CASE REPORT

Unfortunate Series of Fractured Cannula: Rare Venous Access Complications

Md Noor J[ab], *Mokhtar MF*[b]

[a]Department of Risk Management, Compliance and Quality, Hospital Al-Sultan Abdullah (HASA), Universiti Teknologi MARA, Selangor, Malaysia
[b]Department of Emergency Medicine, Faculty of Medicine, Universiti Teknologi MARA, Selangor, Malaysia

ABSTRACT

Cannulas are essential medical devices that are used daily for intravenous access, facilitating fluid and medication delivery. Although complications such as phlebitis, pain, and swelling at the cannulation site are commonly observed, cannula fractures remain a rare but potentially serious complication. This case series describes four incidents of fractured intravenous cannulas, occurring within 6 months at a tertiary centre without vascular surgery services, during its early operational phase. All cases were successfully managed through prompt identification and removal under local anaesthesia. Investigations revealed contributing factors, including inappropriate cannula size selection, prolonged dwell time, insertion in high-mobility areas, and patient-related anatomical challenges. These cases highlight the need for strict adherence to intravenous catheter protocols and proper cannula selection based on indication and duration. These case series aim to raise awareness among medical professionals and manufacturers about the associated risks, promote better prevention strategies, and drive improvements in cannula design and manufacturing, ultimately enhancing patient safety.

Keywords
venous access complication, cannula fracture, fluid therapy, intravenous catheter, patient safety

Corresponding Author
Assoc. Prof. Dr. Mohd Fazrul Mokhtar
Department of Emergency Medicine, Faculty of Medicine, Universiti Teknologi MARA, Selangor, Malaysia
E-mail: fazrul2293@uitm.edu.my

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INTRODUCTION

Intravenous cannulation (IVC) is a routine procedure for medication and fluid administration, yet it carries risks ranging from pain and phlebitis to extravasation. Rarely, serious complications such as cannula fracture may occur, posing risks of embolization and tissue injury. The incidence of such fractures ranges from 0%, and 2.1%[1], often underreported due to its rarity.

Because this complication is uncommon, it may not be recognised early. In many instances, the intravenous cannula appears externally intact even when the patient complains of discomfort, and in the absence of obvious signs such as extravasation, swelling, or phlebitis, healthcare providers may assume the device is functioning normally. However, a fractured cannula tip retained within the vein can lead to serious sequelae, including tissue damage, vasculitis, migration, or embolization.[2]

Mechanically, catheter fractures may result from excessive torque, repeated flexion at the insertion site, forceful advancement against resistance, or damage from needle reinsertion.[3] Material factors include polymer degradation, loss of tensile strength, and poor bonding between the hub and the catheter shaft.[3,4] Manufacturing defects and extended cannula dwell time further increase risk.[5,6]

This case series described four cases of fractured intravenous cannulas managed in a tertiary centre without vascular access services, over 6 months, aiming to raise awareness of this rare but preventable complication.

CASE PRESENTATIONS

CASE 1

A 45-year-old woman with a BMI of 35 kgm[2] presented with giddiness and vomiting. An 18-gauge cannula was inserted into the right antecubital fossa for hydration and medication at the emergency department. On the sixth day of admission, prior to discharge, the staff nurse discovered that the catheter had fractured when the

cannula was removed. This was further confirmed by bedside ultrasound and plain radiography of the right upper limb (Figure 1). Consequently, the patient underwent vascular exploration under local analgesia, and the fractured component was successfully retrieved (Figure 2). The procedure and recovery process were uneventful.

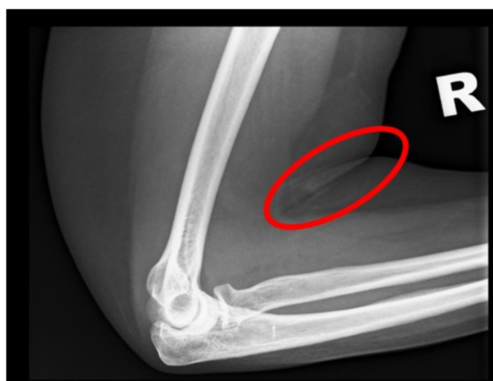

Figure 1: Radiograph of the right elbow in lateral view. An elongated hyperdense foreign body was observed in the superficial layer of the right antecubital fossa.

