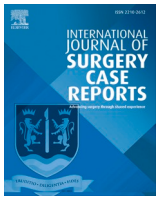
International Journal of Surgery Case Reports 102 (2023) 107813

Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.elsevier.com/locate/ijscr



Case report

A case of accidental displacement of a central venous catheter in lung parenchyma leading to hydrothorax: A case report

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ARTICLE INFO

Keywords:
Central venous catheter
Central line
Hydrothorax
CVC misplacement
Iatrogenic complications

ABSTRACT

Introduction: Effective critical care requires the placement of a central venous catheter (CVC), which is frequently indicated for volume resuscitation, hemodynamic assessment, and the administration of vasopressors, blood products, and parenteral nourishment. However, central venous catheterization is not without its complications. The majority of these problems are avoidable and treatable with proper patient selection, cautious insertion technique, and attention after catheter insertion.

Case: We present a case of a 34-year-old male patient who developed unilateral hydrothorax as a result of a central venous catheter malposition in the lung parenchyma. The condition was resolved since the complication was identified and treated quickly.

Conclusion: Previous studies have revealed a few unusual incidences of catheter misplacement. This case report can be serviceable to the medical community as they should be aware of this unique presentation, it's management and outcome.

1. Introduction

Central venous catheterization is an invasive medical procedure, routinely used to acquire vascular access for a variety of clinical indications. They allow peripheral venous access, drug administration, renal replacement treatment, total parenteral nutrition, cardiac catheterization, and trans venous cardiac pacing [1]. Complications of central venous catheter (CVC) placement are not uncommon. Pneumothorax, hemothorax, nerve damage, arteriovenous fistula formation, catheter fragmentation with subsequent embolization, and catheter malposition are some of the most prevalent complications [2]. CVC malposition is a well-known complication of IJV cannulation, occurring at a rate of 1 %–2 % [3].

This case report discusses an unusual complication of accidental misplacement of CVC in right lung while attempting to gain central access via the Inferior Jugular Vein (IJV).

2. Case presentation

A 34 years old male patient, known case of G6PD deficiency presented for donor hepatectomy. This case has been presented in accordance with SCARE Guidelines [4]. After smooth induction of anesthesia, ultrasound guided 7.5 Fr four lumen ht. IJ silicon catheter was inserted successfully, without any resistance using Seldinger's Technique in first attempt, as part of usual practice. Backflow through all the ports had been observed confirming the correct position of central venous catheter. The position was further confirmed by ultrasound. After that, Fluid resuscitation was started with crystalloids at a brisk pace. Patient remained stable hemodynamically throughout and after the procedure and patient handed over to surgical team.

Patient had no relevant drug history. Upon inquiry from his attendants, no significant family history including any relevant genetic information and psychosocial history was found.

2 h later, after the abdomen had been given incision by the consultant general surgeon. The surgeon noticed fluid in pleural cavity. Still the patient was hemodynamically stable. His vitals being BP- 110/75, pulse 76, Respiratory rate of 15 and oxygen saturation 99 %. He didn't have hypotension, desaturations or rise in peak airway pressures. Fluid administration was stopped instantly and backflow from the CVC ports was rechecked which was absent now.

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https://doi.org/10.1016/j.ijscr.2022.107813
Received 4 October 2022; Received in revised form 22 November 2022; Accepted 24 November 2022
Available online 29 November 2022

The chest X-ray revealed right sided opacification was observed with CVC displaced in lung parenchyma. Chest drain was then inserted on right fifth intercostal space and 1500 ml of light straw-colored fluid was drained. Until now 1800 ml of fluid had already been administered. Patient remained stable the entire time. Surgery was completed in 8 h and 29 mins. He was extubated in the operating room and remained stable for the 3–4 l of oxygen requirement via nasal cannula. CVP was seen in Lung parenchyma intra-operatively, as shown in Fig. I.

Despite of hydrothorax, patient was stable post operatively as shown in Fig. II.

3. Discussion

Central venous catheter placement is a common practice in operating room and intensive care unit. Despite being a safe technique in competent hands, it still causes difficulties in a considerable number of patients. Complications of CVC placement can be divided as early or late. Early complications include mechanical complications (arterial puncture, hematoma and pneumothorax) and malposition and arise directly after inserting a CVC catheter. Late complications include infections and thrombotic events and may be provoked by CVC malposition [5]. According to studies, the incidence is greater than 15 %; with mechanical problems occurring in 5–19 % of patients [6].

