



Perforation of the left innominate vein during placement of a hemodialysis catheter: Medical image.

Luis Rafael Álvarez Velazquez ¹, Luis R Álvarez-Bribiesca ².

1. Nephrology Service, General Hospital of Zone No 83, Morelia, Michoacan-México.
2. Emergency Service, ISSSTE Clinic. La Piedad-México.

Abstract


Received: November 19, 2024.
Accepted: February 22, 2025.
Published: February 24, 2025.
Editor: Dr. Franklin Mora Bravo.

How to cite:

Alvarez-Velazquez L, Alvarez-Bribiesca L. Perforation of a left innominate vein, in the placement of a catheter for hemodialysis: Medical Imaging. REV SEN 2025; 13(1):36-42.

DOI: <http://doi.org/10.56867/93>
Sociedad Ecuatoriana de Nefrología, Diálisis y Trasplantes.

ISSN-L: 2953-6448

 Copyright 2025, Luis Rafael Álvarez Velazquez, Luis R Álvarez-Bribiesca. This article is distributed under the [Creative Commons CC BY-NC-SA 4.0 Attribution License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows the use and redistribution of the article, citing the source and the original author for noncommercial purposes.

Introduction: The left internal jugular vein travels through two angles, joining the subclavian and right brachi to form the superior vena cava. These angles are challenging for hemodialysis access during puncture.

Clinical case: This is a 32-year-old man with polycystic kidney disease who required hemodialysis for six years. After a failed kidney transplant, the patient resumed hemodialysis due to uremia. A central approach was chosen for the left internal jugular vein. The initial procedure was uneventful.

Diagnostic workshop: A follow-up chest X-ray revealed an anomalous catheter trajectory projecting along the left edge of the aortic arch. CT angiography confirmed perforation of the left brachiocephalic vein by the catheter.

Treatment: The patient underwent thoracotomy, which revealed a perforation in the anterior wall of the left innominate vein, with the catheter tip lodging in the pericardial fat. The catheter was removed, and the venous laceration was repaired. A tunneled catheter was inserted through the right internal jugular vein.

Outcome: The patient recovered uneventfully and was discharged.

Conclusions: Difficult passage of the guidewire or dilator should alert patients to a possible abnormal position or kinking of the guidewire, which could result in vascular injury. Abnormal postplacement chest X-rays should alert patients to the extravascular position, arterial position, or venous variants, even if the placement procedure is uneventful.

Keywords:

Chronic kidney disease, vascular access, innominate vein perforation, hemodialysis catheter, case report.

* Corresponding author

Email: Luis Rafael Álvarez Velazquez <alvarezlr.65@gmail.com>/

Address: Perif. Paseo de la República 1935, Colonia No Assignment Zone, 58290 Morelia, Michoacán. Zona General Hospital No 83 Morelia Michoacán, Mexico Tel [52] 35 25 92 26 91 REV SEN 2025; 13 (1): 36-42 |



The puncture of the left internal jugular vein for vascular access was utterly opposite to the puncture of the right internal jugular vein. The anatomical course of the right internal jugular vein has a straighter and more direct path to the superior vena cava, so its puncture rarely causes complications. In contrast, the left internal jugular vein has an angled path, joining the subclavian vein to form the left brachiocephalic vein, which in turn must cross the midline to join the right brachiocephalic vein and form the superior vena cava [1]. This path presents two potentially challenging approach angles during puncture. The thoracic duct, the main lymphatic vessel in the body, is located on the left side of the neck and empties near the junction of the left subclavian vein and the left internal jugular vein. An accidental puncture on the left side has an increased risk of injuring this duct, which can lead to chylothorax in the pleural space [2]. On the other hand, although the carotid artery is located on both sides of the neck near the internal jugular vein, some studies suggest a slight increase in the risk of inadvertent arterial puncture on the left side. This could be due to subtle anatomical differences in the relationship between the vein and the artery on that side [3].

Puncture of the right internal jugular vein is most commonly recommended at the beginning of hemodialysis treatment; however, when the catheter has been prolonged, dysfunction is present, a puncture of the left side is needed [4]. Additionally, patients who lose their vascular access due to fistula thrombosis during hemodialysis treatment must temporarily return to the placement of temporary access. There is a complication in the intervention of the left internal jugular vein.

Clinical case

Clinical history

We present the case of a 32-year-old male patient with chronic kidney disease secondary to autosomal dominant polycystic kidney disease who required hemodialysis for six years. Eight years after a cadaveric donor kidney transplant, the patient developed chronic graft dysfunction secondary to chronic antibody-mediated rejection.

