Case report

Rupture along with fibrin clot occluding the middle port of the triple lumen catheter: an uncommon complication of central venous catheterisation

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Accepted 21 August 2019

SUMMARY

Central venous catheter (CVC) insertion is a commonly done procedure but associated with some potential complications. In our case, intraoperatively we placed a CVC into the right subclavian vein of the patient for a neurosurgical procedure. Subsequently, in the neurosurgical intensive care unit, on checking the patency of the CVC, only the distal and proximal lumens were working and no backflow of blood was detected from the middle port. A chest X-ray and ultrasound were done immediately, which did not reveal why the middle port was blocked. Later CVC was removed, and on examination of the catheter, we noted an intraluminal fibrin clot and a partial tear near the opening of the middle port. This is an uncommon complication of a CVC insertion that is catheter tear along with fibrin clot occluding the middle port of the CVC, which was detected in time and managed successfully.

BACKGROUND

Central venous catheter (CVC) insertion is a commonly done procedure in an emergency department (ED), operative room and neurosurgical intensive care unit (NSICU). CVC insertion is commonly indicated for fluid administration, haemodynamic monitoring and drug infusion. Although it is a safe procedure, complications with CVC insertion and use are also well known.^{1,2} These complications can occur at the time of catheter insertion and/or during catheter maintenance.¹ Catheter-related thrombosis (CRT) is also one of the known complications with a reported incidence of 14%–18%.² The usual symptoms of CRT are pain, swelling and tenderness at the catheter insertion site but many times they will not produce any symptoms at all. They are discovered usually when there is an inability to infuse or withdraw blood from one of the CVC ports. On the contrary, shearing of the catheter is a rare complication associated with the use of CVC.³ Here, we report a rare event wherein a combination of intraluminal fibrin clot along with partial tear near the middle port of a triple lumen CVC, which were noted simultaneously.

CASE PRESENTATION

A 50-year-old man was admitted to our centre after traumatic brain injury. He was intubated in the ED in view of poor Glasgow Coma Scale (GCS) (E1V1M4). There were no associated injuries, and

baseline investigations like complete blood count, ECG and chest X-ray were within normal limit. He was transported to the operative room and underwent decompressive craniectomy for bifrontal contusions. Intraoperatively, a 7.5 Fr triple lumen catheter (Certofix, B-Brown, Germany) was inserted in the right subclavian vein using anatomical landmark technique uneventfully. All the ports were checked for their patency and the distal port was used for central venous pressure (CVP) monitoring, the middle port was used for norepinephrine infusion and proximal port for fluid administration. The patient had 1500 mL blood loss and was adequately resuscitated with blood and blood products, and norepinephrine was started intraoperatively to maintain the blood pressure during the operative period.

The patient was transported to NSICU after surgery. Mechanical ventilation was initiated for further management. Infusion through the central line continued. After half an hour, a swelling was noticed on the right side of the neck surrounding the clavicle and extending from the entry point of the central line ([figure 1](#)). The infusions were immediately stopped and the patency of all the three ports was rechecked by aspiration of blood with a syringe half-filled with saline. The distal port (yellow) and the proximal port (white) were functioning well with adequate to and fro blood flow. On the contrary, the middle port (blue) could not be aspirated. Largely, forward flow was also absent through the middle port, with excess pressure, some amount of forward flow could be appreciated. Interestingly, there was no alarm of occlusion from the infusion pump that was connected to the middle port but the calculated volume of the drug to be infused was less than the set parameters.

An urgent ultrasound and chest X-ray showed a satisfactory position of the CVC but were not able to disclose the aetiology of the blocked catheter. On closer inspection, there was no local site haematoma but rather only diffuse oedema of the subcutaneous and muscle planes. In order to avoid any untoward effects from a malfunctioning CVC, we decided to take the central line out. After removal of the catheter on examination, a well-formed fibrin clot in the lumen and the circumference of the middle port (opening) that was acting as a one-way flap valve and perhaps causing the partial obstruction of the middle lumen of the catheter was observed

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To cite: Burman S, Kumar N, Goyal K, et al. *BMJ Case Rep* 2019;**12**:e231290. doi:10.1136/bcr-2019-231290

Figure 1 Swelling near the entry site of the central venous catheter (CVC).

Figure 2 Rupture and fibrin clot near the middle port of central venous catheter (CVC).

([video 1](#)). Additionally, a partial shearing near the opening of the middle port was also noticed in the axial plane ([figure 2](#)). It was not a complete breakage, that is, the distal portion of the catheter was still attached to the main body of the catheter. A new CVC was inserted in the right internal jugular vein (IJV) under ultrasound guidance uneventfully.

INVESTIGATIONS

So we investigated the case by doing aspiration of the catheter lumens; chest X-ray and ultrasound.

DIFFERENTIAL DIAGNOSIS

The possible differential diagnosis for such case could be catheter obstruction, catheter thrombosis, malpositioning of the catheter, catheter tear and catheter embolisation.

TREATMENT

The malfunctioning CVC was removed and a new CVC was inserted in the right IJV under ultrasound guidance uneventfully.

Video 1 Saline flush to check the patency of each port of the triple lumen central venous catheter (CVC) (showing blocked middle port whereas proximal and distal port is still patent).

OUTCOME AND FOLLOW-UP

After a short stay in NSICU, elective tracheostomy was performed in view of the requirement of long-term mechanical ventilation due to poor GCS. Later the patient was transferred to the ward for further management in a haemodynamically stable condition.

