

## Bifurcation of Carotico-Subclavian Artery Injury due to Central Venous Catheterization

Erhan Hafız<sup>1</sup>, Vahap Sarıççek<sup>2</sup>, Ayhan Özkur<sup>3</sup>, Hayati Deniz<sup>1</sup>

<sup>1</sup>Department of Cardiovascular Surgery, Gaziantep University Faculty of Medicine, Gaziantep, Turkey

<sup>2</sup>Department of Anesthesiology and Reanimation, Gaziantep University Faculty of Medicine, Gaziantep, Turkey

<sup>3</sup>Department of Radiology, Gaziantep University Faculty of Medicine, Gaziantep, Turkey

### Abstract

The traditional use of catheters in anesthesia, critical care, cardiovascular surgery, and acute medicine continues, and there is also a rapidly increasing requirement for medium-or longer-term central venous catheterization for parenteral nutrition, hemodialysis, cancer chemotherapy, prolonged antibiotics, and other interventions. In this case, we want to present a pseudoaneurysm of bifurcation of a carotid-subclavian artery injury with hematoma due to central venous catheterization. (*JAEM 2014; 13: 146-8*)

**Key words:** Central venous catheterization, artery injury, pseudoaneurysm

### Introduction

For clinical management of several patients, it is important to have central venous access catheters (1).

Central venous access catheters are generally used for administration of vasoactive drugs, hemodialysis, hemodynamic monitoring, parenteral nutrition, and volume resuscitation (2). The process is comparatively secure but not wholly without difficulties. The occurrence of severe problems from central venous access catheter differs from 0.4% to 9.9% (3). The problems consist of air embolism, cardiac tamponade, central venous thrombosis, hemothorax, hydrothorax, local hematoma, and pneumothorax because of damage to the right side of the heart or superior vena cava. Out of all central venous access catheters that are placed, only about 5% causes inadvertent arterial puncture, which can cause arterial dissection, arteriovenous fistula formation, hematoma, pseudoaneurysms, and also stroke (4).

The carotid artery is exceedingly prone to arterial injury, while on the other hand, bypass of the carotid-subclavian artery injury because of central venous catheterization is unusual (5). In fact, a few cases of subclavian and vertebral artery injuries secondary to jugular or subclavian vein catheterization have been reported (6), but not on bifurcation of the carotid-subclavian artery to our knowledge.

We recorded an incident of one pseudoaneurysm-bypass of the carotid-subclavian artery-after internal jugular vein catheterization was tried.

### Case Presentation

A 48-year-old man with chronic renal insufficiency presented in June 2012. Internal jugular vein catheterization was attempted in the Nephrology Department for hemodialysis filtration with no success. After attempted catheterization, acute neck pain and hematoma occurred. Before the computed tomographic angiogram (CTA) with Doppler ultrasonography (USG) was diagnosed hematoma. (Figure 1-2).

A computed tomographic angiogram of the neck and chest led to the diagnosis pseudoaneurysm of the subclavian artery with a hematoma (Figure 3). The size of the hematoma measured approximately 52.66x70.55mm, and surgical procedure was planned for this patient.

### Anesthetic and Surgical Procedure

After the patients was taken to the surgery room, standard monitors, including electrocardiography, noninvasive blood pressure measurement, and EtCO<sub>2</sub>, and pulse oximetry were used. After pre-oxygenation, anesthesia was induced using fentanyl 2 µg/kg (Tadilat, Vem ilaç, Istanbul, Turkey), propofol 2 mg/kg (Propofol; Fresenius Kabi, Istanbul, Turkey), and rocuronium bromide 0.6 mg/kg (Myocron, Vem ilaç Istanbul, Turkey) to facilitate tracheal intubation and was maintained using bolus injections at a dose of 0.05 mg/kg. Anaesthesia was maintained using air 60% air and 1.5%-2.5% sevoflurane (Sevorane; Abott, Istanbul, Turkey) in oxygen. Controlled mechanical ventilation with an initial tidal volume of 6-8 mL/kg and

