an attempt to ascertain the cause of hypotension, the following image is obtained. What is the next step in management?

Answer: The image demonstrates a collapsible IVC. Recall that 13% or greater collapse of the IVC indicates that the patient may be volume responsive. It is also important to rule out other causes of hypotension in a patient with a history of CAD, such as new ischemia leading to loss of ventricular function. A bedside TTE should be performed and formal TTE should be ordered, as well as troponins, CBC and electrolytes.

#### Case 6:

A patient is having a central line placed. The following image is obtained during the procedure. What is the next step in management of this patient?

Answer: The image demonstrates a long axis view of the vein with the wire in it. The next step would be to dilate over the wire and thread the catheter. When using ultrasound to place a central line, two images should be documented. The first image should demonstrate a patent vein and the second image should demonstrate the wire in the vein prior to dilation. The needle should always be transduced with the tubing provided prior to threading the wire. This done by connecting the tubing to the wire and allowing the blood to fill it. When the tubing is held vertically, there should be an absence of pulsatile flow. Depending on the patient's CVP, the blood may even start descending back out of the tubing and into central circulation. Always ensure that no air is entrained when transducing the needle.

## Case 7:

In the process of inserting a central line, the following image is obtained. What is oval-shaped structure superficial to the internal jugular vein?

Answer: This is a lymph node. Superficial and deep cervical lymph nodes run the course of the vasculature in the neck. An image of the vein unobstructed by lymph nodes should be obtained prior to central line placement.

## Case 8

You are the provider in the intensive care unit when a patient is admitted to the unit who is in emergent need of dialysis. The patient has a potassium of 6.9 which has been treated medically, however, the treatment is not sufficient. For the patient to receive emergent dialysis, you must place a temporary dialysis catheter. Knowing the utility of ultrasound in central venous line placement, you decide to use ultrasound to place an internal jugular dialysis line. Prior to positioning the patient, you should obtain an ultrasound of the IJ to identify the appropriate vessel.

The first image that you obtain is as follows: [Vasc1-Venous-Compression](#)

What vessels do you identify in this image? **The vessels that are present in this image are the internal jugular vein and the carotid artery.**

From this ultrasound, how do you determine which vessel is the artery and which vessel is the vein? **The vein is noted on the left (on your screen) side of the artery. The internal jugular vein is compressible when you push down with the ultrasound probe. The artery is not collapsible.**

What other characteristics of the vein should you evaluate prior to initiating placement of the temporary dialysis catheter? How will you fully evaluate the vessel? **In addition to compressibility of the vessel, one should evaluate the vessel for any thrombosis, calcification, or anatomical abnormality which would prevent the placement of the catheter. This can be done by fanning the probe superiorly and inferiorly to fully evaluate the vessel.**

You have now identified that the internal jugular vessel is a suitable site for placement of the temporary dialysis catheter and you proceed with placement. You continue to utilize the ultrasound during placement of the catheter using the Seldinger technique. After placing the guidewire in the vessel, you obtain the following image: [Vasc8-Guidewire](#)

How would you describe the view seen in this image? **This is a cross section or short axis view of the vessel.**

How do you interpret this ultrasound? What should you evaluate that you cannot see in this image? **This is a still image of a guidewire in a vessel. Because this image is a still image, you cannot say which vessel the guidewire is in. To further evaluate, one would need to again check the compressibility of the vessel by pushing down with the probe, if the vessel is collapsible, it is the vein. If it is not collapsible, it is the artery.**

What image could you obtain to further evaluate the guidewire prior to placing the line? **The longitudinal view can further evaluate the guidewire and ensure that the guidewire follows the vessel and is not through the vessel or coiled in the vessel. The following is an example of a longitudinal view of the guidewire: [Vasc6-Guidewire](#)**

Case 9:

You are the provider on a medical-surgical floor. On morning rounds, you go in to evaluate a patient who has had a prolonged hospital course in the intensive care unit. The patient was transferred to the floor approximately 4 days ago. He has been doing well, however, in the last 12 hours has acutely began complaining of left lower extremity pain. You examine him and find him to have a warm calf, which is normal in color, but is painful to touch. You decide to further evaluate the patient utilizing ultrasound. You obtain the following ultrasound: [vasc7-Thrombus](#)

How would you interpret the above ultrasound? **A large clot is seen in the vessel.**

What did the ultrasonographer who performed this ultrasound fail to do that would help to further characterize the abnormality? **To evaluate if a clot is in an artery or a vein, one must compress the vessel to differentiate. For further purposes of this case study, let us assume that the clot is in a vein.**

What would be the next step for the prudent provider in the treatment of this abnormality? **First one must assess the patient for bleeding risk. After this evaluation, if the patient is deemed appropriate, the patient should be initiated on systemic therapeutic anticoagulation. The specific medication utilized can be provider dependent, but you must stop the propagation of the clot to prevent further disability.**