

## CASE REPORT

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# Right subclavian artery injury secondary to blunt trauma successfully treated in a patient with situs inversus totalis: Case report

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## ABSTRACT

**Introduction:** Subclavian artery injury secondary to blunt trauma is rare. Most patients with blunt trauma that affects the major vessels die before reaching the hospital due to trauma kinematics. Appropriate intervention requires immediate identification and proper surgical approach. The intraoperative diagnosis is more common due to the hemodynamic instability of most patients; however, conventional angiography and computed tomography (CT) angiography are also useful diagnostic modalities in stable patients to determine the location of the injury prior to surgery. We present a case of blunt trauma associated with situs inversus totalis which is a rare congenital condition characterized by complete transposition of the thoracic and abdominal viscera.

**Case Report:** A 22-year-old man was brought to our trauma center, victim of motorcycle collision, with an

occlusive bandage on the right neck/thoracic region. Due to hemodynamic stability, CT scan conducted directly. The patient was treated with surgical exploration of the injury with a supraclavicular incision, osteotomy of the middle third of the clavicle, proximal, and distal control of the subclavian artery. There was no evidence of brachial plexus injury. Small laceration was identified in the right subclavian artery caused by a bone fragment of the clavicle fracture. We performed a debridement of the subclavian injury and primary suture with Prolene 5-0.

**Conclusion:** Treatment of the subclavian artery trauma requires solid anatomy for understanding the accurate localization of the arterial injury—when possible—prior to surgery to ensure the approach will be target effective with minimal time loss.

**Keywords:** Blunt trauma, Subclavian artery injury, Trauma outcomes, Vascular repair, Vascular surgery

## How to cite this article

Carregal DC, Rabelo PMA, Amaral MTP, Souza Junior FDPA, Figueiredo Junior FDAF. Right subclavian artery injury secondary to blunt trauma successfully treated in a patient with situs inversus totalis: Case report. Int J Case Rep Images 2021;12:101275Z01DC2021.

Article ID: 101275Z01DC2021

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doi: 10.5348/101275Z01DC2021CR

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Received: 16 September 2021

Accepted: 30 November 2021

Published: 17 December 2021

## INTRODUCTION

Subclavian artery injury secondary to blunt trauma is a rare condition [1]. In a 6-year follow-up of 167 patients

with treatment of the subclavian and superior mediastinal arteries injures, Costa and Robbs are shown that only 15 of these injuries (9%) occurred after blunt trauma [2]. Much more common, subclavian artery injuries occur from penetrating mechanisms or as a consequence of iatrogenic injury during central catheter placement [3]. Blunt-related injury is associated with high morbidity and mortality. Most patients with blunt trauma that affects the subclavian arteries, and the major vessels die before reaching the hospital due to blood loss related to the trauma kinematics. Hospital mortality remains high [4]. The subclavian arteries are protected by the clavicles, ribs, and chest wall. The clinical management and surgical approach vary depending on the specific lesion [1]. We report a blunt trauma case with open right clavicle fracture and subclavian artery injury accompanied by hemorrhage in a patient with situs inversus totalis.

## CASE REPORT

A 22-year-old man was brought by the paramedics to our trauma center after being thrown from his motorcycle during an accident on the highway hitting a light pole. On initial examination, he had an open airway, normal breathing with a respiratory rate of 14 breaths/min, was hemodynamically stable with a blood pressure of 110/70 mmHg, and a pulse rate of 98 beats/min. He was conscious and had a Glasgow Coma Scale of 15.

On physical examination we noticed a large open right neck/subclavian soft tissue wound with clots, active bleeding, and exposure of the clavicle. The radial and ulnar pulses were palpable in the right hand (Figure 1). Compressive bandage was applied. The patient was hemodynamically stable and was able to undergo cross-sectional imaging. Computed tomography angiography of the neck and right upper extremity showed dextrocardia with situs inversus totalis (Figure 2). Computed tomography showed left pulmonary contusion and pneumothorax (Figure 3), and right open, mid-shaft clavicle fracture (Gustilo Grade 3c—vascular injury requiring vascular repair, regardless of degree of soft tissue injury) (Figure 4). Accompanied by a subclavian injury with contrast leak (Figures 5 and 6). Computed tomography scan showed no occlusion of the subclavian artery (Figure 6). Abdominal CT showed situs inversus totalis with no major abdominal trauma.

