MedCrave
Step into the World of Research
Journal of Anesthesia & Critical Care: Open Access

Case Report

Open Access
CrossMark

Management strategy for inadvertent arterial cannulation during central venous catheter insertion

Abstract

Central venous cannulation is a routine procedure in the intensive care unit with inherent risks. We report a case of inadvertent arterial placement of central venous catheter during ultrasound guided cannulation of left sided internal jugular vein. We present the various strategies available for identification and management of malpositioned central venous catheter and discuss the technique of percutaneous closure device used for our patient in conjunct with interventional radiological services. We hereby reiterate the need to use multiple techniques to confirm correct placement and position of central venous catheter tip and importance of a multidisciplinary approach for management of inadvertent malpositioning.

Keywords: catheter malposition, ultrasound, interventional radiology, percutaneous closure device

Volume 10 Issue 6 - 2018

Bhakti Trivedi, Anamika Yadav, Sanika Patil

Department of Anaesthesia, Critical Care and Pain, Tata Memorial Centre, India

Correspondence: Sanika Patil, Senior resident, Department of anaesthesia critical care and pain, Tata Memorial Centre, India, Tel +91-9987050726; Email patilsenikaj@gmail.com

Received: October 17, 2017 | **Published:** December 17, 2018

Abbreviations: ICU, intensive care unit; IJV, internal jugular vein, NIV, non invasive ventilation; LV, left ventricle; USG, ultrasonography; CVP, central venous pressure; CXR, chest x-ray; CVC, central venous catheter; CT, computerized tomography

Introduction

Central venous cannulation is a routine procedure in the ICU, which is generally safe in experienced hands, more so if done under ultrasound guidance. Central venous cannulation is associated with various complications, some being potentially dangerous like inadvertent arterial puncture. We hereby report a case of inadvertent cannulation of left subclavian artery during ultrasound guided placement of central venous catheter in left IJV.

Case presentation

A 46-year-old female with no known co-morbidities presented to our casualty with cough and breathlessness on day 2 of second cycle of chemotherapy. She had undergone right sided modified radical mastectomy a year ago.

A 2D echocardiogram showed an ejection fraction of 20-25 %, with dilated LV and diastolic dysfunction. Anti-failure treatment was initiated. She developed increasing dyspnoea and hypotension and hence, was shifted to ICU for further management. As her condition worsened, she was intubated and ventilated. She had cardiac arrest and post resuscitation was started on vasopressors. Right IJV was cannulated under sonoguidance. In view of infection noticed at the insertion site two days later, left IJV was cannulated and right central venous catheter was removed thereafter.Under all aseptic precautions using ultrasound, linear probe, 6-10 MHz with colour Doppler confirmation, left IJV was differentiated from left carotid artery and punctured in first attempt with “out of plane technique”, there was no pulsatile flow noted through the puncture needle. The procedure was uneventful.

Following this the patient received multiple drugs including inotropes through the newly inserted left IJV catheter. While checking CVP of the patient, after attaching pressure transducer a high mean pressure was noticed with an arterial waveform. Hence, the blood from the central line was sent for gas analysis which confirmed that it was an arterial cannulation. Chest X ray was reassessed and the tip of catheter was found to be straight and not crossing midline. A CT angiogram done, showed the presence of central venous catheter in the subclavian artery behind the clavicle with the distal tip just at the arch of aorta. The needle had brushed past without puncturing the left IJV, directly puncturing left subclavian artery between the origin of vertebral artery and thyrocervical trunk and left internal mammary artery.

Fluoroscopy guided removal of catheter was planned in IR with vascular surgeon standby, under general anaesthesia. Left femoral artery sheath was inserted by interventional radiologist. A guide wire was passed through central catheter followed by removal of the central line catheter over the guide wire. Percutaneous closure device was passed over the wire and deployed to seal the puncture site. Check angiography was done which showed no contrast extravasation. Post procedure serial USG Doppler of left axillary artery was performed to confirm normal arterial flow (Figure 1).

