

Complication of central venous cannulation

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Complications during central venous cannulation are quite common, and various attempts have been made to prevent them. We report a case of innominate artery puncture that occurred during an attempt to cannulate the right internal jugular vein (IJV), and we discuss the management of such a complication.

Case report

A 45-year-old man underwent right IJV cannulation in preparation for dialysis. The trainee registrar noticed that he did not get a free aspirate of blood with the initial puncture. However, after completing the cannulation, he noted pulsatile flow through the cannula. Because we suspected carotid artery puncture, we used duplex ultrasonography to ascertain the position of the puncture. The entry point of the cannula into the vessel was not visible, so we resorted to computed tomography (CT). This showed the cannula passing subcutaneously between the right IJV and common carotid artery (CA), superior to the right brachiocephalic vein, then crossing the midline, entering the innominate artery immediately distal to its origin with the cannula tip in the aortic arch (Fig. 1, Fig. 2). Because the patient had abnormal bleeding parameters and the distal puncture point was not accessible for compression, we performed a sternotomy, removed the cannula and sutured the opening in the innominate artery.

Discussion

Complications during the insertion of a

central venous line can be attributed to the unsafe manipulation of the dilators, sometimes even causing ventricular perforation. Other possible mechanisms of injury include kinking of the guide wire, resulting in misdirection of the dilator, and perhaps insertion of the guide wire outside the vessel.¹ All these complications result from inexperience, the number of needle passes made, the use of a relatively larger gauge needle than usual, severe dehydration, morbid obesity and coagulopathy. In our patient, puncture was made under ultrasonographic guidance, and this complication could have been prevented if the operator had confirmed that blood was coming through the cannula and had used the dilator properly.

Carotid artery puncture is the most common complication associated with landmark-guided IJV catheterization. Its rate of occurrence ranges from 6% to 25%.^{1,2} Studies show that the IJV frequently overlaps the CA, a situation that

has been postulated to increase the rate of arterial injury.¹ Even though this complication is usually self-limiting, it should not be dismissed as inconsequential because it can lead to substantial morbidity and mortality,³ even if the puncturing needle is of a relatively small gauge or the catheter is correctly placed in its intended venous location in subsequent attempts. Up to 40% of carotid punctures are associated with uncontrollable bleeding or hematoma.² This, in conjunction with manual pressure, can lead to cerebrovascular neurologic deficit (27%) and death (20%–40%).³ Perforation of the subclavian artery occurs in about 0.1%–1% of cases,² leading to hemothorax (1%) and rarely quadriplegia.³ Perforation of the aorta and cardiac tamponade can occur if the cannula-site perforation is within the pericardial reflection. This complication is associated with a 90% death rate.^{4,5} Pseudoaneurysms,

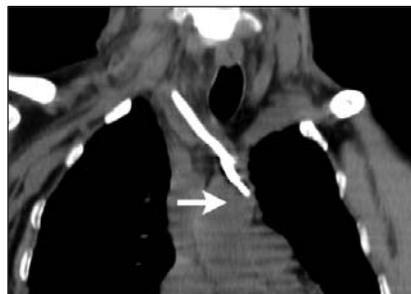


FIG. 1. Computed tomography scan, coronal view, of the neck and the thorax showing the catheter passing through the superior mediastinum into the ascending arch of the aorta (arrow).



FIG. 2. Sagittal section of the thorax showing the tip of the catheter in the aortic arch (arrow).

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Accepted for publication Jan. 16, 2008

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Note de cas

arteriovenous fistulas and vertebral artery injuries are rare complications (0.2%).⁶ The fact that the right subclavian–jugular venous junction overlies the subclavian artery and the right subclavian vein enters the innominate artery at a sharper angle makes these vessels more vulnerable to perforation if a firm dilator is inserted too deeply. A central line entering the innominate artery has not been reported.

Whatever management choices are made to treat these arterial complications, it is prudent to leave the offending catheter in place until the next step is taken. The diagnosis of an aortic injury and the estimation of its extent require careful assessment. Duplex ultrasonography and CT are helpful in understanding the problem, as in this case. If the injury is central, a CT angiogram is preferred. Treatment options include surgery, thrombin injection, percutaneous suture, covered stent graft placement and balloon tamponade.

The best way to prevent arterial perforations during central venous catheter insertion is to use ultrasonography or Doppler guidance and to recognize that the needle entering the vessel is actually in a vein. Usually, the operator can rapidly determine that the vessel is an artery because of pulsatile back flow, but that is not always the case. Routinely measuring blood gas levels or attaching the catheter to a transducer is not always practical and cannot be practised on every patient. A simple and practical method of confirming arterial placement is to run a saline solution through the line before using a volumetric pump.

Competing interests: None declared.

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