



Case report | Prikaz slučaja

## Intravascular Misplacement of Central Venous Catheter – Recommendations for Practical Management

### Intravaskularna transpozicija centralnog venskog katetera – praktične preporuke

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#### Descriptors

CVC; MISPLACEMENT; COMPLICATION

#### Deskriptori

CVK, POGREŠNA POZICIJA, KOMPLIKACIJA

**SUMMARY.** There are various complications of central venous catheter (CVC) insertion, including misplacement. We present case report where CVC was misplaced from right internal jugular vein (IJV) to right subclavia. The patient was 70 years old male with intestinal neoplasma, undergoing the procedure of hemicolectomy and CVC was inserted in the operation ward considering possible blood loss. The CVC was placed using blind technique and without difficulty, through right IJV. It was completely functional during surgery. Upon admission to Intensive Care Unit, routine chest radiograph was obtained which detected misplacement of the CVC. The position of the CVC was unusual, and clinical signs of misplacement were missing. An attempt to reposition the catheter was made, which was unsuccessful. Chest radiograph showed no signs of pneumothorax so the misplaced catheter was removed and a new one was placed in the same place – right IJV, once again using blind technique. The correct position of the CVC was confirmed by another chest radiograph. We concluded it is important to consider CVC misplacement, even though there are no clinical signs of it. When there is a lack of clinical presentation, imaging is the only indicator of incorrect CVC position. Misplaced CVC should be corrected regardless of its functionality.

**SAŽETAK.** U literaturi su opisane različite komplikacije vezane za postavljanje centralnog venskog katetera (CVK), uključujući i pogrešno pozicioniranje. Predstavljamo prikaz slučaja gdje je CVK transpozicioniran unutar velikih vena, odnosno, iz desne unutarnje jugularne vene (VJI) u desnu potključnu venu. Pacijent je sedamdesetogodišnji muškarac s dijagnozom neoplazme, za kojeg je planiran operativni zahvat hemikolektomije. Imajući u vidu moguću iskrvarenje, CVK je plasiran u operacijskoj sali slijepom metodom kroz venu jugularis internu (VJI) bez poteškoća. Kateter je za vrijeme operacije bio u potpunosti funkcionalan. Po prijemu na Odjel za intenzivno liječenje kirurških bolesnika, napravljena je rutinska radiografija prsnog koša, kojom je detektirana neispravna pozicija CVK. Klinički znakovi transpozicije nisu bili prisutni. Načinjen je pokušaj repositioniranja CVK, ali bez uspjeha. Budući da na RTG prsnog koša nije bilo znakova pneumotoraksa, CVK je odstranjen a na isto mjesto je plasiran novi, ponovno korištenjem slijepo metode i ponovno kroz desnu VJI. Točna pozicija CVK potvrđena je radiografijom prsnog koša. Zaključili smo da je iznimno važno razmišljati o intravaskularnoj transpoziciji CVK čak i u odsustvu kliničke prezentacije iste. U slučajevima odsustva kliničkih znakova pogrešnog pozicioniranja CVK, jedini pokazatelj adekvatne pozicije su slikovne pretrage. Nepravilno pozicioniran CVK treba se korigirati bez obzira na njegovu funkcionalnost.

Central venous catheter (CVC) placement is very common in anesthesiology and intensive care medicine. Some indications for CVC placement include blood transfusion, fluid resuscitation, drug infusion, central venous pressure monitoring, emergency venous access for patients in which peripheral access cannot be obtained, etc (1, 2). The placement of CVC is done by experienced medical professionals, but it carries significant levels of risk and complications for a patient. The main complications regarding CVC placement include pain at cannulation site, haematoma, infection, misplacement into another vessel, vessel laceration or dissection, air embolism, thrombosis, and pneumothorax requiring a possible chest tube (1, 2, 3).

We present a case report where CVC was inserted in the operation ward, through the right internal jugular

vein and misplaced into the right subclavian vein, which was recorded on a chest radiograph (CXR) obtained on the arrival of the patient into the Intensive Care Unit (ICU).

#### Case report

The patient was a 70 years old male, undergoing elective surgery of intestinal neoplasma, and initial surgery plan was to perform laparoscopic hemicolectomy. The anesthesia team decided to insert CVC in the operation ward, considering possible complica-

