Case Report

DOI: 10.7860/JCDR/2025/76483.21036

Radiology Section

Successful Endovascular Management of Inferior Thyroid Artery Pseudoaneurysm after Unsuccessful Internal Jugular Vein Catheterisation: A Rare Case Report

SUSHIL KUMAR PATIL[1], ANIKETH DAVANGERE HIREMATH[2]

ABSTRACT

Central Venous Catheters (CVCs) are essential for maintaining venous access; however, they are associated with complications such as arterial injury. The present case report details a rare complication of an inferior thyroid artery pseudoaneurysm in a 25-year-old female with lupus nephritis, which occurred following multiple failed attempts at Internal Jugular Vein (IJV) catheterisation. Despite immediate compression, the patient developed tender neck swelling and imaging confirmed the presence of an inferior thyroid artery pseudoaneurysm. Endovascular coil embolisation was performed successfully, with no intraoperative complications. The present case highlights the importance of prompt diagnosis and intervention in managing arterial injuries during CVC placement.

Keywords: Arterial injury, Central venous line, Embolisation, Neck swelling

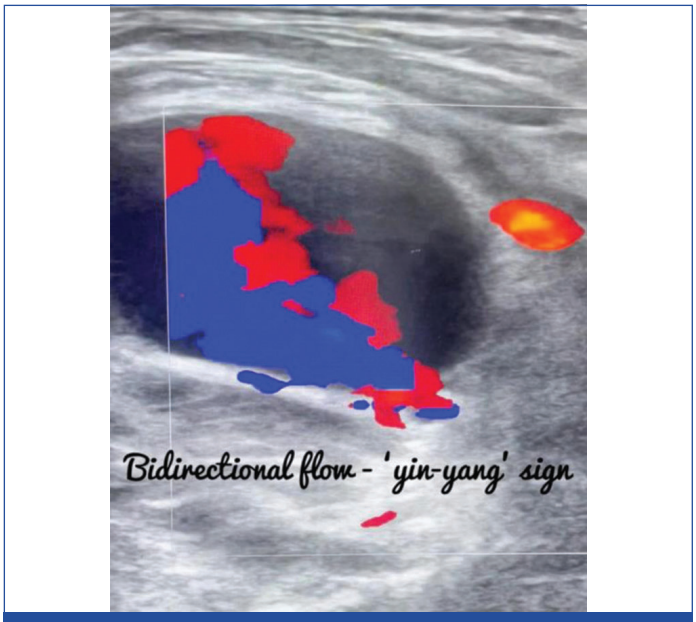
CASE REPORT

A 25-year-old female patient diagnosed with lupus nephritis presented with uremic symptoms and underwent left brachiocephalic fistula creation one month prior. Ultrasonography (USG)-guided IJV catheterisation was advised for interim dialysis until fistula maturation. She had no surgical history and no anomalies were noted in the neck on physical examination. Vital parameters were normal, with both the platelet count and liver function within normal limits. The haemoglobin level was 7 g/dL, for which one pint of packed red blood cells was administered, leading to partial correction of anaemia. The International Normalised Ratio (INR) was 1.24 and Prothrombin Time (PT) was 14.6, both well within the normal ranges. Electrocardiography and chest radiography revealed no significant findings. The patient was scheduled to undergo IJV cannulation the following day.

The patient was placed in the Trendelenburg position and her head was tilted to the left by approximately 45°. The right side of the neck was prepared and draped for CVC insertion using a conventional anatomical landmark approach under ultrasound guidance. An 18 G introducer needle with a 10 mL syringe for aspiration was inserted obliquely into the skin towards the right nipple and the needle was advanced until blood was aspirated. Multiple attempts were made. After aspirating a bright red pulsatile blood column, inadvertent arterial injury was suspected, prompting the removal of the needle. Immediate manual compression was applied locally for 15 minutes to achieve haemostasis. After compression, diffuse swelling was observed over the medial aspect of the right supraclavicular region. At that time, no pulsation or bruit was detected over the area. Subsequently, the CVC line was successfully inserted via a right femoral vein puncture under real-time ultrasound guidance in one attempt.

The following day, the swelling persisted and increased in size. The patient reported severe pain in this region. On palpation, a soft, tender, pulsatile swelling with a systolic bruit was present. The patient's blood pressure was recorded at 140/90 mmHg, heart rate at 90 beats per minute, respiratory rate at 30 cycles per minute and temperature at 36.4°C.

