

Seek and You Shall Find—Retrieval of a Retained Fractured Intravenous Cannula by Z-Plasty Incision: A Case Report

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Summary

Peripheral venous cannulation is a common invasive procedure. Fracture of an intravenous cannula is rare and an under-reported complication of peripheral venous cannulation. Embolization of the intravenous fragment into the central venous system is potentially fatal. Urgent surgical retrieval, which is performed through a transverse or longitudinal incision, is the treatment of choice. We herein present the use of Z-plasty incision for the retrieval of a retained fractured peripheral intravenous cannula in a 61-year-old Nigerian man on hemodialysis for chronic kidney disease. The major benefits of this innovation are facilitation of access for exploration and prevention of joint contracture.

Keywords: Fractured intravenous cannula, Surgical retrieval, Z-plasty, Incision, Case report

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Introduction

Peripheral vein cannulation is a common invasive procedure performed for blood sampling, drug administration, parenteral fluid administration, and patient monitoring(1). However, it may be associated with complications such as extravascular infiltration, thrombophlebitis, bacteremia, septicemia, embolism, hematoma, and surrounding soft tissue damage, i.e., tendon, nerve, and muscle damage (2).

Fracture of a peripheral intravenous cannula is a rare and under-reported complication that is potentially serious(2). Its most feared sequelae include dysrhythmia and myocardial infarction, which occur secondary to proximal embolization of the retained fractured segment

into the central venous system. Distal embolization has also been reported(3). Early diagnosis and detection of the retained fractured cannula fragment and its subsequent removal are important in preventing embolization and potential complications. Radiologic modalities for detection of the retained fractured fragment include plain x-rays(4), ultrasonography(2,5), computed tomography (CT) scan(6), and C-arm fluoroscopy(4), and these procedures are accompanied by surgical retrieval of the retained fractured cannula fragment.

In resource-poor settings, as may be seen in low- and medium-income countries (LMICs) with inadequate or

inappropriate radiologic facilities aforementioned above, clinical presentation, physical examination, and reliance on a detailed knowledge of venous anatomy may be relied upon to surgically retrieve the retained fractured cannula fragment. The surgical techniques published in literature for retrieval of the retained fractured cannula segment include transverse (5–7) or longitudinal incisions(2,8). To our knowledge, there is no previous report of the use of a Z-plasty incision for this procedure.

This case report aimed to showcase the utility and application of a Z-plasty technique as a preferred option for surgical exploration and retrieval in an unlikely rare presentation of a retained fractured intravenous cannula.

Case presentation

A 61-year-old Nigerian man with poorly controlled hypertension complicated by chronic kidney disease with uremic gastritis presented at the emergency unit with complaints of generalized body weakness, history of repeated vomiting, and hiccups. Physical examination revealed a resting tachycardia of 112 bpm and an elevated blood pressure of 240/120 mmHg. Other notable physical findings included a grossly enlarged prostate with benign features on digital rectal examination. His body mass index was 26 kg/m².

Laboratory indices showed a pack cell volume of 35% and unbalance electrolyte values, including elevated serum urea and creatinine of 39.3 mmol/L and 2889 µmol/L, respectively. His prostate-specific antigen was also elevated at 14.4 ng/mL. Renal ultrasonography revealed background renal parenchyma disease.

He underwent hemodialysis, and central venous access was secured using the left femoral vein with an accompanying peripheral venous access on the right cephalic vein over the right cubital fossa. On the seventh day of admission, a fracture of his intravenous cannula at the right cubital fossa was observed after a failed attempt at administering his routine prescribed intravenous antibiotics. There was retention of the distal fractured cannula segment within the tissues despite all attempts at removal. This elicited a referral to the plastic surgery unit for retrieval.

Physical examination by the plastic surgery team showed erythema and swelling over the lateral border of the right cubital fossa. Tenderness was also elicited on palpation with a thickened cord felt over the lateral border of the right cubital fossa (Figure 1).



Figure 1. Initial clinical presentation as thrombophlebitis of the cephalic vein (blue arrow) over the right cubital fossa.

An ultrasound scan of the right cubital fossa and right arm identified the location of the retained fractured intravenous cannula. This location was identified, and surface mapping was performed using ultrasound guidance. (Figure 2).

