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A missing piece: Fracture of peripheral intravenous cannula, a case report

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ABSTRACT

INTRODUCTION AND IMPORTANCE: Peripheral venous cannulation is the most common procedure, often performed by junior colleagues. Despite its benign nature, it is associated with extravascular infiltration, thrombophlebitis, hematoma, catheter-associated bloodstream infections, trauma to surrounding structures, including tendon and nerve injuries, hematoma formation and air embolism. Fracture of a peripheral intravenous cannula in situ is a rare, potentially serious complication that is underreported. More importantly, the etiology and prevention of this complication are not widely known by those performing cannulation. This case report will increase awareness and knowledge on intravenous peripheral cannula fracture to improve peripheral intravenous cannulation safety.

CASE PRESENTATION: In this case report, we describe a fracture of a size 18 G plastic peripheral intravenous cannula (Neovac-Neomedic) in situ in a 76-year-old hypertensive male managed at Aga Khan Hospital Dar es salaam, Tanzania. The cannula's fracture was noticed 24 h later during the cannula's removal, where a fragment of the cannula was noted, and a palpable cord-like structure was appreciated along the cubital fossa. Ultrasound was done to localize the distal segment, confirming a cannula fracture with the distal fragment's retention. Surgical exploration under local anesthetic was necessary, retrieving the fragment. There were no intra-operatively or post-operative complications encountered. Proximal migration of the segment risks the chances of developing sepsis, dysrhythmia, and myocardial infarction, but this did not occur in our case.

CLINICAL DISCUSSION: Reinsertion of the guide needle into the plastic sheath in situ most probably caused the fracture. Additional healthcare costs are incurred for investigation, admission, and surgical procedures. The patient experience may be affected by this complication.

CONCLUSION: Understanding the guide needle's reinsertion may result in cannula fracture, allows safer cannulation practices by the clinician and adequate counseling of the patient before the procedure.

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1. Introduction

Peripheral intravenous cannulation is the most common procedure performed in the in-patient setting, often by junior colleagues. Despite its benign nature, it is potentially associated with extravascular infiltration, thrombophlebitis, hematoma, catheter-associated bloodstream infections, trauma to surrounding structures including tendon and nerve injuries, hematoma formation and air embolism [1].

This case report describes fracture of a peripheral intravenous cannula in situ, a rare complication, with potential for proximal migration. Factors related to this complication include reinsertion of the guide needle into the plastic sheath in situ during cannulation [2]. The more described central venous catheter fracture

is further associated with proximal migration of distal fragments leading to sepsis, vascular perforation and hemorrhage, thrombosis, dysrhythmias, air embolism and myocardial infarction [3]. These complications have also been reported to occur with peripheral venous catheter fracture, where one case report resulted in mortality [4,5]. When cannula fracture occurs, additional measures are instituted, including image localization and surgical procedures for fragment retrieval [6].

This complication is probably common and underreported. It is hypothesized that in settings where clinicians would be motivated to decrease the number of cannulas used, they would be more likely to perform insertion and reinsertion of guide needle than using a new cannula, hence increasing chances of cannula fracture [7]. More importantly, its mechanism, and therefore, how to prevent it, is not widely known by those performing cannulation. This case report will increase awareness and knowledge on intravenous peripheral cannula fracture to improve peripheral intravenous cannulation safety. This article has been registered with the Research

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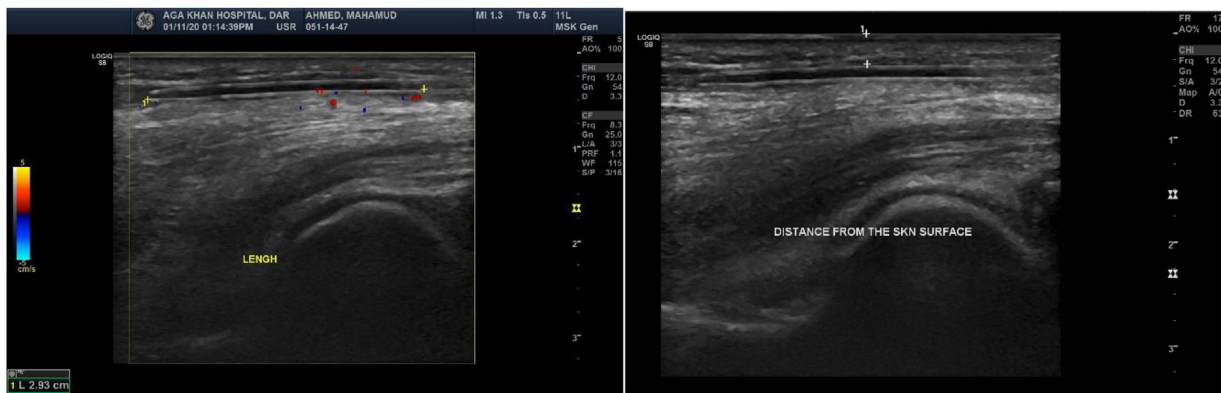


Fig. 1. Ultrasound Images of Cannula Fragments.

