

Where has the Central venous Catheter gone? Common catheter malpositions occurring in a tertiary care teaching hospital

Address for correspondence:

Dr. Sanjay Agrawal,
Professor, Department of
Anesthesia, HIMS Dehradun
(India).
E-mail:
drumstix1972@yahoo.co.in

Sanjay Agrawal

Department of Anesthesia, HIMS Dehradun, (India)

INTRODUCTION

Central Venous Catheterization (CVC) is a common procedure in intensive care units, operation theatres, access for emergency dialysis and long term chemotherapy. They are usually placed from central veins like internal jugular (IJV) or subclavian (SCV) veins and peripheral sites such as basilic and femoral veins. The catheter are intended to lie at the junction of Superior Vena Cava (SVC) and right atrium for correct measurement of Central Venous Pressure (CVP) or for fluid or drug administration. Landmark technique is a frequently used technique for insertion of such catheters. Complications such as malpositions, vessel/pleural perforations, migration of guide wires are rare but potentially serious. The incidence of malpositions may range from 27% with visible complications in 6%¹ to as high as 40%². We present the selected complications seen in our institute from over 1000 catheterization done during the period of April 2008-June 2012.

MATERIALS AND METHODS

After Institutional Review Committee approval all the CVC catheterization between the period of April 2008 to June 2012 done in the Intensive care unit of our hospital were confirmed by the post procedural chest X rays. If the position of the catheter was not found in the correct position ie at the junction of superior Vena cava and right atrium, the X rays were stored by the author and their records were retrieved to ascertain the data regarding site of puncture, number of attempts taken, vascular injury at time of puncture and the position of the catheter were noted.

RESULTS

A total of 1000 CVC were inserted during the study period however the records of 50 insertions were incomplete in

terms of inadequate data about the site and complications during insertions and were excluded from the study. Data of 950 catheterizations were evaluated.

Of the 950 catheters inserted, 636 (67%) were in males. Type of catheters inserted included triple lumen (Certofix Trio, B Braun, Melsungen AG, Germany) for Internal jugular Vein (IJV) and subclavian (SV) approach while 45 cm peripheral lines (Cavafix, B Braun, Melsungen AG, Germany) for basilic and femoral catheterizations (PICC).

Internal jugular vein (IJV) cannulations were more frequent (636/950) followed by subclavian vein cannulation. Majority of cannulations were done on right side. A total of 40 catheter tip malpositions were seen with the incidence being 4.31% (Table 1).

Table 1: Total Number of cannulation according to site with malpositions

Puncture site	Total number(%)	Malposition(%)
Right Internal jugular (RIJV)	614(64%)	13(2.1%)
Left Internal jugular (LIJV)	4(0.43%)	3(75%)
Right Subclavian vein (RSV)	209(22%)	11(5.2%)
Left Subclavian vein (LSV)	10 (1.05%)	1(11.1%)
Right Basilic (RB)	79(8.3%)	10(12.6%)
Left Basilic Vein (LB)	30(3.16%)	2(6.6%)
Femoral (F)	4(0.43%)	1(25%)
Total	950	41

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.

How to cite this article: How to site the article: Agrawal S. Where has the Central venous Catheter gone? Common catheter malpositions occurring in a tertiary care teaching hospital. Central Journal of ISA 2017;1:38-40.

Catheter tip is considered to lie at an aberrant position if not present at the junction of SVC and right atrium. Bifurcation of trachea on radiograph is reference for this junction^{3,4}. The catheter may be directed to ventricle, axillary, branchiocephalic, subclavian and internal jugular veins of the same or opposite side. Presence of congenital anomaly such as persistent left sided SVC may also produce aberrant position (Figures 1, 2).

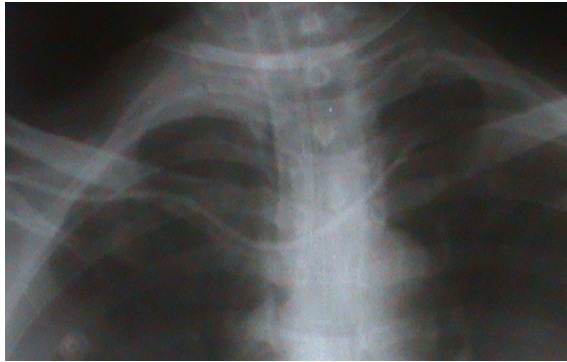


Figure 1. X-ray showing CVC insertion through subclavian vein crossing the midline and migration to opposite site.

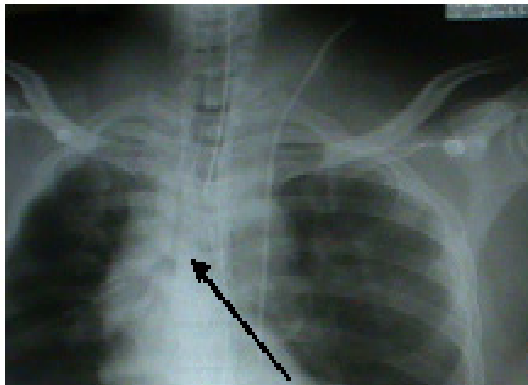


Figure 2. Persistence of left superior venacava.

