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Case Report

MANAGEMENT OF IATROGENIC SUBCLAVIAN ARTERY RUPTURE: TWO CASE REPORTS

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ABSTRACT

Bleeding of the branches of a subclavian artery can be a life-threatening condition. Subclavian artery bleeding can lead to tracheal obstruction, hemothorax, respiratory failure, hemorrhagic shock, and death if not diagnosed early and treated promptly. Injury to the subclavian artery occurs in multiple different manners including blunt, penetrating, or iatrogenic trauma. Here we reported two cases of injury of the branches of the right subclavian artery (RSA); one following a central venous catheterization and the other following a thoracic drainage tube placement. Herein we describe two endovascular treatment options used in the management of rupture of a subclavian artery. The proximal tract of the subclavian artery and its main branches is also considered a 'border territory' between interventional vascular radiology and interventional neuroradiology because it gives rise to branches both cervical and to the upper limbs.

1. Case number one

A 46-year-old male, with a kidney transplant and a history of end-stage renal disease had been on hemodialysis for 3 years. This patient was admitted to our emergency service complaining of severe asthenia, diarrhea, bilateral sloping edema and worsening of renal function indices (creatinin 6.29 mg/dl).

Vital parameters are shown in Tab.1:

In patients with end-stage renal disease, temporary placement of venous catheters for haemodialysis (HD) is often necessary, and the right internal jugular (RIJ) vein is the usual preferred site of HD catheter placement.

Several attempts to access the right internal jugular vein (IJV) were unsuccessful, arterial puncture was noted and bleeding was controlled by local compression and the procedure was abandoned. Subsequently a tunneled cuffed right femoral vein hemodialysis catheter was placed (Covidien MAHURKAR 11.5 Fr X 19.5 Fr).

Immediately after the procedure, the patient developed neck swelling on the right side that was thought to be a hematoma.

With suspected bleeding an urgent CT-scan was required. The CT-scan showed no fluid collection but there was an enhancing locus at the base of the right neck, posterior to the jugular vein, consistent with a focal pseudoaneurysm; the precise site of origin could not be determined but the radiologist suspected a lesion of a small branch of the posterior subscapular portion of the right subclavian artery.

The patient was transferred to the angiographic room for treatment of the disrupted vessel.

Digital subtractive angiography via the right omeral artery was performed. The subclavian artery and its branches were evaluated, showing the presence of a rounded area in the vascular field of the thyrocervical trunk. This finding was possibly the site of the pulsating hematoma highlighted in CT that was caused by a small branch arising from the origin of the inferior thyroid artery.

A transarterial embolization was conducted to occlude the arterial feeder at a site close to its entry into the pseudoaneurysm. The feeding artery was cannulated and the microcatheter was advanced to the entry site of the pseudoaneurysm. Occlusion of the feeding artery of the pseudoaneurysm was performed by deploying one fibered platinum coil.

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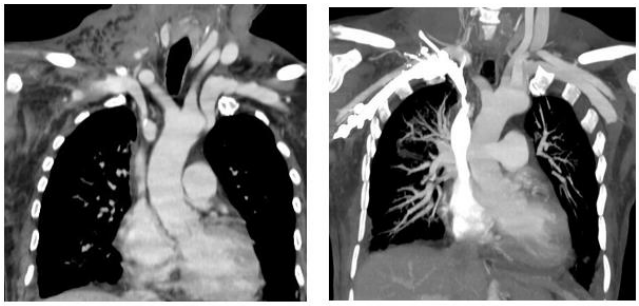
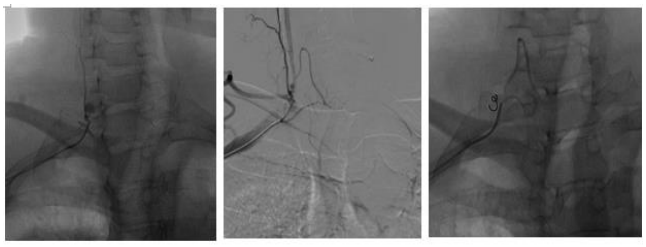


(A) (B)

Figure 1 (A and B). The CT-scan showed no fluid collection but there was an enhancing locus at the base of the right neck, posterior to the jugular vein, consistent with a focal pseudoaneurysm.

