

Incidence and Pattern of Malpositioning of Central Venous Catheters with Left Internal Jugular Venous Route

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Left internal jugular vein of 75 patients was cannulated. All patients belonged to pediatric age group (03—12 years) and scheduled for various closed heart surgical procedures through a left thoracotomy approach. Post operative x-ray chest revealed that 9 Catheter (12%) were malpositioned. Aberrant positions included right internal jugular, right and left subclavian and brachiocephalic veins

Key words: Malposition, central vein, catheter, internal jugular

Placement of central venous catheter is useful and commonly performed procedure. A number of routes have been described for access to the central circulation. Tip of the central venous catheter should be located within the true central venous system. The preferred position is in the upper part of superior venacava above the pericardial reflection. Irrespective of route of insertion the catheter may settle in an undesirable position. Veins used for access have their own peculiar anatomy which predisposes the catheters inserted to an aberrant position.

We analyzed the incidence of malpositioning of central venous catheters placed via left internal jugular vein by noticing the catheter position on x-ray chest done post operatively in patients who under went various elective closed heart surgical procedures

Material and Methods

Left internal jugular vein (L.I.J.V) of 75 patients was cannulated. Procedure was done after the induction of anaesthesia. A standard approach to LIJV was used and in all patients a triple lumen central venous catheter (Hydrocath TM, 5F, 7845—1) was threaded in using Seldinger's technique. Catheters were judged to have been placed in an optimum position by using various clinical criterias (free back flow of blood through catheter, length of the catheter inserted).

X-ray chest of every patient was done in post operative period to confirm the position of the catheter. Catheter was labeled to be correctly placed if its tip is seen within 2 cm joining the lower surface of medial ends of both the clavicles on post operative x-ray chest.

Results

Left internal jugular vein (LIJV) of 75 patients belonging to pediatric age group (3—12 years) was cannulated. Types of surgery and number of patients is shown in table -1. All central venous catheters were judged to have been placed at a satisfactory position on clinical grounds, however radiological examination revealed 12% (9 catheters) incidence of malpositioning. Pattern of malpositioning is shown in table-11. All malpositioned catheters were either removed or repositioned and no undesirable effects were noticed in this regard

Discussion

The central venous catheter serve as a source of information which helps in the management of patients perioperatively and in intensive care setup. Moreover it also acts as a crucial pathway for intravenous therapy

Complications associated with the procedure are related to malpositioning of the catheter and injury to surrounding structures. There have been incidents of severe and fatal complications such as air embolism¹, pneumothorax², bilateral hydrothorax and hydromediastinum³, thoracic duct injury⁴, horner's syndrome⁵, stroke⁶, extradural insertion of catheter⁷, vascular erosion⁸, arrhythmias and complete heart block have been reported resulting from guide wire insertion during central venous cannulation⁹

Tip of the central venous catheter inserted should be located within the true central venous system (in a large intrathoracic vein beyond all venous valves which interfere with the direct transmission of right atrial pressure to the catheter). The preferred position is in the upper part of superior venacava above the pericardial reflection¹⁰. On as x-ray chest it should be medial to the anterior end of first rib¹¹, or it should be no more than 2cm below a line joining the lower surfaces of the medial ends of both the clavicles¹².

With increasing awareness of complications related to catheter tip malpositioning, the Food and drug administration (FDA) has issued a firm statement regarding catheter tip location stating "except for pulmonary artery catheters the catheter tip should not be placed in or allowed to migrate into the heart. Catheter should be placed in the superior venacava above its junction with the right atrium. Catheter tip position should be confirmed by radiograph or other imaging modality and be rechecked periodically"¹³

Veins used for access have their own peculiar anatomy which predispose the catheter inserted to unique aberrant positions. The catheters inserted may curl on itself and pass retrogradely. Most anaesthetists prefer right internal jugular vein for central venous catheter placement as it has a predictable anatomy and a higher success rate. Incidence of catheter malpositioning with this route are on the lower end of spectrum. Moreover it is also a preferred

site for threading of pulmonary artery catheter.

Left internal jugular vein (LIJV.) is not the first choice regarding central venous catheterization as the venous course to superior vena cava is longer, tortuous and incidence of malpositioning is higher with this approach as several small veins opens into the left brachiocephalic vein opposite to the left internal jugular vein. Aberrant positioning into the left pericardiophrenic¹⁴, left internal thoracic¹⁵, left superior intercostal vein¹⁶, and azygos arch cannulation¹⁷, have been reported when L I J V was used for central venous access.

Left sided approach to central circulation is preferred involving a left thoracotomy approach as in case of pneumothorax during central venous cannulation it will be on the left side and by all means left hemithorax is going to be opened during surgery thus not adding any more morbidity to the patient. Moreover, intravenous site is more readily accessible in right lateral position with left sided approach to central circulation.