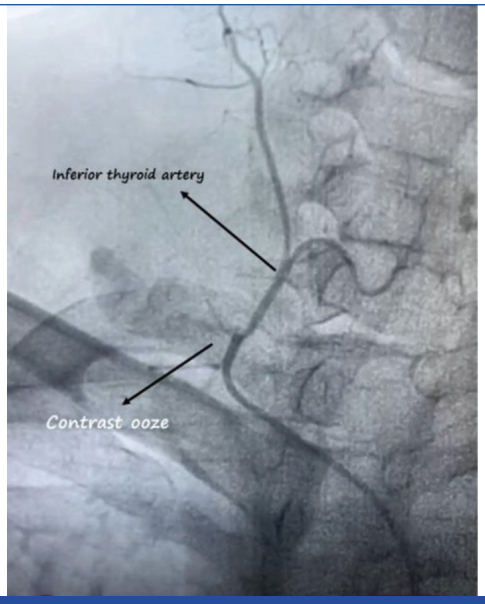
Emergency colour Doppler and Computed Tomography (CT) angiography were advised. On ultrasound Doppler, there was evidence of a well-circumscribed pulsatile cystic mass measuring 2.7×2.2×2.6 cm in the medial aspect of the right supraclavicular region, linked to a nearby vessel located lateral to the Common Carotid Artery (CCA). The orifice of the mass measured 3 mm in diameter, with a flow velocity of up to 52-58 cm/s. However, the precise site of origin could not be determined. The classic 'yin-yang' sign was demonstrated on colour Doppler, leading to a presumptive diagnosis of pseudoaneurysm [Table/Fig-1].



[Table/Fig-1]: USG colour Doppler of the right neck swelling demonstrating bidirectional 'yin-yang' flow within anechoic structure, suggestive of pseudoaneurysm.

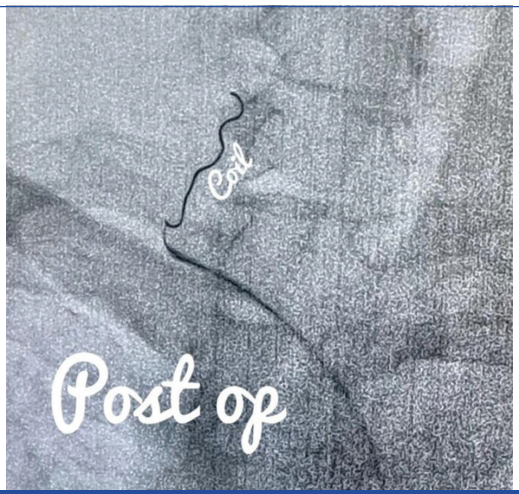
The CT angiography was performed to evaluate the arterial anatomy, confirming a well-circumscribed enhancing haematoma collection on the right side of the neck, which arose from the inferior thyroid artery, a branch of the thyrocervical trunk [Table/Fig-2].

Digital subtraction angiography via the left femoral arterial approach was conducted. A selective angiogram of the right subclavian, right common carotid, right vertebral arteries and thyrocervical trunk was performed using a 6Fr H1 catheter. With a 6Fr Judkins Right (JR) catheter, selective cannulation of the right thyrocervical trunk was



[Table/Fig-2]: Superselective angiogram of thyrocervical trunk revealing contrast ooze from the origin of right inferior thyroid artery, suggestive of pseudoaneurysm.

achieved and a Progreat microcatheter was advanced into the inferior thyroid artery. A pseudoaneurysm arising from the inferior thyroid artery was confirmed and its neck was embolised with a Cook clip Hilal/Nester® Embolisation Microcoil (18-2.0-2, Cook Incorporated, Bloomington, USA) [Table/Fig-3].



[Table/Fig-3]: Selective coil embolisation of the right inferior thyroid artery and thyrocervical trunk.

Glue and additional coils could not be used, as the mouth of the pseudoaneurysm was very close to the subclavian artery, posing a risk of non targeted coil or glue embolisation. Percutaneous thrombin injection was deferred due to the short aneurysmal neck, which carried a high chance of inadvertent distal embolisation into the subclavian and carotid arteries. The procedure was uneventful and the formation of thrombus was confirmed with follow-up ultrasound at 12 and 24 hours post-procedure [Table/Fig-4]. The patient remained haemodynamically stable and was discharged without any long-term sequelae.

DISCUSSION

The CVC are used extensively to maintain venous access in critically ill patients. Their usage ranges widely from the administration of medications to parenteral nutrition, fluid resuscitation, chemotherapy and the maintenance of haemodialysis in patients with chronic renal failure. CVCs come in various sizes and types, depending on the site of insertion. However, the insertion procedure is associated with a multitude of complications.

The incidence rate of arterial complications during IJV catheterisation ranges from 4.2% to 9.3% [1,2]. The presentation of these

[Table/Fig-4]: Post coil embolisation USG revealing stasis of blood with thrombus formation within the pseudoaneurysm sac.