Showing ultrasound images of cannula fragment in the median cubital vein right upper limb.

Registry with identification number researchregistry6319 and can be found through the following hyperlink Browse the Registry - Research Registry. This paper has been reported in line with the SCARE 2020 criteria [8].

2. Case presentation

2.1. Introduction & background

A 76-year-old Tanzanian male with poorly controlled chronic hypertension due to irregular medication usage presented as a self referral from home to the outpatient clinic with complaints of difficulty in passing urine. He does not know his anti-hypertensive medications; he did not report to have familial diseases, nor was he using cigarettes or alcohol. He had undergone TURP and DVU 4 years ago, and over a period of two years, he developed progressively worsening chronic urinary retention. Ultrasound evaluation revealed recurrent enlargement of the prostate, with no focal lesions, an intact capsule, estimated on USS to be 63.9 g, with post-void urine residual volume of 51 mL. He had orthopnea and bilateral lower limb pitting edema, high blood pressure of 254/134 mmHg, pulse rate of 92, respiratory rate of 18 and peripheral saturation of 92% on room air fitting the criteria NYHA class II, and the criteria of hypertensive emergency. His ECG findings were normal for his age, and he had an elevated pro-BNP of 903.8 pg/mL (normal 0–125 pg/ml), signifying heart failure. Echocardiographic findings revealed mild to moderate left ventricular hypertrophy, normal systolic function with an ejection fraction of 60%, grade II diastolic dysfunction characterized by mild to moderately impaired relaxation, decreased compliance and elevated left ventricular filling pressures. Assessment of renal function was within normal limits with creatine of 90.14 $\mu\text{mol/L}$ and normal serum electrolytes.

He was transferred to the emergency department and subsequently admitted for further treatment for hypertensive emergency associated heart failure with preserved ejection fraction. Cannulation was planned. The chosen site was the right median cubital vein, as more distal sites were thought to have a higher chance of failure in this patient. A size 18 G peripheral intravenous plastic cannula (Neovac-Neomedic) was selected; after sterilizing the site, the cannula was inserted, piercing the skin advanced in the direction of the vein. Blood was visualized in the flash chamber. The guide needle was retracted; resistance was experienced on advancing further the plastic sheath. The needle guide was re-introduced into the plastic sheath, the direction modified, and the needle retracted, and the plastic sheath was advanced without resistance into the median cubital vein. He received Furosemide 40 mg stat, to continue once daily as a treatment for heart failure. After 24 h of treatment, his BP was 128/78

mmHg, pulse rate of 90, respiratory rate of 18 with saturations of 99% on room air. The plan was for discharge counseling to continue treatment with oral medications.

3. Clinical and diagnostic assessment

On removing the cannula, only part of the cannula was retrieved; a cord-like structure was palpable about 1 cm proximal to the cubital fossa, in the direction of the median cubital vein. No surrounding features of inflammation or hematoma were elicited. With an impression of a retained cannula fragment, an ultrasound was done to mark the position superficially and confirm the cannula fragment's location. The 5 cm distal fragment was identified in the medial cubital vein (Fig. 1). A general surgeon was consulted and advised for exploration under local anesthesia and removal of the foreign body, given the possible risk of proximal migration compared to the ease of retrieval of the fragment. After preoperative counseling, the patient consented for the procedure.

4. Therapeutic information

Under sterile conditions, 2% lignocaine was infiltrated over the marked site and surrounding area. The anesthetic effect was confirmed, and under ultrasound marking, a 2 cm longitudinal incision was made over the median cubital vein using a size 15 blade. The wound was explored, and the median cubital vein was identified. The fragment was not palpated at the marked site; the incision was extended an additional 2 cm proximally along the vein course until the cannula fragment was palpated. The fractured component was extracted from the vein via a partial venotomy. No significant bleeding from the venotomy site was observed. Hemostasis was ensured before closure (Fig. 2).

At five weeks post-surgical exploration, we have not noticed any wound complication nor evidence of thrombophlebitis.