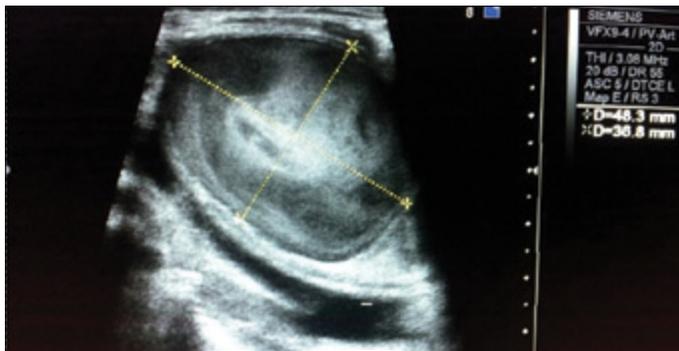


**Correspondence to:** Vahap Sarıççek; Department of Anesthesiology and Reanimation, Gaziantep University Faculty of Medicine, Gaziantep, Turkey  
Phone: +90 533 549 16 64 e-mail: vahapsaricicek@hotmail.com

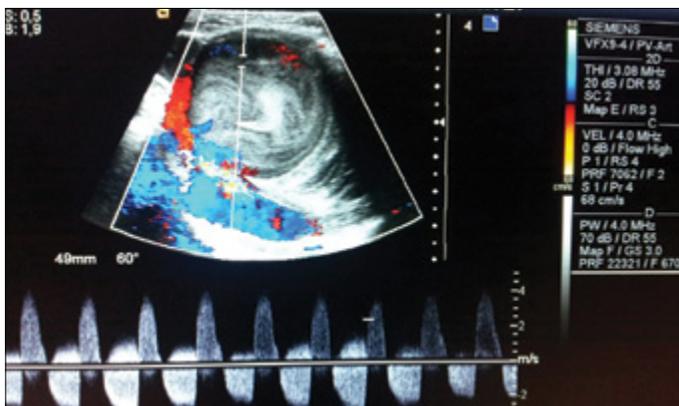
**Received:** 01.04.2014 **Accepted:** 02.05.2014

©Copyright 2014 by Emergency Physicians Association of Turkey - Available online at [www.akademikaciltip.com](http://www.akademikaciltip.com)  
DOI: 10.5152/jaem.2014.179

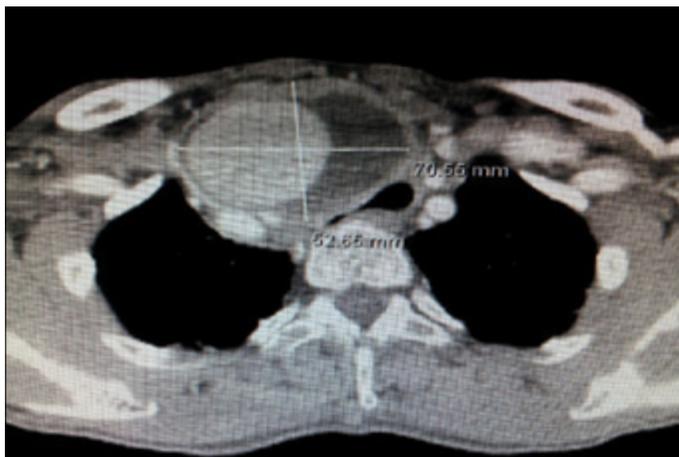
a respiratory frequency of 12 breaths per minute were adjusted to maintain the end-tidal CO<sub>2</sub> between 35 and 40 mm Hg. A surgical incision was made medially to the lower part of the sternocleidomastoid muscle (SCM), and it was extended towards under the sternal side edge. The subclavian artery reached the lateral side of the pseudoaneurysm vesicle. The bleeding point of the vesicle was found at the junction of the carotid-subclavian artery. The size of the hematoma vesicle was approximately 5-7 cm (Figure 4).



