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Mohamad M. Gouda
Mataria Teaching Hospital, Gouda69.mg@gmail.com

Mohamad Taha
Mataria Teaching Hospital

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Case Report

Endovascular repair of traumatic subclavian artery pseudoaneurysm: a case report and review of the literature

Mohamad M. Gouda, Mohamad Taha
Department of Vascular Surgery, Mataria Teaching Hospital, Cairo, Egypt

Abstract

Traumatic subclavian artery injury resulting in pseudoaneurysm formation is relatively uncommon. With the increasing percutaneous arterial interventions utilization worldwide, the number of pseudoaneurysm formation has increased owing to iatrogenic arterial injury. After trauma, injury of subclavian artery early appears, and many complications such as life-threatening bleeding, the creation of pseudoaneurysm, and brachial plexus compression may be caused by the arterial rupture. The presence of large hematoma and pulsatile palpable mass in the supraclavicular region should raise the suspicion of severe vascular injury. Surgical thoracotomy and direct arterial repair traditionally treated subclavian artery pseudoaneurysms. However, significant morbidity is usually associated with surgical repair. In recent years, endovascular stent grafting has become an attractive intervention with less invasiveness and morbidity for these injuries. We have a case report of pseudoaneurysm following traumatic right subclavian artery owing to penetrating neck trauma caused by bullet injury, which was treated successfully by endovascular stent grafting, providing a complete review of the literature.

Keywords: Endovascular, pseudoaneurysm, subclavian artery, trauma

Introduction

Blunt and penetrating trauma presents a challenging complication owing to an injury to the subclavian artery. Urgent repair is needed when bleeding is active or there is presence of pseudoaneurysm or critical limb ischemia. It usually causes hemorrhages, which is life-threatening, frequently caused by the arterial rupture. It needs to be carefully ruled out by physical examination and rapid imaging for diagnosis [1].

The traditional management for this is open surgery, which is associated with high morbidity, as we need extensive exposures by resection of clavicle, thoracotomy, or median sternotomy [2].

In recent years, owing to the technological evolution and growing operators' experience, endovascular stent grafting has attracted surgeons to manage these injuries noninvasively with low morbidity [3].

We report a case of traumatic pseudoaneurysm of the right subclavian artery after penetrating neck trauma by bullet injury, which was treated successfully by endovascular stent grafting.

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Case Report

A previously healthy 29-year-old Libyan man had a bullet injury to the right side of the neck during a war in Libya. He reported a painful swelling in the right supraclavicular region. He came after 3 weeks from the trauma to our hospital in Egypt.

He was complaining of severe pain in the neck and right upper limb. The pain was not responding to analgesics. The patient was vitally stable, fully conscious, and well oriented. The patient was hemodynamically stable; blood pressure was 120/80 mmHg, with a 90-beats/min heart rate.

Physical examination revealed patent airway. He was breathing normally, with a respiratory rate of 19 beats/min, and the trachea was lying on the midline. There was a huge pulsating swelling in the right supraclavicular region with normal overlying skin (Fig. 1) and intact right upper limb peripheral pulsations down to the radial pulse.

Correspondence to: Mohamad M. Gouda, MD.
Department of Vascular Surgery, Mataria Teaching Hospital, Cairo, Egypt. Tel: 01111996622.
E-mail: Gouda69.mg@gmail.com

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No signs of brachial palsy were observed. Intact bilateral carotid pulsations were observed. A chest plain radiography was performed; there were no signs of pneumothorax. Initial presence of a large pseudoaneurysm in the right supraclavicular fossa was confirmed by ultrasound duplex scans.

A contrast-enhanced computed tomography scan (Fig. 2) demonstrated a large pseudoaneurysm of ~8 × 5 × 5 cm, originating from the first part of the right subclavian artery near the origins of the right internal mammary artery and the right common carotid artery.

