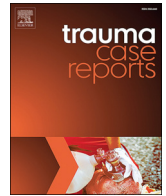


Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Trauma Case Reports

journal homepage: www.elsevier.com/locate/tcr

Case Report

Hybrid approach to complex vascular injury secondary to blast induced scapulothoracic dissociation[☆]

Rebecca Jordan^{*}, Melissa Obmann, Boyoung Song, Shivprasad Nikam, David Mariner, Frederick Toy, Richard Lopez

Geisinger Wyoming Valley, Department of Trauma Surgery, Department of Vascular Surgery, 1000 E. Mountain Blvd, Wilkes Barre, PA 18711, United States of America

ARTICLE INFO

Keywords:

Scapulothoracic dissociation
Subclavian artery injury
Vascular trauma
Blunt trauma, penetrating trauma

ABSTRACT

Scapulothoracic dissociation is a rare but devastating injury complex involving high velocity blunt trauma to the osseous, muscular, neurologic, and vascular structures of the shoulder girdle. Often seen following a motor vehicle or motorcycle accident, this injury complex presents with vascular trauma in over 80% of cases. We present a unique case of scapulothoracic dissociation secondary to a self-inflicted shotgun wound to the shoulder, not previously reported in the literature. The patient presented in hemorrhagic shock, with an open wound to the chest, and a flaccid, pulseless left upper extremity. Imaging was consistent with subclavian artery transection with thrombosis. He underwent successful upper extremity revascularization with a hybrid approach including open wound exploration and endovascular repair of the subclavian artery. Furthermore, we review the diagnosis and treatment of scapulothoracic dissociation and discuss the safety of emerging hybrid vascular techniques in the management of subclavian and axillary vessel trauma.

Scapulothoracic dissociation (SD) is a devastating injury complex following high-energy blunt trauma to the osseous, muscular, neurologic and vascular structures of the shoulder. With vascular injury noted in up to 88% of cases and mortality rate of 10%, a high level of suspicion is warranted in those who present with blunt trauma to the shoulder and torso [2]. We present an interesting case of combined penetrating and blast induced SD secondary to a shotgun blast. Timely surgical intervention with a hybrid vascular approach allowed for effective hemorrhage control and successful limb revascularization in an unstable trauma patient.

Case report

A young male presented with a self-inflicted shotgun wound to the left upper chest. Primary survey revealed a patent airway with diminished breath sounds to the left lung fields. He was hemodynamically unstable with a blood pressure of 80/62 and heart rate of 110 with a Glasgow Coma Score of 15. An open wound was noted to the left upper chest with a pulseless, insensate, and flaccid left upper extremity. Resuscitation was initiated with crystalloid followed by two units of packed red blood cells (PRBC) with transient response. A focused assessment with sonography in trauma (FAST) was performed showing pericardial fluid and a left thoracostomy tube was placed. Computed tomography angiogram of the neck, chest, and left upper extremity revealed multiple rib fractures,

[☆] Presented as an oral case presentation at American College of Osteopathic Surgeons Clinical Assembly, October 2018. This case report was reviewed by the local institutional review board, and the need for informed consent was waived.

^{*} Corresponding author.

E-mail address: rmjordan@geisinger.edu (R. Jordan).