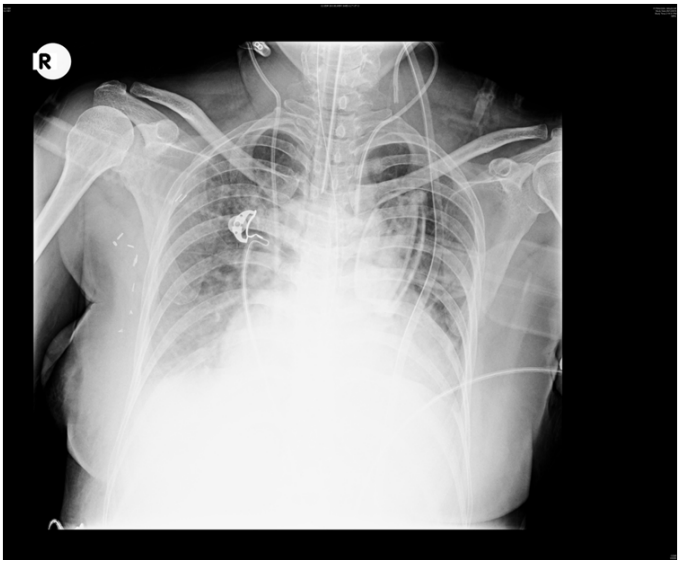

Figure 1 Chest X-ray showing left sided central line catheter not crossing midline. Right sided IJV central line catheter seen insitu.

Discussion

An observational cohort study of 385 consecutive central venous catheter attempts over a six-month period found that mechanical complications occurred in 33% of attempts. Complications included failure to place the catheter (22%), arterial puncture (5%), catheter malposition (4%), pneumothorax (1%), subcutaneous hematoma (1%), haemothorax (less than 1%), and asystolic cardiac arrest (<1 %).[1] According to a study by McGee, et al.[2] arterial puncture was noted in 3 to 15 % of central venous access procedures.[2] Unrecognized arterial cannulation with subsequent dilation and catheter placement is associated with life-threatening haemorrhage and neurologic complications.[3] Late recognition of arterial cannulation increases the risk of hemorrhagic complications that may require surgical intervention.[4]

Various risk factors have been identified for CVC misplacements like obesity, short neck, lack of USG guidance, coagulopathy, intubated patient, hypovolemic, hypotensive patient (less pulsatile backflow), congenital malformations, oedematous patient etc. Two single-centre randomized trials found that cannulation of the left jugular vein is more time-consuming and associated with a higher incidence of complications.[5,6]

Various means have been suggested to prevent the misplacements of IJV catheters like use of USG and fluoroscopic guidance. Early detection of misplaced catheters can be done by using CXR, arterial blood gas analysis, transthoracic echocardiography and central venous pressure monitoring. A chest X-ray is recommended after inserting IJV catheter to check whether the placement in central vein is consistent with the trajectory of SVC. Arterial blood gas analysis seems to be an easy, effective and definitive way of confirming the placement of IJV catheter.

The measures to manage inadvertent arterial trauma are catheter removal and external compression, endovascular intervention in the form of stents, closure devices, or direct surgical arterial repair. For considering removal of a catheter and external compression the artery should be easily accessible and compressible, e.g. femoral artery. Subclavian artery being below the clavicle is inaccessible. Carotid artery compression involves risk of cerebral ischaemia, dislodgement of embolus. Guilbert et al.[7] concluded that pull and pressure method involves highest number of complications and recommended surgical arterial repair. They also proposed a Guilbert management algorithm[7] suggesting that if the site of repair is easily accessible like carotid artery surgical repair should be done and if not like in subclavian artery, an endovascular repair should be done. The choice and use of endovascular techniques varies as per the patient factors, coagulation status and site of vessel punctured. Two types of endovascular devices are available, stent grafts or percutaneous vascular closure devices. Two types of closure devices are available i.e., suture based and collagen based. Collagen based devices are currently licensed for femoral arterial puncture and demonstrated to be safe and effective and have been successfully used even in subclavian arterial puncture. Suture closure devices are currently recommended for femoral arterial puncture.