Consent for surgical retrieval was obtained from the patient and his family. He was prepared for surgery under local anesthesia, by having a third session of hemodialysis and a preoperative fast of 6 hours after the hemodialysis. The preoperative fast time also allowed the anticoagulant effect of the heparin utilized in the hemodialysis to wear out. A Z-plasty incision was used for surgical exploration of the right cephalic vein in the

right cubital fossa and the adjoining forearm. The procedure was carried out under local anesthesia using 1% lidocaine and 0.05mg adrenaline.



Figure 2. Surface marking from ultrasound imaging for locating the fractured retained cannula.



Figure 3. Surgical exposure of the right cephalic vein (indicated by needle holder) at the cubital fossa

The arm, elbow, and forearm were cleaned with chlorhexidine solution and 70% alcohol solution in preparation for surgery and isolated using sterile surgical drapes. A pneumatic tourniquet was applied on

the right arm for 5 minutes after exsanguination by assisted elevation of the right upper limb for 5 minutes without complaints of pain from the patient. Proximal migration of the retained cannula before exsanguination was prevented by adopting a gentle gravity-assisted non-expressive method. A 'Z'-shaped incision was made over the previously mapped area on the lateral aspect of the right cubital fossa with diagonal/oblique stroke of the 'Z' traversing the anterior elbow joint line. The two triangular flaps on either side of the diagonal stroke of the Z-plasty incision were elevated to expose the underlying cephalic vein. (Figure 3). The cephalic vein was palpated to identify the intravenous fractured cannula segment. Venotomy was performed at the proximal end of the retained cannula, and a 3.2-cm distal fractured segment of an intravenous cannula was retrieved with a pair of artery forceps. (Figure 4).



Figure 4. Retrieved fracture segment of intravenous cannula

The tourniquet was kept for only 5 minutes of the operation time, in order to prevent pain of ischemia. It was removed soon after retrieval of the retained fractured cannula segment from the cephalic vein. The venotomy was not sutured, as the cephalic vein was ligated proximal and distal to the venotomy site. The wound was irrigated with saline. The triangular flaps were repositioned as before incision and closed in a single tissue layer by simple interrupted suturing. (Figure 5). The duration of the surgical procedure was 15 minutes. Post-operative analgesic (paracetamol) and antibiotic (amoxicillin/clavulanic acid) were prescribed.

Post-operative review after 8 months showed satisfactory wound healing and stable renal function, and the patient had no complaints.



Figure 5. Post-operative wound closure of z-plasty incision

Discussion

Fracture and retention of intravenous cannulas are under-reported(1) or rare(5,7). Intra-vascular fracture of peripheral intravenous cannula may result from poor insertion techniques, multiple attempts at cannulation, which compromise the structural integrity of the cannula, prolonged cannulation, and ab-initio poor quality of the cannula(1). Prolonged cannulation from the index patient's medical condition was identified as a significant risk factor. Additionally, another risk factor is the consequent poor structural integrity of the cannula at the cubital fossa, secondary to repeated flexion and extension movements at this location. Another associated cause mentioned in literature includes "self-inflicted" injury in a restless, intoxicated patient in an attempt to discontinue intra-venous access.

The complications of retained fractured intravenous cannulas may be local or systemic. The local complications include extravascular infiltration and retention(7), thrombophlebitis, hematoma, and soft tissue trauma, etc.(2). Our patient had thrombophlebitis (Figure 1). Systemic complications include distal embolization of the fractured segment, sepsis with

resultant endocarditis, cardiac perforation, and atrial and ventricular arrhythmias(8). Dreaded complications of a fractured intravascular cannula are usually associated with fragment embolism(1). This embolism is frequently proximal to the site of insertion, but distal embolization has also been reported(3).

There is presently no standardized protocol for managing retained fractured intravenous cannula(1,7). However, as a "first principle," proximal embolization of the retained fractured cannula should be prevented if its location can be determined by clinical examination. The next line of management includes radiologic imaging for precise location of the fractured cannula. The radiologic modalities used in this scenario include plain x-rays, ultrasonography (which was used in our case, images unavailable) and CT scan(1–5,7). In all cases of retained fractured intravascular cannulas, surgical exploration for retrieval was the definitive therapy (1,2,5–8).

Transverse(5–7) or longitudinal(2) incisions in surgical procedures have been the preferred options in all reported cases of this rare condition. A major disadvantage of these two incisions is inadequate exposure with consequent limited access, which may necessitate a re-incision at a new site(4). In addition, the resultant "longitudinal scar" from a longitudinal incision may traverse a flexural joint surface with a potential complication of a joint contracture.

