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Critical upper limb ischemia due to thrombus in the right subclavian artery: An uncommon complication of right internal jugular vein cannulation

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Abstract

Internal jugular catheterization is associated with arterial puncture in 6.3–9.4% of cases and subclavian artery (SCA) injuries are probably under-reported. Several complications like hemothorax, delayed presentation of hemomediastinum due to SCA injury have been reported. We report a case of critical upper limb ischemia due to SCA thrombosis developing a few hours after a difficult right internal jugular vein cannulation without any evidence of initial arterial injury with the finder or introducer needle and which was successfully treated by surgical thrombectomy. Arterial trauma should be kept in mind during subsequent manipulations and at all stages, particularly if a technical difficulty arises during the procedure. Although the ultrasound (US) was not used in this case, US should be used not just to identify the vein, but also to verify guide-wire and catheter insertion. High index of suspicion is necessary for detection of postprocedure thrombosis of SCA. Close monitoring for neurologic and vascular sequelae after the procedure is suggested in all difficult catheter insertions, even without a direct arterial puncture.

Keywords: Internal jugular vein, subclavian artery, thrombosis

INTRODUCTION

Central venous (CV) catheters are associated with a complication rate of >15%.^[1] Complications of internal jugular vein (IJV) catheterization vary from an innocuous arterial puncture to life-threatening hemorrhage or stroke.^[2] Although the commonest arterial injury associated with IJV cannulation is carotid artery puncture, subclavian artery (SCA) injuries have also been reported.^[3] Hemothorax delayed hemomediastinum, SCA laceration and pseudoaneurysm have all been reported.^[4,5,6,7,8] Only one case of SCA thrombosis has been reported previously.^[9] However, there was evident introducer needle induced arterial puncture during IJV cannulation, and right subclavian vein catheterization was performed following failure to catheterize IJV. In this case, peripheral pulsations were lost soon after catheterization with early suspicion of vascular occlusion. Whether subclavian catheterization contributed to SCA injury in this case is not known.

We report a case of critical upper limb ischemia due to SCA thrombosis developing a few hours after a difficult right IJV cannulation without any evidence of initial arterial injury with the finder or introducer needle.

CASE REPORT

This case is being reported after obtaining written consent from the patient.

A 38-year-old woman was admitted with per rectal bleeding and abdominal pain. She had a history of Crohn's disease. She had undergone four previous bowel resections during the last 15 years. Total parenteral

gaining CV access. Preprocedural examination showed normal vital signs. The patient's coagulation profile was normal. Patient had been receiving azathioprine, zopiclone, tramadol, and amitriptyline. She had history of the previous catheterization of both the right and left internal jugular veins during the last 5 years.

With noninvasive monitoring of blood pressure and pulse oximetry established, right IJV catheterization was attempted in the High Dependency Unit (HDU) using a triple lumen catheter (16 cm 7.5 Fr Multicath 3 L Expert/VYGON GmbH and Co., Germany). Due to technical reasons, ultrasound (US) could not be used, and the right IJV was accessed by the standard landmark approach at the apex of two heads of sternomastoids using the Seldinger's technique. The right IJV was first accessed with a 22G finder needle. The vein was then cannulated with the 70 mm larger needle and nonpulsatile dark blood was aspirated freely. The J-tip guide-wire was then passed successfully through the needle, and the dilator was advanced without any resistance over the guide-wire and was then removed. The catheter was threaded over the guide-wire up to the 7 cm mark, when some resistance was encountered. Further attempts to thread the catheter were abandoned as aspiration revealed bright red and pulsating blood giving rise to suspicions of an arterial placement. Immediately, the catheter along with the guide-wire was removed, and firm pressure applied over the site. 4 h later, IJV cannulation was performed on the same side by identifying the IJV with a finder needle and then successfully inserting the catheter without any resistance. Dark venous blood was aspirated freely from all the three ports of the catheter. A chest X-ray was taken, and satisfactory position of the catheter tip was confirmed. 2 h later, the patient woke up from sleep complaining of pain from the right shoulder to the elbow and also a dead feeling in the right arm. Physical examination revealed a cold and tender right arm, with a delayed capillary refill and absent radial, brachial and axillary pulses on the right side. Doppler signals were also negative for axillary, brachial and radial pulsations on this side. The radial and brachial pulsations on the other side were normal. A partial or complete arterial occlusion due to spasm or thrombosis was suspected, and the patient was transferred to the regional vascular center for further management. At the regional center, the IJV catheter was removed and anticoagulation by low molecular weight heparin was commenced. Ascending aortography with selective catheterization of the brachiocephalic trunk was performed subsequently, which confirmed an intraluminal thrombus in the proximal right SCA [Figure 1]. The patient was started on a heparin infusion. Thrombolysis was not thought to be appropriate in view of the risk of bleeding at the CV access site, active rectal bleeding and Crohn's disease. Subsequently, right SCA thrombectomy with graft was performed under general anesthesia. A Fogarty catheter was passed easily, and a large volume of clot extracted. Postoperatively positive Doppler signals for arterial flow were obtained. She was transferred to the ward after 3 days of monitoring in the intensive care unit and was discharged home a week after surgery.

