

CASE REPORT

Retained Fractured Fragment of A Central Venous Catheter: A Minimally Invasive Approach to Safe Retrieval

Mohammed Hamad¹, Reynu Rajan¹, Nik Kosai¹, Paul Sutton², Srijit Das³, Hanafiah Harunarashid¹

ABSTRACT

BACKGROUND: *Complication following fracture of a central venous catheter can be catastrophic to both the patient and the attending doctor. Catheter fracture has been attributed to several factors namely prolong mechanical force acting on the catheter, and forceful removal or insertion of the catheter.*

CASE DETAILS: *In the present case, the fracture was suspected during the process of removal. The tip of the catheter was notably missing, and an emergency chest radiograph confirmed our diagnosis of a retained fracture of central venous catheter. The retained portion was removed by the interventional radiologist using an endovascular loop snare and delivered through a femoral vein venotomy performed by the surgeon.*

CONCLUSION: *Endovascular approach to retrieval of retained fractured catheters has helped tremendously to reduce associated morbidity and the need for major surgery. The role of surgery has become limited to instances of failed endovascular retrieval and in remote geographical locations devoid of such specialty.*

KEYWORDS: *Central venous catheter, fracture, endovascular, interventional radiology*

DOI: <http://dx.doi.org/10.4314/ejhs.v26i1.14>

INTRODUCTION

Werner Forssman first reported the insertion of a central venous catheter (CVC) almost 86 years ago. Thirty years later, introduction and wide spread use of the Seldinger technique made the procedure safer and easily reproducible (1). Patients with end stage renal impairment are often the most common subset of patients whom require insertion of central venous catheters. The catheter acts as a hemodialysis access point pending creation of a more permanent arterio-venous fistula (AVF). It is also inserted in patients presenting with blocked AVF, for the purpose of emergency hemodialysis (2). Central venous catheter related complications can be classified into mechanical events, infection and venous

thrombosis (3). Since the first report of an embolised catheter fragment in 1954, overall complication rates have remained low and are only reported to occur in less than 1% of cases. Fractured catheters account for less than 0.1% of this total number (4). Prior to introduction of endovascular approach, retrieval of a fractured segment almost always required high risk open surgery such as thoracotomy (5).

Since the late 70's, combined endovascular and open approach has seen much success and gained popularity as first line treatment in the advent of a retained fractured central venous catheter (6). Limitation of the use of this approach would be in rural health care settings devoid of access to an interventional radiologist. We report

¹Department of Surgery, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur, Malaysia

²Institute of Translational Medicine, University of Liverpool, United Kingdom

³Department of Anatomy, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur, Malaysia

Corresponding Author: Nik Ritza Kosai, Email: nikkosai@yahoo.co.uk

our experience with a successful retrieval of a central venous catheter utilizing the combined endovascular and open approach.

CASE REPORT

A third year medical resident noticed an incomplete catheter tip post removal of a right subclavian central venous catheter in a 56 year old man diagnosed to have end-stage renal disease. The patient was otherwise well and did not complain of chest pain or shortness of breath. The catheter had been earlier used as a temporary access for hemodialysis pending maturation of a more permanent brachiocephalic arterio-venous fistula (AVF). During the visit to the nephrology outpatient clinic, it was decided that the AVF was ready for use and that the central venous catheter was no longer needed. Emergency chest radiograph was requested, and it confirmed the diagnosis of retained fractured central venous catheter (Figure 1). The case was discussed with the interventional radiologist, and a central venogram was performed to identify the exact location of the fractured segment and to plan for retrieval approach. The venogram noted the fractured catheter segment to lie at the junction of the right brachiocephalic vein and subclavian vein (Figure 2). Following discussion with the vascular surgeons interventional radiologists, decision was made to proceed with combined endovascular and open approach of retrieval. Under Image Intensifier guidance, a 15mm Amplatz GooseNeck® snare (ev3 Inc, USA) was inserted through the right femoral vein, and the fractured catheter fragment pulled-back all the way to the groin region. The surgical team then externalized the retrieved fragment through a femoral vein venotomy, all the while ensuring good proximal and distal control (Figures 3, 4). The venotomy site was then closed using non-absorbable sutures in the usual manner. The combined endovascular and open approach was successful with no complications noted. The patient was discharged the next day and continued with his hemodialysis through his matured brachiocephalic AVF.



