Endovascular Repair of Concomitant Vertebral Artery and Subclavian Artery Iatrogenic Perforations

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Inadvertent arterial puncture is a well-established complication of central venous catheter insertion. The carotid artery is the most frequently injured artery involved with injury to the subclavian artery and vertebral artery being much less common. When these injuries do occur, they are often treated with open surgical repair or endovascular, with stent-graft placement or embolization. Repair of acute vertebral artery injury with endovascular stent-graft repair has not been well represented in the literature to date. The present report discusses the successful treatment of concomitant injuries to the left subclavian and left vertebral arteries from acute iatrogenic puncture with endovascular stent-graft placement.

Inadvertent arterial puncture/perforation is one of the more common complications of central venous catheter (CVC) insertion. Carotid artery injury during internal jugular vein (IJV) catheterization attempts occurs with a frequency of 6−10%. Puncture of the subclavian artery is even less frequent, occurring in 0.5−4% of patients. Vertebral artery injuries are the rarest complications of CVC insertions. These perforations rarely result in severe consequences and most frequently resolve with manual pressure. Some of these may lead to hematoma formation. More devastating consequences tend to occur with inadvertent cannulation and dilation of these often unrecognized arterial perforations. Arterial cannulation only occurs in 0.1−1% of cases, and 30% of these patients become symptomatic with bleeding, stroke or neurologic deficits, or other sequelae.[1] This case report presents one such complication with successful endovascular repair of concomitant left vertebral artery and left subclavian artery perforations that occurred during insertion of a left IJV CVC.

CASE REPORT

A 36-year-old woman with multiple medical comorbidities, including end-stage renal disease on hemodialysis, hypertension, hyperlipidemia, and diabetes mellitus, presented with myocardial infarction. Cardiac catheterization demonstrated 3-vessel coronary artery disease, including left main coronary artery disease, with severely depressed left of 25−30%. It was recommended that the patient proceed with coronary artery bypass grafting. She was therefore taken to the operating room to undergo a left internal mammary artery (LIMA) to the left anterior descending (LAD) coronary artery bypass. The patient was successfully intubated and underwent smooth induction of general endotracheal anesthesia. Placement of a Swan-Ganz catheter sheath (9F) into the left IJV was then attempted, but after placement of the catheter sheath, a return of arterial blood flow was noted. The catheter was left in place and at this point, vascular surgery was consulted emergently in the operating room for further management.

After initial evaluation of the patient, a retrograde hand injection through the left-sided sheath was performed (Fig. 1). This injection demonstrated good perfusion of contrast through the left subclavian artery and into the aortic arch. At this point, it appeared that the catheter had been inadvertently placed into the left

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Fig. 1. Hand injection through sheath showing perfusion into the left subclavian artery.

Fig. 2. Aortogram showing bovine anatomy, defect noted in the left subclavian artery due to the sheath, and absence of the left vertebral artery.

subclavian artery. The sheath was left in place, right common femoral artery percutaneous access was then obtained under fluoroscopic guidance, and a 4F sheath was placed. A pigtail catheter was positioned in the aortic arch, and an arch aortogram was performed (Fig. 2). Good perfusion was found through the aortic arch and into the great vessels. The patient was noted to have bovine anatomy with the left common carotid artery arising from the right innominate artery. The right vertebral artery was patent and 3 mm in size. The sheath was noted to be in the left subclavian artery at the level of the left vertebral artery takeoff. The left vertebral artery was not visualized. This finding was not in concordance with her preoperative angiogram to evaluate the LIMA, which demonstrated a large patent left vertebral artery. This finding raised concern for concomitant left vertebral artery injury.

Now that the extent of the injury had been evaluated further, we proceeded with the idea repairing the lesions with stent grafts. An 8F long sheath was placed and positioned in the left subclavian artery. The left subclavian vein catheter was pulled back partially, and a hand-injected retrograde angiogram was repeated through the catheter, showing perfusion through the left vertebral artery, confirming perforation of the catheter into the left vertebral artery. Selective cannulation of the left and right vertebral arteries was then performed. Brisk runoff was demonstrated bilaterally, into the basilar artery without note of intimal defects or thrombus. Wire access of the left vertebral artery was then obtained, and a 5×25 mm^2 self-expanding Viabahn (Gore, Newark, DE) stent graft was deployed in the left vertebral artery under fluoroscopic guidance, covering the perforation site. As the stent graft was deployed, the catheter was simultaneously withdrawn from the vertebral artery under fluoroscopic guidance. In a similar fashion, a 7×25 mm^2 self-expanding Viabahn (Gore, Newark, DE) stent graft was deployed in the left subclavian artery. The left subclavian stent graft was placed to cover the perforation in a position proximal to the left vertebral artery and the LIMA. Care was taken to assure the patency of the LIMA, so that it could be used for the originally planned LIMA to LAD coronary bypass.

After placement of both stent grafts, a completion angiogram was performed (Fig. 3). The angiogram demonstrated good perfusion of contrast through the left subclavian artery and brisk flow into the left vertebral artery and LIMA. Flow continued into the distal left subclavian artery and brachial artery. There were no extravasations or flow-limiting dissections or stenosis noted on angiography. Wires and catheter sheaths were then removed from the right common femoral artery, and an 8-mm Angio-Seal device (St. Jude Medical, St. Paul, MN) was used to close the puncture site. The left-sided sheath was then removed, and pressure was held at the puncture site for 30 minutes.

Postoperatively, the patient remained intubated and was placed in an intensive care unit bed. She was extubated later the same day. On postoperative evaluation, the patient was found to have no gross neurologic deficits, and her cranial nerves, as well as recent and remote memory, were intact. She returned to the operating room on postoperative day 2 to receive her originally scheduled coronary bypass surgery. At 1-month follow-up, a computed tomography angiography (CTA) of the head and neck was obtained. Vascular stents within the left subclavian artery and origin of the left vertebral artery were noted to be patent.

DISCUSSION

Vertebral artery injury is a rare complication of CVC insertion (1, 2, 3, 4, and 5). When vertebral artery injury does occur, it often has a delayed presentation through the formation of arteriovenous