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# Challenges in acute care surgery: management of severe proximal blunt aortic injury

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## CASE SUMMARY

An adult patient in their 60s presents to the emergency department after sustaining injuries in a motor vehicle collision. At the scene, the patient was intubated for airway protection. The patient had absent breath sounds on the right with obvious chest wall trauma, and a field needle thoracostomy was performed. Once the patient arrived at the trauma center, they were hypotensive with systolic blood pressure of 70 mm Hg. The airway was confirmed, whereas simultaneous right tube thoracostomy and blood product transfusion were initiated. They had rapid improvement in their hemodynamics. A focused assessment with sonography for trauma examination demonstrated no fluid in the abdomen or pericardium. Pelvic X-ray showed no significant injury; however, the patient's chest X-ray was significant for widening of the mediastinum.

CT imaging was performed which revealed multiple bilateral rib fractures, a small subdural hemorrhage and small subarachnoid hemorrhage, C2 vertebral body fracture with possible ligamentous injury, a left humerus and scapular body fracture, manubrium fracture, and a severe blunt aortic injury (BAI) with pseudoaneurysm proximal to the left subclavian artery (American Association for the Surgery of Trauma (AAST) grade IV or Society for Vascular Surgery (SVS) grade III) measuring almost 2 cm in size (figure 1). They were also noted to have an anatomic variant with the left vertebral artery arising directly from the aortic arch.

## WHAT WOULD YOU DO?

A. Admit to the intensive care unit (ICU), no impulse control, and repeat CT scan 24–48 hours
B. Admit to the ICU with impulse control, and repeat CT scan 24–48 hours
C. Proceed to the operating room for endovascular repair of BAI
D. Proceed to the operating room for total arch replacement for BAI

## WHAT WE DID AND WHY

C. Proceed to the operating room for endovascular repair of BAI

Our decision to pursue an endovascular repair of this injury was multifactorial. In the setting of a severe (AAST grade IV or SVS grade III) BAI, non-operative management was not indicated. The neurosurgery team was reasonably comfortable with anticoagulation administration for an endovascular repair of the aortic injury. The two operative options considered were endovascular repair or an open repair; however, it was thought that an open total arch repair or replacement, with high-dose heparinization and cardiopulmonary bypass, was exceedingly risky in this multiple system-injured patient. Therefore, an endovascular technique was pursued. The location of the injury (proximal to the subclavian artery, as well as an anatomic variation of the vertebral artery arising directly from the aortic arch) significantly increased the complexity of the case. It was expected that the planned thoracic endovascular aortic repair (TEVAR) would cover the left subclavian artery and left vertebral artery takeoff from the aortic arc and therefore preoperative discussions with family regarding risk of stroke and upper extremity ischemia were made.

In the operating room, bilateral common femoral arteries were accessed percutaneously. An aortic arch aortogram was obtained (figure 2) which confirmed aortic pseudoaneurysm proximal to left subclavian at the level of the left vertebral artery takeoff from the arch. Systemic heparin was given. Unfortunately, there was little room between the vertebral artery and common carotid artery takeoff. To completely cover the injury, the decision was made to cover both the left vertebral and left subclavian artery. The thoracic aortic endograft was deployed without issue and showed resolution of the aortic injury on completion angiography (figure 3).

The primary challenge in this case was triage of injuries and determination of most appropriate therapeutic intervention for the patient's BAI. In this case, with the absence of intra-abdominal

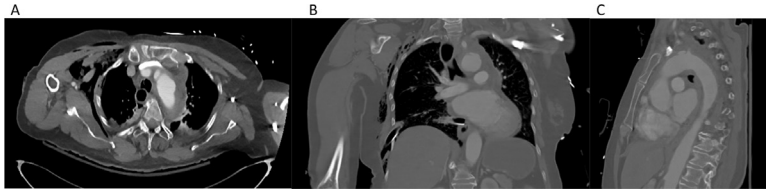


**Figure 1** Initial chest CT scan demonstrating an aortic pseudoaneurysm with periaortic hematoma in the axial (A), coronal (B), and sagittal (C) planes.



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**Figure 2** Initial aortogram revealing a pseudoaneurysm proximal to left subclavian origination at about the level of the left vertebral takeoff from the aortic arch.

**Figure 3** Completion aortogram after deployment of thoracic endograft. The left subclavian and left vertebral arteries were intentionally covered.

hemorrhage requiring intervention, the BAI was deemed the most immediately life-threatening injury. Endograft coverage of the left subclavian artery for thoracic aortic aneurysms and injuries is not uncommon, as the left subclavian artery may need to be covered in 26% to 40% of patients. In some cases, a carotid subclavian bypass may be considered to improve perfusion of the upper extremity. However, in the setting of acute injury and polytrauma with instability, bypass is not recommended and coverage of the left subclavian is typically well tolerated. However, it is important to remain vigilant for development of left upper extremity ischemia in the immediate postoperative period. In the setting of upper extremity ischemia, a left common carotid artery to left subclavian artery bypass should be considered first choice for revascularization. In instances that the left common carotid artery is not suitable (significant atherosclerosis, stenosis, or dissection), a right axillary to left axillary artery bypass can be performed as an alternative. Another concern is the coverage of the left vertebral artery which puts patients at risk of posterior circulation stroke. However, due to the proximity of the left vertebral and subclavian arteries in relation to the location of the injury, coverage of these two vessels was unavoidable. In patients with normal anatomy of the left vertebral artery, arising from the left subclavian artery, a carotid to subclavian artery bypass may be performed to allow blood flow from the subclavian to the vertebral artery. However, some studies suggest that stroke risk after TEVAR is the same regardless of revascularization of the left subclavian artery. In this patient, the left vertebral artery arose directly from the aorta and revascularization via a carotid subclavian bypass would not be possible. An additional point of consideration for this case was the possibility that partial or complete coverage of the left common carotid may have been necessary to achieve adequate proximal seal of the endograft. Fortunately, that was not required.

Postoperatively, the patient was managed in the ICU without ongoing impulse control. The spine was managed without surgery and the humerus was repaired. They had no evidence of left upper extremity ischemia postoperatively. Further, they had no evidence of stroke as a result of the left vertebral artery coverage. The patient was ultimately discharged to rehabilitation on day 17 after injury.

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