The patient came to the emergency room with elevated uremia and creatinine (urea nitrogen, 108 mg/dL; creatinine, 10.1 mg/dL) and anemia (hemoglobin, 9.7 g/dL), requiring the insertion of a temporary catheter for hemodialysis. The left internal jugular approach was chosen with a central approach. The initial procedure passed without apparent incident.

Diagnostic workshop

A control chest X-ray revealed an abnormal catheter path projecting along the left edge of the aortic arch (Figure 1). Given the initial suspicion of a congenital venous anatomical variant, emergency computed tomography angiography was performed. This study confirmed the perforation of the left brachiocephalic vein (Figure 2).

Treatment

The patient was transferred to a cardiothoracic center for surgical intervention. A left exploratory thoracotomy was performed, identifying a perforation in the anterior wall of the left innominate vein with the tip of the catheter lodging in the pericardial fat. The catheter was removed, and the venous laceration was repaired. A tunnel catheter was inserted through the right internal jugular vein without complications.

Evolution

After the surgical procedure, the patient recovered without incident.

Discussion

Acute catheter complications are typically associated with the procedure itself, as well as the technique and specific conditions of each patient. Utilizing ultrasound and/or fluoroscopy to assess vascular anatomy and guide cannulation enhances the likelihood of successful placement [4].

Cannulation of the left internal jugular vein is linked with a higher rate of complications and failures due to a longer and more challenging pathway that requires the catheter to reach the right atrium. Key factors contributing to the increased risk of complications include the angle between the left internal jugular vein and the left brachiocephalic vein, longer catheter lengths for left-sided procedures, and external compression of the left brachiocephalic vein by surrounding structures [5-7].

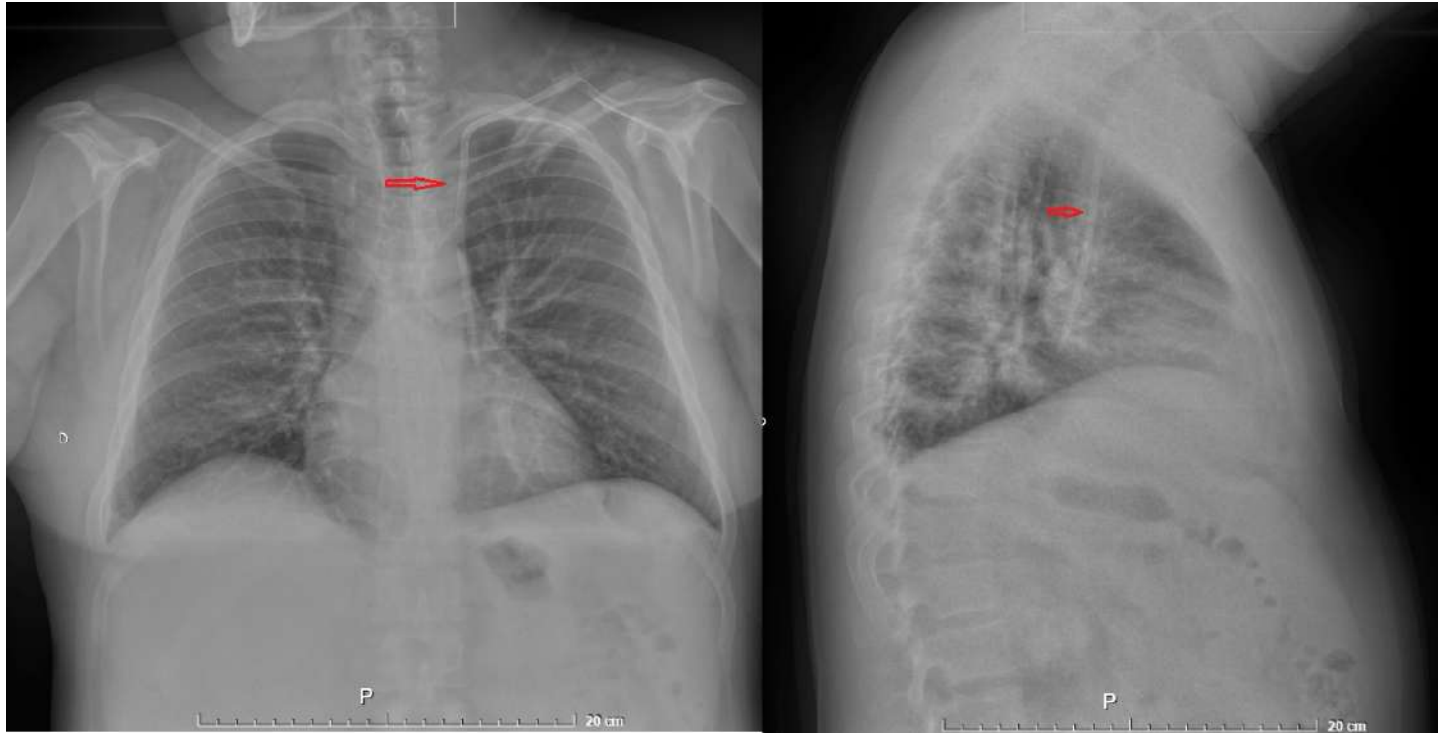
Since perforation is still a rare complication, perforation of the left innominate vein is usually more common because of the complex anatomical characteristics the guidewire, dilators, and catheter must pass through to reach the right atrium.

