

“Fishing for lines”: removal of endovascular catheters from the cardiovascular system

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ABSTRACT

We present two infants whose endovascular lines were accidentally cut or fractured, and had to be retrieved via transcatheter means in the cardiac catheterisation laboratory. The first case was a two-month-old infant with transposition of the great arteries, requiring an emergency balloon atrial septostomy. An indwelling vascular catheter that was placed in the right femoral vein was accidentally cut and had migrated into the inferior vena cava, before being retrieved. The second case was a one-week-old neonate who presented with pneumonia at birth, and had a long intravenous catheter placed in the left saphenous vein, which became fractured, and subsequently migrated into the heart. This case presented as a pulmonary embolus with haemodynamic instability, as the catheter had partially obstructed the right ventricular outflow tract. This was later retrieved via transcatheter means.

Keywords: endovascular catheter complications, endovascular catheter removal, indwelling venous catheters, snare, transcatheter retrieval

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INTRODUCTION

Critically-ill newborns and young infants often require the placement of peripherally-inserted central venous catheters (or central lines). These can occasionally fracture, or be accidentally released into the cardiovascular system, necessitating surgical removal of these fragments. Transcatheter removal of these embolised materials may preclude the need for surgery. There have been reports of removal of these lines via transcatheter means.⁽¹⁻⁶⁾ We report two such similar cases with one catheter lodged in the infundibular region, presenting as a pulmonary embolus with haemodynamic instability.

CASE REPORTS

Case 1

A two-month-old Malay male infant was noted to

have cyanosis on the first days of life, and required ventilation at a neighbouring hospital and the use of quadruple intravenous inotropes consisting of adrenaline, noradrenaline, dopamine and dobutamine infusions, because of perceived shock. Because of severe cyanosis and vascular instability, a congenital cyanotic heart was also suspected, and at the same time, the child was managed for severe sepsis. The patient was then transferred to our care for a cardiological opinion. An echocardiogram revealed a simple transposition of the great arteries (TGA) and a closed foramen ovale – the combination of a parallel circulation TGA with a closed foramen did not allow exchange of blood between the right (deoxygenated blood) and left (oxygenated blood) sides of the heart, hence causing the child to become severely cyanosed and acidotic (shock-like presentation).

At that point, an emergency balloon atrial septostomy (BAS) was performed in our general intensive care unit as it was felt that optimal care could be rendered there (this consensus was reached after a long discussion with the paediatrician in charge of the neonatal unit). The procedure was unencumbered, with the approach through the right femoral vein using a 22G cannula, and then inserting a guidewire through that into the inferior vena cava (IVC), followed by dilations with a 5F arterial sheath, and finally, inserting a 7F arterial sheath. A Miller balloon atrial septostomy catheter was introduced and passed from the IVC into the right atrium, and with manoeuvring of the 7F arterial sheath, the BAS catheter crossed an unfavourable septum secundum via the foramen ovale. The size of the atrial septal defect created was only 2 mm even after four attempts, and it was subsequently dilated to 4 mm using the Maverick® (4 mm) coronary angioplasty balloon catheter (Boston Scientific, Natick, MA, USA). The patient made remarkable progress thereafter, and was weaned from all inotropic support over the next 36 hours, but was ventilated for five days because of pneumonia and nosocomial sepsis.

Following extubation, the stormy course of this patient became even more difficult, when a 22G central venous catheter, inserted via the left femoral vein and secured by sutures, was accidentally cut during its removal, leaving the catheter in the IVC (Fig. 1a). The

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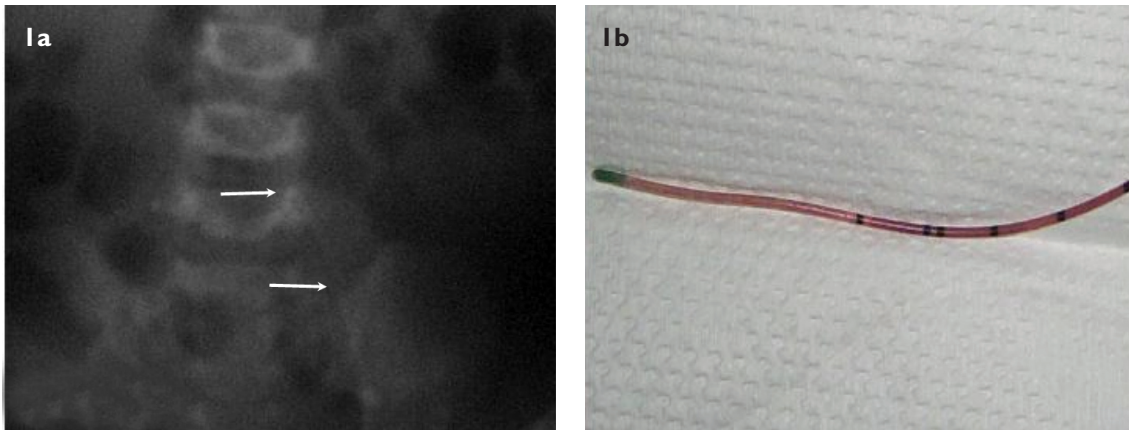


Fig. 1 (a) Abdominal radiograph shows the intravenous catheter in the inferior vena cava and left femoral vein (arrows). (b) Photograph shows the intravenous catheter retrieved from the two-month-old infant in Case 1.

