Endovascular repair of traumatic axillary artery transection associated with scapulothoracic dissociation complicated by stent separation

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ABSTRACT

We report the case of a 23-year-old female pedestrian who had been struck by a car and had presented with axillary artery transection in the setting of scapulothoracic dissociation. The initial endovascular repair was compromised by her shoulder instability and had required the addition of bridging stent placement. Caution is advised with endovascular repair in this clinical scenario because of possible stent separation. (J Vasc Surg Cases Innov Tech 2023;9:1-3.)

Keywords: Arterial trauma; Axillary artery injury; Axillosubclavian artery injury; Endovascular repair; Scapulothoracic dissociation

Scapulothoracic dissociation (SD) was first described in 1984 as a complex injury secondary to high energy trauma. Oreck et al[1] defined SD as lateral displacement of the scapula and acromioclavicular separation without amputation through the soft tissue—essentially a closed forequarter amputation. It is often accompanied by brachial plexus and axillosubclavian vessel injuries. We have described a case in which endovascular repair of an axillary artery transection was successfully performed but with an important lesson learned in the setting of SD. The patient provided written informed consent for the report of her case details and imaging studies.

CASE REPORT

A 23-year-old female pedestrian who had been struck by a car was transferred to our institution for a higher level of care. She had experienced traumatic amputation of her right hand, with occlusion of the ipsilateral axillary artery revealed by computed tomography. Her other injuries included an open right tibia/fibula fracture and nasal bone fracture.

Her vital signs on presentation were a temperature of 98.3°F, blood pressure of 141/50 mm Hg, heart rate of 130 bpm, respiratory rate of 16 breaths/min, and oxygen saturation of 95% with a nonrebreather mask. Her Glasgow coma scale score was 15. She had large soft tissue swelling and ecchymosis around the right shoulder. She had no motor function nor sensation in her entire right upper extremity. Her brachial pulse was not palpable. The hand had been amputated at the wrist with degloving up the forearm.

Computed tomography angiography showed a right axillary artery occlusion with a large surrounding hematoma. A comminuted fracture of the scapula was present with marked anterolateral displacement and severe separation of the acromioclavicular joint of >8 cm (Fig 1). Avulsion of the trapezius muscle from the scapula was also present.

The patient was taken emergently to the hybrid operating suite for planned endovascular repair, followed by exploration of the wound. After induction of general anesthesia, a 7F sheath was positioned into the right subclavian artery from a transfemoral approach. The brachial artery was accessed with a 6F sheath. A glidewire was advanced through the femoral sheath, snared within the hematoma, and brought out through the brachial sheath for through and through wire access (Fig 2). Using available stock, the transected artery was repaired with overlapping 7-mm × 10-cm and 7-mm × 7.5-cm Viabahn stents (W. L. Gore & Associates, Flagstaff, AZ) placed from the femoral access. After ensuring an adequate proximal and distal seal, the overlap between the stents was 2.2 cm. The stents were postdilated with a 7-mm balloon. A completion angiogram showed successful exclusion of the injury.

The arm, which had been at the patient's side, was then abducted slightly to ligate the radial and ulnar arteries. Immediately, the patient become profoundly hypotensive, followed by pulseless electrical activity arrest. During cardiopulmonary resuscitation, an angiogram from our sheath still in place showed the stents had separated, resulting in large extravasation. An 8-mm balloon was inflated in the proximal stent to control the hemorrhage, and the patient stabilized. We reestablished through and through wire access and deployed an 8-mm × 10-cm Viabahn stent from the brachial access to

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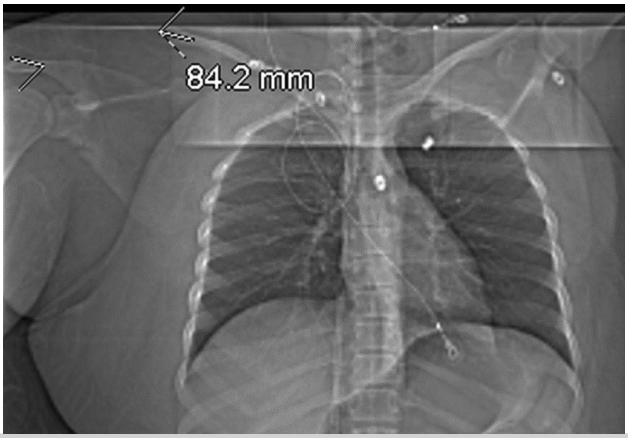

Fig 1. Scout film from computed tomography scan showing an acromioclavicular joint separation of 8.4 cm.

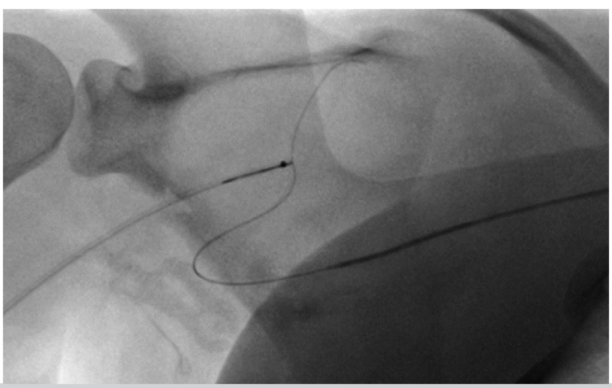

Fig 2. Scan showing wire from the femoral access snared from the brachial access within the surrounding hematoma.

bridge the previous stents. The sheath sites were closed, and open forearm amputation was performed by the orthopedic team. Afterward, the arm was continuously supported with a sling when the patient was erect and by a carter pillow when she was supine.