Although we are uncertain about the mechanism of the injury, the perforation was likely caused by the relatively sharp curvature of the wire to the right when it entered the innominate vein from the left internal jugular vein, which was trapped at this point. When the dilator and/or catheter are inserted, they pierce the vascular structures in their path (Figure 3).

Although vascular perforation is suspected, the catheter must remain in place until the diagnosis is confirmed. Treatment options include open surgical repair, vascular endoprosthesis, and endovascular coils with cyanoacrylate glue, yielding different clinical results [8-10].



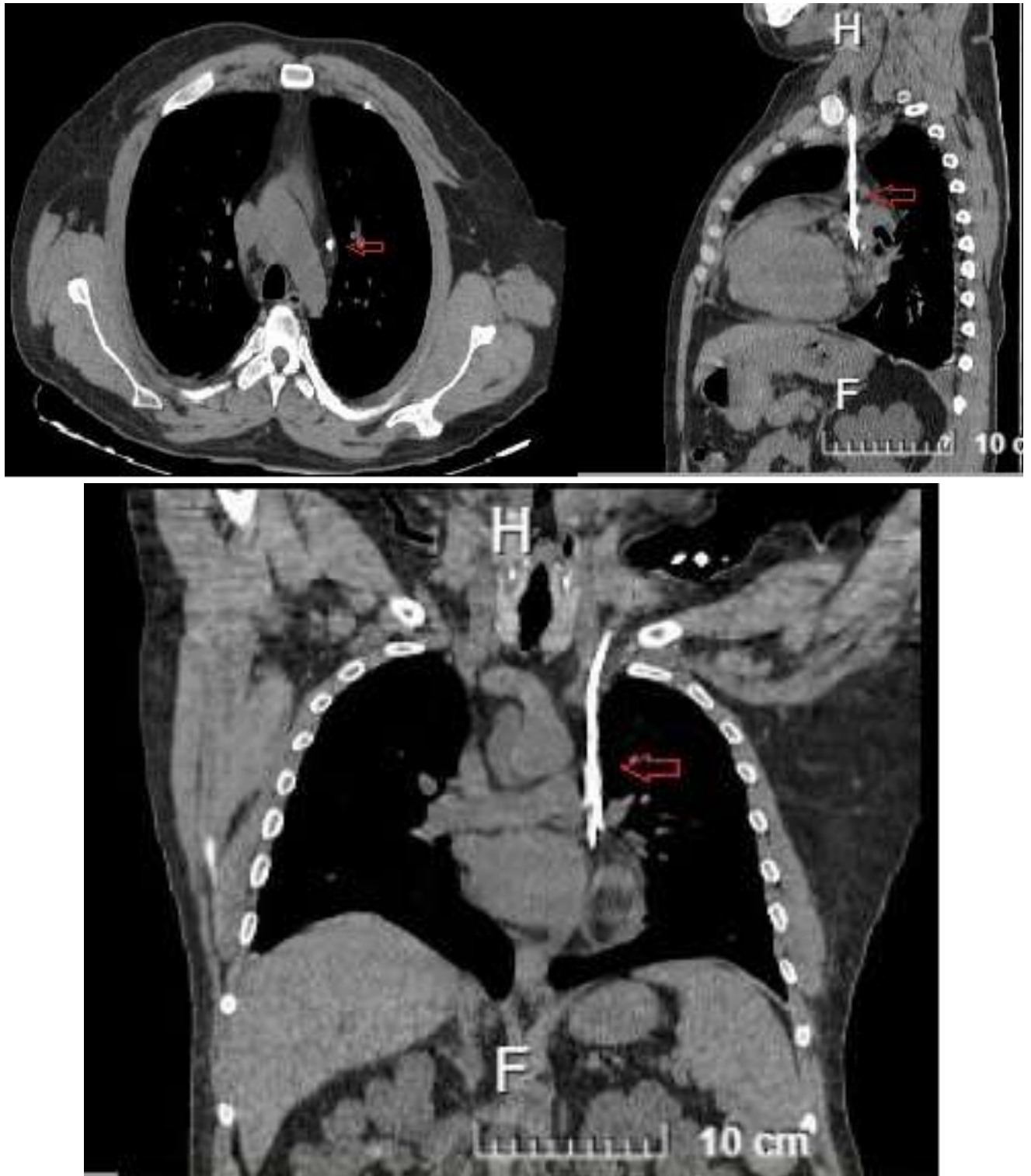
Figure 1 . Postero-anterior and right lateral chest X-ray.