<https://doi.org/10.1016/j.tcr.2019.100236>

Accepted 21 July 2019

Available online 14 August 2019

2352-6440/© 2019 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

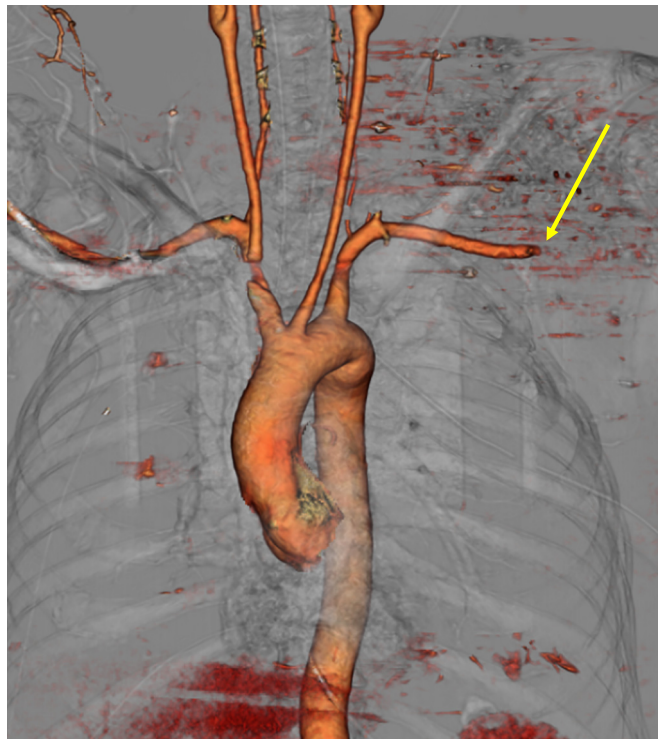


Fig. 1. Computed Tomography Angiogram showing partial transection of left subclavian artery (yellow arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

scapular fracture, and partial transection of the left subclavian artery with suspected thrombosis (Fig. 1).

The patient was taken emergently to the hybrid operating suite where he underwent wound exploration by trauma surgery. The wound was extended by infraclavicular incision to control hemorrhage and gain proximal vessel control with ligation of the thyrocervical trunk. Intra-operatively, the patient remained hemodynamically labile necessitating further blood transfusion. A sub-xyphoid pericardial window was created to evaluate the pericardial effusion seen on FAST with no cardiac tamponade or injury found. The sub-xyphoid incision was closed and the chest wound packed for continued hemostasis. Overall, he received six units PRBC, six units fresh frozen plasma, and one unit of platelets.

Vascular surgery simultaneously worked to repair the subclavian artery via left brachial artery cutdown. Retrograde access was achieved with a micro-puncture needle and a selective catheter utilized to traverse the area of injury. Angiography revealed flow proximal to the lesion with an abrupt cutoff and distal reconstitution of flow. Contrast extravasation was noted from several muscular branches just distal to the injured vessel. Two Viabahn covered stents (GORE, Flagstaff AZ), 8 mm × 5 cm and 8 mm × 10 cm were



Fig. 2. Intra-operative angiogram with abrupt cutoff at the level of the left subclavian artery (yellow arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

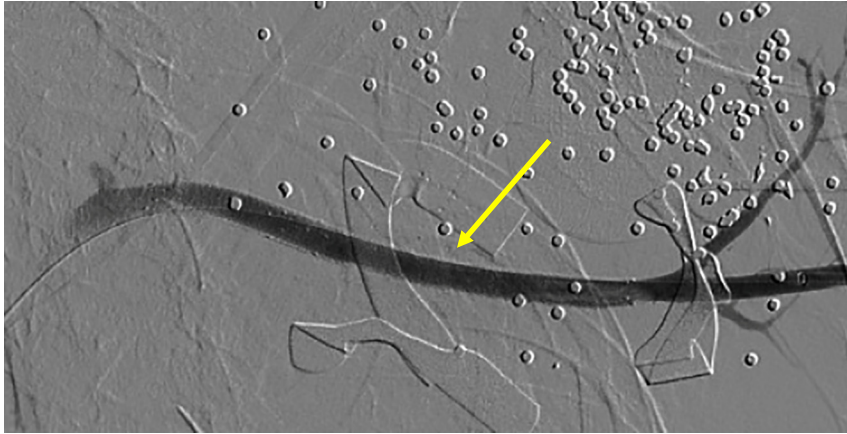


Fig. 3. Intra-operative angiogram with patent left subclavian artery after placement of two covered stent grafts (yellow arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

then placed with overlap of 2 cm (Figs. 2, 3). Repeat angiography showed a patent subclavian artery and intact flow to the distal extremity without active extravasation. There were palpable radial and ulnar pulses. He was stabilized in the intensive care unit and underwent delayed wound closure on hospital day three with subsequent extubation.

Scapulothoracic dissociation was diagnosed based on imaging and physical exam (Fig. 4). Orthopedic surgery and Neurology each elected for supportive management. The left upper extremity remained well perfused with palpable pulses. Function slowly improved with return of elbow and wrist flexion/extension and weak grip strength. He was ultimately discharged to inpatient psychiatry on Aspirin 81 mg and Plavix 75 mg daily but failed to return for follow-up.

