



Vertebral Artery Injury with Dialysis Catheter

Muhammad Asim Rana, Omar E. Ramadan, Kaisor Iqbal¹, Waleed Tharwat Hashim Aletriby, Ahmed Hossam Awad

Intensive Care Unit and Vascular Surgery¹, King Saud Medical City, Riyadh, KSA.

Abstract:

Vertebral artery pseudo-aneurysms and dissections are known to occur as a result of mechanical manipulations of the cervical region, traumatic injury, spontaneously and iatrogenic injury because of central venous catheterization. Central venous lines have become an integral part of patient care, but they are not without complications. Vertebral artery injury (leading to pseudo-aneurysm and dissection) is one of the rarer complications of central venous catheter placement. We report a case of inadvertent vertebral artery catheterization during a dialysis catheter placement which subsequently demonstrated arterial blood. Duplex ultrasound and computed tomographic (CT) scan confirmed vertebral artery catheterization. It was successfully treated with open surgical technique by the vascular surgeon because of the size of catheter and subsequent requirement of artery repair. There were no neurological sequelae. Open surgical repair remains the gold standard of treatment. Endovascular repair of vertebral artery pseudo-aneurysms has been described with promising outcomes, but long-term results are lacking. This case report describes the rare iatrogenic event of vertebral artery injury and reviews its etiology, diagnosis, complications, and management.

Key words: Central Venous Catheters, Catheterization, Dissecting Aneurysm, Iatrogenic Diseases, Vertebral Artery.

Introduction

With advent and widespread usage of central venous catheterization techniques where the provision of vasoactive and centrally administered drugs have become possible in intensive care units, there iatrogenic arterial injuries have also come out as one of the complications of central venous catheterization which may take place when proper technique is not used during insertion like proper positioning of patient, disregarding the anatomical

land marks, insufficient use of ultrasound guidance or if the person attempting procedure is new and unsupervised.

Publishing serious complications may not be appealing, particularly when the outcome is unfavorable or fatal. This may be a significant factor contributing to under reporting of serious complications related to the procedures such as

Corresponding Author: Dr. Muhammad Asim Rana

Email: drasimrana@yahoo.com

Received: April 29, 2015 | **Accepted:** August 24, 2015 | **Published Online:** August 30, 2015

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (creativecommons.org/licenses/by/3.0)

Conflict of interest: None declared | **Source of funding:** Nil | **DOI:** <http://dx.doi.org/10.17659/01.2015.0096>

central venous catheter placement. Although the incidence of this complication is without doubt very low, we speculate that the true occurrence may be higher and the course more often complicated than is suggested by currently available data.

Case Report

A 65 years old male patient with diabetes, hypertension and chronic renal impairment was admitted from medical floor for hypotension and impending sepsis secondary to chest infection and acute kidney injury (AKI) on chronic kidney disease (CKD).

The patient was planned for continuous renal replacement therapy (CRRT) as his kidney functions were deteriorating. In course of preparation for CRRT, a dialysis catheter was passed through left internal jugular approach. The catheter subsequently showed arterial blood which was proved by blood gas analysis. The catheter was not used and a series of investigations were done to ascertain the position of catheter starting from a chest X-ray then ultrasound assessment but eventually the catheter was confirmed to have penetrated vertebral artery at level of C1 vertebra and reached aortic arch via left subclavian artery by duplex and contrast enhanced CT neck [Fig.1-3].

We did not attempt to remove the catheter as it was too big and the site of insertion was very deep. Case was therefore, referred to vascular surgeon who decided to remove it surgically considering inability to compress because of depth of vertebral artery and chances of major bleed as injury to vessel was big because of big diameter of dialysis catheter. Operative findings confirmed penetration of vertebral artery by the dialysis catheter at its first segment. The catheter was removed under direct vision and artery was repaired. The patient subsequently recovered without any neurological sequels.