The red arrow indicates the left jugular catheter



Figure 2 . Axial, coronal and sagittal tomography of the chest.



Axial, coronal and sagittal computed tomography image, catheter extravascular route through the left mediastinum with distal end in the left atrium.



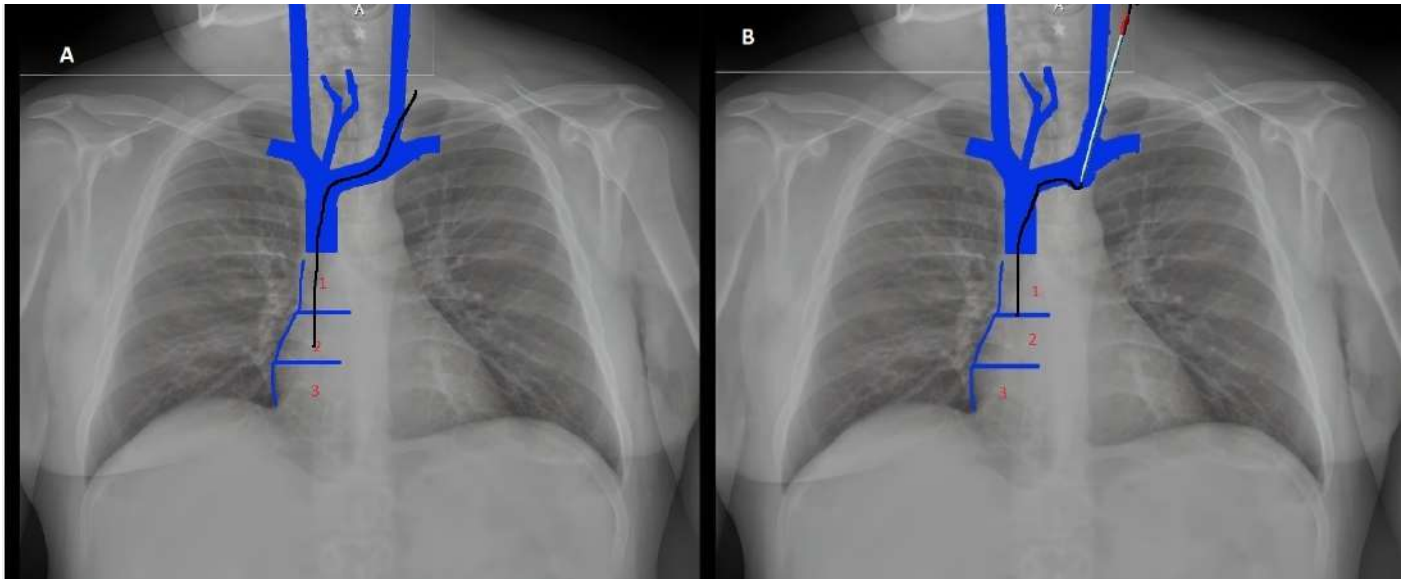
Once a perforation is identified, no action can prevent it; however, during the planning and placement of vascular access, preventive measures that minimize the incidence of complications, such as the following, can be implemented:

1. The patient is placed in the Trendelenburg position to increase the diameter of the internal jugular vein, and the puncture is

directed via ultrasound to reduce the possibility of extravascular and/or arterial puncture [11].

2. The use of a fluoroscope to orient and locate the anatomical position of the wire guide, dilators, and catheter in real time. Placing the metal guide below the diaphragm rules out arterial puncture, as these are never found beneath it [12].

