**Iatrogenic Innominate Vein Injury during Percutaneous Perm-Catheter Placement**

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**Abstract**

Large vessels injury is a rare but serious complication of percutaneous central venous catheter placement, which can be fatal. Herein a case of right innominate vein perforation during right internal jugular perm-catheter placement - resulted in thoracotomy because of patient’s hemodynamic instability - is reported. © 2015 Tehran University of Medical Sciences. All rights reserved.

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**Introduction**

Nowadays, percutaneous central line catheter placement is a prevalent procedure in critical care medicine. However, it should always be kept in mind that, although it is a common procedure done by different specialists, it has several complications, although not too common, can be lethal. Early complications are technical errors, including pneumothorax, hemothorax, cardiac arrhythmias, venous and arterial injuries, hematoma, catheter malpositioning, and rarely heart perforation, cardiac tamponade, cerebral edema, and quadriplegia. Use of Doppler ultrasound guidance in central line placement has been shown to be effective in the reduction of lots of these complications and its routine use in the insertion of central vascular catheters is strongly recommended.

Large venous injuries - Including internal jugular vein, subclavian vein, innominate vein, and superior vena cava - are rare, and there are few reports of these potentially lethal complications. Herein we report a case of perforation of right innominate vein following perm-catheter placement in a 79-year-old man, which finally led to severe morbidity and needed for reoperation.

**Case Report**

A 79-year-old man with alcoholic cirrhosis, chronic obstructive pulmonary disease, and diabetes mellitus, was referred to the surgery ward because of newly diagnosed renal failure and need for vascular access for hemodialysis. The patient’s child score was C and his coagulation profile was impaired. His coagulation abnormalities were corrected and his last coagulation profile was as follows: prothrombin time = 15.2, international normalized ratio = 1.5, partial thromboplastin time = 30, platelet count = 84,000. The patient was scheduled for perm-catheter placement. Routine preparation and draping and patient positioning was done. The right internal jugular vein was cannulated posterior to the sternocleidomastoid muscle without the use of ultrasound guidance. Guidewire was threatened readily and a catheter was inserted; but at the end of the procedure, no blood could be aspirated from the catheter. In the post catheter insertion chest X-ray (CXR) the catheter seemed to be in the correct position at the entrance of right atrium (Figure 1); For further inspection, small amount of contrast was injected into the catheter line and CXR was repeated (Figure 2), which showed contrast extravasation in the mediastinum and right pleural space. Due to catheter malpositioning and probable venous perforation, it was decided to remove the catheter. The catheter was removed after the normal coagulation profile was assured. The patient’s vital signs were monitored diligently for any signs of hemodynamic instability and his hemoglobin level was checked every 6 hours. His CXR was repeated which showed no evidence of fluid collection in right pleural space; for further confirmation right pleural space ultrasonography was done which showed mild amounts of fluid aggregation. Next day, the patient became tachycardic with no change in blood pressure recordings, but his hemoglobin level decreased from 7 to 5.6. He received two units of packed red blood cell. CXR was repeated which showed no significant
changes in comparison with previous imaging. But according to clinical suspicious right pleural space ultrasonography was done which showed moderate amount of blood in the right hemithorax. A chest tube was inserted in right hemithorax and upon insertion about 1300 cc blood was evacuated; meanwhile patient’s condition was deteriorated and so he was transferred to the OR and right thoracotomy was done. It was about 200 cc blood in the right hemithorax. A 1-cm laceration was observed in the dome of right hemithorax in the parietal pleural and innominate vein with some clot adhering to it; No active bleeding was observed. The laceration was repaired and the patient was transferred to the intensive care units. In the four following post-operative days, the patient was extubated and his chest tube was removed. Hemodialysis was started 2 days post-operatively. He finally died in the same admission because of blood pressure decrease and cardiac arrhythmia during a dialysis session.

Discussion

Central line catheters are an integral part of today’s critical care medicine. Like every other procedure and intervention, it has its own complications. Although they are not common, they pose a great risk of morbidity and mortality.

Complications of central vein catheterization are either early or late; the former ones are usually due to technical errors, and the later ones are related to the long-term use of catheters.

A dreadful complication of central catheters is injury to great vessels, including internal jugular vein, subclavian vein, innominate vein, superior vena cava and carotid artery, which has been reported to have prevalence < 1% (1). There are few reports of these complications which in most, reoperation has been done to correct the complication and save patient’s life; perforation of innominate vein is reported during catheterization of right internal jugular in a 78 years old patient during repair of abdominal aortic aneurysm, which the patient underwent thoracotomy and repair of injured vessel because of hemodynamic instability (2). Also, internal jugular vein perforation has been reported in a 13-year-old girl which finally needed thoracotomy (3).

In these reports and several other reports, multiple technical factors and non-technical factors has been elucidated as causative factors for these dreadful complications (1-3).

Technical factors

1. Needle insertion and importance of Doppler ultrasound guidance: Difficulty in venous cannulation is a contributing factor to vessel injury in central venous catheter placement. In different studies, use of ultrasound guidance has been reported to decrease complications and its morbidity, and in some medical centers, ultrasound guidance for every percutaneous catheterization has been reported to be essential (4,5). Use of ultrasound in central line catheterization has been associated with decreased risk of catheter placement failure, failure to place a catheter in the first attempt, arterial punctures and hematoma formation (5). Although some other reports have conflicting results about Doppler effect in reduction of vascular complications in children (6), ultrasound guidance in central line placement, has been shown to be effective in reduction of lots of vascular complications, and its routine use in the insertion of hemodialysis catheters is strongly recommended by most studies.

2. Guidewire: Another important factors are problems related to guide wire. “Up beveling” of the needle upon insertion in curved tip guide wires, reduces the risk of malposition; for example, it prevents final positioning of presumed subclavian catheter in the same lateral internal jugular or contralateral subclavian vein. Perforation of the vein...
happens more commonly when stiff, and angle tipped catheter are used instead of curved (J) tip catheters (2). Inserting suitable length of wire in the vein and free movement of the guide wire with no undue forces in entire procedure will confirm the intravenous position of the wire and would be helpful in preventing venous lacerations. Like ultrasound guidance, detecting guide wire place with the use of fluoroscopy is an excellent tool for reduction of complications related to wire place. Also checking guide wire after taking it out for its completeness and existence of any signs of kinking would be helpful in the diagnosis of probable complications (7). It should be noted that guidewire kinking during advancement of a vessel dilator can lead to vascular perforation.

**Non-technical factors**

The most important non-technical factor is patient’s underlying disease and coagulopathy. In different reports, as our case, coagulopathy - such as platelet dysfunction in patients with renal failure - has been postulated to prevent clotting and spontaneous closure of small injuries, which usually happens in most catheterizations. This is exacerbated with the use of large bore dilators as used for hemodialysis catheters. Association of these two factor-coagulopathy and large bore dilators- in most patients with renal failure, puts them in high risk for complications and its severity and ensuing poor prognosis (2).

In our case, the most probable cause of the complication that could be prevented was “blind cannulation and catheter insertion” without Doppler and fluoroscopy guidance especially in this special patient with known coagulopathy and multiple comorbidities.

**Conclusion**

Finally, we emphasize that, central venous catheterization -although a routine procedure which seems too simple and is done by different medical professions even with low level of training and experience - can have severe lethal complications that can happen to every specialist with every level of expertise. Correction of underlying coagulopathies as much as possible, use of imaging guidance wherever possible, and being sensitive for detecting signs of possible complications and prompt therapeutic intervention, is essential for decreasing rate of complications and its morbidity whenever one happens.

**References**