Figure 1: Chest radiograph showing the right subclavian catheter prior to planned removal

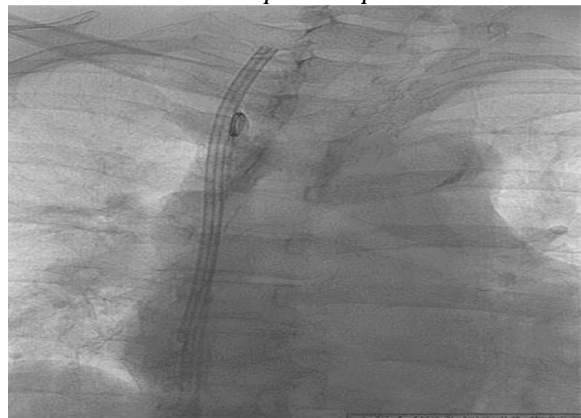


Figure 2: Retained portion of catheter seen on venogram



Figure 3: The tip of the retained part as being extracted from femoral vein via groin incision



Figure 4: *The fractured retained part of the catheter after being completely retrieved in one piece*

DISCUSSION

Central venous catheters are increasingly used worldwide in critically ill patients for administration of intravenous resuscitation fluids and medication, parenteral nutrition, chemotherapy agents, and monitoring of central venous pressure. They have become ubiquitous in the intensive care unit and are available as single and multi-lumen variety. Despite being a commonly performed procedure, it is not devoid of risks and complications. Mechanical complications include hemorrhage, pneumothorax, cardiac arrhythmias, malposition, catheter fracture and distant embolization of the fractured fragment into cardiac chambers or pulmonary artery. Infectious complications include thrombophlebitis and septic shock secondary to line related sepsis. Venous thrombosis and central vein occlusion have also been noted to occur with long-term central vein catheter placement (3,4).

The reported rate of intravenous catheter fracture is around 0.1% (6). Patients with a fractured catheter may remain asymptomatic or experience shortness of breath, chest pain and even syncope. Diagnosis is often incidental and made in the presence of a radiopaque fragment on routine chest radiograph. Incomplete catheter tip noted during the process of catheter removal may also give rise to clinical suspicion that would warrant further radiological confirmation. Mechanism of catheter fracture has been largely attributed to mechanical shearing forces acting on

the catheter over a prolonged period. This is more commonly seen in catheters inserted through the infraclavicular approach. Although it is a less popular approach, the supraclavicular technique is actually a safer option as it avoids many of the complications otherwise noted in the infraclavicular counter-part. Complications such as guide wire kinking, catheter compression and catheter fracture are less frequently seen in supraclavicularly placed catheters. The reason for the apparent superiority has been studied and linked to the coaxial lie of the catheter itself within the vessel, and absence of need to maneuver through narrow musculo-osseous spaces (7).

Besides being fractured, the retained portion of the catheter may also dislodge and embolise distally. Mortality rate associated with intravascular foreign body embolization has been reported to range anywhere from 24% to 60% (3,8).

Retrieval of retained intravascular devices may be approached through the conventional open technique or percutaneous method. To date, there are no consensus or clear guidelines for management of a fractured and retained central venous catheter. Over the years, endovascular approach to retrieval of such intravascular foreign bodies has been reported with much success (6). The lack of need for major open surgery has propelled its popularity due to the obvious reduction in overall morbidity and mortality. Patients who were subject to the endovascular approach were also able to assume normal activity of daily living sooner and experience early return to work. Given such positive results, conventional surgical approaches have been limited to instances of failed endovascular approach or in rural areas devoid of access to an interventional radiologist.