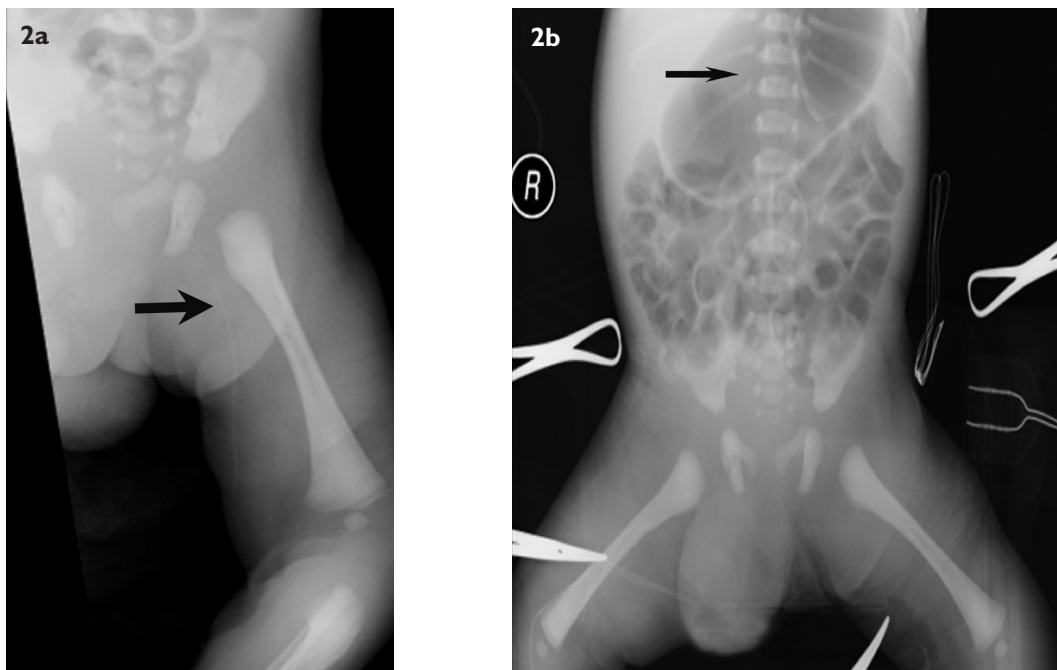


Fig. 2 (a) Radiograph of the left leg shows the migration of the intravenous catheter (arrow) into the femoral region. (b) Abdominal radiograph of the neonate in Case 2 shows the thin outline of the migrating intravenous catheter (arrow) in the inferior vena cava.

patient then underwent an emergency snare procedure to remove the remains of the venous catheter from the IVC via a 4-mm 4F goose neck loop snare. The catheter was successfully retrieved (Fig. 1b), and the patient was then flown to the National Heart Institute and operated on.

Case 2

A one-week-old Chinese male neonate was admitted at birth for ventilation because of congenital pneumonia. A long indwelling venous catheter, which was inserted for antibiotics in the left saphenous vein at the ankle, was fractured due to pinching of the catheter hub on the catheter line (Fig. 2a). The patient was referred to our

surgical colleagues, but as no surgical operating theatre was immediately available, the line migrated, and a cut-down of the femoral vein was not fruitful. A radiograph of the abdomen, taken in the operating theatre, revealed that the catheter had migrated into the IVC (Fig. 2b). Hence, an emergency cardiac catheterisation was arranged. By the time the patient was prepared for the cardiac catheterisation laboratory, the line had migrated into the right ventricular outflow tract (RVOT). Being flexible, the line had most likely coiled around itself and had lodged in the RVOT, blocking blood flowing from the right ventricle into the pulmonary trunk (Fig. 3a), thus mimicking a pulmonary embolus, with decreasing oxygen saturations (SaO_2) to 25%,

