

# Peripheral Intravenous Cannula Fracture: Increasing Incidence and Management

Christian Emeka Amadi<sup>1</sup>, Justina Omoikhefe Alegbeleye<sup>2,\*</sup>

<sup>1</sup>Department of Surgery, University of Port Harcourt, Rivers State, Nigeria.

<sup>2</sup>Department of Obstetrics and Gynaecology, University of Port Harcourt, Rivers State, Nigeria

\*Corresponding author: Justina Omoikhefe Alegbeleye

Received February 10, 2024; Revised March 12, 2024; Accepted March 19, 2024

**Abstract Background:** Peripheral Intravenous Cannulation is a routine invasive procedure in clinical practice with various associated complications including cannula fracture. **Objective:** To evaluate the incidence of peripheral intravenous cannula fracture and its management. **Materials and Methods:** This was a prospective cross-sectional study conducted at the University of Port Harcourt Teaching Hospital between April 1, 2019, and December 31, 2021. A data collection tool designed specifically for the study was used to obtain information on the size of the cannula, cadre of doctor that inserted the cannula, the brand of the cannula, history of reinsertion of the introducer needle during cannulation, duration of the intravenous cannulation, time of presentation and successful retrieval rate. **Results:** There were 15 cases of broken peripheral IV cannulae. The patients were aged 25-44years, consisting of 1 (6.67%) male and 14 females (93.33%). All the cannulae were 16G (gray) and were inserted mostly preoperatively for caesarean section, 7 (46.67%) of them were inserted by consultants, 4 (26.67%) by Senior Registrars and 4 (26.67%) by Registrars. All the 16G cannulae were made by the same manufacturer. The introducer needle was reinserted in 4 (26.67%) cases. On the average, the cannulae lasted between 3-5days intravenously, 10 (66.67%) of the cases presented within 24hours while 5 (33.33%) presented after 24hours. Most 12 (80%) of the fractured cannulae segments were successfully retrieved while 3 (20%) had migrated. These peripheral cannula fractures were more prevalent in the first year of the study, where 12 cases were reported. The hospital management was notified of the increase in the rate of peripheral cannula fracture and the use of the brand of peripheral cannula was discontinued. **Conclusion:** Though technical error during insertion is an issue, the quality of the cannula in these cases appeared to contribute to the increased rate of cannula fracture. Hence, timely presentation is key to successful retrieval.

**Keywords:** Cannula, Intravenous, Peripheral, Fracture, Retrieval, Port Harcourt

**Cite This Article:** Christian Emeka Amadi, and Justina Omoikhefe Alegbeleye, "Peripheral Intravenous Cannula Fracture: Increasing Incidence and Management." *American Journal of Clinical Medicine Research*, vol. 12, no. 1 (2024): 13-17. doi: 10.12691/ajcmr-12-1-2.

## 1. Introduction

Aside from vital sign measurement, intravenous cannula insertion is one of the first procedures carried out on patients in both the emergency and in-patient wards [1]. Since its discovery by Christopher Wren in the 16th century, the procedure has become one of the most widely used intravascular procedures [1,2]. A peripheral intravenous cannula (PIC) is inserted into the peripheral vein for the purpose of blood sample collection, drug administration, and fluid administration [3]. Generally, important components of a PIC include the hub, flashback chamber, pair of wings, catheter, metal trocar and trocar grip [3]. Common medical devices such as cannulae, catheters, needles, and other metallic tools may be trapped distally along the blood circulation, resulting in bleeding, infections, and thrombosis [4].

Although PIC fracture is rare and sometimes not reported or even under reported, it could result in severe

complications [5]. Thrombophlebitis, haematoma, extravascular infiltration, septicaemia, embolism, nerve injuries, tendon, and muscle damages, have all been associated with PIC fracture [5,6]. Proximal embolization of the fractured segments may cause secondary complications like dysrhythmia and myocardial infarction [5]. However, distal embolization has been reported to occur, which is a condition where the fractured cannula segments migrate from the site of the fracture and embolize to another location [7]. Furthermore, mortalities arising from complications of PIC fracture was reported by Freiberg et al and Bloom et al [8,9].

The diagnosis and detection of PIC fractured segments is often challenging. Early diagnosis and detection are however made easier with the aid of radiological techniques such as computed tomography (CT) scan, plain X-ray, C-arm fluoroscopy and even ultrasonography [6,7,10,11,12]. Surgical interventions such as longitudinal and transverse techniques are therefore employed for immediate retrieval [5]. There is paucity of data on the incidence and management of PIC fracture in our

environment. Therefore, the study sought to investigate the increasing incidence of peripheral intravenous cannula fractures in our environment and their management.