Percutaneous retrieval of intravascular foreign bodies was initially reserved for retained catheters and wire fragments. In recent years, the spectrum of intravascular device and objects has broadened significantly to include items such as vena cava filters, embolization coils, and endovascular stents. A wide variety of percutaneous tools have been reported to be successful in retrieval of retained intravascular devices. They include snares, biopsy forceps, Dormia baskets, and tip-deflecting wires (6). The Amplatz GooseNeck® snare (ev3 Inc, USA) used

in our patient is a nitinol based micro snare that has gained tremendous popularity over the years. The snare's super-elastic construction makes it less likely to be kinked or deformed during introduction into the vessel of choice. This feature makes it ideal for challenging intravascular foreign body retrieval. The snare catheter also contains Gold tungsten loops that provide excellent radiopacity for improved procedural precision (9).

Given the possible catastrophic complications following fracture of an intravascular catheter or device, it has become prudent to ensure that all cases of catheter fracture or retained catheter fragments are treated as an emergency situation that mandates prompt removal. Due to the superiority and good safety profile, percutaneous retrieval technique should be the treatment of choice (8). Loop snares such as the Amplatz GooseNeck[®] snare (ev3 Inc, USA) should be used when and if available. In the advent of failure to retrieve the retained catheter using a loop snare, the likelihood of success with other percutaneous tools is low, and open surgery should be considered (8,9).

Catheter fracture is a rare but dreaded complication of central venous catheter lines. Interns and junior doctors should be made aware of this condition. Early identification can save lives. Percutaneous retrieval by interventional radiologist should remain the preferred treatment modality. This, however, does not rule out the need for surgery in case of failed endovascular therapy.

REFERENCES

1. McGee DC, Gould MK. Preventing Complications of Central Venous Catheterization. *N Engl J Med*, 2003; 348(26):1123-33.
2. Kotsikoris I, Zygomalas A, Papas T, Maras D, Pavlidis P, Andrikopoulou M, Tsanis A, Alivizatos V, Bessias N. Insertion of central venous catheters for hemodialysis using angiographic techniques in patients with previous multiple catheterizations. *Eur J Radiol*, 2012; 81(9): 2270 – 72.
3. Bessoud B, de Baere T, Kuoeh V, Desruennes E, Cosset MF, Lassau N, Roche A. Experience at a Single Institution with Endovascular Treatment of Mechanical Complications Caused by Implanted Central Venous Access Devices in Pediatric and Adult Patients. *AJR Am J Roentgenol*, 2003; 180(2):527–32.
4. Oduntan O, Turner J. Empyema thoracis due to intrapleural migration of retained vascular catheter. *Ann Thorac Surg*, 2013;95(5):e123-5.
5. Milbrandt K, Beaudry P, Anderson R, Jones S, Giacomantonio M, Sigalet D.. A multiinstitutional review of central venous line complications: retained intravascular fragments. *J Pediatr Surg*, 2009; 44(5):972-6.
6. Gabelmann A, Kramer S, Gorich J. Percutaneous Retrieval of Lost or Misplaced Intravascular Objects. *AJR Am J Roentgenol*, 2001; 176(6):1509–13.
7. Muhm M, Sunder-Plassmann G, Apsner R, Kritzinger M, Hiesmayr M, Druml W. Supraclavicular approach to the subclavian/innominate vein for large-bore central venous catheters. *Am J Kid Dis*, 1997; 30(6): 802–8.
8. Bernhardt LC, Wegner GP, Mendenhall JT. Intravenous catheter embolization of the pulmonary artery. *Chest*, 1970; 57(4):329–32.
9. Yedlicka JW Jr, Carson JE, Hunter DW, Castaneda- Zuniga WR, Amplatz K. Nitinol gooseneck snare for removal of foreign bodies: experimental study and clinical evaluation. *Radiology*, 1991; 178(3):691–3.