Complete occlusion of the arterial feeder by the coil was demonstrated after the embolization.
The procedure was performed under local anesthesia and conscious (light) sedation.



(A) (B) (C)

Figure 2. Angiography of the right subclavian artery. A, B: Pseudoaneurysm of the inferior thyroid artery. C: The bleeding was stopped using fibered platinum coil.

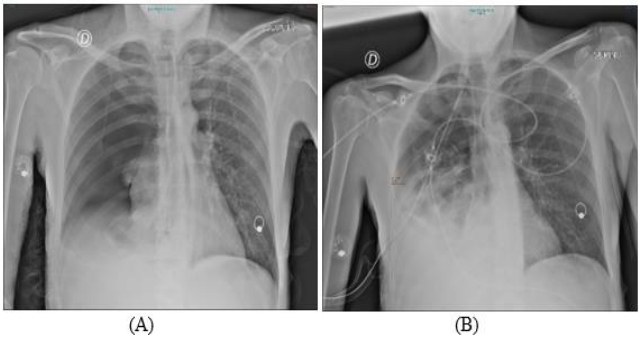
A follow-up ultrasound and a CT-scan, one week later, showed modest edematous imbibition of the laterocervical tissue of the neck within the pseudoaneurysm. The patient was subsequently discharged home without any further complications.

(A) (B)

Figure 3 (A and B). Ultrasound and a CT-scan, one week later, showed modest edematous imbibition of the laterocervical tissue of the neck within the pseudoaneurysm.

2. Case number two

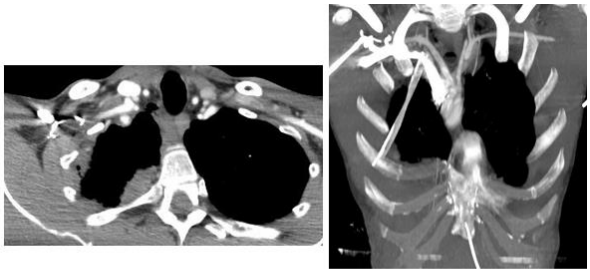
A 47-year-old man was admitted to our emergency service with chief complaint of a persistent pain on the right chest and dyspnea. There was no history of trauma, injury, difficulty breathing, or palpitations.
There was no prior history of blood transfusions, surgical procedures, or other serious events in his medical history.
A physical examination (PE) revealed a young man awake and alert.
Vital parameters are shown in Tab. 2
A chest X-ray (CXR) was requested (Fig. 4A). The radiographic findings revealed a massive right-sided pneumothorax and an ipsilateral basal pleural effusion. Prior to anesthetic assistance, a right thoracostomy tube was immediately placed, with gradual release of air and improvement of dyspnea.
Another CXR was performed (Fig. 4B), to evaluate the position of the thoracostomy tube and re-expansion of the collapsed lung was observed. The patient was admitted to the surgical department.



(A) (B)

Figure 4. A: X-Ray showed massive right sided PNX with basal pleural effusion. B: X-Ray demonstrated the correct position of thoracostomy tube and partial re-expansion of the collapsed lung.

While in the surgical department, approximately 1000 mL of blood was drained from the thoracostomy tube, and he developed obvious hemodynamic instability with hypovolemic shock (his blood pressure dropped to 85/40 mmHg). With suspected bleeding an urgent CT-scan was required, revealing a large hematoma in the right subclavian area with extension in the right lateral hemothorax, with active bleeding signs from the right subclavian artery, but without any precise location (Figure 5 A, B).



(A) (B)

Figure 5 (A and B). CT-scan demonstrated active bleeding signs from right subclavian artery, but without precise location.

The radiologist suspected a lesion of a small branch of the posterior subscapular portion of the right subclavian artery, probably on an iatrogenic basis.
Bleeding from the right subclavian artery was suspected, and an emergency angiography via the right femoral artery was performed. Angiography was performed to assess the thoracic aorta and the right intercostals arteries, resulting negative for active bleeding.
Angiography showed some collateral arteries from the RSA to the apex of the right lung; in the proximal tract of the RSA, near the origin of the ascending cervical artery, the presence of a rounded area is noted, possibly the site of the pulsating hematoma highlighted in CT.
The superselective angiography of the thyrocervical trunk and the ascending cervical artery demonstrated no ongoing bleeding.
Proximal site of the bleeding prevents embolization by coils or microparticles.