After initial imaging, the patient was emergently conducted to the surgical center to repair the right subclavian vasculature. No sufficient endovascular equipment was available at the hospital. Surgical exploration of the lesion with a supraclavicular incision, osteotomy of the middle third of the clavicle, ligation of the subclavian vein, which presented a >90% circumferential lesion, proximal and distal control of the subclavian artery. There was no evidence of brachial plexus injury. A laceration was identified in the right subclavian artery caused by a bone fragment of the clavicle

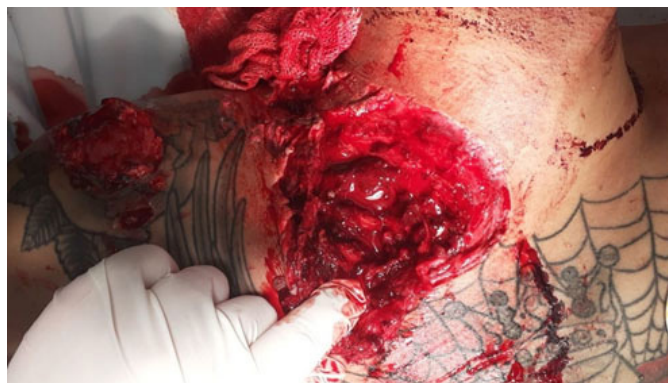


Figure 1: Large open right neck/subclavian soft tissue wound exposing the clavicle with clots and active bleeding.



Figure 2: CT scan—dextrocardia with situs inversus totalis.



Figure 3: CT scan showing pulmonary contusion and pneumothorax.

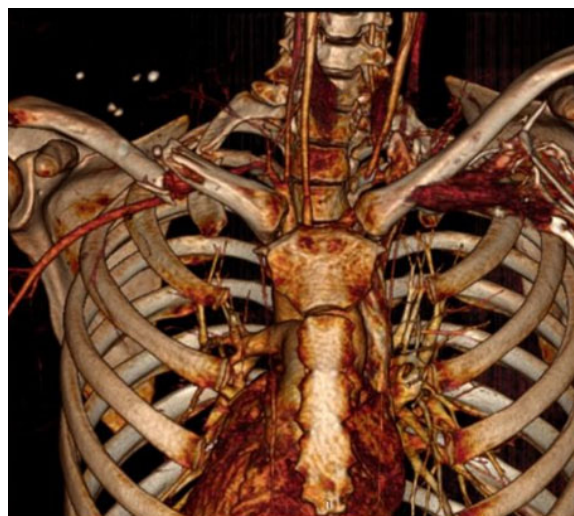


Figure 4: CT angiography reconstruction—A mid-shaft right clavicle fracture and fractures of the 1st and 2nd right ribs.

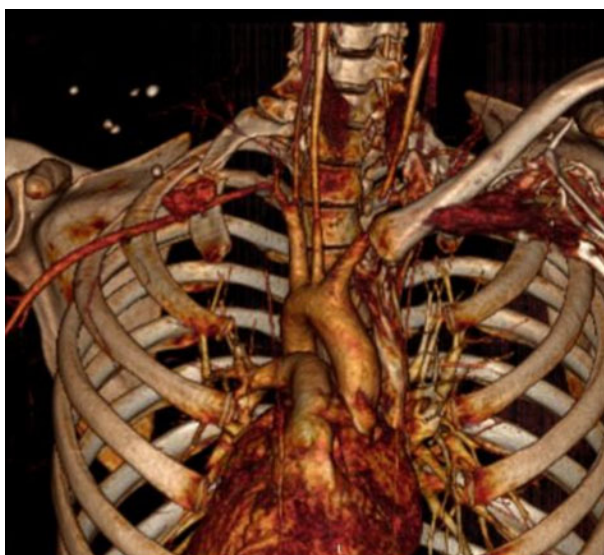


Figure 5: CT angiography reconstruction—Right subclavian injury.

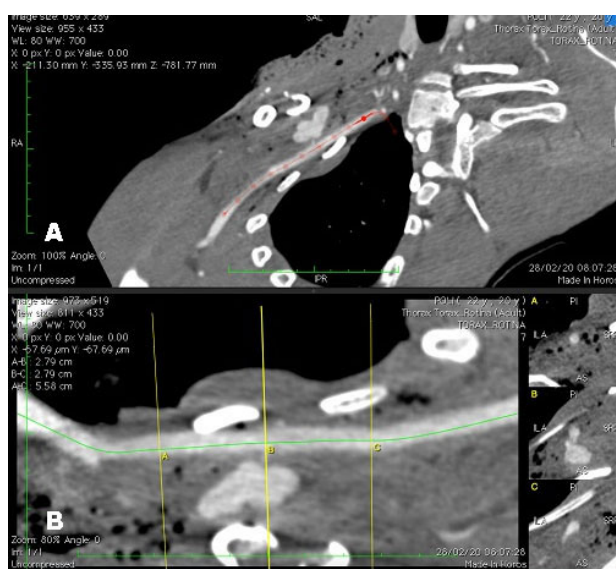


Figure 6: (A) Right subclavian artery injury with contrast leak. (B) No traumatic occlusion of the subclavian artery, with subsequent CTA showed a *normal* appearance flow pattern.

fracture. Debridement of the punctiform lesion with primary suture with Polypropylene 5-0 was performed. On immediate postoperative radial and ulnar pulses were present. Antithrombotic therapy with heparin was not performed due to trauma kinematics. The patient received prophylactic enoxaparin during hospitalization and discharged with acetylsalicylic acid 100 mg PO daily.