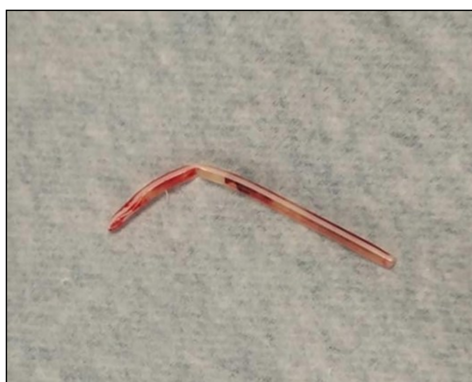

Figure 2: The retrieved fractured catheter

CASE 2

A 45-year-old male admitted for wound debridement had an 18-gauge cannula inserted in the left antecubital fossa for antibiotic therapy. After four days, the team decided to remove this peripheral line and replace it with a peripherally inserted central catheter (PICC) for long-term antibiotic administration. During the removal of the 18-gauge cannula, the staff nurse discovered that the catheter had fractured, and a segment was retained in the vein. The fragment was subsequently removed through ultrasound-guided incision and exploration under local analgesia.

CASE 3

A 61-year-old male with community-acquired pneumonia received intravenous antibiotics through a 20-gauge right antecubital fossa cannula. The same cannula remained in place for more than four days and continued to be used as it appeared externally intact, with no signs of complication. However, on the sixth day of insertion, the cannula started leaking and was removed. Upon removal, it was noted that its tip had fractured and remained inside the vein. The fractured segment was not visible on elbow radiography. A CT scan of the right upper limb revealed an elongated hyperdense structure, partly in the subcutaneous tissue and partly within the superficial vein, consistent with a fractured catheter fragment (Figure 3). The fragment was successfully removed via ultrasound-guided incision and exploration under local analgesia.

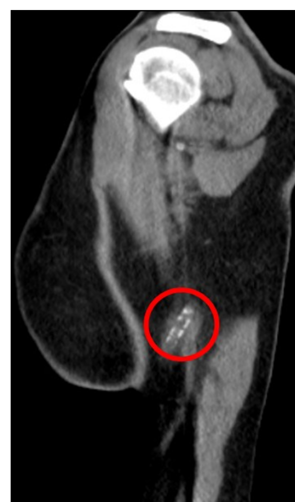

Figure 3: Elongated hyperdense structure partly in the superficial vein and partly in subcutaneous tissue representing a fractured catheter fragment.

CASE 4

A 65-year-old man was admitted for septic shock secondary to community-acquired pneumonia. Intravenous inotrope was required, but as peripheral venous access was difficult, a standard 16-gauge peripheral intravenous cannula, which is normally inserted in the upper limb, was placed in the right femoral region due to poor peripheral veins. After the cannula was used for initial inotrope administration, a more secure central venous catheter was subsequently attempted. During the

removal of the earlier cannula at the femoral site on the same day of insertion, it was discovered that the cannula had fractured from the hub. Radiography of the pelvis and femur did not visualize the fragment due to vascular calcifications. Targeted ultrasound of the right femoral region revealed a 2.3 cm tubular structure in the superficial subcutaneous tissue, parallel to the femoral vessel, with its most superficial point 0.2 cm below the surface (Figure 4). The fractured fragment was removed at the bedside under local anaesthesia.

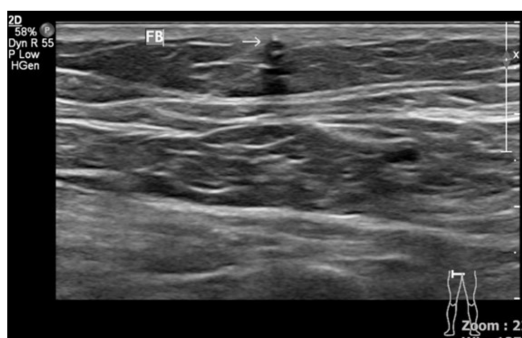

Figure 4: Targeted ultrasound over the right femoral region reveals a tubular-walled structure (white arrow) in the superficial subcutaneous tissue inthe right femoral region, located parallel to the femoral vein below.

DISCUSSION

Peripheral IVC is generally safe but carries the risk of rare complications, such as cannula fractures. While most literature focuses on common issues like thrombophlebitis and extravasation, cannula fractures are underreported, emphasizing the need for greater awareness.[7]

In managing these incidents, early identification and diagnosis were achieved through clinical examination and radiological confirmation, using X-ray, ultrasound, or computed tomography (CT) to detect the fractured cannula. In situations where the fractured cannula is not visible on radiograph or has potentially migrated to deeper tissues or embolized into central vessels, the use of a tourniquet is recommended to prevent embolization.[8] The fractured fragment is commonly embolized proximally to the central venous system; however, distal embolization can also occur.[9] In this case series, none of the broken cannulas had migrated.