We selected the group of patients in which, L I J V was preferred site for central venous cannulation as in all these patients surgery was performed through a left sided thoracotomy approach

Muhum and Sunder¹⁸ concluded that the frequency of malpositioning was related to the anatomical approach and the catheter type used but not to physician's experience. In their experience the respective incidences were 4.12% for left internal jugular access and 1.1% for right internal jugular approach. Misplacement was more frequent with silicone catheters than with semi rigid catheters..

Malatinsky¹⁹ showed a 5% incidence of malpositioning with both right and left internal jugular veins while Belani²⁰ had a 99% success rate with both the internal jugular veins in proper placement of central venous catheters. When external jugular vein was used for central venous catheter placement the incidence of malpositioning was found to be between 30—50%¹⁹.

Azygos arch cannulation is a rare but hazardous central venous catheter malposition and carries a substantial risk. Bankier et al¹⁷ studied the frequency of azygos arch cannulation. Catheter malposition in azygos arch was seen in 1.2% post procedural radiographic examination. Of those malposition catheters 69% had been inserted in the left subclavian, 19% in the left jugular, 12% in the right subclavian and 0% via the right internal jugular venous route. The study highlighted that risk of azygos arch cannulation is substantially increased if the catheters are inserted in left sided veins.

A central venous catheter is judged to be positioned correctly on clinical criteria by the length of the catheter inserted by free back flow of blood through the catheter and by fluctuations in the venous pressure with respiration. Right atrial electrocardiography is also useful technique that assures catheter tip placement outside heart in

accordance with FDA guidelines^{21,22}. If the location of catheter remains in question contrast injection or C.T is confirmatory.

We analyzed the incidence of central venous catheter malpositioning with left internal jugular vein in pediatric age group. We tried to standardize many aspects of our work and came up with a higher incidence of catheter malpositioning with L.I.J.V as compared with the previous work done in this regard. In our study 09 catheters (12 %) were malpositioned. This observation was made by analyzing the post procedural x-ray chest which was done after surgery in all patients. Pattern of malpositioning is shown in table 2. All malpositioned catheters were removed or repositioned and no undesirable effects were noticed in this regard.

An aberrant positioned catheter may cause signs, symptoms or radiographic findings fairly specific to its location²³. Every possible route of central venous catheterization carries a certain incidence of catheter malpositioning. This aspect of central venous catheterization should be kept in mind while performing the procedure, moreover caution with the length of the catheter inserted helps to decrease its incidence. Finally post procedural check x-ray should be done in every case as it confirm the position of the catheter

Table 1. Types of surgery and no of patients (n=75)

P.A (Pulmonary Artery) banding	30 (40%)
PDA (Patent Ductus Arteriosus) ligation	25 (33.33%)
Pericardectomy	16 (21.33%)
Closed mitral valvotomy	4 (05.33%)

Table 2. Pattern of malpositioned catheters (n=09)

Right internal jugular vein	4 (44.44%)
Right subclavian vein	2 (22.22%)
Brachiocephalic vein	1 (11.11%)
Left subclavian vein	1 (11.11%)
Loop formation (Retrograde passage)	1 (11.11%)



Figure 1 Catheter tip is seen in the right internal jugular vein

Malpositioning of Central Venous Catheters

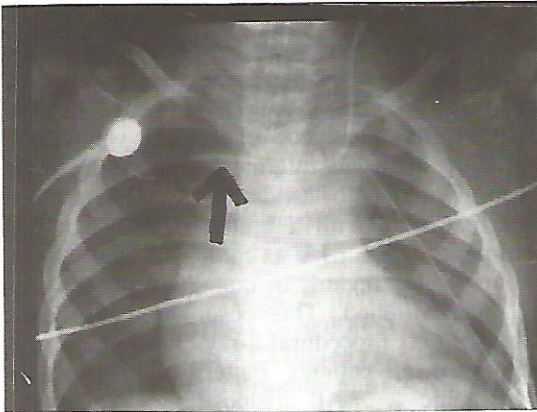


Figure 2 Catheter tip is seen in right subclavian vein

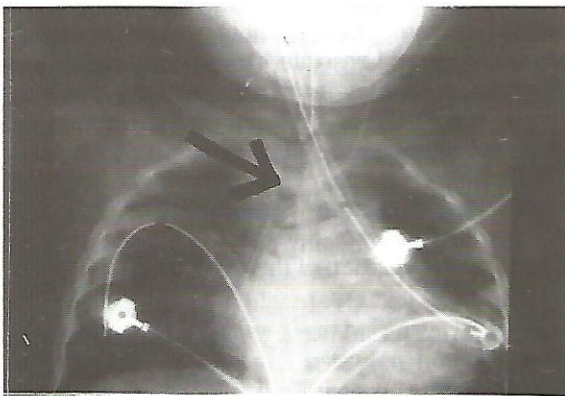


Figure 3 A malposition catheter in the brachiocephalic vein is seen

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