In our case the patient was ventilated, hypotensive, in cardiac failure and coagulopathic with low platelet count. The procedure was performed by a qualified anaesthetist under USG guidance with colour Doppler confirmation. Misplacement could not be diagnosed immediately due to lack of pulsatile flow from the catheter, even drug infusions were administered without any pulsatile backflow. With the cannulation of the subclavian artery with tip lying in the arch of aorta, there was no role of pull and pressure technique, surgical repair would involve sternotomy and high morbidity. As our patient was on inotropes and in cardiac failure, endovascular repair either by stent or a percutaneous closure device was the only safe and feasible option. In a study by Pikwer et al.[8] out of 6 cases of inadvertent subclavian artery cannulation, 4 were managed under general anaesthesia by stenting and 2 by endovascular closure device under local anaesthesia and none of the cases developed any complications. Ganapathy et al.[9] reported two cases of subclavian arterial puncture sealed with vascular closure devices in IR without any complications.

Inadvertent arterial cannulation is a known complication during CVC placement, the combined use of ultrasound measurement and arterial blood gas analysis helps in picking up the arterial puncture at the earliest. The management is based on the site of arterial puncture and patient factors. Endovascular repair using suture based closure device for inadvertent subclavian artery cannulation is a safe method and should be done under fluoroscopic guidance in intervention radiology suite under anaesthesia with cardiovascular surgeon standby.

Acknowledgments

Dr. JV. Divatia, Dr. Vijaya Patil, Dr. Suyash Kulkarni, Dr Nitin Shetty.

Conflicts of interest

Authors declare that there is no conflict of interest.

References

1. Eisen LA, Narasimhan M, Berger JS, et al. Mechanical complications of central venous catheters. *J Intensive Care Med.* 2006; 21(1):40–46.
2. McGee DC, Gould MK. Preventing complications of central venous catheterization. *N Engl J Med.* 2003;348(12):1123–1133.
3. Oliver WC Jr, Nuttall GA, Beynen FM, et al. The incidence of artery puncture with central venous cannulation using a modified technique for detection and prevention of arterial cannulation. *J Cardiothoracic Vasc Anesth.* 1997;11(7):851–855.
4. Bowdle A. Vascular complications of central venous catheter placement: evidence-based methods for prevention and treatment. *J Cardiothoracic Vasc Anesth.* 2014;28(2):358–368.
5. Sulek CA, Blas ML, Lobato EB. A randomized study of left versus right internal jugular vein cannulation in adults. *J Clin Anesth.* 2000;12(2):142–145.
6. Muralidhar K. Left internal versus right internal jugular vein access to central venous circulation using the Seldinger technique. *J Cardiothoracic Vasc Anesth*. 1995;9(1):115–116.
7. Guilbert MC, Elkouri S, Bracco D, et al. Arterial trauma during central venous catheter insertion: case series, review and proposed algorithm. *J Vasc Surg.* 2008;48(4):918–925.
8. Pikwer A, Acousta S, Kolbel T, et al. Management of inadvertent arterial catheterisation associated with central venous access procedures. *Eur J Vasc Endovasc Surg.* 2009;38(6):707–714.
9. Ananthakrishnan G, White RD, Bhat R, et al. Inadvertent subclavian artery cannulation: Endovascular repair using a collagen closure device-report of two cases and review of the literature. *Case Rep Vasc Med.* 2012;150343.

Citation: Trivedi B, Yadav A, Patil S. Management strategy for inadvertent arterial cannulation during central venous catheter insertion. *J Anesth Crit Care Open Access.* 2018;10(6):238–239. DOI: 10.15406/jaccoa.2018.10.00397