Discussion

Scapulothoracic dissociation is a potentially limb- and life-threatening injury complex seen following blunt trauma to the shoulder girdle involving substantial distraction force. Originally described by Oreck et al. [1], SD presents with a laterally displaced scapula

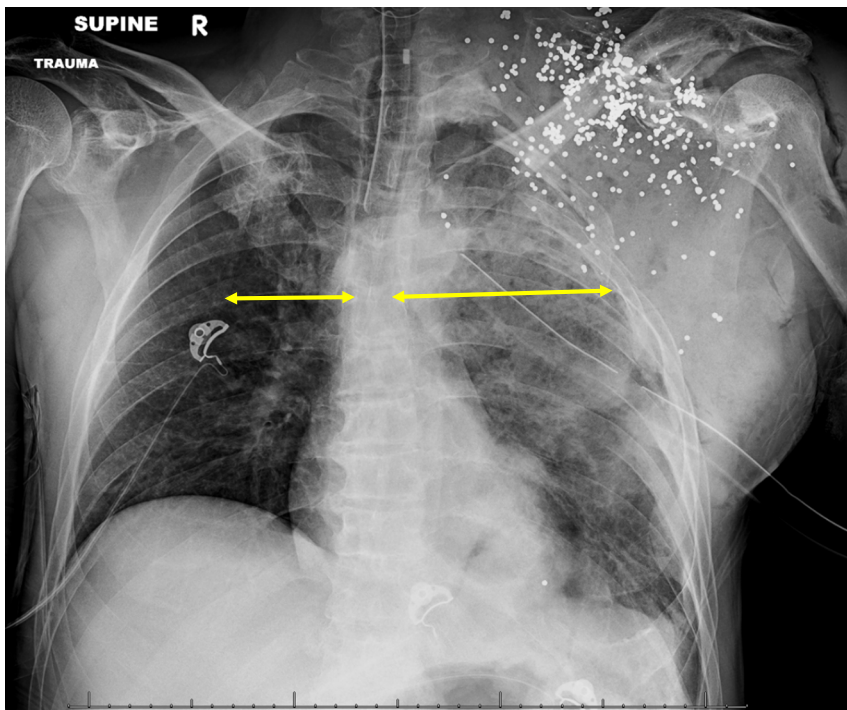


Fig. 4. Chest radiograph showing increased scapular index (yellow arrows) indicating scapulothoracic dissociation of the left shoulder. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

and ipsilateral acromioclavicular joint separation, with varying degrees of brachial plexus disruption and subclavian vessel injury [2]. Up to 79% of reported cases involve high-speed motor vehicle or motorcycle collisions. This “distracting force” is thought to originate from a sudden deceleration while the extremity remains gripped to a steering wheel or handle bar [2]. Our patient presented with SD in the setting of combined penetrating and blast induced blunt trauma, not previously described in the literature.

Diagnosis is determined by the scapular index, or the ratio of distance from a thoracic spinous process to the medial border of both scapulae on a non-rotated AP chest radiograph [1]. Increased lateral displacement of the scapula greater than 1 cm or a scapular index of greater than 1.29 is consistent with SD [2]. No standardized management algorithm exists given the rare and variable presentations. Need for immediate surgical intervention is often based on level of vascular injury. Musculoskeletal reconstruction is frequently warranted but timing varies based on hemodynamic and neurologic stability [2]. Neurologic management options include observation, neurolysis, nerve repair/grafting, tendon or muscle transfers, and amputation. Reported mortality is approximately 10% and up to 21% of patients undergo early above elbow amputation [2].

While SD is discussed primarily in Orthopedic literature, awareness is important for vascular and trauma surgeons alike. Vascular injury is reported in up to 88% of cases, most often presenting as thrombosis of the subclavian artery [2]. Initial management once consisted of open repair with either lateral thoracotomy or median sternotomy to control subclavian bleeding. However, surgical exploration often revealed subclavian artery and vein thrombosis with blood loss from “torrential hemorrhage issuing from myriad perforating arteries and veins of the chest wall” [3]. As such, angiography of the injured extremity is recommended in the hemodynamically stable patient to distinguish vascular lesions. Identified injuries may then be repaired by open bypass grafting, endovascular stent grafting, or combined hybrid techniques [2]. One report offers observation alone as a viable option in injuries without active extravasation [6].

