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Malposition of central venous catheter from right internal jugular vein into ipsilateral subclavian-Axillary vein: Report of a rare case

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Abstract
Central venous catheters (CVCs) are placed for many different indications in cardiac, non-cardiac surgery and ICUs. These include inadequate peripheral venous access, administering of medications, (anaesthetic and vasoactive agents, antibiotics, chemotherapy), and central venous pressure (CVP)or hemodynamic monitoring, measurement of central venous oxygen saturation, dialysis, and administration of hypertonic saline, blood and its products, and for cardiac catheterization, and even for transvenous cardiac pacing, ECMO therapy, and plasmapheresis and repeated blood sampling [1, 2, 3]. Normally, the tip of CVC is placed, where the SVC and RA merge. Even with the highest level of skill of the operator and the use of ultrasound guidance, CVC placement can result in various malpositions. Easy and uncomplicated catheterisation, free aspiration of blood and monitoring of catheterisation do not guarantee correct placement of the internal jugular vein (IJV) catheter. Though, placement of a catheter through the RIJV is associated with the lowest incidence of malposition. Ultrasound, ECG guidance, real-time X-ray imaging, confirmation either by palpation in SVC or visualized in the RA during open heart surgery, and saline injection test are definite confirmation and dramatically increase the successful placement of needles, guidewires, and catheters, but significant numbers of catheter misplacements can still occur, particularly if operators are not fully proficient in such techniques. Ruesch *et al*. have reported the catheter malposition rates as 5.3% and 9.3% for IJV and subclavian vein respectively [4]. Mispositioning of the RIJV insertion into ipsilateral subclavian vein is an extremely unusual event. Here, A case of RIJV inserted CVP catheter malposition into the Right subclavian vein and further into right axillary vein has been reported in a 65 years old male, weighing 70 kg, admitted in emergency department with 67% first degree burns, who deteriorated over the 24 hrs and had cardiac arrest. The malposition was confirmed on the routine check Chest X-Ray.

Keywords: Axillary vein, CVP, malposition, right internal jugular vein, right subclavian vein, triple lumen catheter

Introduction
Now adays, central venous catheter insertions are being regularly practiced by anaesthesiologists in the major surgeries involving haemodynamic changes and massive fluid shifts, or inadequate peripheral access in major accidents or burns, cardiac lesions like systolic dysfunctions undergoing surgical procedures and also used for administration of drug therapy and plasmapheresis and haemodialysis. In addition, in potential candidates for air embolism like posterior fossa surgery in sitting position or laparoscopic surgeries. In addition to the complications like haemorrhage, hemothorax, pneumothorax, chylothorax, thrombosis and arrhythmias, a more frequent complication is misplacement of RIJV central line in the other intravenous sites instead of the SVC- RA junction. We present a RIJV- CVP catheter rare malposition into the right subclavian vein inserted using standard landmark technique in a 65 years old male, weighing 70 kg admitted with 67% burns in emergency department.

Case presentation
A 65 -year-old male, weighing 7okg and height of 175cm admitted to the emergency department of our institute with 64% superficial (first degree) burns involving mainly face, neck and chest.

He was initially fully conscious and oriented but gradually deteriorated over the next 24hrs and had a cardiorespiratory arrest. The ROSC occur on CPR with external cardiac massage and DC shock of biphasic 200J. Patient required central line insertion for administration of fluids and vasoactive agents. Therefore, an informed consent was obtained from the relatives, and A 7.5 Fr, 15 cm triple lumen catheter was inserted in first attempt by the trainee anaesthetist under USG guidance via RIJV and fixed at 15 cm. The CVP line placement was guided by the ultrasound and confirmed by the free blood flow from all the three ports on the aspiration. However, the vasopressors and fluid therapy has a sluggish effect on hemodynamic. The routine check X-ray chest revealed the malposition of the CVP line inserted via the RIJV into the right subclavian vein and further in the axillary vein instead of the normal SVC - RA junction. [Figure 1a & 1b] Due to the unexpected complication and apprehension the CVP line was removed and fluid and drugs infusions were maintained through the small bore peripheral venous access, and patient was transferred to the burn unit of higher centre for the further management.