Figure 3 . Anatomical diagram of catheterization of the left jugular vein



Suspected mechanism of perforation. A. Route of the metal guide to the superior vena cava. B. Dilator that penetrated the wall of the brachycephalic vein

3. In adult patients, the guide is inserted to an upper limit of 18 cm to reach the cavoatrial junction; this suggested distance is less if it is placed in the right internal jugular vein than on the left side [13]. Identifying resistance during the guide's insertion may indicate an abnormal position of the guide. In the same way, an exaggerated resistance when advancing the dilator and/or the catheter over a bent guide could warn about an incorrect route of the guide.

4. The dilator should be inserted only 10 cm in length; it is not essential to insert it completely, only what is necessary to dilate the catheter's entrance into the vessel. Excessive insertion can lead to perforation [14].

5. During the introduction of the dilators and the catheter, the displacement of the guide should be verified to ensure that the tip of the dilator is not trapped in the vein's wall.

6. Before catheters are used, postplacement radiographical control or tools such as point-of-care ultrasound and agitated saline can help confirm the correct position of the catheter and rule out pneumothorax [15].

Owing to the increase in patients in hemodialysis programs [16], a more significant increase in the use of catheters for unscheduled hemodialysis initiation is expected.

Conclusions

Innominate vein perforation is a rare complication; however, it more commonly occurs when catheters are inserted through the left jugular vein when they cross a complex anatomical pathway. Difficult passage of the guidewire or the dilator should alert patients to a possible abnormal position or twist of the guidewire that can lead to vascular injury. Postplacement chest X-ray, which reveals an abnormal course, should be used to determine the extravascular position, arterial position, or venous variants, although the placement procedure proceeded without difficulty.

Abbreviations

dL: deciliter.



Supplementary information

The supplementary materials have not been declared.

Acknowledgments

Does not apply.

Authors' contributions

Luis Rafael Álvarez Velazquez: Conceptualization, methodology, research, Writing - Original draft.

Luis R. Álvarez-Bribiesca: Conceptualization, Project management, Supervision, validation, visualization, Writing - review and edition.

All the authors read and approved the final version of the manuscript.

Financing

The authors self-financed the study, and the patient's insurance company assumed treatment and intervention costs.

Availability of data or materials

Does not apply.

Declarations

Ethics committee approval and consent to participate

It does not apply to clinical cases.

Consent for publication

The authors have written permission from the patient.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Author information

Not declared.