In our index case, a Z-plasty was used without transposition of the triangular flaps (Figure 5). The Z-plasty is a procedure that involves the transposition of two inter-digitating triangular flaps(9). Normally, a transposition of the triangular flaps would lead to a gain in length along the direction of the common limb of the Z—"the diagonal stroke"(9). In this scenario, however, the aim was not to gain length but to improve access. The common limb of the "Z" was positioned across the cubital fossa (Figure 5), and elevation of the triangular flaps afforded adequate access for exploration of the foreign body (fractured intravenous cannula) and its retrieval. Beneficially, this procedure has the potential for proximal and distal extensions for greater access and exploration in scenarios when there is short distance propagation of the foreign body (fractured cannula).

This is quite useful and practicable in low-resource settings where real-time radiologic imaging may be unavailable, with attendant sole reliance on knowledge of surgical anatomy and clinical presentation. More importantly, this incision obviates the possible development of a scar contracture across the joint, as a result of the diagonal placement of the common limb of the “Z-incision”.

A clear operating field in this surgical exploration scenario is quite important, and this was guaranteed in this procedure by a pneumatic tourniquet temporarily limiting blood flow to the site. This, coupled with the Z-plasty, facilitated a short surgery duration that allowed precise identification of structures with no inadvertent injury to nearby structures. Previous literature on this rare condition did not identify or describe a “pneumatic tourniquet” as part of the surgical procedure.

Conclusion

Retained fractured peripheral intravenous cannula is a rare complication of peripheral vein cannulation. Standard principles of management for this condition are yet to be described. However, early management emphasizes immediate prevention of embolization, accompanying diagnostic imaging to identify precise location with the end aim of surgical retrieval. A “Z-plasty” incision employed for surgical exploration, as described in this case report, affords better access for exploration and possibility for further extension of the incision while eliminating the dreaded complication of scar contracture for incisions over the joint, as seen in our index patient. Complimentary to this incision is the use of a previously undescribed pneumatic tourniquet, which greatly facilitated the surgical retrieval operation.

Ethical consideration

Ethical approval (reference number UNIMEDTHC/RE/0203), for this case report was obtained from the research and ethics committee of the hospital. Informed consent was obtained from the patient for the surgical procedure as well as for academic publication. All research carried out was in keeping with the Declaration of Helsinki regarding studies in human subjects.

Author contributions

IE led in the conceptualization and writing of the first draft. All other authors contributed equally to reviewing and editing the original draft.

References

1. Khoo PJ, Tay KL, Jamaluddin AAA, et al. Self-inflicted and iatrogenic peripheral intravenous cannula fracture: a case report. *Ann Med Surg.* 2018; 33: 44-6.
2. Nyamuryekung'e MK, Mmari EE, Patel MR. A missing piece: fracture of peripheral intravenous cannula, a case report. *Int J Surg Case Rep.* 2021; 78: 296-9.
3. Khadim MF, Leonard D, Moorehead RA, et al. Back to basics: iatrogenic intravenous cannula embolus. *Ann R Coll Surg Engl.* 2013; 95: 3-4.
4. Song M, Wei M, Song Z, et al. A foreign body in the cephalic vein: a case report. *Med (United States).* 2018; 97: 23-6.
5. Kumar RR, Ranjan P. Case report: iatrogenic fracture of intravenous cannula during removal with proximal migration. *Int J Surg Case Rep.* 2020; 76: 562-5.
6. Singh A, Kaur A, Singh MJ, et al. Ct guided removal of iatrogenic foreign body: a broken intravenous cannula. *J Clin Diagnostic Res.* 2015; 9: PD28-9.
7. Adeosun PO, Abdulazeez AT, Okeke UI, et al. CT-guided retrieval of a fractured intravenous cannula in a toddler: a case report. *Afr J Emerg Med.* 2020; 10: 277-80.
8. Arun O, Oc B, Gunduz E, et al. Fracture of an intravenous cannula in the vein due to reinsertion of the guide needle: a case report. *J Cardiovasc Surg.* 2014; 2: 28.
9. McGregor IA. The Z-plasty in hand surgery. *J Bone Jt Surg Br.* 1967; 49: 448-57.