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Case Report Open Access

Endovascular Treatment of a Gunshot Injury of the Subclavian Artery

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Abstract

Objectives: We present a case of a patient with a right subclavian artery injury due to a gunshot, treated by endovascular approach in our clinic in Kielce, Poland.

Case report: A 35-year-old male, presented with a penetrating injury of the right supraclavicular region due to a shotgun slug. The patient was hemodynamically unstable. Both chest radiograph and CTA (Computed Tomography Angiography) imaging presented an injury of the right subclavian artery, multisegmental rib fractures of ribs I-III and a hemo-pneumothorax. Endovascular repair of the subclavian artery was performed, followed by insertion of a Redon wound drain and right-sided pleural drain. The patient was then transported to the thoracic surgery unit, where further therapy, including a removal of the bullet from the thoracic wall, was performed. Upon a 4 months follow-up visit, the patient was in a good condition and a CTA scan performed at this time confirmed the patency of the right subclavian artery.

Conclusions: Endovascular repair presents a viable alternative option for treating subclavian artery injuries, even in hemodynamically unstable patients.

Keywords: Subclavian artery; Penetrating injury; Gunshot; Endovascular repair

Introduction

The incidence of injuries to the subclavian artery is rare, representing 2-5% of all acute vascular trauma [1,2]. As the subclavian artery is overlain by the clavicle, the vast majority of injuries are penetrating injuries (eg. gunshot or stab). Blunt trauma represents only 1-5% of all subclavian artery trauma [1,3] Although incidence is low, injuries of the subclavian artery are associated with a high risk of severe bleeding. As the mortality reaches 10-30%, an immediate start of therapy is of critical importance to reduce patient mortality [4].

The vast majority of the existing literature concerning subclavian artery injuries originates from the United States and South Africa. In this article, we present a case of 35-year-old patient with a right subclavian artery injury after a gunshot, treated by endovascular approach in our clinic in Kielce, Poland.

Case Report

A 35-year-old male presented to our clinic with a penetrating injury of the right supraclavicular region caused by a shotgun slug (Figure 1). Upon arrival he was in a severe condition with heart rate of 80 bpm, blood pressure, measured on the left upper limb, of 100/70 mmHg and SpO_2 of 95%. No pulse in the right upper limb was detected. Patient's condition systematically worsened and he became hemodynamically unstable. After CTA scan, his vitals worsened with a heart rate of 120 bpm, BP of 60/0 mm Hg and SpO_2 of 85%.

The chest radiograph (Figure 2) and CTA (Computed Tomography Angiography) scan (Figure 3) performed immediately after arrival presented an injury to the right subclavian artery, multi-segmental rib fractures of ribs I-III, a hemo-pneumothorax.

Immediately following his CTA, the patient was transported to the operating room while constant manual pressure was applied to the site of injury. The patient was placed under general anesthesia and during the operation, received 3 units of erythrocytes and 3 units of fresh frozen plasma.

Figure 1: Penetrating injury of the right supraclavicular region

The procedure was performed by right femoral access. Brachiocephalic trunk was catheterized and angiography was performed, demonstrating the injury location (Figure 4). A soft

hydrophilic catheter 0.035 mm (Terumo, Tokio, Japan) was navigated past the injury location. Then, an 8 × 100 mm Viabahn (Gore, Newark, New Jersey, USA) covered stent was placed in the right subclavian artery across the site of injury and balloon-postdilated (Figure 5). Arteriography performed at the end of the procedure demonstrated a complete coverage of the injury, patency of the subclavian artery and no contrast agent extravasation (Figure 6). The operation was followed by a wound revision with an insertion of Redon wound drain and right-sided pleural drain (Figure 7) for the decompression of the existing hemo-pneumothorax.

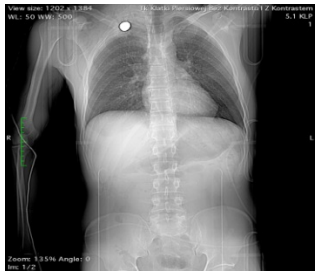

Figure 2: Chest X-ray obtained immediately after admission, demonstrating a bullet in the right supraclavicular region

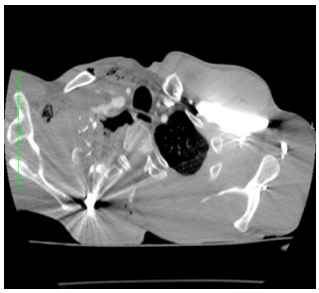

Figure 3: CTA obtained immediately after admission, presenting the injury of the right subclavian artery, hematoma with air collection within the soft tissue and the bullet

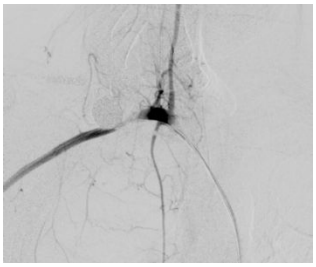

Figure 4: Intraoperative angiography before implantation of the stent, revealing a patent proximal part of the right subclavian artery, followed by a several centimeters long part of the vessel damaged by the bullet, with a return of the contrast agent in the distal, unchanged part of artery; Visible hands of the surgeon as a continuous compression of the artery was necessary.