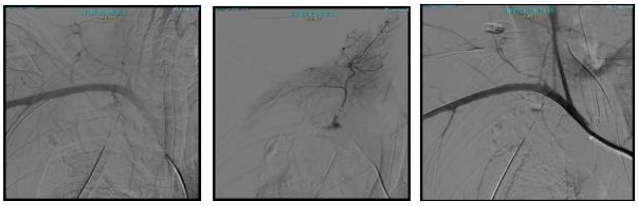


Figure 6. Angiography of the right subclavian artery. (A, B): Bleeding from a branch of the right subclavian artery. C: The bleeding was stopped using stent.

A stent-graft (7x50mm Viabhan) was deployed in the proximal tract of the RSA, with careful attention to avoid occlusion of the vertebral artery and with successful sealing of the perforation.
On control angiography, the right carotid artery, the right vertebral artery, and the internal mammary artery were patent; even the origin of the ACA, which is however completely covered by the stent.
The shock and bleeding continued during the procedure, and the massive blood transfusion was continued.
After placement of the stent, the patient's vital signs stabilized. Post intervention contrast-enhanced CT showed that the cervical hematoma was completely absorbed and that the stent graft in the right subclavian was in a satisfactory position and unobstructed (Figure 7).

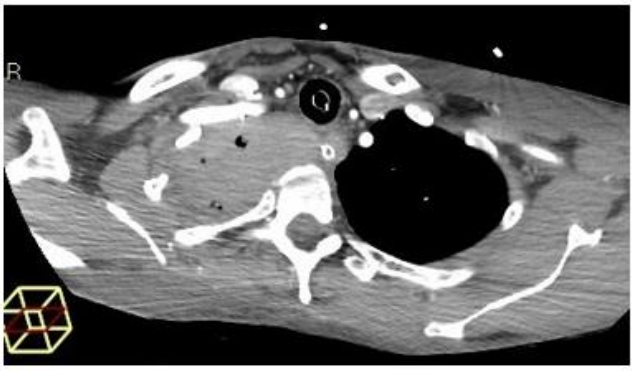


Figure 7. Post-operative control CT showing the stent well positioned and no signs of bleeding in progress.

Following endovascular treatment, after an attempted drug suspension, the patient experienced difficulty awakening. For this reason, a brain CT scan was requested.
The CT scan showed the presence of a triangular-reflective area of parenchymal hypodensity in the right upper cerebellar region, compatible with a recent ischemic lesion (Figure 8).

Figure 8. Brain CT showed the presence of an area of parenchimal ipodensity in the right upper cerebellar region, compatible with a recent ischemic lesion.

Afterwards the discovery of these radiological findings, the patient was taken in charge by neurologists and physiatrists.
One week after endovascular treatment, the patient appeared fully awake and cooperative; none of these new lesions were symptomatic regarding neurological deficits.
The patient was discharged with the following physiatric indications: physiotherapy treatment in the ward aimed at increasing lung volumes and resuming walking resistance.
The patient was discharged with dual antiplatelet therapy (acetylsalicylic acid + clopidogrel).
One month after discharge, a color doppler ultrasound of the upper limbs was performed which highlights the good positioning of the stent and a flow of the right subclavian artery that was normally represented.

3. Discussion

During The subclavian artery has three parts, medial to lateral in direction. The vertebral artery, thyrocervical trunk and internal thoracic artery arise from the first part while the second part usually gives rise to the costocervical trunk. The thyrocervical trunk usually divides immediately into the inferior thyroid, suprascapular (transverse scapular) and transverse cervical branches**.** (2)
Rupture of these branches of subclavian artery is rare, and very few cases are reported in the literature. Injury to the subclavian artery occurs in multiple different manners including blunt, penetrating, or iatrogenic trauma. (3) Herein we report two clinical cases of iatrogenic rupture of the subclavian artery.

In case 1 we report a patient on hemodialysis who developed inferior thyroid artery pseudoaneurysm following an attempted right internal jugular vein catheterization.