**Figure 1.** Grayscale ultrasound image of a large pseudoaneurysm in front of the right subclavian artery



**Figure 2.** Duplex Doppler USG of the neck showing the pseudoaneurysm and a hematoma over the right subclavian artery



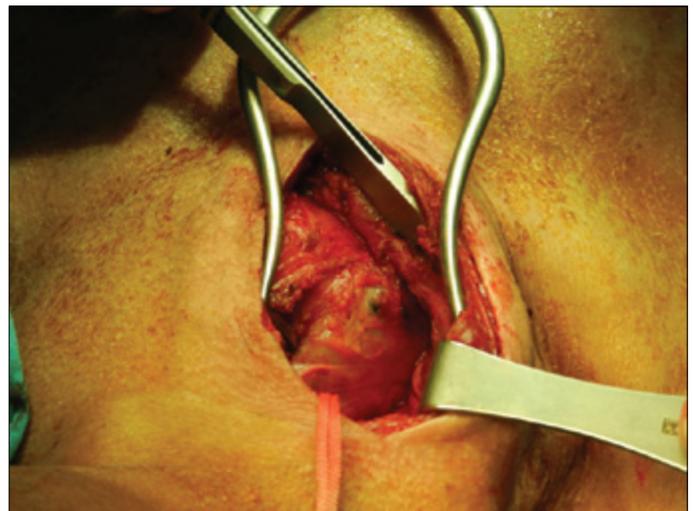
**Figure 3.** Intravenous contrast material-enhanced cross-sectional computed tomography scan shows large right subclavian artery pseudoaneurysm (arrow) causing mass effect in the right upper hemithorax

The pseudoaneurysm was repaired without crossclamping and no interruption of carotid flow with stitches. The following hematoma was evacuated.

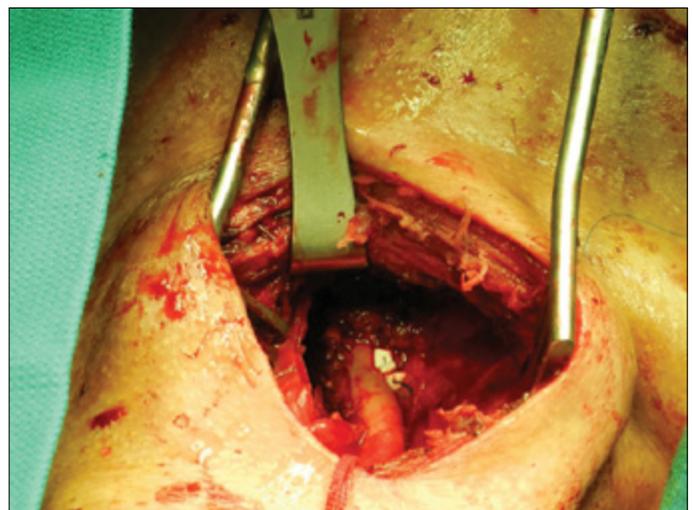
As a result of the all-encompassing association of the pseudoaneurysms, there was sufficient extent of basic rebuilding. The choice was basically mending (primary repair) (Figure 5). Despite extensive mobilization, reach to the leaking area was not so easy. After skin closure at the end of surgery, anesthetic agents were discontinued, and the residual neuromuscular blockade was antagonized with intravenous neostigmine (Neostigmine; Adeka ilaç, Samsun, Turkey) (0.05 mg/kg) and atropine (Atropine; Biosel, Istanbul, Turkey) (0.02 mg/kg), and the patient was extubated. The patient's postoperative course was uneventful. Written informed consent was obtained from the patient who participated in this study.

### Discussion

Central venous catheterization is important for hemodialysis, resuscitation, and hemodynamic monitoring of the acutely ill patient. Millions of central venous catheters are placed every year.



**Figure 4.** Intraoperative picture of the pseudoaneurysm



**Figure 5.** Intraoperative picture of primary reconstruction of the pseudoaneurysm

Arterial injuries secondary to central venous catheters have been well documented in the literature (7). When comparing the subclavian and internal jugular vein approaches for central venous catheterization, most inadvertent arterial punctures occur during the internal jugular approach (4, 8). The carotid artery is most susceptible to arterial injury (5). Though, damage to the brachiocephalic artery, subclavian artery, thyrocervical trunk, and vertebral artery has been explained (9). As per the information available, bypass of the carotid-subclavian artery injury because of central venous catheterization is unusual.

Symptoms may include a supraclavicular neck mass, pain, stridor, and dysphagia. Complications include dissection, thrombosis, and pseudoaneurysm formation. Although pseudoaneurysm formation after central line placement has been well documented in the literature, with an incidence rate of 0.05% to 2%, most iatrogenic pseudoaneurysms arise as a complication of femoral central line attempts (10).

In this case, the pseudoaneurysm was acutely progressive and was diagnosed using a color Doppler USG and CTA. However, most pseudoaneurysms can be diagnosed with a duplex ultrasound to assess size and artery of origin (11). It is not easy to judge the neck of a pseudoaneurysm when the position of the pseudoaneurysm is in the subclavian or vertebral artery; thus, to understand the anatomy of the pseudoaneurysm, better angiography ought to be done. Angiography could even show luminal blood flow in the artery, which is an important detail to plan the surgery better (12). Actually, as in our patient, the damage of central venous catheterization has been cured with open surgical repair.