The patient was transferred to the Cathlab for elective angiographic study and endovascular occlusion of the pseudoaneurysm. The patient, on the day of the angiogram, was started on 150 mg of aspirin and 75 mg of clopidogrel. Moreover, 5000 IU of a bolus of heparin intravenously was given during the angiogram.

The right femoral artery was accessed using a standard Seldinger technique, and an 11-cm 6-Fr sheath introducer (1600 West Merit Parkway South Jordan UT 84095 USA) was placed. Using a hydrophilic 0.035 guidewire (300 Boston Scientific Way Marlborough, MA 01752-1234) and with the aid of a 5-Fr Bern catheter (Impress angiographic catheter; Merit Medical), aortic arch was reached. At this moment, left subclavian artery selective arteriography was done and showed patent left vertebral artery (Fig. 3).

Selective angiogram of the right subclavian artery was then done to determine the extent of the lesion, and it confirmed the presence of right subclavian artery pseudoaneurysm, adjacent to the right vertebral artery and near the origin of the right internal mammary artery (Fig. 4).

We decided to treat the lesion with a stent graft. Coiling of the right internal mammary artery was done at first to avoid endoleak by MReye embolization coil (Cook) by two coils: 0.035–8 cm – 5 mm (Fig. 5).

The wire was exchanged by a stiffer one, 260-cm long 0.035 (Amplatz super stiff; Boston Scientific).

A 10 × 60 mm Fluency plus (BARD) peripheral endovascular stent graft was advanced in anterograde fashion after replacement of the sheath introducer by a 9-Fr sheath introducer; then it was deployed across the injured segment of the subclavian artery under fluoroscopic visualization.

The covered stent was decided to cover at least 1.5–2 cm of healthy artery proximal and distal to the injury and to reach 10–15% oversizing. The right vertebral artery was sacrificed. The stent was postdilated to 10 mm by an angioplasty balloon (10×60 mm) (ClearPAC Omega; Clearstream Technologies) for better apposition between the stent and vessel wall. Control angiography revealed a stented segment with regular contours, without residual stenosis. An aneurysm was not opacified (Fig. 6).

After the procedure, the patient started dual antiplatelet therapy with aspirin 150 mg and clopidogrel 75 mg once daily for 12 months. We did not use antiplatelet treatment preoperatively.

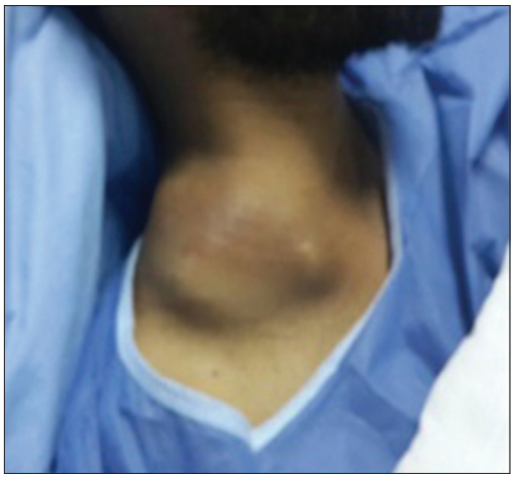

Figure 1: Large pulsatile mass in the right supraclavicular region.

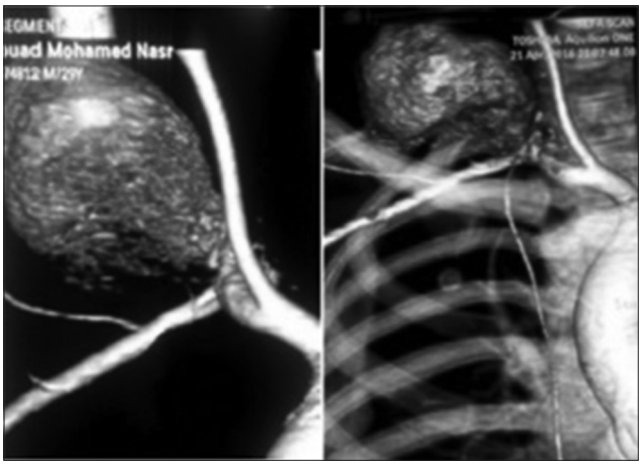

Figure 2: Computed tomographic three-dimensional reconstruction showing a large pseudoaneurysm originating from the first part of the right subclavian artery.