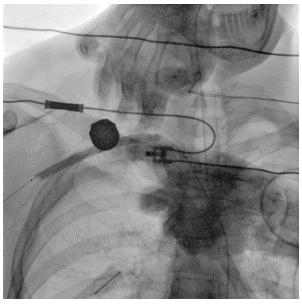

Figure 5: Intraoperative scan presenting a dilated covered stent in the right subclavian artery, as well as the bullet in the right supraclavicular region; Visible hands of the surgeon as a continuous compression of the artery was necessary.

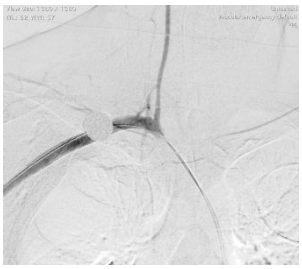

Figure 6: Intraoperative angiography after implantation of the stent, revealing a patency of the stent.

Figure 7: The patient after surgery, with inserted wound and pleural drains.

The patient was transported to an intensive care unit where he remained for 3 days. The gunshot wound as well as the operative site showed expected improvement during this time and a pulse was detected in all arteries of the right upper limb. Symmetrical blood pressure was detected on both upper limbs. However, an insufficient expansion of the right lung was detected (Figures 8 and 9). Therefore, on post-operative day 8, the patient was transported to the thoracic surgery unit and operated on in multiple steps, including an evacuation of the pleural hematoma, decortication of the right lung, chest tube placement in the apical right lung and removal of the bullet from the thoracic wall (Figures 10 and 11).

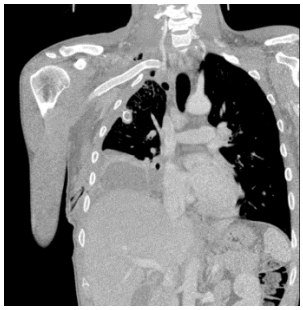

Figure 8: Postoperative CT scan in coronal plane, demonstrating a patent stent in the right subclavian artery and hemothorax of the right lung.

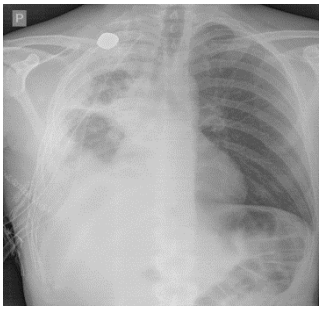

Figure 9: Chest X-ray obtained in the 8th post-operative day, demonstrating an insufficient expansion of the right lung, as well as the remaining bullet in the right supraclavicular region

Figure 10: The bullet removed from the chest wall.

The patient was discharged home in good condition 21 days after the accident.

Upon a 4 months follow-up visit, the patient was in a good condition. However, he complained about numbness in the right hand and forearm. Physical examination at this time confirmed the presence of both right radial and ulnar pulses, symmetrical blood pressures in both upper limbs, as well as full range of motion. Wound site and operative site showed normal signs of healing and a CTA scan confirmed the patency of the right subclavian artery (Figure 12).

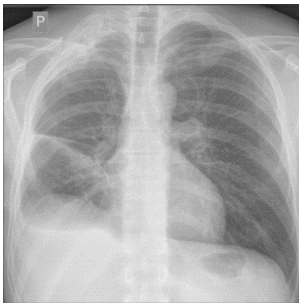

Figure 11: Chest X-ray obtained in the 21st day after accident, revealing a fully expanded lung and removed bullet from the chest wall

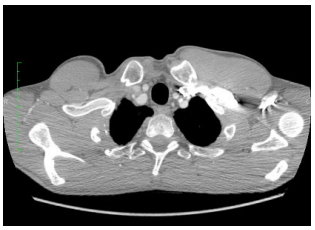

Figure 12: CTA scan obtained 4 months after accident, presenting a patent stent in the right subclavian artery

Discussion

Due to the difficulties associated with open surgical access, injuries to the subclavian artery remain a challenging problem. Existing therapeutic options of these injuries are either open surgery (with access options either through median sternotomy or by supraclavicular approach with or without clavicular resection) or endovascular treatment. Apart from the typical complications of surgery such as e.g. infection, open surgery of the clavicular region is associated with a risk of large vessel, brachial plexus or pleural injuries. Therefore, more physicians tend to an endovascular repair of subclavian artery injuries. Studies confirm a reduction of mortality after treatment of these injuries from 10-40% (open repair) to 5% (endovascular repair) [5]. However, endovascular repair is not always possible, e.g. in cases with long segmental injuries or a difficult proximal landing zone [6]. According to some authors, hemodynamic instability might be a contraindication for an endovascular repair [7]. Our case demonstrates the viability of endovascular repair even in hemodynamic unstable patients. In these cases, excellent cooperation of a vascular surgeon or interventional radiologist and the anesthesia team is of critical importance. In our opinion, endovascular repair can always be tried in hemodynamically unstable patients. If a catheter cannot be pushed beyond the location of the injury, there is still a possibility of balloon occlusion of the proximal portion of the artery to stabilize the patient, followed by conversion to an open surgery.

As the numbers of subclavian artery injuries are low, no randomized-controlled trials dealing with this problem exist. The current literature contains mainly case reports and case series. The choice of the best therapy option should be discussed in a

multidisciplinary team including an experienced vascular and thoracic surgeon and an interventional radiologist. However, the endovascular therapeutic options are becoming more available and applicable in a wider spectrum of cases, and are associated with good results and less complications than open repair. Therefore, they may become a standard of care of the subclavian artery injuries, even in hemodynamically unstable patients.

Acknowledgments

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