Soft tissue injury was sutured to bring the skin closer but not fully closed. Osteosynthesis of the clavicle was not performed. Second look was performed in 48 hours to close the suture.

The patient was discharged on day 10 and continued to be free of complications at the 6-month follow-up. The patient did not present any neurological symptoms.

## DISCUSSION

Blunt trauma, causing damage to the subclavian arteries, is rare with a reported incidence of less than 1% of all arterial injuries of thoracic traumatic injuries [2] and it is usually associated with other major injuries. The necessity of immediate identification and appropriate surgical approach for repair is mandatory because such injuries carry high rates of mortality and morbidity [1]. In general, the proper management of the subclavian artery injury depends on the mechanism and extension of the injury. The intraoperative diagnosis of subclavian artery trauma is more common due to hemodynamic instability caused by the bleeding. However, in most patients, conventional angiography and CT angiography are also useful diagnostic modalities [4]. The preoperative planning in our case was essential due to the anatomical variation presented by the patient to determine the best surgical planning. Surgical procedures are considered more difficult than in other patients because of the different anatomical position of the organs. Situs inversus totalis is a rare congenital condition that occurs in 1 in 4000–20,000 people, characterized by complete transposition of the thoracic and abdominal viscera. Surgical procedures are considered more difficult than in other patients because of the different anatomical position of organs. There is a high risk of intraoperative complications, in this case specifically due to variation in the aortic trunk [5].

As seen in our case the only decision left is surgical method which would be the best approach considering the patient's anatomic particularities and lack of availability of endovascular material. Such decisions require a solid understanding of the complex underlying anatomy and accurate localization of the arterial defect prior to surgery to ensure the approach will be effective and with minimal time loss [6].

Considering the active hemorrhage, and the lack of endovascular devices, we decided for an open approach with a superior clavicular incision, osteotomy of the middle third of the clavicle exposing the right subclavian artery, performing a fast repair of the artery laceration. In general, the prognosis is favorable for patients successfully treated with vascular repair [1, 4].

Proposed algorithms for traumatic subclavian injuries are stratified based on clinical stability, with the general opinion that stable patients should proceed to the hybrid room for endovascular repair [7]. An open surgical approach is one of the treatment options for subclavian artery injury. However, this approach requires an extensive incision to obtain proximal and distal control, which is invasive and difficult to perform taking into consideration the anatomic distortion caused by the trauma [6, 7]. In our case, the patient presented an open fracture, with a high risk of infectious complications in postoperative if used synthetic grafts [6]. Minimally invasive endovascular treatment has good results for vascular injuries caused by penetrating trauma such

as a gunshot, stab, or iatrogenic catheter injury. Stent-graft repairs have been found to have early stent patency comparable to open repair [8–10].

## CONCLUSION

Blunt subclavian artery trauma is an uncommon but challenging surgical problem. In our practice, all hemodynamically stable patients are referred to CT angiography to plan the best surgical approach. If the patient is unstable, he is immediately taken to the surgical center for emergency treatment. Decision making is about which surgical method would be the best approach. It may take into consideration the patient's particularities described above. Such decisions require a solid understanding of the complex anatomy and accurate localization of the arterial defect prior to operation—when possible—to guaranty the approach will best target the affected site with minimal time lost. We do not have endovascular materials for emergency treatment although the use of endovascular treatment is creating a valid and solid alternative to classic surgical approaches in this anatomic territory. Regardless of the type of treatment chosen, endovascular × open surgical repair, treatment cannot be postponed, causing a great impact on mortality.

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## Author Contributions

Daniel Corradi Carregal – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Paloma Maciel Araujo Rabelo – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Maria Teresa Prata Amaral – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Francisco De Paula Alves Souza Junior – Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Fernando De Assis Figueiredo Junior – Interpretation of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

## Guarantor of Submission

The corresponding author is the guarantor of submission.

## Source of Support

None.

## Consent Statement

Written informed consent was obtained from the patient for publication of this article.

**Conflict of Interest**

Authors declare no conflict of interest.

**Data Availability**

All relevant data are within the paper and its Supporting Information files.

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