Figure 3: Left subclavian artery selective arteriography showing patent left vertebral artery.

Postoperatively, the patient had palpable pulses, excellent blood flow to the arm, disappearance of pain; moreover, the swelling decreased in size and became nonpulsating.

A few days later, duplex was done and demonstrated complete occlusion of the pseudoaneurysm (Fig. 7) neck, and the patient was discharged.

Consent

The patient had been informed, and his written consent was obtained for using the images for the case report to be published.

Discussion and Review of the Literature

Subclavian arterial injuries account for only 2–5% of acute vascular injuries. A penetrating trauma is the most common cause of these injuries. According to the literature, blunt trauma results in a minority (1–5%) of all subclavian artery injuries and usually has fractures or dislocations associated with it [4].

Pseudoaneurysms are false aneurysms that are defined as a contained rupture of the layers of arterial wall, in which the actual blood collection is without walls and is in direct contact with a defect in the artery. The most common traumatic pseudoaneurysms are in the common femoral artery [5].

A history of trauma should be suspected of a bone injury. The upper limb physical examination must be focused on the color of the skin, the sensation of temperature, the mobility of the hand as well as radial pulsation. Moreover, it is often to find shoulder hematoma. Contrast-enhanced computed tomography, mainly available in trauma centers, plays a critical role in diagnosing and surgical planning as it can show us the site of the lesion and its extension [2].

An untreated pseudoaneurysm complication is caused by continuous expansion and may end by its rupture, arterial thrombosis, compression of the adjacent neurovascular structures, and erosion through the skin surface, leading to external bleeding [4].

Penetrating trauma to the subclavian artery and pseudoaneurysm formation, although infrequent, can be challenging to treat. Primary surgical repair has historically been the first line of treatment. However, the extensive exposure required for access to the subclavian artery makes surgical repair complicated [6].

Surgically, we can repair it by an approach of supraclavicular entry with or without resection of the clavicle, by median sternotomy, by thoracotomy, or for exposures that are more extensive by combined access. There is a high risk of injury to subclavian vein and brachial plexus regardless of the surgical technique. Moreover, a higher risk of bleeding carries a significant threat to life. The mortality reported in some studies has an average of 10 and 30% [7].

The focus of surgeons has shifted to endovascular techniques to decrease the morbidity and mortality associated with the open procedure. Various alternative minimally invasive methods of pseudoaneurysm repair have been described, including endovascular stent graft placement and percutaneous thrombin injection [6].

Endovascular graft repair of arterial injury was first described in 1969 and first reported in the 1980s [8]. The endovascular repair of a subclavian injury was successfully reported by Parodi [9] using an endovascular technique in 1995 when a traumatic arteriovenous fistula was treated with a covered stent. Another early article by Patel *et al.* [10] on endovascular

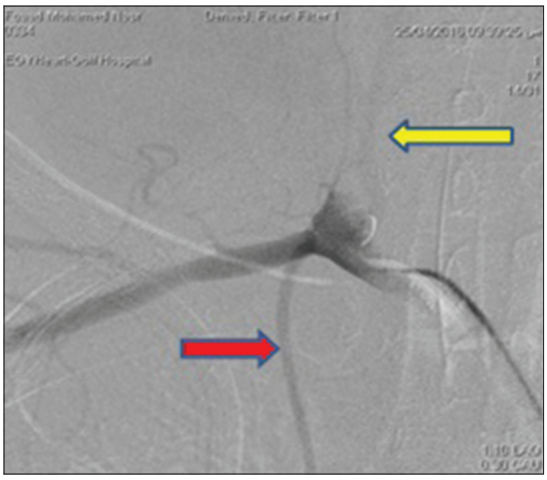

Figure 4: Selective angiogram of the right subclavian artery showing a right subclavian artery pseudoaneurysm.