The patient subsequently underwent a transhumeral amputation on hospital day 4 and was discharged to a rehabilitation center on day 15 with a palpable brachial pulse and taking aspirin and clopidogrel. The patient missed all of her follow-up appointments with us because of the geographic distance and also missed her appointments for surveillance duplex ultrasound. The primary care notes at 1 and 3 months after her injury documented a well-healed amputation, compliance with physical therapy, and “reasonable motion of the amputation stump.” A telephone interview with the patient at 6 months postoperatively was performed, at which her only complaint was occasional phantom pain.

DISCUSSION

SD is a rare, but devastating, condition associated with high morbidity and mortality.[2-4] It is characterized by traumatic disruption of the shoulder involving injuries

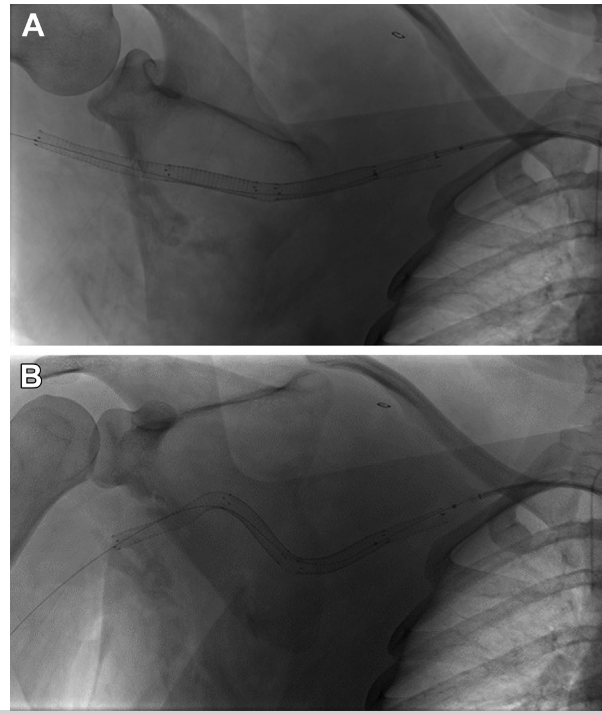

Fig 3. Images showing arm abducted **(A)** and adducted **(B)** with resulting configuration change of the axillary stents.

to the osseous structures, soft tissue, brachial plexus, and axillosubclavian vessels. The incidence of arterial injury has been reported to range from 64% to 100%.[5] The original report of SD described complete avulsion of the brachial plexus and subclavian artery and vein; however, the definition has been liberalized since then to include a spectrum of injuries.[1] Two proposed classification systems both included a mandatory musculoskeletal injury but with increases in the grade with increasing severity of any neurologic deficit and the presence of vascular injury.[2,6] Damschen et al[2] reported that of 54 injuries, 52% of patients had had flail extremity and 21% had required early amputation, with a 10% mortality rate. The diagnosis can be delayed because of the intact skin and other distracting injuries; however, asymmetric swelling of the shoulder should be an early indication. Radiographic findings of an acromioclavicular or a sternoclavicular joint disruption or distracted clavicle should also raise suspicion for SD.[7] Arterial injuries will often require the most urgent intervention. Concomitant venous injuries can be ligated or managed conservatively. The need for, and timing of, nerve repair and musculoskeletal stabilization should be individualized.[5] Various techniques of osseous stabilization using hooks, wires, and plating have been described for the acromioclavicular separation, with no single technique shown to be superior.[8]

For the arterial injury, we used a rendezvous technique of snaring a wire because of the large gap between the transected ends of the artery.[9] We believed through and through wire access was necessary for the delivery of the stents. Initially, the right arm was adducted to facilitate wire management toward the foot of the bed. However, simply articulating the arm board out caused enough displacement for the stents to separate. Fortunately, we were able to reinforce our repair with an additional stent. The stent position of our patient with the arm abducted and then adducted is shown in Fig 3. With abduction (Fig 3, *A*), lengthening of the artery and straightening of the stents will occur. In contrast, with adduction (Fig 3, *B*), shortening of the artery caused an S configuration of our stents.

In general, endovascular repair of axillosubclavian injuries has been shown to be an acceptable alternative to open surgical repair.[10,11] Lower complication and mortality rates have been reported with endovascular repair compared with open repair in this location.[12] With the poor prognosis of the limb from a functional status, some have suggested conservative management for the vascular injury, with ligation only for active bleeding.[3] For our patient, the amount of neurologic recovery our patient could experience was not clear nor was the level of amputation that should be attempted; thus, we believed revascularization would give her the best chance of saving as much of the arm as possible.

The present case illustrates the importance of shoulder stabilization during and after endovascular repair of an axillosubclavian injury when associated with SD. With the extreme instability of the shoulder joint, stents can become separated from the proximal or distal seal zones or from each other if more than one stent has been used. Minimizing the number of stent overlaps might yield better results, and the length of stent coverage should be checked in both the adducted and the abducted positions.

CONCLUSIONS

Endovascular repair of an axillosubclavian injury associated with SD is possible but should be used with caution. Heightened awareness is required regarding the possible need for a longer stent according to the position of the arm to avoid compromise of the arterial repair.

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