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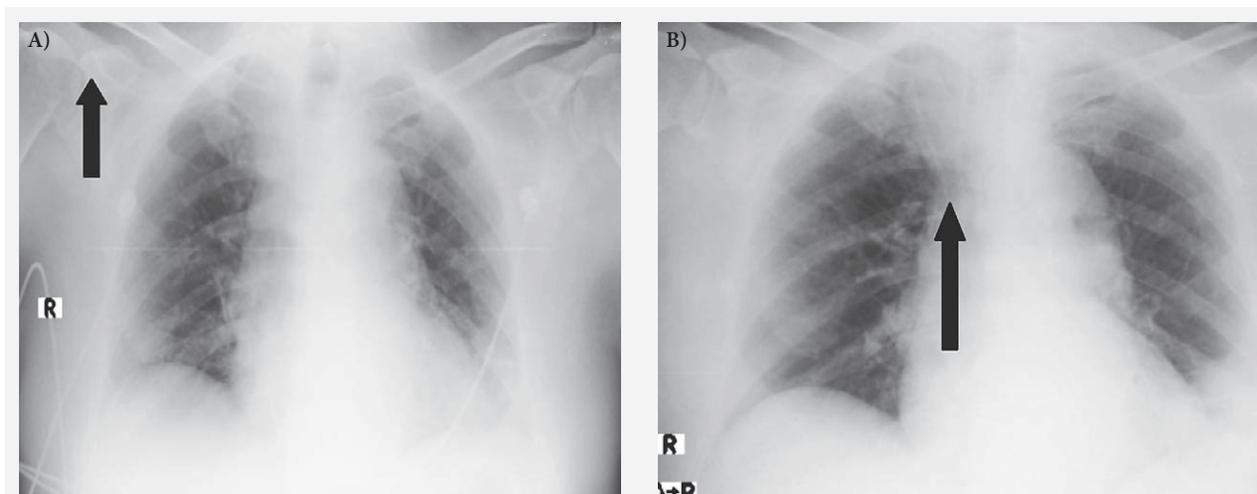


FIGURE 1. A DIFFERENT POSITION OF THE CATHETER TIP IS INDICATED BY BLACK ARROWS;  
 A) IS CXR OBTAINED UPON THE ARRIVAL OF THE PATIENT TO THE ICU; MISPLACED CATHETER IS VISIBLE – THE TIP DOES NOT END IN SUPERIOR VENA CAVA, IT BENDS AND GOES TO RIGHT SUBCLAVIA;  
 B) IS CXR AFTER MISPLACED CVC IS REMOVED AND NEW ONE IS INSERTED, IT SHOWS CORRECT POSITION.

tions, eventual blood loss and a few-day postoperative stay in the ICU.

After the induction to anesthesia, the preparations were made. The resident supervised by a senior anesthesiologist inserted the introducer needle into the right internal jugular vein and aspiration was made. Passive blood flow indicated that the introducer was inside of the vein, so the procedure continued. The guide wire passed the vein without significant resistance and double-lumen CVC was inserted inside of the vein, at the depth of 16 cm. Immediately after insertion, the trial was done to see if the both lines were functional. A blood was drawn using a syringe from both lines of the CVC and washed with sterile 0,9% NaCl, after that the infusion bag was connected and placed below the heart level and passive flow of venous blood was visible inside of the lines of the CVC. Approximately one hour into the surgery, the surgeon reported that the right renal vein was torn which resulted in significant blood loss and conversion to open abdominal surgery. The blood and fluids were administered through the placed CVC, with constant check ups of its functionality.

After the surgery was over, the patient was transferred to the ICU and routine CXR to check the position of CVC was done. The CXR (Figure 1A) indicated that CVC was inside of the right internal jugular vein (IJV), but instead of going into the superior vena cava, it bent and turned further right toward the right subclavian and axillary vein. There were no signs of pneumothorax on CXR. The patient was feeling well, reported no neck pain and the skin on the right side of the neck was normal in terms of color. At this point, the CVC was functional. The senior anesthesiologist who was on call in the ICU was informed about the

misplaced catheter and decided to try to reposition it without complete removal. However, this appeared to be unsuccessful, and a decision was made to take out the CVC. A new CVC was also placed into the right internal jugular vein, without complications. Control CXR was made and it indicated the correct position of the catheter (Figure 1B).

### Discussion

Most common routes for central venous cannulation are internal jugular vein and subclavian vein. There are no fixed guidelines when it comes to the length of insertion of CVC, or its optimal position (4, 5). Generally, it is believed that the tip of the catheter should be placed in the middle superior vena cava (SVC), outside the pericardial reflection enveloping the lower SVC. This corresponds to the level of the tracheal carina, which is around 2 cm above the junction of the SVC and the right atrium (4, 5, 6, 7).

Misplacement of CVCs occurs frequently due to often central line cannulations and can be related to congenital or acquired abnormalities, but can also happen in patients with normal anatomy of blood vessels (8). It is sometimes associated with other factors, such as body constitution of a patient, the position of the introducer bevel, a change in the patient's position, etc (9). Positioning of the tip of the catheter in unintended place is relatively common, and in most often cases described, it is from subclavia to the internal jugular vein (10, 11). Malposition in the opposite way, which is from internal jugular vein to subclavia and further lateral is on rare occasions and not often described.