5. Discussion

Fracture of the peripheral intravenous cannula is rarely reported; only a few case series exist of this complication from peripheral cannulas, compared to central lines fractures in situ. From the findings of this case report, we hypothesize the etiology of the complication to be reinsertion of the needle guide into an already advanced plastic sheath. The sheath might be curved due to the insertion angle or due to the vein's trajectory. Advancing the needle may partially or entirely transect the plastic sheath. We further theorize that there was a partial transection in our case, and during removal of the cannula, the partial cut-edge might have lodged into venule intima, and further force to remove the can-

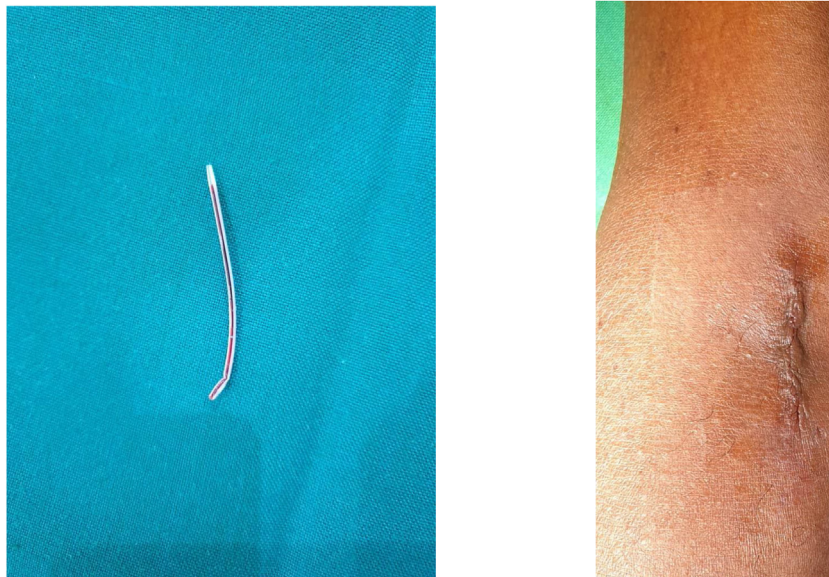


Fig. 2. Operative findings. Showing retrieved cannula fragment, and status of the wound immediately post op. 3 cm incision was made for retrieval of cannula fragment.

nula completed the transection resulting in the retention of the distal fragment. This would explain delayed recognition of the cannula fracture. A guide needle reinsertion is described as the most common mechanism for peripheral intravenous cannula fracture [2,9,10].

When cannula fracture in situ occurs, additional costs are incurred related to prolonged admission, imaging investigations such as X-rays, ultrasounds, and CT scans to localize the foreign body, invasive procedures such as wound exploration, anesthesia, with its attendant risks. In a report by Singh et al., the patient had to be readmitted 15 days after discharge for exploration, following phlebitis development [6]. In another report by Dell'Amore et al., a fragment migrated from the median cubital vein to the sub-segmental pulmonary artery that required mini-thoracotomy after two months [11]. Delayed exploration results in increased chances of infection, proximal migration, and mortality; hence urgent retrieval of the fragment becomes a priority [4,12]. Patient dissatisfaction and grievances might arise as they were not aware of cannulation risks [6].

To prevent this complication, it might be safer to recommend a single cannula attempt per cannulation. However, the risk of cannula fracture and its possible consequences must be weighed against the single attempt approach's feasibility. In a limited resource setting, this is incredibly challenging, and hence insertion and reinsertion is commonly performed and was hypothesized as a leading factor of this complication by Olalekan et al. [7]. A different study design is advocated for accurate quantification of the risk of needle reinsertion as an etiology. Understanding that guide needle's reinsertion may result in cannula fracture allows for safer cannulation by the clinician and adequate patient counseling before the procedure.

Conflicts of interest

No conflicts of interest.

Funding

No funding was provided for research.

Ethical approval

Case study is exempt from ethical approval in my institution.

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 on request.

Author contribution

MASAWA KLINT- Study conceptualization, Data Collection, Preparation of Manuscript, Review of Manuscript.

MITEN PATEL- Study conceptualization, Data collection, Preparation of Manuscript, proof reading.

ELIZABRTH MMARI- Manuscript review and Proof reading.

Registration of research studies

researchregistry6319 available at: <https://www.researchregistry.com/browse-the-registry#home/registrationdetails/5fc645c51d19fe001b789611/>.

Guarantor

Dr. Miten Patel.

Provenance and peer review

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Patient perspective

I am happy to be a part of this study as this is a chance to assist in patient care who would be faced with a similar situation. More importantly, I hope the chances of this complication can be reduced from this report and its accompanying review.

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