## 2. Materials and Methods

### 2.1. Study Area

This study was conducted at the obstetrics and gynaecology and cardiothoracic and vascular surgery unit of the University of Port Harcourt Teaching Hospital (UPTH). The University of Port Harcourt Teaching Hospital is a 988-bed hospital in Alakahia, in Obio-Akpor Local Government Area of Rivers state. It is a tertiary hospital that serves as a referral centre for all levels of healthcare in Rivers state and other neighbouring states including Bayelsa, Imo and Abia. The department of obstetrics and gynaecology has 175 beds, making up 17.7% of the total bed spaces. Patients who had peripheral intravenous cannula fracture were evaluated by cardiothoracic and vascular surgery unit at the in-patients and the accident and emergency wards and recruited for the study.

### 2.2. Methods

This was a prospective cross-sectional study of 15 patients with peripheral intravenous cannula fracture who were managed at the University of Port Harcourt Teaching Hospital between April 1, 2019, and December 31, 2021. After obtaining informed consent, the patients' information was collected using a data collection tool and data was entered into a Microsoft excel spreadsheet in sequential order. Data obtained included the size of the cannula, cadre of doctor that inserted the cannula, the brand of the cannula, history of reinsertion of the introducer needle during cannulation, duration of the intravenous cannulation, time of presentation and successful retrieval rate. Each patient was given a unique identifier number to ensure anonymity and ease of identification. The data collection tool was checked for accuracy and completeness.

### 2.3. Retrieval Procedure

Following notification of PIC fracture by the managing team, the cardiothoracic and vascular surgery unit evaluated the patient. Thereafter, a tourniquet was applied proximal to site of cannula fracture, to limit the chances of migration. Within a 30-minute period, the fractured segments for most of the reported cases were confirmed by palpitation, though some required the use of a Duplex scan. However, when the fractured segment was not readily palpable, marking of the site was done using a duplex scan and the patient was taken to a procedure room. Under aseptic conditions and local anaesthesia, a skin incision was made at the site and venotomy was carried out. The fractured segment was retrieved, with the venotomy repaired or ligated depending on the size of the vein after heparinized saline irrigation.

### 2.4. Data Analysis

The data was collected using a proforma which was

entered into a Microsoft excel spreadsheet. The data and medical information were summarized using descriptive statistics as appropriate. Data analysis was done using statistical packages for social sciences (SPSS) version 25.

### 2.5. Ethical Considerations

The study was approved by the research and ethics committee of the University of Port Harcourt Teaching Hospital.

## 3. Results

A total of 15 patients were recruited for the study during the period under review. All 15 (100%) cannulae were 16G (gray) and were inserted pre-operatively. Of these, 13 (86.6%) cases were for caesarean section, 1 (6.7%) for abdominal myomectomy and the only male 1 (6.7%) was for a case of intestinal obstruction for laparotomy. Seven (46.67%) of the cannulae were inserted by consultants, 4 (26.67%) by senior resident doctors, and 4 (26.67%) by junior resident doctors. All (100%) of the 16G cannulae were made by the same manufacturer. The introducer needle was reinserted in 4 (26.67%) cases, the cannulae were in situ for an average of 3-5days intravenously, most 10 (66.67%) of the patients presented within 24hours, while 5 (33.33%) presented after 24hours. Two of the forearm veins around the wrist were ligated in two patients; while 1 at the proximal forearm, 10 at the cubital fossa and 2 at the neck (external jugular) were repaired. The three fractured cannulae that migrated were from the cubital fossa and were all retrieved. They were all observed in 5 patients that presented after 24 hours of the incident.

**Table 1. Demographic Characteristics of the patients**

Variables	Frequency	Percent (%)
Age Group (years)		
25-29	5	33.33
30-34	4	26.67
35-39	4	26.67
40-44	1	6.67
45-49	1	6.67
Gender		
Male	1	6.67
Female	14	93.33

**Table 2. Distribution of site of cannula fracture**

Site	Frequency	Percent (%)
Cubital fossa	10	66.67
Forearm	3	20.00
Neck	2	13.33

One-third 5 (33.33%) of the patients were aged 25-29 years, while only 1 (6.67%) was in the 40-44 years and 45-49 years group respectively. Most 14 (93.33%) were females. This is shown in [Table 1](#). [Table 2](#) showed the site distribution for the fractured intravenous cannula. The cubital fossa was the most common site 10 (66.67%), while 3 (20%) and 2 (13.33%) were in the forearm and neck respectively. As shown in [Table 3](#), 13 (86.67%) patients had a longitudinal venotomy and vein repair with

Prolene 7/0, while 2 (13.33%) had longitudinal venotomy and ligation. Eight (53%) of the retrieved fractured segments were identified by finger palpation, four (26.6%) were with the aid of ultrasound scan, while the migrated three (20%) could not be identified. The outcome of interventions is displayed in Table 4. Of the 15 patients, 12 (80%) had successful retrieval of the fractured distal segment, while 3 (20%) experienced unsuccessful retrieval with migration of the fractured segment.