Kinking or coiling back of the catheters may be visualized on post procedure chest X rays. In such cases abnormal tracings of the CVP waveforms or resistance to flow of infusion may give a clue to its occurrence.

Vascular injury occurs usually at the site of insertion of CVC, leading to inadvertent injury to carotid, subclavian or femoral arteries respectively. Few incidences of catheterization of arteries are present in the literature. Care must be taken during catheterization as formation of hematoma, thrombosis or spasm of artery may lead to vascular insufficiency distal to the site of insertion. Radiological features of vascular injury included mediastinal widening, pleural effusion, pneumothorax or apical cap secondary to extrapleural hematoma. Striking

of the catheter tip at an angle $>40^\circ$ to the wall of the vessel is associated with increased risk of perforation⁵.(Figure 3).

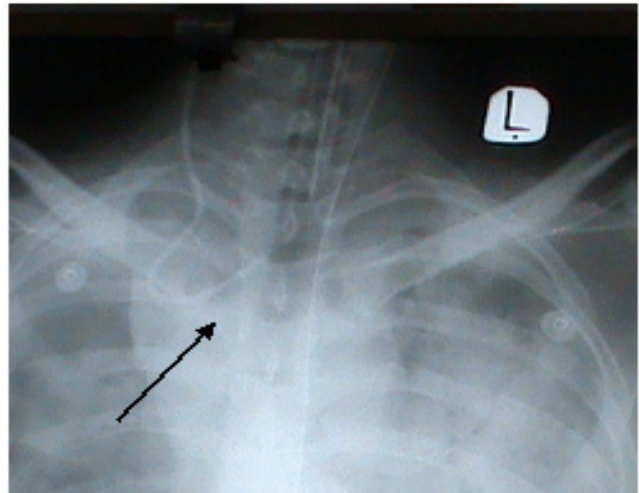


Figure 3. X-ray shows vascular injury with widening of mediastinum (haemomediastinum).

Migration of guide wire into the vascular system is a consequence associated with fatal consequences if remedial measures are not taken. Endovascular retrieval technique is needed for removal of such guidewire.

DISCUSSION

The common complications in closed malpractice claims against anaesthesiologists related to central catheters are wire/catheter embolus, cardiac tamponade, carotid artery puncture/ cannulation, hemothorax, and pneumothorax^{6,7}. Choosing the site of insertion of CVC has a bearing to the number of complications^{8,9}. Utility of post procedural chest X-ray lies for assessment of position of catheter tip as well as knowing about complications. Major disadvantage of their being, it is a time consuming procedure, exposure to radiation and high cost¹⁰. Use of ultrasound has been recommended for placement of CVC both in the elective and emergency situations. Its use is associated with decrease in the rate of failure and complications and thereby increasing the safety of the patient¹¹.

CONCLUSION

Although the incidence of malposition of CVC insertions is low, catheter misplacement and malpositions, inadvertent vascular injury occurs. Knowledge of the risks, complications and identification are critical for patient care and safety.

REFERENCES

1. Bekemeyer WB, Crapo RO, Calhoun S, Cannon CY, Clayton PD. Ef-

Brief Communication

- ficacy of chest radiography in a respiratory intensive care unit. A prospective study. *Chest* 1985;88:691–6.
2. Trotman-Dickenson B. Radiography in the critical care patient. In: McLoud TC, Boiselle P editors. *Thoracic radiology: the requisites*. Philadelphia, PA: Mosby Elsevier. 2010; 136–59
 3. Schuster M, Nave H, Pieperbrook S, Pabst R, Panning B. The carina as a landmark in central venous catheter placement. *Br J Anaesth* 2000; 85:192–4.
 4. Alberecht K, Nave H, Breitmeier D, Panning B, Troger HD. Applied anatomy of superior vena cava- the carina as a landmark to guide central venous catheter placement. *Br J Anaesth* 2004; 92:75–7
 5. Gravenstein N, Blackshear RH. In vitro evaluation of relative perforating potential of central venous catheters: comparison of material, selected models, number of lumens and angles of incidence to simulated membrane. *J Clin monit* 1991; 7:1–6.
 6. Domini KB, Bowdle A, Posner KL, Spitellie PH, Lee LA. Injuries and liability related to central vascular catheters. *Anesthesiology* 2004; 100:1411–8
 7. Cook TM. Litigation related to central venous access by anaesthetists: an analysis of claims against the NHS in England 1995-2009. *Anaesthesia* 2011; 66:56–7
 8. Reusch S, Walder B, Trammer MR. Complications of central venous catheters: Internal jugular versus subclavian access-A systematic review. *Crit Care Med* 2002; 30:454–60
 9. Trerotolia SO, Thompson S, Chittams J, Vierregger KS. Analysis of tip malpositions and correction in peripherally inserted central catheters placed at bedside by a dedicated nursing team. *J Vasc Interv Radiol* 2007; 18:513–8.
 10. Lessnau KD. Is chest radiography necessary after uncomplicated insertion of a triple lumen catheter in the right Internal Jugular vein using anterior approach? *Chest* 2005; 127:220–3.
 11. Matsushima K, Frankel HL. Bedside Ultrasound can Safely Eliminate the Need for Chest Radiographs after Central Venous Catheter Placement: CVC Sono in the Surgical ICU (SICU). *J Surg Res* 2010; 163:155–61.