Although the mechanisms of CVC malpositioning are unknown, it appears to be multifaceted. According to some studies, the bevel orientation facilitates the progression of the guide wire in the appropriate direction after needle insertion [7]. While according to other studies body habitus (e.g., obesity or large breast), changes in position and even breathing movements can also play a part in CVC displacement [8,9]. Other experts ascribe malpositioning to venous anatomical abnormalities. These variances can cause catheter misguidance into vein tributaries that provide low-resistance paths for the catheter tip to penetrate. There are two types of venous anatomical variants: congenital and acquired. Congenital variations in CVC patients are frequently detected incidentally on imaging after CVC placement. Although these variations are typically asymptomatic, they might make determining the radiologic position of the CVC tip problematic. The congenital variations in venous anatomy include persistent left sided SVC, dextrocardia, a dominant supreme intercostal venous drainage to the hemiazygos vein, inferior vena cava variations, partial anomalous pulmonary venous drainage, and azygos vein abnormalities; among which left sided SVC has the highest incidence [10].

Risk factors for CVC complication include underlying disease, comorbidities, tendency to bleed due to regular medication or other factors, a high risk of thromboembolism due to arteriosclerosis, and modifications to the anatomical pathways of vessels caused by genetic or enzymatic problems, surgery or bone fracture [11].

G6PD deficiency is an X-linked recessive genetic condition that affects men more than women. It is the most frequent enzymatic abnormality involving red blood cells in humans, caused by mutations in the