The procedure for the retrieval of fractured peripheral intravenous cannula identified by palpation before retrieval in two patients is displayed in Figure 1. The proximal and retrieved distal segments of a fractured peripheral intravenous cannula from two different patients is shown in Figure 2.

**Table 3. Interventions Carried Out**

Intervention	Frequency	Percent (%)
Venotomy and vein repair with Prolene 7/0	13	86.67
Venotomy and ligation	2	13.33

**Table 4. Outcome of Interventions**

Outcome	Frequency	Percent (%)
Successful Retrieval of fractured distal segment	12	80
Unsuccessful Retrieval with migration of fractured segment	3	20



**Figure 1.** Operative sessions for two different patients with the fractured peripheral intravenous cannula segments sticking out just before retrieval



**Figure 2.** Proximal and retrieved distal segments of a fractured peripheral intravenous cannula from two different patients

### 4. Discussion

Peripheral intravenous cannulation is a common procedure in medical practice, with the possibility of fracture and eventual retention of broken parts in veins considered a rarity [4]. A total of 14 females and 1 male had PIC fracture in this study. The predominant age group was 25-29 years (33%) as seen in this study, while the oldest age was 49 years. Similarly, Isiguzo et al<sup>1</sup> also reported a 33% incidence of PIC fracture among the 25-29 years age group at a tertiary hospital in Southeast Nigeria. However, cases of PIC fracture had been reported to occur at all age groups. Furthermore, PIC fracture had been reported in patients as young as 30-month-old, and as old as 76 years [3,5,6,13].

PIC fracture can occur at any insertion site within the body; however, the major site in this study was the Cubital fossa with 66% of reported fractures occurring at this site. This is the highest documented incidence among several case series previously reported. Similar findings were observed by Isiguzo et al [1], Ezeah et al [5], Kumar et al [11], Masood et al [4], and Singh et al [12], who all reported fractures at the cubital fossa.

The least occurring site for the fracture in our study was the neck, as this was only observed in two of the cases. The main reason for this might be because the arms offer a



more comfortable position for cannula insertion, and the neck is only used in special situations. Moreover, thirteen of our cases were women who were to undergo caesarean section, thus the most common site for cannula insertion in these cases were the arms. However, the jugular vein seems to be the most widely used area in the neck for cannula insertion. Reports from Gunawardena and Gunawansa [13], Mishra et al [15], and Syeda et al [16] had all shown the occurrence of PIC fracture at the jugular veins of the neck.

Inexperienced insertion technique, several failed attempts at cannulation and structural defect of the cannula have been reported to cause PIC fractures [14]. Similarly, intravenous cannulations carried out under emergencies are at higher risk of resulting in complications [11]. Another factor that may cause cannula fracture is the continuous attempt to remove the device by the patient [5]. However, in this study all the 16G cannula that were fractured were from the same manufacturer, which further raised suspicion about the integrity of the cannula. The incidence of cannula fracture drastically reduced when another brand of cannula was used. Hence, it was evident that cannula integrity was also a risk factor for PIC fracture.

Currently, there is no standardized protocol for retrieving intravenous fractured cannula [3,4]. Although the first principle is to quickly locate the fractured cannula by clinical examination to forestall embolization at the proximal site [5]. Failure of clinicians to detect the fractured segments is an indication for radiologic techniques. In this study, eight of the cases were identified by finger palpation, four were diagnosed using radiologic technique, specifically ultrasound, while three cases could not be identified due to migration of the fractured segments. In all twelve cases where the fractured segments were detected, venotomy under local anaesthesia was conducted with the successful removal of these fractured segments. Although all the cases were fractured segments of 16G cannulae, this technique agrees with other authors who had successfully used venotomy to retrieve 23G and 17G cannulae [13,17]. In other literatures, other types of surgical techniques such as Z-Plasty Incision [5], novel J-Flap technique [1], surgical incision and phlebotomy [15], have all been described for retrieval of fractured cannula segments.