DISCUSSION

CVC is a commonly done procedure in an operation room and associated with some complications.^{4,5} Subclavian, internal jugular and femoral are the most commonly selected veins for the placement of CVC. These devices are very useful for intravenous fluids and drug delivery as well as blood sampling and CVP monitoring. The incidence of complication depends on many factors including the site of cannulation, procedural settings and operator experience. The complication associated with CVC insertion may be at the time of insertion and/or during maintenance. Immediate complications include artery puncture, haematomas, pneumothorax and nerve injury. Similarly, some of the delayed complications are infection, thrombosis and catheter malposition.⁶ Complication related to the catheter includes kinking, knotting, occlusion, thrombosis, fracture, shear and embolisation. CVC fracture is a rare but potentially a serious complication.^{7,8}

It is our usual practice to check all the ports of the catheter for its proper functioning (free aspiration of blood and flushing) before infusion of any fluid or blood. In our case, two ports were working and one port (middle) was not working because of occlusion. Since the diagnosis of such a case of catheter occlusion was very difficult with any of imaging modality, hence, it was decided to take out the catheter and examine it. On removal, the catheter showed a fibrin clot along with shearing of the middle port of the CVC.

CVC occlusion is a serious issue causing malfunctioning of the catheter.⁹ Most often we encounter scenarios when there is an inability to draw blood out of these catheters or it is difficult to push fluids through the ports. Based on this, there can be a complete obstruction, that is no forward or backward flow

Table 1 Causes of catheter occlusion (obstruction)⁹

1.	Catheter malpositioning or kinking
2.	Overtight suturing of the catheter
3.	Vessel wall abutting the catheter tip
4.	Pinch-off syndrome (compression of the catheter between the clavicle and first rib)
5.	Obstruction caused by drug infusion (inappropriate mixture can cause precipitation)
6.	Obstruction caused by infusion of lipids (fat emulsion) especially with total parenteral nutrition
7.	Fibrin sheath formation or intraluminal fibrin clot, catheter-related thrombosis

through the ports or there can be an incomplete obstruction, which is characterised by the ability to inject fluid through the catheter lumens with minimal resistance. Thrombotic complications are the most common cause of catheter-related complications during the maintenance phase. In most of the cases, an intraluminal fibrin clot acts like a one-way flap valve mechanism, which allows forward flow but prevents backflow as it happened in our case causing obstruction of the middle port.¹⁰ There are several other causes of CVC obstruction (table 1).⁹ CVC obstruction could be because on mechanical such as kinking or malpositioning of the catheter, inappropriate administration of incompatible drugs or total parenteral nutrition (TPN). In our case, TPN was not being administered through the central line instead vasopressor agent was being administered through the syringe pump.

There are also several possible mechanisms for producing catheter rupture. In our case, partial shearing of the middle port might have been caused by repeated negative pressure applied during the aspiration of blood to check its patency. As we were infusing vasopressor through the middle port via an infusion pump, another hypothesis is excessive pressure build-up near the opening of the blocked lumen of the middle port. This excessive pressure might have caused the rupture near the opening of the lumen of the middle port. Compression and damage of the middle portion of the catheter can also be caused by 'Pinch-Off-Syndrome'. It is characterised by the compression and narrowing of the lumen of the catheter as it passes in-between the clavicle and the first rib in the costoclavicular area.^{11 12} Mahadeva *et al*⁷ have mentioned some other causes of catheter rupture such as catheter damage by the tip of the introducer needle, bolus infusion causing high pressure damage within the lumen of catheter, forceful removal of a stuck catheter within the lumen of the vessel, movement of the tricuspid valve resulting in the weakening of the tip of the catheter, catheter compression between the clavicle and the first rib and body movement causing fracture of the external portion of the catheter.

Sometimes the CVC may be completely broken and the distal segment migrates distally (catheter embolisation) resulting in some serious complications such as arrhythmias myocardial perforation, tamponade, pericarditis and cardiac arrest. The distal segment may act as a foreign body that may result in thrombus formation.^{3 8}

Hence, in this case, we would like to highlight an uncommon scenario of catheter tear simultaneously with the fibrin clot of one of the port (middle) of a triple lumen catheter resulting in the occlusion and malfunctioning of the CVC.

Learning points

- ▶ A proper evaluation of each port of central venous catheter (CVC) should be ascertained before proceeding with its use.
- ▶ Catheter malfunction should be recognised at an early stage to prevent any catastrophe.
- ▶ Have a low threshold for investigation of catheter location when untoward events are noted.
- ▶ If there is a difficulty in removing the catheter, forceful extraction of the stuck catheter should be avoided.
- ▶ Adequate knowledge about the proper care and associated complications associated with the use of CVC should be well imparted to paramedical (nurses) staff handling the CVC.

Acknowledgements The authors would like to thank Dr Anuradha Yadav, MDS, Senior Resident, Department of OMR, CDER, AIIMS, New Delhi, India for her assistance in preparing the manuscript.

Contributors NK was involved in conception and design, acquisition of data, interpretation of data, revising it critically for important intellectual content and drafting the article; SB involved in conception and design and acquisition of data; AB interpreted the data and drafted the article; and KG gave final approval of the version and revised it critically for important intellectual content.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Next of kin consent obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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