Flexible Subclavian Artery Closure for an Inadvertent Injury to the Internal Mammary Artery During Internal Jugular Vein Catheterization

Dong-Dong Que, Lei Liu, Xu-Dong Song, Xian-Bao Wang, Xiu-Li Zhang, Yi-Jun Zhou, Li-Yun Feng, Wen-Jie Yu, Yuan-Qing Li, Ping-Zhen Yang
Department of Cardiology, Zhujiang Hospital, Southern Medical University, Guangzhou, Guangdong 510280, China

Key words: Internal Jugular Vein Catheterization; Internal Mammary Artery; Subclavian Artery Injury; Vascular Closure Device

Central vein catheter (CVC) placement, which is widely utilized in clinical departments, is also highly important in preoperative preparations for radiofrequency catheter ablation (RFCA). The internal jugular vein or subclavian vein is the routine target. Arterial injury is not uncommon during the procedure but is potentially devastating in spite of the safety and advantages of the Seldinger technique. Compressing of the airway by a hematoma, as well as hemothorax, pseudoaneurysm, arteriovenous fistula, stroke, and even death, has been well-described.[1] Percutaneous interventional management of inadvertent arterial catheterization during central venous access has been recognized as the first-line treatment. Balloon tamponade, embolization, stent-graft placement, and dedicated percutaneous closure devices can be implemented depending on the type of lesion.[2] Here, we reported an instance of iatrogenic subclavian artery injury associated with the internal mammary artery (IMA) during internal jugular vein catheterization that was repaired using a general vascular closure device.

An underweight 13-year-old boy was suffering from frequent premature ventricular contraction (PVC), and RFCA was suggested. All results of examinations and tests including X-rays and coagulation tests were negative. The internal jugular vein was targeted for the placement of ten-pole (mapping of the coronary sinus) due to underweight of the patient. No anomalies of the neck were detected in physical examination, and all vital landmarks were normal. The patient was lying still with his neck sufficiently tilted to the left, and the triangle consisting of the sternocleidomastoid and clavicle was completely exposed. After local infiltration anesthesia, a syringe was used as finder needle to obliquely penetrate the skin toward the right nipple until blood was aspirated. An alternative 18-gauge introducer needle (Radifocus®, Introducer II, Terumo, Tokyo, Japan) was positioned at the same site with a similar angle and direction. Dark red, nonpulsatile blood was aspirated, and a loach guide wire was smoothly inserted through the introducer, the tip of which was observed at the shadow of inferior vena cava (IVC) in the anteroposterior view. The introducer was advanced routinely along with the wire to its full length to verify the right vessel, and no bright or pulsatile blood was observed. A 6-F Terumo catheter (Radifocus®, Introducer II, Terumo, Tokyo, Japan) was completely inserted.

Coronary sinus electrode placement failed, and the re-placed wire had obviously deviated from heart shadow in the left anterior oblique view and the right lateral view [Figure 1a and 1b]. At this time, we realized that an artery or the lung might have been catheterized. Given the stable hemodynamics, another internal jugular vein puncture was completed via the advancement of the guide wire through the right femoral vein [Figure 1c], and a similar catheter was inserted. RFCA of the PVC was completed with the mistakenly placed catheter in position. Fortunately, the patient did not complain of discomfort during the procedure.

Address for correspondence: Prof. Ping-Zhen Yang, Department of Cardiology, Zhujiang Hospital, Southern Medical University, No. 253, Gongye Road, Guangzhou, Guangdong 510280, China
E-Mail: y.pingzhen@yahoo.com

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

© 2016 Chinese Medical Journal | Produced by Wolters Kluwer - Medknow

Received: 11-12-2015 Edited by: Xin Chen
How to cite this article: Que DD, Liu L, Song XD, Wang XB, Zhang XL, Zhou YJ, Feng LY, Wu WJ, Li YQ, Yang PZ. Flexible Subclavian Artery Closure for an Inadvertent Injury to the Internal Mammary Artery During Internal Jugular Vein Catheterization. Chin Med J 2016;129:868-70.
The contrast medium was injected through the former catheter, and an arteriole was observed instead of contrast dispersion [Figure 1d]. Another contrast injection showed that the IMA had been catheterized after slightly withdrawing the catheter [Figure 1e]. The catheter was carefully removed, and local compression was applied for hemostasis while the wire remained in place. After approximately 15 min of manual compression, no diffuse swelling was noted at the base of the right side of the neck. To prevent undetectable hemostasis, flexible subclavian artery closure was performed with a vascular closure device (Angio-Seal™ VIP, St. Jude Medical, MN, USA) after the wire moved into the subclavian artery [Figure 1f]. No obvious swelling was noted on the right side of the neck during the 1st day after the operation.

