

CASE REPORTS

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Hemothorax and Subclavian Artery Laceration during "J" Wire Change of a Right Internal Jugular Vein Catheter

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CENTRAL venous cannulation *via* the right internal jugular vein is commonly used in the treatment of the critically ill patient. Although complications such as carotid artery puncture or pneumothorax have been reported,¹ that of hemothorax is relatively uncommon. We describe a case of a hemothorax and subclavian artery laceration that was recognized while changing an 8.5-French introducer to a 7.0-French triple-lumen catheter using a "J" wire.

Case Report

A 47-yr-old man presented for emergent cadaveric kidney transplantation. After induction of anesthesia, an arterial cannula was placed in the right radial artery, and the right internal jugular vein was cannulated using the Seldinger technique. The vein was initially located without problem with a 22-gauge "finder" needle at the apex of the triangle formed by the two bellies of the sternocleidomastoid muscle and the clavicle. The vessel was then cannulated with a 2-inch long 18-gauge intravenous catheter. Blood flowing from the 18-gauge intravenous catheter was dark and nonpulsatile. A 0.035-inch "J"-tip guide wire was threaded through the 18-gauge catheter without problem, and an 8.5-French introducer (Arrow®, Reading, PA) was threaded over the wire. To confirm placement, blood was aspirated from the introducer; the blood was nonpulsatile and dark. The

catheter was connected to a pressure transducer and monitor system, and the central venous pressure (CVP) was approximately 11 mmHg with respiratory variation. Although the introducer was mainly used for CVP monitoring, it also was used for the administration of fentanyl and vecuronium for about 30 min after placement. The administration of these drugs led to paralysis of the patient as documented with a neuromuscular blockade monitor, and the patient appeared more deeply anesthetized as noted by a decrease in blood pressure and heart rate. Peak airway pressure of 30 cm H₂O was stable throughout the case. The morphology of the arterial wave form from the arterial line appeared normal and remained the same throughout the case. A hematocrit sampled 1 h before the end of the procedure was 42%.

As the patient had a need for CVP monitoring postoperatively, at the end of the procedure, the 8.5-French introducer was changed to a 7-French triple-lumen catheter (TLC) (Arrow® Reading, PA). The patient was placed in the Trendelenburg position, and a 0.035-inch "J"-tip guide wire, from the 7-French CVP kit, was inserted through the introducer without resistance or arrhythmia, and the introducer was withdrawn. Hemodynamic compromise ensued over a period of 30-60 s with a decrease in arterial blood pressure to 40/30 mmHg, and the end-tidal carbon dioxide tension decreased from 35 to 22 mmHg. He was treated through the peripheral intravenous catheter with fluids and vasopressors, which increased the blood pressure to 100/50 mmHg for a brief period. The TLC was quickly inserted over the guide wire, and neither blood nor air could be aspirated from the TLC. No end-tidal nitrogen was noted by mass spectrometry. Physical examination revealed decreased breath sounds over the right hemithorax to auscultation, and a 16-gauge intravenous catheter was inserted into the second intercostal space to treat a possible tension pneumothorax. Because the hemodynamic status continued to deteriorate, a 30-French chest tube was inserted into the right chest, and 300 cc of blood were drained. A right thoracotomy and sternotomy was performed to identify the source of the bleeding. More than 2000 cc of clotted blood was removed from the right hemithorax. The tip of the TLC was noted in the pleural space, having entered the subclavian artery superiorly and exited inferiorly just lateral to the junction with the carotid artery. Extensive bleeding was noted from the holes in the subclavian artery, both of which were larger than the 7-French TLC. No holes were noticed in either the subclavian vein or superior vena cava. Cardiac arrest ensued requiring chest compressions and cardioversion for ventricular tachycardia along

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CASE REPORTS

with continued blood and fluid resuscitation. The surgeon gained control of the bleeding and repaired the subclavian artery. The patient required 4 l NaCl 0.9%, 22 U packed erythrocytes, 10 U fresh frozen plasma, and 1250 cc of albumin 5%. After the procedure, the patient was admitted to the intensive care unit where he remained hemodynamically stable. The patient awoke neurologically intact, and the trachea was extubated 2 days later. Three weeks later, the patient was discharged home in stable condition with a functioning transplanted kidney.

Discussion

Laceration of the subclavian artery as a consequence of internal jugular cannulation to our knowledge has been reported only three times.²⁻⁴ In one report,² laceration of the subclavian artery was thought to be a result of the use of a cannula-over-needle method of insertion. In the second report,³ hemodynamic compromise ensued immediately after removal of an 8.5-French introducer that was noted to be intraarterial. In the third case,⁴ no hemodynamic collapse occurred, but the patient returned 3 weeks later for repair of a 15-cm pseudoaneurysm of the subclavian artery.

Dilator-associated complications have been reported previously and may have been responsible for our episode.⁵ It is possible that during the initial CVP placement the subclavian artery was transfixated, and the introducer was placed into the pleural space. This would explain how the 7-French TLC was found in the pleural space at thoracotomy. The presence of a CVP tracing with respiratory variation and an appropriate drug response from the fentanyl and vecuronium may be explained by the presence of respiratory variation from an interpleural placement of the catheter and interpleural absorption of the medications.⁶ Aspiration of blood from an intrapleural catheter, as performed at the beginning of the case, would be from a developing hemothorax that is unlikely with a stable hematocrit of 42%.

It is also possible that the subclavian artery may have been initially transfixated by the 18-gauge catheter, the "J" wire placed, and then the stiff introducer and dilator inserted through both walls of the subclavian artery into another vessel, the subclavian vein or superior vena cava. The 8.5-French introducer may have tamponaded both lacerations, and therefore no hemodynamic consequences were noted until it was removed. The subcla-

vian artery is large enough to accommodate an 8.5-French introducer and still provide normal blood flow to the extremity, which would explain the unchanged arterial wave form from the arterial cannula. A hole in the vein may close on its own and therefore may not have been noticed by the surgeon during exploration. However, with this explanation, it is difficult to explain how the TLC catheter was found in the pleural space and not in the vena cava or subclavian vein.

Another possibility is that the 8.5-French introducer may have been properly situated in the right internal jugular vein, and the subclavian artery was lacerated during the wire change to a 7-French TLC. This appears unlikely because the size of the lacerations in the subclavian artery appeared larger than the width of the 7-French TLC.

Despite proper technique, as used in our case and reviewed elsewhere,² the proximity of the great vessels to each other in the neck and to the thoracic inlet make elimination of this type of complication unlikely. However, in the event of hemodynamic collapse, a high index of suspicion and prompt recognition and intervention may prevent a potentially fatal outcome.

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