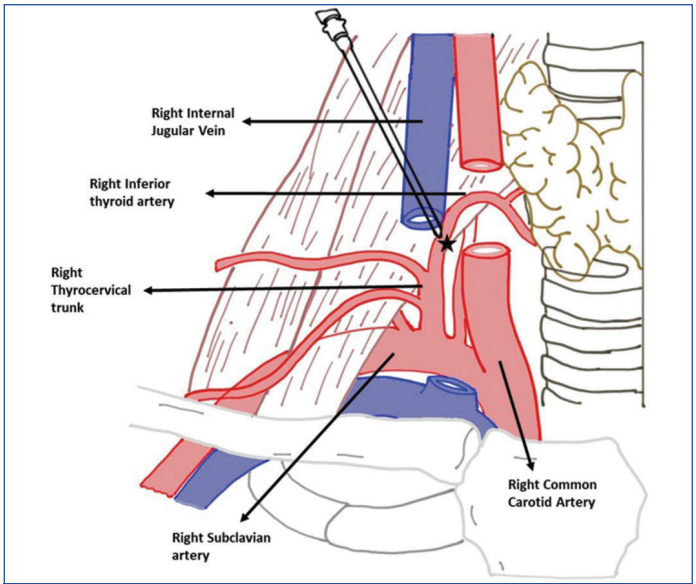
complications can be immediate or delayed and varies based on the type of central venous access. Arterial injury caused by a small-bore needle is usually benign and is managed conservatively. However, misplacement of a large-bore needle into an artery can lead to significantly more serious damage, with an incidence of 0.1% to 0.8% [3].

Complications of Catheter-Related Cervicothoracic Arterial Injuries (CRCAI) include haematoma formation, haemothorax, pseudoaneurysm, arteriovenous fistula and stroke [2-4]. Arterial trauma is generally managed conservatively through the removal of the catheter, combined with external compression (the pull and pressure technique), endovascular intervention, surgical exploration, or direct arterial repair [2,4].

Vascular complications can be substantially reduced by using ultrasound guidance. USG-guided central line insertion offers significant advantages in terms of higher first-attempt success rates, fewer attempts needed and reduced complication rates compared to the landmark technique [5-7]. Guilbert MC et al., upon reviewing arterial complications of CVC placement, found that punctures of the carotid and vertebral arteries with large-bore catheters constituted the majority of devastating complications [4].

Injuries to small-calibre arteries, such as the inferior thyroid artery, are rare and are usually managed conservatively with external compression. Haematoma formation can occur later and expand, causing tracheal compression and airway obstruction. After exiting the jugular foramen, the right IJV is closely related to the Internal Carotid Artery (ICA) and CCA. In the upper half of the neck, the vein is located posterolateral to the ICA/CCA, courses anterolateral to the artery lower down and overlaps with the CCA before joining the subclavian vein behind the medial end of the clavicle to form the brachiocephalic vein [5,6]. The thyrocervical trunk and its branches course along the posterior and medial aspect of the lower end of the IJV. Due to this anatomical relationship, the trunk and its branches are prone to accidental puncture during IJV cannulation [8], as illustrated in the diagram [Table/Fig-5].

To the best of the authors knowledge, only a few previous case reports of inferior thyroid artery injury and pseudoaneurysm formation have been documented in the literature as a result of IJV catheterisation [8-12]. Among these case reports, half were successfully managed with endovascular coil embolisation, one case with USG-guided percutaneous thrombin injection [12] and one with 33% N-butyl 2-cyanoacrylate glue [8].



[Table/Fig-5]: Schematic diagram of the right inferior thyroid artery injury. During the placement of the Central Venous Catheter (CVC), the introducer needle crossed the lumen of the right Internal Jugular Vein (IJV), causing an accidental puncture of the inferior thyroid artery (star).

Several hypotheses have been proposed for the formation of inferior thyroid artery pseudoaneurysms. First, in the present case, the introducer needle may have been directed too medially to the IJV or too deep and caudal to the anatomical landmark. Second, there may have been inadequate manual compression at the site of arterial injury, as there is no bony anatomical landmark against which compression could have been applied. In a few case reports, a third hypothesis suggested that coagulation abnormalities could lead to the formation of haematomas, arteriovenous fistulas and pseudoaneurysms [13-15]. Insufficient clotting factors may theoretically increase the risk of delayed closure of arterial punctures. However, in the present case, there were no abnormalities in the coagulation profile and the Prothrombin Time (PT)/International Normalised Ratio (INR) was well within normal limits. Therefore, the first two hypotheses were confirmed as probable causes in the present case.

In cases of catheter-related cervicothoracic pseudoaneurysms, adequate compression to occlude a pseudoaneurysm is not feasible without compromising carotid circulation. Additionally, the absence of any bony structure against which the pseudoaneurysm can be compressed renders this method less effective and often futile [4]. Therefore, in the present case, embolisation of the feeding artery was performed using coils, resulting in successful complete thrombosis of the pseudoaneurysmal sac without any further complications.