The patient remained stable and was discharged on the 3rd day after the operation without any sequelae. No further abnormalities were observed after 3-month follow-up.

Although complications associated with CVC are relatively rare, they tend to be fatal and devastating with significant morbidity and mortality. The majority of devastating complications of arterial injuries described in the literature were reported in the carotid or vertebral arteries and resulted from the use of large-bore catheters. These complications rarely occur in small caliber arteries such as the IMA. However, IMA pseudoaneurysms have been reported after subclavian line placements or internal jugular catheterization. This unique location coupled with the dynamic motion of the chest wall and the relative lack of surrounding supporting tissue creates an ideal environment for the growth and possible rupture of a pseudoaneurysm arising from the IMA. Both surgical repair and endovascular coiling are optimal treatment options for pseudoaneurysms. However, this may be the first presentation of IMA-mediated subclavian artery injury during internal jugular vein catheterization.

Whether the IMA was helpful or harmful to the subclavian artery injury in this case was difficult to determine. Although dark and nonpulsatile blood was detected, the 18-gauge introducer needle (Radifocus®, Introducer II, Terumo, Tokyo, Japan), which is the finest introducer needle available, might have penetrated the superior wall of SCA and further reached the ostium of IMA. The asterisk represents the penetrated point of the superior wall of SCA, and the arrow shows the tip of introducer needle in the ostium of IMA. SVC: Superior vena cava; LAO: Left anterior oblique view; RL: Right lateral oblique view; IMA: Internal mammary artery; IJV: Internal jugular vein; SCA: Subclavian artery.

Figure 1: The re-advanced loach wire after the coronary sinus electrode placement failure was out of the shadow of SVC in LAO (a) and in front of the heart in RL (b). A guide J-type wire through right femoral vein was advanced to internal jugular vein for puncture of internal jugular vein (c). Contrast medium injected through the mistakenly placed catheter showed arteriole appearance instead of contrast dispersion (d). IMA was proved inadvertently catheterized by contrast injection after drawing the catheter a little (e), and the zoomed local area marked by white asterisk shows the origin of IMA. The wire was pulled out of IMA and into the subclavian artery (f) for closure. An 18-gauge introducer needle might have already penetrated the superior wall of SCA and further reached the ostium of IMA. The asterisk represents the penetrated point of the superior wall of SCA, and the arrow shows the tip of introducer needle in the ostium of IMA (g). SVC: Superior vena cava; LAO: Left anterior oblique view; RL: Right lateral oblique view; IMA: Internal mammary artery; IJV: Internal jugular vein; SCA: Subclavian artery.

Although various methods were applied to ensure the correct catheterization procedure, including multiple fluoroscopic visualizations of the position and blood color verification, accidental catheterization regretfully occurred because the IMA was located opposite to the penetration point. Randomized controlled trials have indicated that real-time ultrasound guided venipuncture of the internal jugular vein has a higher first insertion attempt success rate, reduced access time, higher overall successful cannulation rate, and decreased the rate of arterial puncture compared to the
landmark-guided technique. Although, real-time ultrasound guidance is highly recommended, the high cost of this technique prohibits its use.

**Financial support and sponsorship**
This study was supported by grants from Science and Technology Planning Project of Guangdong Province, China (No. 2013B021800323) and the Popular Science Project of Haizhu District, Guangzhou, Guangdong, China (No. 2014HZKP-TJ-13).

**Conflicts of interest**
There are no conflicts of interest.

**References**
1. 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;48:918-25. doi: 10.1016/j.jvs.
2. Nicholson T, Ettles D, Robinson G. Managing inadvertent arterial catheterization during central venous access procedures. Cardiovasc Intervent Radiol 2004;27:21-5. doi: 10.1007/s00270-003-0043-8.
3. Mercer-Jones MA, Wenstone R, Hershman MJ. Fatal subclavian artery haemorrhage. A complication of subclavian vein catheterisation. Anaesthesia 1995;50:639-40. doi: 10.1111/j.1365-2044.1995.tb15120.x.
4. Kindelan J, Crandall B, Whittaker D. Endovascular coiling of an internal mammary artery pseudoaneurysm following placement of an internal jugular central venous catheter. Mil Med 2010;175:619-21. doi: 10.7205/MILMED-D-10-00029.
5. Koroglu M, Demir M, Koroglu BK, Sezer MT, Akhan O, Yildiz H, et al. Percutaneous placement of central venous catheters: Comparing the anatomical landmark method with the radiologically guided technique for central venous catheterization through the internal jugular vein in emergent hemodialysis patients. Acta Radiol 2006;47:43-7. doi: 10.1080/02841850500406845.