Central venous catheterization (CVC) is frequently used in the intensive care unit in many clinical situations such as fluid, medication, nutrient administration, hemodialysis, and hemodynamic monitoring. (4,5)

Patients with renal failure who are on hemodialysis may have to undergo multiple catheter placements and vascular access interventions. This, along with their comorbid conditions, increases the risk of such complications. Internal jugular vein (IJV) cannulation has become the preferred approach for temporary hemodialysis catheter placement. IJV catheterization is successful about 90% of the time. The overall incidence of complications in IJV catheterization is 0.1–4.2% with a few studies reporting higher incidences. (6)

These complications include hematoma, which can potentially expand and obstruct the airway, hemothorax, pseudoaneurysm, arteriovenous fistula and stroke.

In case 1 the patient develops inferior thyroid artery pseudoaneurysm following an accidental puncture during the attempts of IJV cannulation. In this case the occlusion of the feeding artery of the pseudoaneurysm is performed by deploying one fibered platinum coil that provides good control of the bleeding.

In case 2 we report a patient who developed a bleeding of the proximal tract of the subclavian artery after a thoracic drainage tube placement. In this case a stent-graft was deployed in the proximal tract of the right subclavian artery, with careful attention to occlusion of the vertebral artery and with successful sealing of the perforation. Catheter procedures (cerebral and coronary angiography, carotid and subclavian stenting, and transcatheter aortic valve implantation) are known to lead to silent cerebral infarction. This complication is commonly studied using MRI. DW-spots are found in 48% of patients but none of the new cerebral lesions are usually symptomatic of neurological deficits, as occurred in the presented case report. Studies have shown that silent cerebral infarction is associated with an increased risk of future stroke, dementia, depression, cognitive impairment, and early death, regardless of other vascular risk factors. (7,8)

Should subclavian miscatheterization occur close to the vertebral artery origin, occlusion by stent graft treatment can cause stroke and visual defects so an angiographic verification of contralateral vertebral artery patency must be requested and, in some cases, vertebral artery-to-carotid artery transposition prior to endovascular treatment of pathological conditions of the proximal subclavian.

These two case reports demonstrate the safety and efficacy of endovascular stenting and coil embolization for the management of pseudoaneurysms and arterial bleeding secondary to iatrogenic injuries. (9)

References

(1) Perez-Garcia C. et al. Embolization on through the thyrocervical trunk: vascular anatomy, variants, and a case series. *J Neurointerv Surg 2018; 10(10): 1012-1018*

(2) Cuhaci B. et al. Transverse Cervical Artery Pseudoaneurysm: A Rare Complication of Internal Jugular Vein Cannulation. *Am J Nephrol 2000; 20: 476-482*

(3) Abi-Jaoudeh N. et al. Management of Subclavian Arterial Injuries following Inadvertent Arterial Puncture during Central Venous Catheter Placement. *J Vasc Interv Radiol 2009; 20:396 – 402*

(4) Pikwer A. et al. Management of Inadvertent Arterial Catheterisation Associated with Central Venous Access Procedures. *Eur J Vasc Endovasc Surg 2009; 38: 707-714*

(5) Debek Ali H. et al. Inferior Thyroid Artery Injury After Attempts of Internal Jugular Venous Catheterization. *J Cardiothorac Vasc Anesth 2007; 21(3) (June): 422-424*

(6) YUI PONG SIU Haemodialysis catheter-related right transverse cervical artery pseudoaneurysm and treatment by coil embolization. *Nephrology 2005; 10, 37-39*

(7) Masayasu A, Miyata k, Iihoshi S, Yokoyama R, Yamaoka A, Suzuki Y, Mikami T, Wanibuchi M, Mikuni N. Cerebral Ischemic Complications of Subclavian Artery Stenting: Relationship between Lesion Location and Procedural Strategy. *J Neuroendovascular Therapy 2019; 13: 403-410*

(8) Perera AH, Rudarakanchana N, Monzon L, Bicknell LCD, Modarai B, Kirmi O, Athanasiou T, M. Hamady M, Gibbs RG. Cerebral embolization, silent cerebral infarction and neurocognitive decline after thoracic endovascular aortic repair. *Br J Surg 2018;* 105 (4): 366-378

(9) Jahromi B.S. et al. Inadvertent Subclavian Artery Catheter Placement Complicated by Stroke: Endovascular Management and Review. *Catheter Cardiovasc Interv 2009; 73 (5): 706-11*

(10) Perrucci L. et al. Pitfalls in the embolization of a thyrocervical trunk bleeding: a case report. *Patient Safety in Surgery 2020; 14:19*