Trauma Surgery & Acute Care Open

Subclavian vein injury secondary to blunt chest wall injury

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CASE PRESENTATION

A male patient in his 50s was brought to our emergency department after being dragged for 25 ft while working under his pickup truck. On arrival at the hospital, he was tachycardic, normotensive and tachypneic. On physical examination, he had a central flail appearance as well as a right shoulder deformity. Imaging studies including a chest CT with intravenous contrast revealed numerous multifocal bilateral rib and costochondral fractures, sternoclavicular joint disruption bilaterally, bilateral pneumothoraces with significant subcutaneous emphysema, herniated left upper lobe lung medial to the anterior first and second ribs and complete anterior dislocation of the right shoulder. No vascular injury was identified. Progressive desaturations in the trauma bay ultimately resulted in intubation. He was admitted to the intensive care unit due to ongoing resuscitative needs.

Given the instability of his chest wall and herniation of the left lung, he underwent surgical stabilization of rib fractures (SSRF) and lung herniation repair. The patient was placed in the supine position and the anterior chest wall was accessed via a bilateral inframammary incision using standard endotracheal tube intubation with a single lumen tube. On exposure of the anterior chest wall, it was noted that bilateral lung parenchyma had herniated through the disrupted costochondral fractures (figure 1). Once adequate exposure was obtained, we attempted to reduce each lung herniation. Reduction of the left lung led to significant venous bleeding near the first rib. Bleeding was controlled with tamponade from the lung when fully expanded.

What would you do?

A. Perform a vertical median sternotomy for exposure to identify the source of bleeding.
B. Perform a horizontal median sternotomy for exposure to identify the source of bleeding.
C. Venogram for potential endovascular hemorrhage control.
D. Complete SSRF without further evaluation as the lung is tamponading the bleed.

What we did and why

As the patient remained hemodynamically stable, blood products and cell saver were obtained prior to proceeding in the event of large blood loss. A venogram through the left cephalic vein was performed, which showed no overt extravasation of contrast. Repeat venography was performed with the lung retracted, which showed an area of concern at the junction of the left internal jugular and subclavian vein (figure 2A). As the venogram was not conclusive, the decision was made to deploy a balloon in the area of suspected injury to assess the impact on bleeding within the operative field. With the balloon inflated across the suspected area of injury, bleeding in the surgical field significantly improved. Due to the difficulty in potentially obtaining distal vascular control should a sternotomy be performed, the decision was made to deploy an intravascular 11×79 mm balloon expandable stent (Gore Medical, Flagstaff, AZ) across the origin of the internal jugular vein. Repeat venography demonstrated good positioning (figure 2B) with adequate patency and without extravasation of contrast (figure 2C). The chest cavity was once again inspected and noted to be hemostatic.

We continued the operation with the repair of the bilateral lung herniations and costochondral fractures. A Vicryl mesh was placed into the upper chest cavities in an underlay fashion bilaterally due to the concern for potential contamination from the lung injury and associated air leak. The chest wall was reconstructed over the Vicryl mesh utilizing a combination of polyether ether ketone (PEEK) plates (PEEK, KLS Martin, Jacksonville, FL) and a titanium plating system (T-plate, KLS Martin, Jacksonville, FL) (figure 3). The patient was ultimately extubated on postoperative day 7. To maintain stent patency, he was discharged with Aspirin.

Subclavian vessel injuries are rare, particularly when associated with blunt chest wall injuries, but

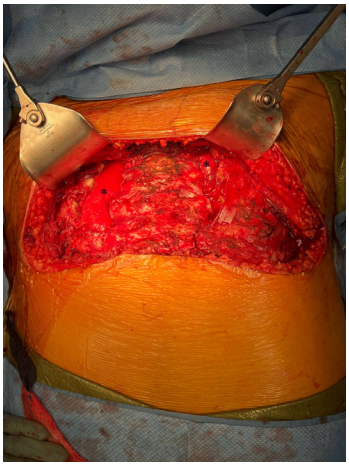

Figure 1 Severe bilateral costochondral fractures with lung herniation, represented by asterisks.

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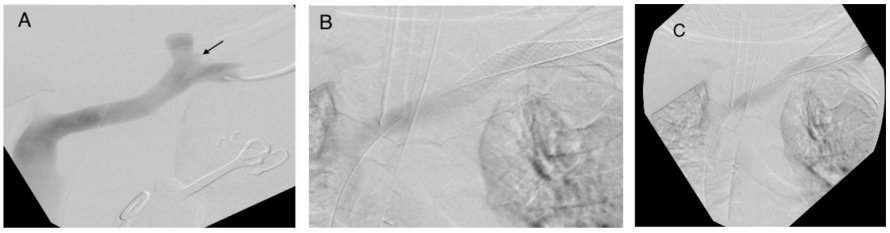

Figure 2 Intraoperative venogram (A) pre-stent deployment with arrow indicating small area of blush; (B) successful deployment of subclavian vein stent; (C) flow through patent stent without extravasation of contrast.

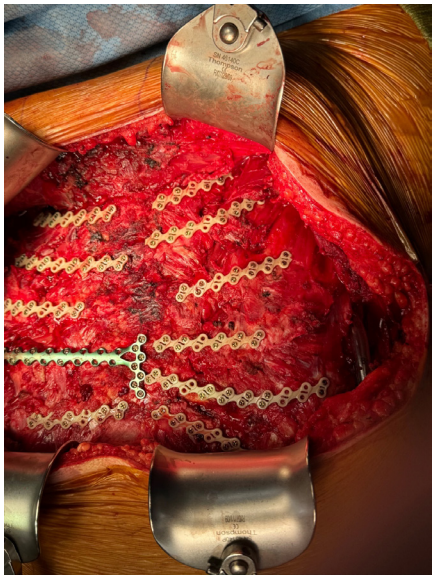

Figure 3 Chest wall reconstruction.

when present carry high morbidity and mortality. High suspicion for these injuries should occur in patients with first rib fractures or sternoclavicular joint disruptions. In hemodynamically stable patients, a CT angiogram can be pursued to evaluate thoracic vessels. When injured, these vessels can be repaired through both an open and an endovascular approach. On review of initial trauma chest CT, there was no obvious vascular or collateral vessel injury. Open repairs to the subclavian vessels can be approached via a clavicular incision with extension proximally to a sternotomy or distally towards the axilla for distal control. An endovascular approach may allow for easier access to the region though not all injuries are amenable to endovascular repair. Had this proximal vascular injury been identified on the original CT scan, an endovascular approach with potential conversion to a median sternotomy with a supraclavicular extension, could be entertained, with the chest wall reconstruction being delayed depending on hemodynamic stability.

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