One of the important decisions for open surgery is the surgical approach. Although, proximal sternotomy, especially in terms of X-clamp control, is proposed; also, a pseudoaneurysm vesicle can be open with sternotomy. In our case, a careful dissection of the lesion was done. The lesion was reached, and blood flow was repaired with a primary suture, and afterward, the aneurysm vesicle was evacuated. Therefore, general anesthesia to the patient was given. During postoperative care, no supraclavicular neck mass, pain, stridor, or dysphagia was followed.

Endovascular exclusion by covered stents might be a possibility for treating pseudoaneurysms of the carotid and subclavian arteries. But, this choice was not practical in this case because of the position of the carotid-subclavian artery bifurcation.

## Conclusion

Carotid-subclavian bifurcation pseudoaneurysm caused by central venous catheterization is rare. We think that the best treatment of injury of carotid-subclavian bifurcation is open surgical procedure.

**Informed Consent:** Written informed consent was obtained from patient who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - E.H., H.D.; Design - V.S., E.H.; Supervision - A.Ö., E.H.; Materials - E.H., A.Ö., V.S.; Data Collection and/or Processing - E.H., V.S., H.D.; Analysis and/or Interpretation - E.H., V.S.; Literature Review - E.H., V.S.; Writer - E.H., V.S., H.D.; Critical Review - E.H., H.D.

**Conflict of Interest:** The authors declared no conflict of interest.

**Financial Disclosure:** The authors declared that this study has received no financial support.

## References

1. Ruesch S, Walder B, Tramèr MR. Complications of central venous catheters: internal jugular versus subclavian access—a systematic review. *Crit Care Med* 2002; 30: 454-60. [\[CrossRef\]](#)
2. Ganeshan A, Warakaulle DR, Uberoi R. Central venous access. *Cardiovasc Intervent Radiol* 2007; 30: 26-33. [\[CrossRef\]](#)
3. Borja AR, Masri Z, Shruck L, Pejo S. Unusual and lethal complications of infraclavicular subclavian vein catheterization. *Int Surg* 1972; 57: 42-5.
4. Golden LR. Incidence and management of large-bore introducer sheath puncture of the carotid artery. *J Cardiothorac Vasc Anesth* 1995; 9: 425-8. [\[CrossRef\]](#)
5. Iovino F, Pittiruti M, Buononato M, Lo Schiavo F. Central venous catheterization: complications of different placements. *Ann Chir* 2001; 126: 1001-6. [\[CrossRef\]](#)
6. Bernik TR, Friedman SG, Scher LA, Safa T. Pseudoaneurysm of the subclavian-vertebral artery junction—case report and review of the literature. *Vasc Endovascular Surg* 2002; 36: 461-4. [\[CrossRef\]](#)
7. McGee DC, Gould MK. Preventing complications of central venous catheterization. *N Engl J Med* 2003; 348: 1123-33. [\[CrossRef\]](#)
8. Jobes DR, Schwartz AJ, Greenhow DE, Stephenson LW, Ellison N. Safer jugular vein cannulation: recognition of arterial puncture and preferential use of the external jugular route. *Anesthesiology* 1983; 59: 353-5. [\[CrossRef\]](#)
9. Aoki H, Mizobe T, Nozuchi S, Hatanaka T, Tanaka Y. Vertebral artery pseudoaneurysm: a rare complication of internal jugular vein catheterization. *Anesth Analg* 1992; 75: 296-8. [\[CrossRef\]](#)
10. Scheer BV, Perel A, and Pfeiffer UJ. Clinical review: complications and risk factors of peripheral arterial catheters used for haemodynamic monitoring in anaesthesia and intensive care medicine. *Critical Care* 2002; 6: 198-204. [\[CrossRef\]](#)
11. Cihangiroglu M, Rahman A, Yildirim H, Burma O, Uysal H. Iatrogenic vertebral artery pseudoaneurysm: US, CT and MRI findings. *Eur J Radiol* 2002; 43: 14-8. [\[CrossRef\]](#)
12. Gottesman RF, Sharma P, Robinson KA, Arnan M, Tsui M, Saber-Tehrani, et al. Imaging characteristics of symptomatic vertebral artery dissection: a systematic review. *Neurologist* 2012; 18: 255-60. [\[CrossRef\]](#)