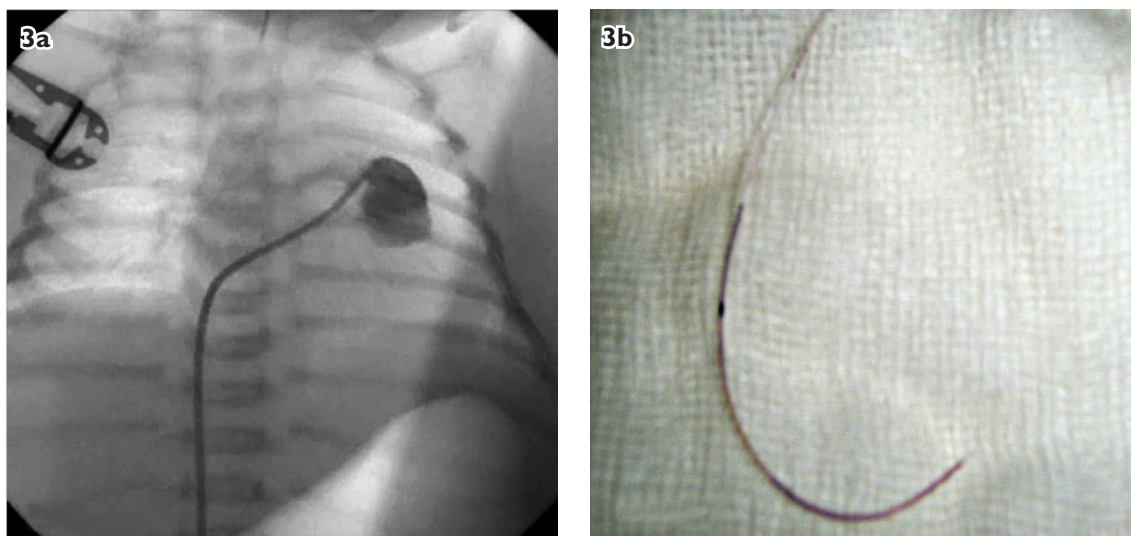


Fig. 3 (a) Angiogram taken in the anteroposterior view shows a partial obstruction of the right ventricular outflow tract. The broken catheter is thin and only partially radiopaque; hence, it is not easily seen with the contrast medium injected. (b) Photograph shows the intravenous catheter retrieved from the neonate in Case 2.

an increasing heart rate of up to 180 beats/min, and a decreasing blood pressure measured from an upper limb neonatal cuff (set at intervals of five minutes). A right femoral venous puncture was achieved rapidly and a 5F sheath was inserted, followed by a 5F multi-purpose catheter that was quickly placed in the RVOT where a contrast agent was injected, demonstrating an almost complete occlusion (Fig. 3a). With the aid of a J-shaped Terumo® glidewire (Terumo Corporation, Tokyo, Japan), the detached line was pushed into the left pulmonary artery. The patient's SaO₂ increased to 98%, heart rate decreased to 120 beats/min, and blood pressure normalised. We then successfully retrieved the line using a 4-mm 4F goose neck loop snare, from the left pulmonary artery (Fig. 3b).

DISCUSSION

Catheter fracture may be related to tearing of the catheter during insertion or traction and/or pinching of the catheter hub junction, allowing fatigue of the catheter material and subsequent dislodgement.⁽²⁾ Prolonged use can also lead to fatigue and subsequent fracture and displacement. In our two cases, it was accidentally cut in the first case, while fracture of the catheter (due to pinching of the hub on the catheter line, with resultant fatigue, leading to fracture of the line on removal) occurred in the second case. Hence, fractures and accidental dislodgement of indwelling catheters occur, but the incidence is relatively rare, being about 1%,⁽³⁾ thus accounting for insufficient data documenting the consequences of such accidental displacement into the cardiovascular system. These instances are rare when

compared with other catheter-related complications, of which sepsis seems to be the most common.⁽⁴⁾

However, it is possible to speculate one of the following consequences, based on the type of catheter and the location of the embolised material:^(1,5,6) (1) It can rest and be retrieved from either the superior or inferior vena cava, where perforation of the vessels remains a possibility. (2) It could become a nidus of infection, regardless of where it may be lodged in the system. (3) It may travel into the atrium or ventricle, and possibly cause fatal arrhythmias. (4) It may perforate the heart at the site of the enlodgement, leading to cardiac tamponade. (5) It may perforate the valvular structures causing regurgitation, but given the current trend of Silastic materials, this would be rather unlikely. (6) It may act like an embolus, causing an infarction of the tissues where it finally comes to rest or, as in our second case, it may become entrapped in the RVOT, simulating pulmonary embolism. (7) It may remain dormant for years.⁽¹⁾

These possibilities, except for pulmonary embolism, have been described in various reports, and in our two patients, one was retrieved from the IVC without major consequences, while in the second case, the catheter, after failing to be retrieved surgically, presented as though pulmonary embolism had taken place, with resultant haemodynamic instability and decreased oxygenation. At catheterisation, it was found to be lodged in the RVOT and tricuspid apparatus, hindering blood flow into the pulmonary circulation. Because of the marked instability of the neonate, the catheter was pushed with the aid of a Terumo® glidewire beyond the RVOT and

the pulmonary valve, until it lodged in the left branch pulmonary artery, thus allowing haemodynamic stability and providing us with time to retrieve it, although with greater difficulty. In conclusion, embolised lines can occur, but this can be prevented by caring for the line, which should involve visualisation of the catheter hub over transparent holding materials, such that “kinking” of the catheter is avoided, and thus decreasing the risk of material fracture and embolisation. Embolised material can be quite safely retrieved via a goose neck loop snare, and presents an attractive alternative to surgical removal of these devices.

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