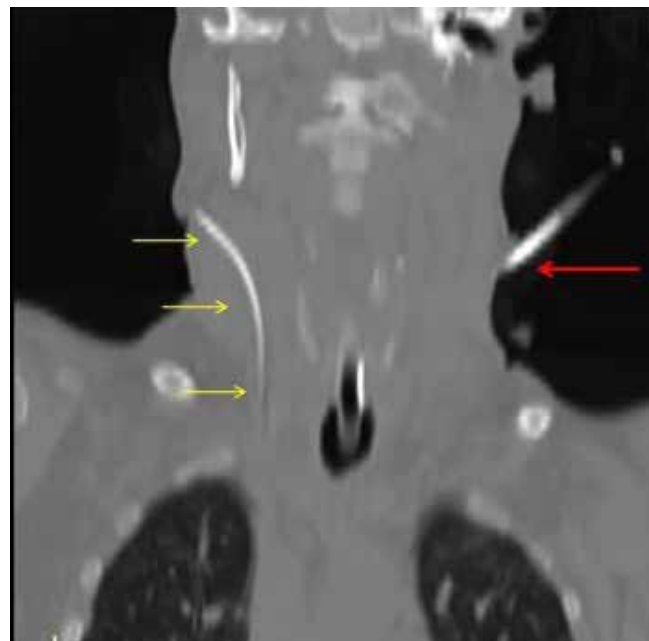


Fig.1: Coronal section CT image showing dialysis catheter (red arrows) and right internal jugular central venous catheter (yellow arrows).

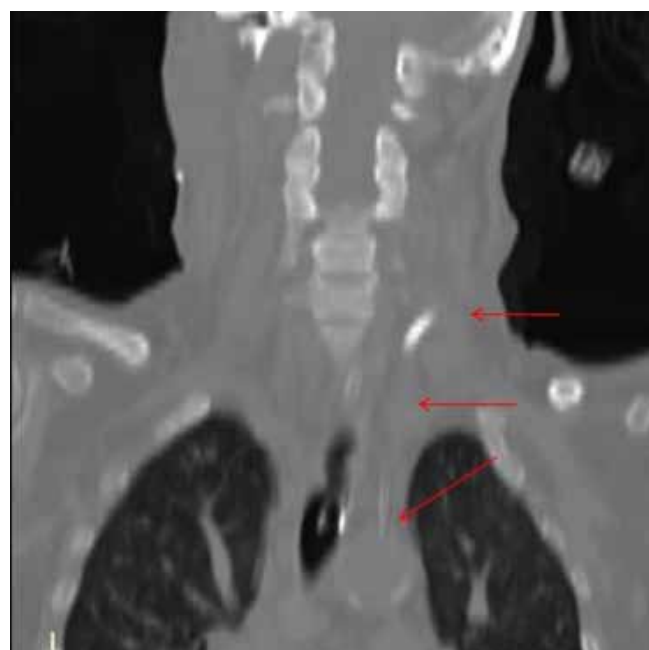


Fig.2: Coronal section CT neck showing dialysis catheter can be seen approaching aorta (red arrows).

Discussion

Central venous catheterization was first described by Aubaniac in 1952 [1]. Since that time, central venous catheters are placed for volume resuscitation, hemodynamic monitoring, and administration of vasoactive drugs. Now millions of catheters are inserted each year [2]. Although the procedure is relatively safe but still carries risk of complications. The incidence of serious complications from venous access ranges from less than half to one percent only. Common complications include local hematoma, pneumothorax, haemothorax, hydrothorax, central venous thrombosis, air embolism, and cardiac tamponade due to perforation of the superior vena cava or right side of the heart. The incidence of arterial placement of catheter during attempts to catheterize a central vein is approximately 5% of all central venous catheter complications. This happens more often with internal jugular vein catheterization, and commonly involves carotid artery due to its anatomical relation to the internal jugular vein [3,4].

Inadvertent arterial catheterization can lead to dissection, thrombosis, formation of arteriovenous (AV) fistulas, and pseudo-aneurysm formation [5]. Although carotid artery is most susceptible to arterial injury however, injuries to other vessels like vertebral, subclavian, brachiocephalic artery, and thyrocervical trunk have also been reported in literature [5,7]. Injury to the vertebral artery can occur while attempting to prick internal jugular vein when the trajectory of the needle is too lateral and too deep to the skin and position of patient is not proper. Same thing probably happened in our case. Most injuries occur at the first portion of the vertebral artery at the point of its origin to the C6 vertebra and these were the exact findings in our patient on contrast enhanced CT scan as well as intraoperative.

Similar to other arterial injuries, injuries of the vertebral artery can also result in AV fistula,



Fig.3: CT neck sagittal section, catheter tip can be seen in aorta (origin of left subclavian artery).

dissection, thrombosis, and pseudo-aneurysm formation. Maximum numbers of pseudo-aneurysm formation have been reported as complication of femoral line attempt while vertebral artery pseudo-aneurysm as a consequence of central line placement is extremely rare.

Excision and bypass is the mainstay of treatment for pseudo-aneurysms of the vertebral artery [8-10]. In fact, all reported pseudo-aneurysms secondary to central venous catheterization have been treated by open surgical repair. Sanson in 1836 wrote that the vertebral artery, on account of its great depth cannot be ligated and wounds of this vessel are beyond the resources of act. Given the difficult surgical approach to the carotid artery at the skull base and the vertebral arteries, the interventional neuroradiologist can provide great support with an endovascular approach to treatment at these sites [11,12].