CVC malpositioning is usually not considered to be a serious complication of central line insertion, but

undiagnosed CVC malpositioning can be associated with significant morbidity and mortality (9) and can lead to serious complications if not addressed (9, 12). Placing the CVC tip in a vessel other than the SVC increases the risks of catheter wedging, erosion or perforation of vessel walls, local venous thrombosis, catheter dysfunction, and cranial retrograde injection, in which the infusate is directed to the head instead of the central circulation (9, 13).

The higher incidence of malpositioning in the left thoracic venous system than on the right side has been documented, which suggests that the right side of the circulation should be considered of first preference for CVC insertion unless those insertion sites are contraindicated (9, 14, 15). In our case, the first choice was right internal jugular vein, having in mind these recommendations. An ultrasound was not available in the operation ward, so the procedure was done using blind technique, as it is common practice in the institution. However, it has been reported that ultrasound guidance can facilitate the identification of vessels but does not necessarily prevent CVC malpositioning (9, 14, 15).

Malpositioned CVC is sub optimal and should therefore be repositioned, replaced or removed as soon as it is practical (9). When deciding to take out a misplaced CVC, a physician should consider its position in relation to surrounding structures, and should know the potential additional complications which can happen due to removal (10). There were no complications prior or after the removal of the catheter in our case.

### Conclusion

A misplacement of the CVC is something that can occur in everyday practice and it is important to think about it. In order to minimize the risk of misplacement, one should take in consideration the anatomy of the patient, choose proper puncture sites, and monitor all steps of CVC placement carefully. It is also important to check the function of the catheter immediately after placement. To make sure that CVC is in the correct place, one should use CXR or other imaging procedures if necessary. Sometimes, as in our case, CXR may be the only thing that indicates the wrong position of the catheter, as no clinical signs of misplacement were present. Misplaced catheters should be repositioned, and if that is not possible, one should remove or replace it.

**Conflict of interest:** None declared.

### REFERENCES

1. Hicks BL, Brittan MS, Knapp-Clevenger R. Group Style Central Venous Catheter Education Using the GLAD Model. *J Pediatr Nurs*. 2019;45:67–72.
2. Pare JR, Pollock SE, Liu JH, Leo MM, Nelson KP. Central venous catheter placement after ultrasound guided peripheral IV placement for difficult vascular access patients. *Am J Emerg Med*. 2019;37(2):317–320.
3. Presley B, Isenberg JD. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jul 31, 2021. Ultrasound Guided Intravenous Access.
4. Tempe DK, Hasija S. Quest to determine the ideal position of the central venous catheter tip. *BJA: British Journal of Anaesthesia*. 2017;118:148–150.
5. Fletcher SJ, Bodenham AR. Safe placement of central venous catheters: where should the tip of the catheter lie? *Br J Anaesth*. 2000;85:188–91.
6. Booth, S. A., B. Norton, and D. A. Mulvey. "Central venous catheterization and fatal cardiac tamponade." *British Journal of Anaesthesia*. 2001;87.2:298–302.
7. Lee, J-H., et al. "Comparison of the bedside central venous catheter placement techniques: landmark vs electrocardiogram guidance." *British Journal of Anaesthesia*. 2009;102.5: 662–666.
8. Gibson F, Bodenham A. Misplaced central venous catheters: applied anatomy and practical management. *BJA: British Journal of Anaesthesia*, 2013;110:333–346.
9. Roldan CJ, Paniagua L. Central Venous Catheter Intravascular Malpositioning: Causes, Prevention, Diagnosis, and Correction. *West J Emerg Med*. 2015;16(5):658–664. doi:10.5811/westjem.2015.7.26248.
10. Malhotra D, Gupta S, Gupta S, Kapoor B. Malposition of Internal Jugular Vein Cannula into Ipsilateral Subclavian Vein in Reverse Direction – Unusual Case Report. *The Internet Journal of Anesthesiology*. 2008;22(1):1–4.
11. Bekele NA, Abebe WA, Shifa JZ. Misplaced subclavian central venous catheter. *Pan Afr Med J*. 2017;27:59.
12. Schummer W, Schummer C, Rose N, Niesen WD, Sakka SG. Mechanical complications and malpositions of central venous cannulations by experienced operators. A prospective study of 1794 catheterizations in critically ill patients. *Intensive Care Med*. 2007;33(6):1055–9.
13. Walshe C, Phelan D, Bourke J, Buggy D. Vascular erosion by central venous catheters used for total parenteral nutrition. *Intensive Care Med*. 2007;33(3):534–7.
14. McGee DC, Gould MK. Preventing complications of central venous catheterization. *N Engl J Med*. 2003;348(12):1123–33. doi: 10.1056/NEJMra011883. PMID: 12646670.
15. Bertini P, Frediani M. Ultrasound guided supraclavicular central vein cannulation in adults: a technical report. *J Vasc Access*. 2013;14(1):89–93.