Figure 5: Coiling of the right internal mammary artery.

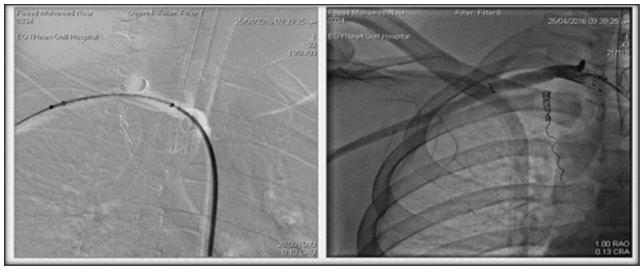

Figure 6: Stent grafting of the pseudoaneurysm.

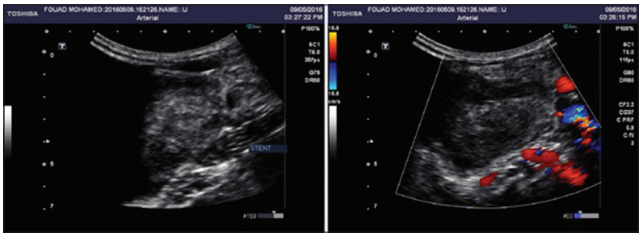

Figure 7: Duplex demonstrated complete occlusion of the pseudoaneurysm.

repair of subclavian artery injury reported shorter procedure times and less blood loss in comparison with surgical repair.

Endovascular graft repair of a pseudoaneurysm is a treatment with few complications, high success rate, and low recurrences rate. The use of endovascular therapy was widely accepted and is less invasively an alternative approach to surgical repair of these injuries [11].

The endovascular approach has a principal advantage of its remote access site insertion. So extensive surgical exposure is not needed. Diminished pain, decreased disability, and rapid recovery are also advantages of the minimally invasive approach.

We now can repair more anatomically tricky lesions using an endoluminal approach, including complete arterial transaction, owing to the advancement of endovascular devices technology and increase in the experience acquired. Starting with the less invasive percutaneous femoral access, even when we are deploying of larger sheaths of the covered stents. Furthermore, this enables quick access for hemostatic catheter-balloon placement proximal to the lesion, which could not be achieved through the arm.

In contrast to aortic stent grafts, these peripheral covered stents require minimal preoperative sizing. In most cases, sizes can be adequately determined from intraoperative angiography.

As the femoral approach is used usually to perform endovascular procedures, femoral access site (groin) complications represent the most common localized complications. The second group of complications is directly related to the stent graft site. These complications can result in adverse outcomes, exposing patients to significant discomfort, additional risk, more prolonged hospital stay, and consumption of extrainstitutional resources.

The main disadvantage is the thrombogenicity of stents, especially in the first month. The long-term durability is unknown.

Stent thrombosis was reported as periprocedural and late complications [12], so we should provide follow-up of long-term clinical and imaging at regular intervals to look for late complications such as device kinking, vessel stenosis, formation of thrombus, flow around the covered stent (endoleak), strut fracture, or device malpositioning [13].

No specific data guide the periprocedural or postprocedural drug therapy with covered stent use. Empirically, the trend is to use long-term combined antiplatelet therapy with aspirin and clopidogrel. Many reports suggest that antiplatelet and antithrombotic therapies are valuable adjuncts. Long-term use of vitamin K antagonists is not recommended after covered stent placement [14].

Conclusion

The trauma of subclavian artery is a severe fatal injury and potentially life-threating complications. The endovascular approach has been established as a feasible and beneficial technique. Vascular surgeons must be trained and become familiar with this approach.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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