Surgical management of subclavian and axillary vessel trauma is challenging. Open repair remains the primary approach to penetrating vascular injuries [5] but involves several highly morbid exposures. Patients who present in extremis may require resuscitative thoracotomy to control subclavian artery hemorrhage by direct apical thoracic pressure. Proximal control of the subclavian artery may necessitate median sternotomy, lateral thoracotomy, limited or trap door sternotomy, or a supraclavicular incision with distal extension [4]. Of course the presence of concomitant thoracic and abdominal injuries must be considered requiring a combination of incisions.

Expanding endovascular and hybrid techniques provide a solution to difficult and morbid surgical exposure. Recent review of a prospective registry of trauma patients with vascular injury revealed that endovascular techniques were mostly used in blunt, non-compressible torso injuries but infrequently utilized in penetrating and limb injuries [5]. Endovascular approaches, however, provide the benefit of remote access, avoiding surgical dissection in a traumatized area and decreasing the risk of injury to important adjacent structures [7]. A Western Trauma multicenter review addressed contemporary management of subclavian and axillary artery injury showing low early complication rates and equal limb salvage in open and endovascular techniques [4]. Similar case reports support a hybrid approach for timely control of hemorrhage in the unstable patient while providing access for revascularization and definitive repair [8]. In the setting of uncertain neurologic dysfunction and recovery, endovascular stent grafting may also provide a bridge to open bypass grafting once the patient is hemodynamically stable and surgically optimized. Although debate remains concerning stent graft outcomes in unreliable populations, limited studies have demonstrated acceptable risk [9].

Conclusion

Awareness and a high level of suspicion is paramount in timely identification of this rare but destructive injury complex. As the availability and utilization of hybrid operating suites grows, endovascular and hybrid approaches offer a safe approach for hemorrhage control and definitive vascular repair in the unstable trauma patient.

References

- [1] Oreck SL, Burgess A, Levine AM. Traumatic lateral displacement of the scapula: a radiographic sign of neurovascular disruption. *J Bone Joint Surg Am*. 1984;66:758–763.
- [2] Choo AM, Schottel PC, Burgess AR. Scapulothoracic dissociation: evaluation and management. *J Am Acad Orthop Surg*. 2017;25:3390347.
- [3] Johansen K, Sangeorzan B, Copass MK. Traumatic scapulothoracic dissociation: case report. *J Trauma* 1991;31(1):147–149.
- [4] Waller CJ, Cogbill TH, Kallies KJ, et al. Contemporary management of subclavian and axillary artery injuries- A Western Trauma Association multicenter review. *J Trauma Acute Care Surg*. 2017 Dec;83(6):1023–1031.
- [5] Faulconer ER, Branco BC, Loja MN, et al. Use of open and endovascular surgical techniques to manage vascular injuries in the trauma settings: a review of the American Association for the Surgery of Trauma PROspective Observational Vascular Injury Trial registry. *J Trauma Acute Care Surg*. 2018 Mar;84(3):411–417.
- [6] Sampson LN, Britton JC, Eldrup-Jorgensen J, Clark DE, Rosenberg JM, Bredenberg CE. The neurovascular outcome of scapulothoracic dissociation. *J Vasc Surg* 1993;17:1083–90.
- [7] Matsagkas M, Kouvelos G, Peroulis M, et al. Endovascular repair of blunt axillo-subclavian arterial injuries as the first line treatment. *Injury*. 2016 May;47(5):1051–6.
- [8] Diaz-Gutierrez I, Rana MA, Ali B, et al. Hybrid repair of complex left subclavian artery injury with partial transection and complete thrombosis in an unstable patient following blunt trauma. *Ann Vasc Surg*. 2017 Apr;40:298.e11–298.e14.
- [9] Du Toit DF, Lambrechts AV, Warren BL. Long term results of stent grafts treatment of subclavian artery injuries: management of choice for stable patients? *J Vasc Surg*. 2008 Apr;47(4): 739–43.