Root cause analyses were conducted for all four cases, revealing several contributing factors. Cannulations were performed by experienced medical officers and nurses. Each successful insertion was documented as a single attempt at the respective site for that particular patient. In Case 4, multiple failed attempts at other sites preceded the final insertion at the femoral region; however, the femoral cannulation itself was achieved in a single attempt. Despite being classified as single attempts, subtle manipulations such as partial retraction followed by reinsertion of the needle to correct an initial malposition may have damaged the inner plastic liner.[10] Most peripheral intravenous cannulas are made of flexible polymers such as polytetrafluoroethylene or polyurethane, which can be mechanically weakened when the introducer needle is reinserted or adjusted within the catheter. Such manoeuvres may cause micro-tears or partial transection of the catheter wall, predisposing it to fracture during subsequent use or removal.[10,11] Hence, adjustment of the introducer needle within an already advanced plastic cannula should be strictly avoided.

Prolonged cannula dwell time beyond the widely recommended 72 to 96 hours, as seen in Cases 1 and 3, may also have contributed to the complication. Extended use of a single intravenous cannula can result in material fatigue[6], which weakens the polymer structure and increases the likelihood of fracture during removal. Furthermore, failure to replace the cannula within this commonly practiced interval increases the risk of catheter-related infection.

Improper insertion site selection may also have contributed to the risk of catheter fracture. High-mobility areas such as the antecubital fossa (Cases 1-3) are subject to frequent flexion and insertion, leading to repeated micromotion and increased mechanical stress on the cannula.[12,13] In case 4, a standard peripheral intravenous cannula was inserted into the femoral region. The femoral site is not recommended for short peripheral cannulas because of its depth, movement, and proximity to major vessels. Using a short, rigid cannula designed for superficial veins at this deeper location likely increased bending and material stress, predisposing to fatigue and eventual breakage.[7] If femoral access is unavoidable, a catheter with greater tensile strength and flexibility, such

Table I: Summary of Key Clinical Details

Case	Age/ Gender	BMI (kgm-2)	Comorbidities	Cannula Gauge & Site	Cannula Brand	Duration Before Fracture	Difficulty During Insertion	Imaging	Removal Method
1	45/ Female	42	DM, hypertension	18G, right antecubital	Brand A	6 days	Nil	X-ray, US	Local exploration
2	45/ Male	24	Osteomyelitis of the left tibia	18G, left antecubital	Brand A	4 days	Nil	US	US-guided local exploration
3	61/ Male	30	DM, hypertension, ESRF	20G, right antecubital	Brand B	6 days	Nil	X-ray, CT scan	US-guided local exploration
4	65/ Male	29	DM, hypertension, ESRF	16G, right femoral	Brand B	<1 day	Multiple attempts at other sites	X-ray, US	Local exploration

(BMI: Body Mass Index; US: Ultrasound; G: gauge; DM: diabetes mellitus; ESRF: end-stage renal failure)

as an angiographic catheter, should be used, as these are designed to resist kinking and breakage. For safer practice, ultrasound guidance may be employed to facilitate accurate insertion and minimise unnecessary tissue trauma during access.

Patient-related factors such as obesity and vascular calcification may further increase the risk. Obesity presents anatomical and technical challenges by obscuring vascular landmarks and increasing insertion depth, while calcified vessels reduce vascular compliance, limiting the flexibility needed for safe catheter advancement and adjustment.[16,17] Across our series, all patients had chronic comorbidities, and two were classified as obese.

Another recurring theme was the absence of a formalized policy on intravenous cannula management, attributed to the hospital's early operational phase, as the incidents occurred within its first two years of operation. Comprehensive guidelines on cannula selection and insertion site have not yet been established. In response, the hospital introduced several measures, including clearer directives on proper technique, stricter adherence to usage duration, and regular intravenous line training for all staff, particularly new ones. Ultrasound-guided insertion is encouraged for patients with difficult access to reduce repeated attempts. The existing venous access care and monitoring protocol was reinforced after the first incident to heighten vigilance, but subtle complications such as catheter fracture may remain undetected, as the cannula can appear intact and patients remain asymptomatic. This highlights the limitation of routine inspection alone and reinforces the need for careful technique and prevention.

Two different brands of cannulas were involved in the reported incidents. In response, we contacted the manufacturing companies to inquire about the structural integrity. Rigorous tensile strength and leak testing were conducted, and confirmed that the devices complied with ISO 10555 standards for safety and quality. Following these incidents, another cannula brand was introduced to replace the previously used devices in the hospital. Since the adoption of improvement measures, no further incidents of cannula fractures have been reported, indicating the effectiveness of these interventions.

CONCLUSION

This case series emphasises the importance of addressing the rare but significant complication of cannula fracture. Learning from these cases, particularly the contributing factors and system gaps, supports ongoing staff education, encourages safer cannulation practices, and helps prevent similar events in the future.

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