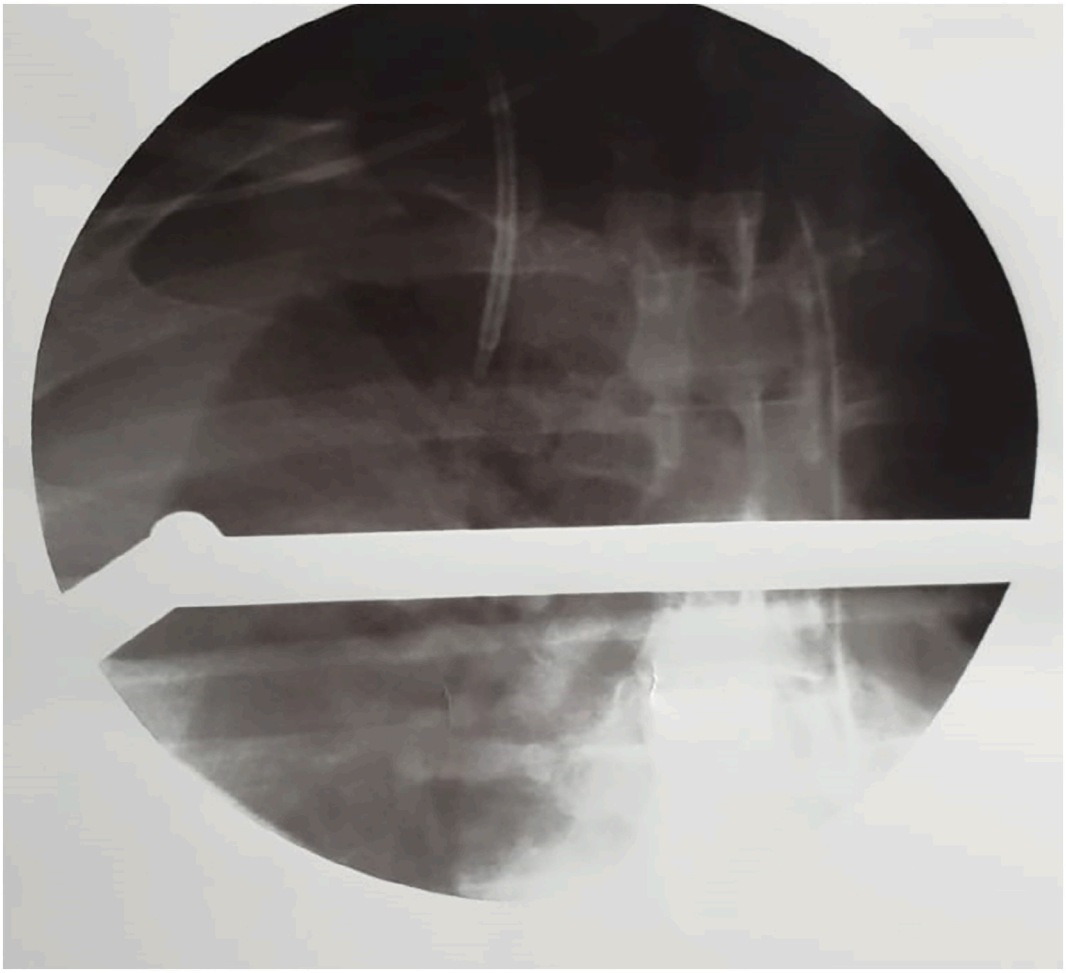

Fig. I. CVP seen in lung parenchyma.
Patient was then shifted to the Surgical ICU, where he remained stable. A follow up chest X-ray revealed resolution of hydrothorax with mild subcutaneous emphysema. Post-operatively the chest drain collected 300 ml, 200 ml and 30 ml on the 0, 1st and 2nd post-operative day respectively. On 2nd post-operative day, the chest drain was clamped and X-ray was done after 4 h to rule out pneumothorax. After obtaining a clear chest radiograph, chest drain was removed.

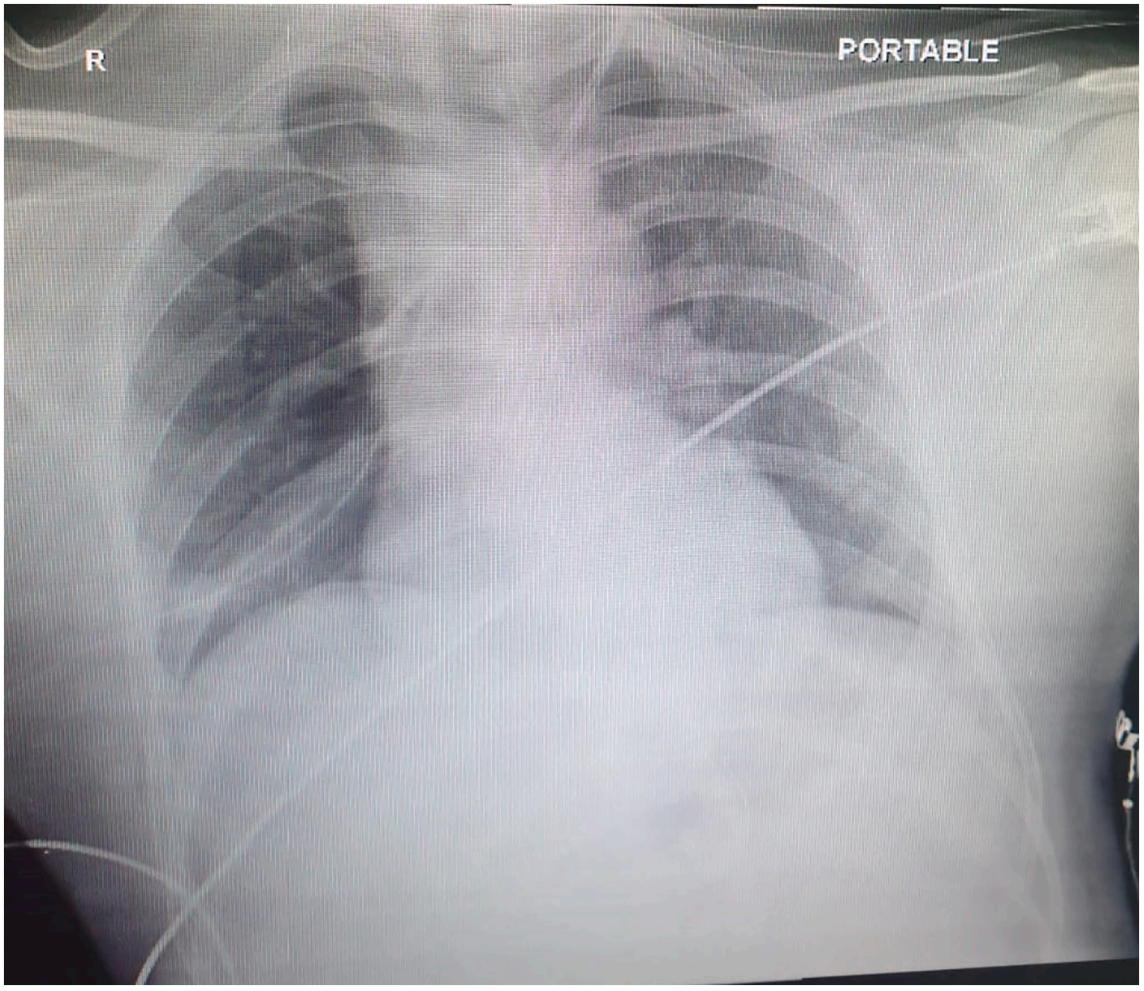

Fig. II. Post-operative Xray.
The patient was discharged on 8th post-operative day in a stable condition and follow up was planned in OPD after one week.