Discussion

Now a days, CVP line placement is used for lot of reasons including inadequate peripheral access, administration of drugs such as anaesthetic drugs and vasoactive agents, hemodynamic management, parental nutrition, plasmapheresis [5, 6]. Indications for placing a CVP line in the ICU include the need for long-term IV access, administration various medications or fluids, hemodynamic monitoring, and emergency resuscitation. The most preferred and safest site for CVP line placement for short term access is the internal jugular vein due to its straight and shortest course to RA [4, 7, 8]. However, for longer duration or in patients potential for infection, the subclavian vein is often considered safe and allows greater patient mobility, though it is technically more difficult compare to RIJV and is associated more with complications such as haemothorax and pneumothorax. Furthermore, the CVP line insertion via femoral vein is particularly reserved for critically ill patients or those where the neck and chest are not accessible [9]. But it also has a higher risk of infection and thrombosis. This can be due to factors like an improper insertion technique, and while the catheter might still function, it carries risks of blood clots and infection. The CVP line insertion via RIJV can have malposition at several sites like carotid artery, azygous vein, contralateral innominate vein, contralateral subclavian vein, internal mammary and vertebral vein and even in the extradural, mediastinum, pleural space, and to the contralateral side subclavian vein [10, 11, 12]. Right subclavian vein has the highest risk (9.1%) of malposition as compared with the right IJV (1.4%) [11]. Mohan *et al.* have reported that malposition into the right subclavian vein is more frequent with the left internal jugular vein access (11/94, 11.7%) compared with the right internal jugular vein access (relative risk: 13.12, p = 0.015) [13]. The chances of ipsilateral malposition to right subclavian vein from the RIJV are rare because of the 90 degree angle of union of internal jugular and subclavian vein. However, the angle at which the subclavian vein meets the SVC can be influenced by patient position, as raising the patient's arm can change the angle, making it more favourable for subclavian catheter placement, but difficult for the malposition of RIJV catheter to the ipsilateral subclavian vein [14]. The risk factors for CVP catheter malposition include anatomical variations, operator related and patient specific like presence of left sided superior vena cava, kinking or stenosis of SVC, needle bevel position, excessive resistance during guidewire insertion, experience of the operator, neck position, short and thick neck [12]. However, we have reported the malposition of a 15 cm long, triple lumen CVP catheter from RIJV to the ipsilateral subclavian vein and further to the axillary vein, even after placing ultrasound guided, which has not been reported in the literature. [Figure 1 a & b]

Malposition can cause even serious complications like pulmonary thromboembolism, pneumothorax, and hemothorax, arrhythmias, chylothorax, depending on the final position. Usually malposition in the venous system may remain asymptomatic and diagnosed on routine chest X-Ray. In addition, ECG guidance, real-time X-ray imaging, surgical confirmation either by palpation in SVC or visualization in the RA by the surgeon during cardiac surgery, and turbulence on saline injection test, or TEE imaging of catheter tip in RA and SVC using mid-oesophageal bicaval view are definite confirmation means, and significantly increase the successful placement of needles, guidewires, and catheters, but catheter misplacement can still occur, if operator is not fully proficient in CVP line catheterization [12]. The malposition in the Subclavian vein may not function optimally for all medications including inotropes and takes longer time to stabilize the hemodynamics with fluid and drugs therapy. More so, CVP catheter mispositioning can provide erroneous CVP readings resulting in mismanagement as improper use of fluid and vasoactive agents [15]. However, the catheter malposition in other venous sites may be left in-situ with an intend to accept a slightly delayed effects of the therapy used through the CVP line, as repositioning might be associated with increased infection and perivascular bleeding, air embolism, catheter fracture, damage to surrounding structures, pneumothorax and cardiac tamponade [16]. The relative risk of a malposition with the left internal jugular approach is higher, and the most common malposition has been in the right subclavian vein [13]. Correct placement requires the tip to be in the SVC, and malposition is often identified via a chest X-ray. The care provider should carefully pull the line back to the correct location in such a way that repositioning does not cause further complications.

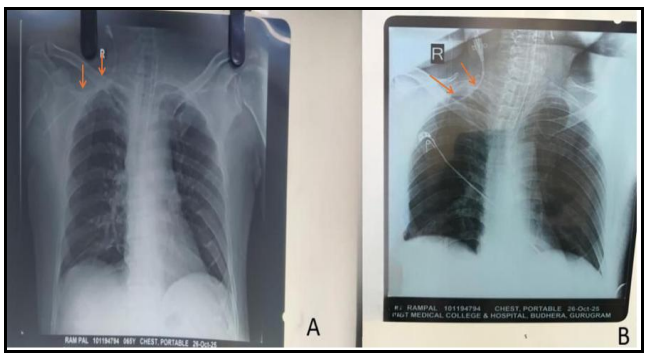

Fig 1a & b: Chest X-ray demonstrating a RIJV -CVP line malposition into the right subclavian vein (1a) (red arrows) and further in the axillary vein (1b). (red arrows) As there was a free blood flow in all the three ports on aspiration, erroneous placement was not noticed until a post-procedure chest X-ray was obtained.

Conclusion

CVP line insertion using RIJV/LIJV or subclavian vein can develop malpositions at various sites even when inserted by the experienced care provider under USG guidance. The RIJV - CVP line insertion has the most infrequent malposition. The extra venous CVP catheter malpositioning can present with serious complications like haemothorax, pneumothorax, arterial bleeding, chylothorax, hemopericardium. This single case report suggest that a check X-ray chest should always be performed to confirm the correct position of the CVP catheter tip even after USG guided CVP line placement.

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Conflict of the Interest

There is no conflict of the interest

Registration of the clinical research

Does not required for this case report

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