CONCLUSION(S)

The present case report illustrates a rare and significant complication of repeated internal jugular venous punctures and catheterisation, namely, inferior thyroid artery pseudoaneurysm. With its successful endovascular management, the case highlights the crucial role of timely diagnosis and intervention. It is important for healthcare workers to remain vigilant regarding potential complications and to employ ultrasound guidance as part of the routine protocol to reduce such adverse events.

REFERENCES

[1] Deere M, Singh A, Burns B. Central venous access of the subclavian vein. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan.
[2] Bowdle A. Vascular complications of central venous catheter placement: Evidence-based methods for prevention and treatment. J Cardiothorac Vasc Anesth. 2014;28(2):358-68.
[3] Reuber M, Dunkley LA, Turton EP, Bell MD, Bamford JM. Stroke after internal jugular venous cannulation. Acta Neurol Scand. 2002;105(3):235-39.
[4] Guilbert MC, Elkouri S, Bracco D, Corriveau MM, Beaudoin N, Dubois MJ, et al. Arterial trauma during central venous catheter insertion: Case series, review and proposed algorithm. J Vasc Surg. 2008;48(4):918-25.
[5] Hamza HA, Iqbal TA, Zia MS, Arif SI, Jawed S. Comparing the complications in central venous catheterization by ultrasound guidance vs anatomical landmark technique in critical ill ICU patients. Ann Pak Inst Med Sci. 2024;20(3):511-16.
[6] Kumar M, Kumar S, Kumar R. Internal jugular vein catheterization "a comparative study of real-time ultrasound - guided technique versus conventional landmark guided technique". Global Journal for Research Analysis. 2022;33-34.
[7] Marques MG, Cesar RG. Ultrasound-guided central venous catheterization: A protocol to be followed in pediatrics? Open Journal of Pediatrics. 2017;7(3):128.
[8] Ono Y, Ueshima E, Nakanishi N, Shinohara K, Yamada I, Kotani J. Right thyrocervical trunk rupture after right internal jugular vein puncture: A case report and systematic review of the literature. JA Clin Rep. 2022;8(1):74.
[9] Schummer W, Schummer C, Paxian M, Fröber R, Settmacher U. ECG recording of central venous catheter misplaced in inferior thyroid artery. Br J Anaesth. 2005;94(3):296-99.
[10] Debek AH, Jammaleddine GW, Bou-Khalil PK. Inferior thyroid artery injury after attempts of internal jugular venous catheterization. J Cardiothorac Vasc Anesth. 2007;21(3):422-24.
[11] Ruan J, Zhang C, Peng Z, Tang DY, Feng Z. Inferior thyroid artery pseudoaneurysm associated with internal jugular vein puncture: A case report. BMC Anesthesiol. 2015;15:71.
[12] Gorsi U, Babu S, Jugpal TS, Bhatia V, Taneja S. Percutaneous management of inferior thyroid artery pseudoaneurysm developed after central line placement in a cirrhotic patient. Journal of Clinical Interventional Radiology ISVIR. 2020;4(02):115-17.
[13] Adrian M, Borgquist O, Kröger T, Linné E, Bentzer P, Spångfors M, et al. Mechanical complications after central venous catheterisation in the ultrasound-guided era: A prospective multicentre cohort study. Br J Anaesth. 2022;129(6):843-50.
[14] Droll KP, Lossing AG. Carotid-jugular arteriovenous fistula: Case report of an iatrogenic complication following internal jugular vein catheterization. J Clin Anesth. 2004;16(2):127-29.
[15] Cuhaci B, Khoury P, Chvala R. Transverse cervical artery pseudoaneurysm: A rare complication of internal jugular vein cannulation. Am J Nephrol. 2000;20(6):476-82.

PARTICULARS OF CONTRIBUTORS:
1. MD Radiodiagnosis, FVIR (Fellowship in Vascular Interventional Radiology), Department of Interventional Radiology, Mahatma Gandhi Mission Institute of Health Sciences, Kamothe, Navi Mumbai, Maharashtra, India.
2. MD Radiodiagnosis, FVIR (Fellowship in Vascular Interventional Radiology), Department of Interventional Radiology, Mahatma Gandhi Mission Institute of Health Sciences, Kamothe, Navi Mumbai, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Aniketh Davangere Hiremath,
D1-1104, Ganga Skies, Vallabh Nagar, Pimpri,
Pimpri-Chinchiwad-411018, Maharashtra, India.
E-mail: kyathadh@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Oct 26, 2024
- Manual Googling: Jan 24, 2025
- iThenticate Software: Jan 28, 2025 (9%)

ETYMOLOGY: Author Origin

EMENDATIONS: 5

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Oct 24, 2024**
Date of Peer Review: **Dec 25, 2024**
Date of Acceptance: **Jan 31, 2025**
Date of Publishing: **May 01, 2025**