We sought help from vascular surgeon as interventional neuro-radiologist wasn't available in our hospital. Vascular surgeon however did a great job by removing the catheter through open surgical approach and repairing a difficult to access vessel. Although treatment of carotid and vertebral arterial dissections remains somewhat controversial most conservative approach includes medical management, with ongoing debate as to whether anticoagulation with heparin and/or antiplatelet therapy is more effective especially in case of traumatic dissection and the reports reveal that medical management has resulted in 50% to 70% successful arterial recanalization rates [13,14].

Stents have been used to treat patients who have contraindications to anticoagulation or antiplatelet therapy, although adjunctive antiplatelet therapy is often used to ensure long-term stent patency. Endovascular treatment with stents has also been described in patients who fail medical management either with ongoing or new neurological symptoms, or enlargement of a dissecting aneurysm on follow-up evaluation [14,15].

Conclusion

Ultimately, the best treatment of these iatrogenic injuries should start with prevention. Well-documented techniques like using ultrasound guidance to minimize mechanical complications, including inadvertent arterial puncture, should be practiced and taught in training programs to avoid the potentially devastating consequences.

Acknowledgement

We are indebted to Dr. Mohammed Abusaud and Dr. Kazi Taimur from ICU, King Saud Medical City for their valuable guidance and contribution in writing this manuscript.

References

1. Aubaniac R. Subclavian intravenous injection; advantages and technic. *Presse Med* 1952;60(68):1456.
2. O'Grady NP, Alexander M, Dellinger EP, Gerberding JL, Heard SO, Maki DG, *et al*. Centers for Disease Control and Prevention. Guidelines for the prevention of intravascular catheter-related infections. *MMWR Recomm Rep*. 2002;51(RR-10):1-29.
3. Ruesch S, Walder B, Tramer MR. Complications of central venous catheters: internal jugular versus subclavian access: a systematic review. *Crit Care Med*. 2002;30(2):454-460.
4. Iovino F, Pittiruti M, Buononato M, Lo Schiavo F. Central venous catheterization: complications of different placements. *Ann Chir*. 2001;126(10):1001-1006.
5. Inamasu J, Guiot BH. Iatrogenic vertebral artery injury. *Acta Neurol Scand*. 2005;112(6):349-357.
6. Maddali MM, Badur RS, Rajakumar MC, Valliattu J. Pseudoaneurysm of the innominate artery: a delayed iatrogenic complication after internal jugular vein catheterization. *J Cardiothorac Vasc Anesth*. 2006;20(6):853-855.
7. Janneth Momiy, Jay Vasquez. Iatrogenic vertebral artery pseudoaneurysm due to central venous catheterization. *Proc (Bayl Univ Med Cent)*. 2011;24(2):96-100.
8. Finlay DJ, Sanchez LA, Sicard GA. Subclavian artery injury, vertebral artery dissection, and arteriovenous fistulae following attempt at central line placement. *Ann Vasc Surg*. 2002;16(6):774-778.
9. Khoie B, Kuhls DA, Agrawal R, Fildes JJ. Penetrating vertebral artery pseudoaneurysm: a novel endovascular stent graft treatment with artery preservation. *J Trauma*. 2009;67(3):E78-E81.
10. Shah PM, Babu SC, Goyal A, Mateo RB, Madden

- RE. Arterial misplacement of large-caliber cannulae during jugular vein catheterization: case for surgical management. *J Am Coll Surg.* 2004;198(6):939-944.
11. Reuben BC, Whitten MG, Sarfati M, Kraiss LW. Increasing use of endovascular therapy in acute arterial injuries: Analysis of the National Trauma Data Bank. *J Vasc Surg.* 2007;46:1222-1226.
 12. Herrera DA, Vargas SA, Dublin AB. Endovascular treatment of penetrating traumatic injuries of the extracranial carotid artery. *J Vasc Interv Radiol.* 2011;22:28-33.
 13. Engelter ST, Brandt T, DeBette S, Caso V, Lichy C, Pezzini A, *et al.* Antiplatelets versus anticoagulation in cervical artery dissection. *Stroke.* 2007;38:2605-2611.
 14. Pikwer A, Acosta S, Kölbl T, Malina M, Sonesson B, Akeson J. Management of inadvertent arterial catheterisation associated with central venous access procedures. *Eur J Vasc Endovasc Surg.* 2009;38(6):707-714.
 15. DuBose J, Recinos G, Teixeira PG, Inaba K, Demetriades D, *et al.* Endovascular stenting for the treatment of traumatic internal carotid injuries: Expanding experience. *J Trauma.* 2008;65:1561-1566.