The outcome of retrieval was quite good, as all fractured segments diagnosed by palpation and ultrasound were successfully retrieved, giving an 80% success rate. As observed in this study, early presentation and detection contributed to the successful retrieval of fractured cannula. This agrees with the findings of Freiberg et al [8], Gunawardena and Gunawansa [13] that delayed detection of fractured cannula fragments increases the risk of migration, complications and even death. Despite the 80% success rate, none of the patient had severe complications associated with intravenous cannula fracture. Furthermore, this outcome is like the study by Isiguzo et al [1] who reported a 100% successful retrieval rate and no complications in his case series.

## 5. Conclusion

Though, technical error during insertion could be a contributing factor, the quality of the cannula in this study appeared to have contributed more to the increased rate of cannula fracture as the rate reduced drastically when the brand of peripheral intravenous cannula was discontinued. However, timely detection, reporting and intervention were key to successful retrieval as the few that migrated were observed among those that presented late.

## ACKNOWLEDGEMENT

We would like to acknowledge all the patients who despite the discomfort agreed to take part in the study.

## Funding

No funding sources.

## Conflicts of Interest

The authors have no conflicts of interest to declare.

## References

- [1] Isiguzo C, Opara C, Uzoho A, Opara K. Management of accidental fracture and embolization of intravenous cannula in peripheral veins using a novel J-flap technique: A case series. *Niger J Clin Pract* 2023; 26: 832-836.
- [2] Rivera AM, Strauss KW, Van Zundert A, Mortier E. The History of Peripheral Intravenous Catheters: How Little Plastic Tubes Revolutionized Medicine. *Acta Anaesth Bel* 2005; 12271-12278.
- [3] Adeosun PO, Abdulazeez AT, Okeke UI, Ehinmosan OE, Eze EG. CT-guided retrieval of a fractured intravenous cannula in a toddler: A case report. *Afr J Emerg Med* 2020; 10 (4): 277-280.
- [4] Masood A, Malik M, Khan M. A Foreign Body in the Cephalic Vein: Broken Piece of Intravenous Cannula. *Cureus* 2021; 13 (10): e18813.
- [5] Ezeah I, Nweke CM, Adejumo AO, Junaid AO, Ige OO. Seek and You Shall Find- Retrieval of a Retained Fractured Intravenous Cannula by Z-Plasty Incision: A Case Report. *Annals Afr Surg* 2023; 20 (1): 37-41.
- [6] 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: 296-299.
- [7] Khadim MF, Leonard D, Moorehead RA, Hill C. Back to basics: iatrogenic intravenous cannula embolus. *Ann R Coll Surg Engl* 2013; 95 (7): 110-111.
- [8] Freiberg DB, Barnes DJ. Fatal sepsis following peripheral intravenous cannula embolus. *Chest* 1992; 101 (3): 865-866.
- [9] Bloom A, Woolf Y, Cuenca A. Accidental embolization of an intravenous cannula in the upper limb: retrieval following computed tomography localization, *Eur J Emerg Med* 1996; 3 (2): 106-107.
- [10] Song M, Wei M, Song Z, Li L, Fan J, Liu M. A foreign body in the cephalic vein: A case report. *Medicine (Baltimore)*. 2018; 97(25): e11144.
- [11] Kumar RR, Ranjan P. Case report: iatrogenic fracture of intravenous cannula during removal with proximal migration. *Int J Surg Case Rep* 2020; 76: 562-565.

- [12] Singh A, Kaur A, Singh M, Kaur S. CT Guided Removal of Iatrogenic Foreign Body: A Broken Intravenous Cannula. *J Clin Diagn Res* 2015; 9 (9): 28-29.
- [13] Gunawardena RMTM, Gunawansa N. Intravenous Fracture of a Peripheral Cannula: A Rare Complication of Peripheral Cannulation. *J Case Rep* 2020; 10: 107-109.
- [14] Khoo PJ, Tay KL, Jamaluddin AA, Gunasaker D. Self-inflicted and iatrogenic peripheral intravenous cannula fracture: A case report. *Ann Med Surg (Lond)* 2018; 33: 44-46.
- [15] Mishra S, Vijayan PA, Chandan GS, Sarada PP. Fracture of Intravenous Cannula in External Jugular Vein: A Case Report. *Int Res Med Health Sci* 2020; 3 (3): 1-5.
- [16] Syeda SN, Ketana VRR, Muntimadugu BT, Jaju MR. Management of Fractured Peripheral Venous Cannulae: A Case Report of Two Cases and Review of Literature. *SN Compr Clin Med* 2021; 3 (3): 1-4.
- [17] Karunathilaka C, Wijesundara V, Madushanka N. Intravenous Fracture of a Peripheral Cannula at the Dorsum of the Hand in a Patient Who Used Walking Aids after Surgery. *Open J Orthoped* 2021; 11: 146-152.



© The Author(s) 2024. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).