DISCUSSION

Subclavian cannulation is more likely to be complicated by pneumothorax and hemothorax, whereas internal jugular cannulation is more likely to be associated with arterial puncture.[5] Internal jugular catheterization is associated with arterial puncture in 6.3–9.4% of cases.[10] Great vessel perforation during CV cannulation occurs in <1% of cases and SCA injuries are probably under-reported.[3,11]

Normally, it is not difficult to detect an inadvertent arterial puncture which would be obvious by the pulsatile nature of the flow and the bright red color of arterial blood. In patients with significant hypoxemia and/or reduced circulatory flow, this distinction can sometimes be difficult.[1] Our patient did not have any of these contributory factors, and also the initial flow was dark and nonpulsatile. Arterial injury can occur either with the finder needle, the larger 70 mm needle or the guide-wire. Hemothorax due to dilator induced injury to the first part of the SCA, hemothorax and SCA laceration while changing an 8.5 F introducer to a 7 F triple lumen catheter using a J-wire, delayed presentation of hemomediastinum and pseudoaneurysm due to injury from the finder needle or the J-wire causing SCA injury have been reported.[4,5,6,7,8] Kulvatunyou *et al.* have pointed out that SCA injury is more common on the right side due to a more medial and closer relation of right SCA to the right IJV.[3] Most of these complications apart from pseudoaneurysm presented with hemodynamic compromise and shock. While pseudoaneurysms can rupture or thrombose, in our case established thrombosis of SCA occurred without any hemodynamic compromise or pseudoaneurysm. Also, the SCA anatomy was normal.

position of IJV is outside the pain that had been predicted by the external landmarks.[12] These variations may increase the number of attempts and possibility of obvious or undetected arterial injury. An US study has found that IJV overlies but is not lateral to carotid artery in 54% of patients predisposing for carotid artery puncture.[13] Some operators advance the needle more than required, especially with the landmark technique and then withdraw to find a vein or make a medial or lateral movement with the needle during the venipuncture. This might predispose to undetected arterial injury which is aggravated further by insertion of the guide-wire and catheterization attempts. The use of US during IJV cannulation has beyond doubt proved to be invaluable in avoiding such complications as the operator can both confirm the location of the vein and also visualize the passage of the 70 mm larger needle and the guide-wire in real-time.

Subclavian artery thrombosis associated with inadvertent arterial puncture following attempted right IJV cannulation has been reported wherein the seeker needle identified the right IJV correctly, but there was clear evidence of arterial injury with the longer introducer needle.[9] Subsequently, the triple lumen catheter was inserted through the right subclavian vein. Whether subclavian catheterization contributed to SCA injury in this case is not known. In this case, peripheral pulsations were lost soon after catheterization with early suspicion of vascular occlusion. Presentation in our case was delayed thrombosis postprocedure without any immediate loss of pulse. Hence, high index of suspicion is necessary for detection of postprocedure thrombosis of SCA.

Unintended cannulation of the SCA without any thrombosis during IJV cannulation has been reported. Initial puncture with an 18-gauge needle into the right IJV using real-time US guidance by the short-axi method was successful with no pulsatile arterial backflow. Thereafter, the rest of the procedure with removal of the ultrasound transducer was performed without any resistance to advancing the guide-wire and catheter.[14] Routine postcannulation chest X-ray suggested that the catheter tip had been misplaced into the right SCA. This was treated by surgical exploration. This case emphasizes the use of US till complete guide-wire and catheter insertion.

In our case, the initial IJV identification was successful with both the finder needle and the larger introducer needle. In the absence of hemodynamic compromise, the injury was probably sufficient to cause thrombosis but not hemothorax or hemodynamic instability. We hypothesise that initial insignificant but direct injury to the SCA with either needle, guide-wire or dilator could have occurred which subsequently resulted in thrombotic obstruction. This is more likely to occur if the finder needle or the larger introducer needle had traversed beside or through a vein and injured the outer wall of the artery. It is also possible that the guide-wire punctured the vein extraluminally, which allowed the dilator to follow and injure the artery.[3] Angiographically, the brachiocephalic artery and carotid origin were uninvolved making direct injury to SCA more probable in our case. Thus, an initial vein identification with the finder needle or even with the larger introducer needle will not rule out arterial injury in the subsequent steps. Patients with inflammatory bowel diseases have a 3-fold higher risk of thromboembolism than controls.[15] Thrombus formation in such patients occurs due to various factors including antiphospholipid antibodies and inadvertent arterial trauma during procedures like CV cannulation. Whatever the reason, high index of suspicion is necessary for detection of postprocedure thrombosis of SCA.

The American Society of Anesthesiologists recommends leaving the dilator or catheter in place and obtaining surgical or radiological consultation in cases of inadvertent arterial trauma during CV catheterization.[16] The complication reported in our case was before the publication of this guidance. Thus, to the best of our knowledge, SCA thrombosis following IJV cannulation, without an apparent initial needle induced arterial injury has not been reported.

CONCLUSION

Subclavian artery thrombosis is a rare complication, with serious consequences during IJV cannulation. Arterial injury can occur at any stage during CV cannulation even if there is no evidence of initial arterial puncture and this should be kept in mind during subsequent manipulations, particularly if a technical difficulty should arise during the procedure. US should be used not just to identify the vein, but also to assist guide-wire and catheter insertions.

difficulties/arterial trauma in CV access are encountered, postprocedure monitoring in appropriate setting like HDU is necessary. This is especially true for patients referred from noncritical areas like medical and surgical wards of the hospital as exemplified by our case. Close monitoring for neurologic and vascular sequelae is suggested in all difficult catheter insertions, even without an apparent direct arterial puncture.

Footnotes

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Conflict of Interest: None declared.

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Figures and Tables

Figure 1



Ascending aortogram with selective catheterization of the brachiocephalic trunk showing the thrombus in the proximal subclavian artery (arrow 1) the filling defects are extending to the axillary artery (arrow 2) and the proximal segment of internal mammary artery (arrow 3) the brachiocephalic artery proximal to this view and vertebral and carotid origins were patent and uninvolved

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