Wire Placement into the Dural Venous Sinuses during Central Venous Catheter Placement

Aaron Trimble¹ and Nathaniel Ivanick²

¹Division of Pulmonary Diseases and Critical Care Medicine, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina; and ²Christus St. Vincent Regional Medical Center, Santa Fe, New Mexico

ORCID ID: 0000-0003-4290-8044 (A.T.).

A 70-year-old-woman was admitted to the ICU with septic shock and was treated with fluid resuscitation, broad-spectrum antibiotics, and initiation of vasopressors. An attempt was made to insert a central venous catheter (CVC) in the right subclavian vein. The patient was placed in the Trendelenburg position, with head turned contralaterally and neutral shoulder position. Venous access was obtained with the introducer needle, using landmarks alone without complication, and the guidewire inserted to a depth that was later determined to be approximately 35 cm. The finder needle was withdrawn, and the tract dilated without difficulty. The catheter was smoothly inserted over the guidewire without resistance to a depth of approximately 17 cm. However, significant resistance was encountered in attempting to withdraw the guidewire through the catheter, and the procedure was aborted. Multiple portable bedside radiographs were obtained (Figures 1A and 1B) and showed the guidewire turning cephalad up the internal jugular vein, into the skull via the sigmoid dural sinus, traveling across the right transverse sinus into the left transverse sinus (Figure 1C). The neurosurgical service was consulted, and the wire was removed using significant manual force. After removal, a computed tomography venogram revealed no vascular complications.

Figure 1. (A and B) Plain radiographs demonstrating the path of the guidewire in the venous system of the head and neck. (C) Diagram showing the path of the guidewire. AP = anteroposterior projection; L = left; R = right.

A.T. was supported by NIH grant T32 HL007106 while this work was prepared.

Author Contributions: A.T. and N.I.: clinical care in the described case, conception and design, acquisition of the radiographic images, drafting the article, and final approval of submitted material.

Am J Respir Crit Care Med Vol 198, Iss 1, pp e1–e2, Jul 1, 2018

Copyright © 2018 by the American Thoracic Society

Originally Published in Press as DOI: 10.1164/rccm.201711-2235IM on March 26, 2018

Internet address: www.atsjournals.org

This case demonstrates several important concepts in CVC placement that could have prevented this complication. First, careful attention should be given to guidewire depth, as advancing the wire too far is likely to lead to complications. Proper guidewire depth for a right subclavian approach should typically not exceed 18 cm (1). In addition to arrhythmias (2), more serious guidewire complications have been reported including injury to the heart or great vessels (3), looping and knotting (4), embolization (5), and entrapment within existing hardware (6). Second, the use of ultrasound may have helped prevent this complication. Although the traditional approach to subclavian CVC placement is performed without ultrasound (as in this case), ultrasound could be used after wire placement to confirm that the wire is not present in the internal jugular vein before dilation of the tract, particularly during right-sided approaches. We recommend similar confirmation of proper guidewire orientation during ultrasound-guided right axillary vein approaches, as the more distal insertion site creates a path favorable for cephalad orientation of the guidewire into the jugular vein. Proper patient positioning is also important for successful CVC placement (7, 8). Although the Trendelenburg position may be used, we do not recommend retracting shoulders or pulling the arm downward. In a prospective trial of shoulder positioning, the lowered shoulder position was associated with greater rates of internal jugular malposition compared with neutral shoulder position (9). In addition, we recommend maintaining the head in the neutral position to allow for the optimal relationship between subclavian and internal jugular veins, as contralateral head positioning may increase the risk for internal jugular vein cannulation (8, 10). Last, supervision of the resident performing this procedure by a more experienced operator may have prevented the improper placement of the guidewire. Despite CVC placement being a routine ICU procedure, inexperience is associated with higher complication during CVC insertion (11), as any deviation from proper technique can have serious consequences. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

References

1. 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;28:138–142.
2. Lee T-Y, Sung C-S, Chu Y-C, Liou JT, Lui P-W. Incidence and risk factors of guidewire-induced arrhythmia during internal jugular venous catheterization: comparison of marked and plain J-wires. *J Clin Anesth* 1996;8:348–351.
3. Kornbau C, Lee KC, Hughes GD, Firstenberg MS. Central line complications. *Int J Crit Illn Inj Sci* 2015;5:170–178.
4. Wang HE, Sweeney TA. Subclavian central venous catheterization complicated by guidewire looping and entrapment. *J Emerg Med* 1999;17:721–724.
5. Breznick DA, Ness WC. Acute arterial insufficiency of the upper extremity after central venous cannulation. *Anesthesiology* 1993;78:594–596.
6. Streib EW, Wagner JW. Complications of vascular access procedures in patients with vena cava filters. *J Trauma* 2000;49:553–557.
7. Land RE. Anatomic relationships of the right subclavian vein: a radiologic study pertinent to percutaneous subclavian venous catheterization. *Arch Surg* 1971;102:178–180.
8. Jessep JM, Conces DJ Jr, Augustyn GT. Patient positioning for subclavian vein catheterization. *Arch Surg* 1987;122:1207–1209.
9. Kang M, Ryu H-G, Son I-S, Bahk J-H. Influence of shoulder position on central venous catheter tip location during infraclavicular subclavian approach. *Br J Anaesth* 2011;106:344–347.
10. Conces DJ Jr, Holden RW. Aberrant locations and complications in initial placement of subclavian vein catheters. *Arch Surg* 1984;119:293–295.
11. Bo-Linn GW, Anderson DJ, Anderson KC, McGoon MD. Percutaneous central venous catheterization performed by medical house officers: a prospective study. *Cathet Cardiovasc Diagn* 1982;8:23–29.