References

1. Vachharajani TJ, Taliercio JJ, Anvari E. New Devices and Technologies for Hemodialysis Vascular Access: A Review. *Am J Kidney Dis.* 2021 Jul;78(1):116-124. doi: [10.1053/j.ajkd.2020.11.027](https://doi.org/10.1053/j.ajkd.2020.11.027). Epub 2021 May 6. PMID: 33965296.
2. Ferreira Gomes RA, Tavares Machado T, Sá MPBO, Filho DCS. The complication of left internal jugular vein puncture. *Eur Heart J Case Rep.* 2021 May 14;5(5):ytab182. doi: [10.1093/ehjcr/ytab182](https://doi.org/10.1093/ehjcr/ytab182). PMID: 34109296; PMCID: PMC8184263.
3. Zou ZY, Yao YT. Horner Syndrome Caused by Internal Jugular Vein Catheterization. *J Cardiothorac Vasc Anesth.* 2020 Jun;34(6):1636-1640. doi: [10.1053/j.jvca.2019.06.031](https://doi.org/10.1053/j.jvca.2019.06.031). Epub 2019 Jun 28. PMID: 31350153.
4. Kim GM, Song S, Kim DY, Kim SH, Lee CW, Bae M, Kim JW, Huh U. Impact of insertion into the left internal jugular vein in chemoport-associated infections: a retrospective single-center study of 1690 cases. *Sci Rep.* 2024 Apr 18;14(1):8925. doi: [10.1038/s41598-024-59749-2](https://doi.org/10.1038/s41598-024-59749-2). PMID: 38637601; PMCID: PMC11026388.
5. Sulek CA, Blas ML, Lobato EB. A randomized study of left versus right internal jugular vein cannulation in adults. *J Clin Anesth.* 2000 Mar;12(2):142-5. doi: [10.1016/s0952-8180\(00\)00129-x](https://doi.org/10.1016/s0952-8180(00)00129-x). PMID: 10818329.
6. Oropello JM, Leibowitz AB, Manasia A, Del Guidice R, Benjamin E. Dilator-associated complications of central vein catheter insertion: possible mechanisms of injury and suggestions for prevention. *J Cardiothorac Vasc Anesth.* 1996 Aug;10(5):634-7. doi: [10.1016/s1053-0770\(96\)80142-x](https://doi.org/10.1016/s1053-0770(96)80142-x). PMID: 8841872.
7. Salik E, Daftary A, Tal MG. Three-dimensional anatomy of the left central veins: implications for dialysis catheter placement. *J Vasc Interv Radiol.* 2007 Mar;18(3):361-4. doi: [10.1016/j.jvir.2006.12.721](https://doi.org/10.1016/j.jvir.2006.12.721). PMID: 17377181.
8. Zhou CZ, Liu KC, Wang P, Ren W, Lv WF. Treatment of a central venous perforation caused by dialysis intubation using coils and cyanoacrylate glue: A case report. *Exp Ther Med.* 2019 Oct;18(4):2979-2983. doi: [10.3892/etm.2019.7923](https://doi.org/10.3892/etm.2019.7923). Epub 2019 Aug 20. PMID: 31572540; PMCID: PMC6755472.
9. Pua U. Central vein perforation during tunneled dialysis catheter insertion: principles of acute management. *Hemodial Int.* 2014 Oct;18(4):838-41. doi: [10.1111/hdi.12179](https://doi.org/10.1111/hdi.12179). Epub 2014 May 19. PMID: 24841140.
10. Sánchez Matás C, Manresa Manresa F, Andrades Sardiña D, López Villalobos JL, Bataller de Juan ME. Thoracoscopic approach of iatrogenic superior vena cava perforation after dialysis catheter placement. *Cir Esp (Engl Ed).* 2020 Jun-Jul;98(6):364-366. English, Spanish. doi: [10.1016/j.ciresp.2019.08.010](https://doi.org/10.1016/j.ciresp.2019.08.010). Epub 2019 Nov 9. PMID: 31718782.
11. Clark EG, Barsuk JH. Temporary hemodialysis catheters: recent advances. *Kidney Int.* 2014 Nov;86(5):888-95. doi: [10.1038/ki.2014.162](https://doi.org/10.1038/ki.2014.162). Epub 2014 May 7. PMID: 24805107; PMCID: PMC4220490.
12. Wahaj; Azam MN, Butt B; Salahuddin; Tahir T, Khan NJ, Rahman MK, Raja KM, Arshad AR, Mir AW. Ultrasound Guided Tunneled Cuffed Catheter Placement Without Fluoroscopic Guidance By Anatomical Landmarks; Accuracy And Safety. *J Ayub Med Coll Abbottabad.* 2019 Oct-Dec;31(4):563-568. PMID: [31933312](https://doi.org/10.31933/12).



13. Andrews RT, Bova DA, Venbrux AC. How much guidewire is too much? Direct measurement of the distance from subclavian and internal jugular vein access sites to the superior vena cava-atrial junction during central venous catheter placement. *Crit Care Med.* 2000 Jan;28(1):138-42. doi: [10.1097/00003246-200001000-00023](https://doi.org/10.1097/00003246-200001000-00023). PMID: 10667513.
14. Dorje P, LaGorio J, Mullin V. Dilator-associated complications of central vein catheter insertion; possible mechanisms of injury and suggestions for prevention. *J Cardiothorac Vasc Anesth.* 1997 Jun;11(4):540; author reply 541. doi: [10.1016/s1053-0770\(97\)90090-2](https://doi.org/10.1016/s1053-0770(97)90090-2). PMID: 9188014.
15. Woodland DC, Randall Cooper C, Farzan Rashid M, Rosario VL, Weyker PD, Weintraub J, Bentley-Hibbert S, Kluger MD. Routine chest X-ray is unnecessary after ultrasound-guided central venous line placement in the operating room. *J Crit Care.* 2018 Aug;46:13-16. doi: [10.1016/j.jcrc.2018.03.027](https://doi.org/10.1016/j.jcrc.2018.03.027). Epub 2018 Mar 28. PMID: 29627658.
16. Abril J, Sánchez J. Características de la Enfermedad Renal Crónica en el Ecuador en el años 2009 hasta el 2012. [Tesis de grado]. Universidad de Cuenca. 2012. [Dspace.ucuenca/0f483bd8](https://dspace.ucuenca.org/handle/123456789/0f483bd8)

DOI: Digital Object Identifier. **PMID:** PubMed Identifier.

Editor's Note

REV SENs remain neutral concerning jurisdictional claims on published maps and institutional affiliations.