G6PD gene. G6PD deficiency causes hemolysis after exposure to stressors (oxidative stress, infections, certain drugs) [12]. Hemolysis can sometimes block the vessel and might be one of the reasons in causing misplacement of CVC in our case; but the data is insufficient to support the fact.

Certain factors can increase the prevalence of these complications including puncturing the site of a previous central venous catheterization, past medical history of local radiation therapy, median sternotomy, recent myocardial infarction or thrombocytopenia, patient on fibrinolytic therapy, patient having abnormal BMI, prolonged coagulation time, artificial respiration with high airway pressure, arteriosclerosis, sepsis, ventricular arrhythmia, pulmonary emphysema or chronic obstructive pulmonary disease, hypovolemia or an anxious patient [13].

Our patient was a healthy young male of average height and built. His BMI was normal. He had no respiratory or cardiovascular diseases. He didn't have any past medical, past surgical or drug history.

Ultrasound guidance central venous catheterization has been recommended as a way to reduce the risk of complications during central venous catheterization as compared to traditional blind landmark method. Ultrasound guiding minimizes the number of mechanical difficulties, catheter-placement failures, and the time required for insertion during internal jugular venous catheterization [14]. Insertion of guidewire during the procedure may also reduce the prevalence of CVC malposition [15]. In addition, studies suggest that type of catheter may also contribute in central venous catheter malposition. A soft silicon catheter is claimed to be more likely than a semi-rigid catheter to go in an unanticipated direction and cause more malpositioning [15]. Moreover, resistance during central venous catheter insertion, poor blood aspiration after insertion, aberrant waveform, and abnormally high CVP are all evident symptoms of catheter malpositioning [15].

In this case ultrasound guided IJ CVC was performed using 7.5 Fr silicon catheter. Assistance via guidewire was used. No resistance was encountered during the insertion, catheter was inserted easily in the first attempt and aspiration through all ports was successful.

Post-procedural chest X-ray is currently the most routinely utilized reference standard for detecting CVC malposition and iatrogenic pneumothorax. However, the use of Ultrasound (USG) to assist with CVC installation has been shown to increase procedural success and reduce complications as CVC malposition and iatrogenic pneumothorax. USG is an accurate and viable diagnostic technique. The advantages of US over chest X-ray are that it is quicker and does not expose patients to radiation [5].

In this case a portable chest X-ray was used as no ultrasound device was available in the operating room. The chest X-ray revealed right sided homogenous opacification and the catheter tip could not be seen.

4. Conclusion

The CVC cannulation causing iatrogenic lung parenchymal injury is a rare event. Malposition of CVC can occur due to varied causes, and requires skill management. Correct diagnosis and immediate care under the guidance of chest radiography or CT examination can often prevent

permanent or severe damage. Only a few similar case reports have been reported, and management guidelines are thus inadequate.

Patient perspective

Because of the excruciating pain, I was on the verge of giving up hope, but the physicians' quick diagnosis and care saved me.

Availability of data and materials

Data sharing does not apply to this article as no datasets were generated or analyzed for the current report.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in Chief of this journal.

Sources of funding

Nil.

Ethical approval

Ethical approval is exempt/waived by our institution. Shifa International hospital.

Registration of research studies

NA.

Guarantor

Hassan Mumtaz.

CRediT authorship contribution statement

Rabia Rabia: Conceptualization. **Amna Liaqat:** Conceptualization. **Maria Mariam:** Writing – original draft. **Adeela Kanwal:** Writing – original draft. **Zainab Ali Khan:** Writing – original draft. **Hassan Mumtaz:** Writing – review & editing.

Declaration of competing interest

Nil.

Acknowledgements

Resear-Ligent Limited UK. https://www.linkedin.com/company/researligent/.

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