

Percutaneous transcatheter retrieval of intracardiac central venous catheter fragments in two infants using Amplatz Goose Neck snare

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Central venous catheter (CVC) fracture with embolization is a serious and rare complication, and few cases have been reported in children. Catheter fragments may cause cardiac perforation, arrhythmias, pulmonary embolism, and sepsis. We report the successful retrieval of intracardiac CVC fragments by percutaneous transcatheter technique in two infants, aged 8 and 15 months. Double-lumen 7 French Hickman CVCs were accidentally fractured during their removal. Chest radiographs of the two patients revealed migrated intracardiac catheter fragments extending from the superior vena cava (SVC) to the right atrium and from the SVC to the right ventricle, respectively. The procedure was performed under ketamine anesthesia and fluoroscopic guidance using a percutaneous femoral vein approach. Nitinol Amplatz Goose Neck™ snares (10 mm in diameter) were used to successfully retrieve the catheter fragments without any complication. Percutaneous transcatheter retrieval of catheter fragments using Goose Neck snare is a safe and successful technique and can be chosen before resorting to surgery, which has potential risks related to general anesthesia, thoracotomy and cardiopulmonary bypass.

Key words: catheter fracture, dislodged catheter, percutaneous retrieval, transcatheter retrieval, goose neck snare.

Central venous catheters (CVCs) have been widely used as a route for administration of chemotherapy, total parenteral nutrition, transfusion of blood products, and blood sampling. Major complications include infection, thrombosis, arrhythmia, and embolization.

Catheter fracture with embolization is a serious and rare complication and few cases have been reported in children¹⁻⁵. Management of dislodged CVCs includes percutaneous transcatheter retrieval, open thoracotomy retrieval and oral anticoagulant therapy. Among these techniques, percutaneous transcatheter retrieval is an easy, safe and efficient method.

We report the successful percutaneous transcatheter retrieval of dislodged intracardiac CVC fragments in two infants. The literature was also reviewed for clinical features of catheter dislodgement, mechanisms responsible for

catheter fracture, nonsurgical techniques for catheter retrieval, and the success rates and complications of percutaneous transcatheter retrieval technique.

Case Reports

Case 1

An eight-month-old infant with body weight of 7 kg was admitted with complaints of bloody diarrhea and seborrheic skin lesions at two months of age, and was diagnosed as Langerhans' cell histiocytosis by skin and colon biopsy. After three months of systemic chemotherapy and remission of the disease, a double-lumen 7 French (F) Hickman CVC (Bard Access Systems; Salt Lake City, USA) used for chemotherapy was accidentally fractured during its removal from the skin. The patient was asymptomatic; however, serial

chest radiographs demonstrated migration of a 7 cm radiopaque CVC fragment from the right subclavian vein to the superior vena cava (SVC) (Fig. 1a). Echocardiography showed that the distal tip of the catheter fragment was in the right atrium (RA), oriented towards the tricuspid valve (Fig. 2a).

Case 2

A 15-month-old infant with body weight of 8 kg was referred to our hospital for bone marrow transplantation with diagnosis of severe combined immunodeficiency at five months of age and had successful engraftment after the third haplo-identical peripheral stem cell transplantation at nine months. Double-lumen 7F Hickman CVC used for central venous access for 10 months was accidentally fractured during its removal. The patient had no symptoms. Chest radiograph demonstrated a migrated 7.5 cm radiopaque CVC fragment extending from the SVC to the right ventricle (RV) (Fig. 1b). Echocardiography showed the distal tip of the catheter fragment was in the RV, passing through the tricuspid valve (Fig. 2b).

The patients were discussed and percutaneous transcatheter retrieval technique was chosen before surgical modalities. Informed consents were obtained from the families. The procedure was performed under fluoroscopic guidance. Antibiotic (cefazolin, 50 mg/kg, intravenous [i.v.]) was administered. 6F and 7F femoral sheaths were placed in the two patients, respectively, in the right femoral vein. Ketamine

(1 mg/kg/dose, i.v.) was used for sedation and repeated if further sedation was necessary. A 10 mm in diameter nickel-titanium (nitinol) Amplatz Goose Neck™ snare (Microvena Co; White Bear Lake, MN) was advanced from an Amplatz Goose Neck™ snare catheter (Microvena Co; White Bear Lake, MN) to the RA. The proximal tip of the catheter fragment was encircled with the snare and the snare was then slid over the fragment to the distal end, which was successfully captured using anteroposterior views (Figs. 3a, 3b). The catheter fragment and snare were carefully pulled back until reaching the distal end of the femoral sheath (Fig. 3c). The retrieved catheter fragment and snare could not be introduced together into the femoral sheath in either patient; therefore, they were retracted gently from skin incision in the first patient and extracted by femoral vein dissection by cut-down technique in the second patient (Fig. 4). The total procedure times were 60 minutes and 45 minutes and fluoroscopy times were 9 and 8 minutes, respectively. After the procedure, patients were monitored, and chest radiographs and echocardiographic examinations were normal. No complications (arrhythmia, bleeding, vascular/cardiac perforation or local hematoma) were observed during or after the procedure.

Discussion

Catheter fracture with embolization is a serious and rare complication, and the incidence was reported to range between 0-4.1% in adult



(a)



(b)

Fig. 1. a) Chest X-ray of Case 1: the proximal tip of the central venous catheter fragment migrated from the right subclavian vein to the superior vena cava (SVC) and the distal tip was at the right atrium.
b) Chest X-ray of Case 2: the catheter fragment extended from the SVC to the right ventricle.

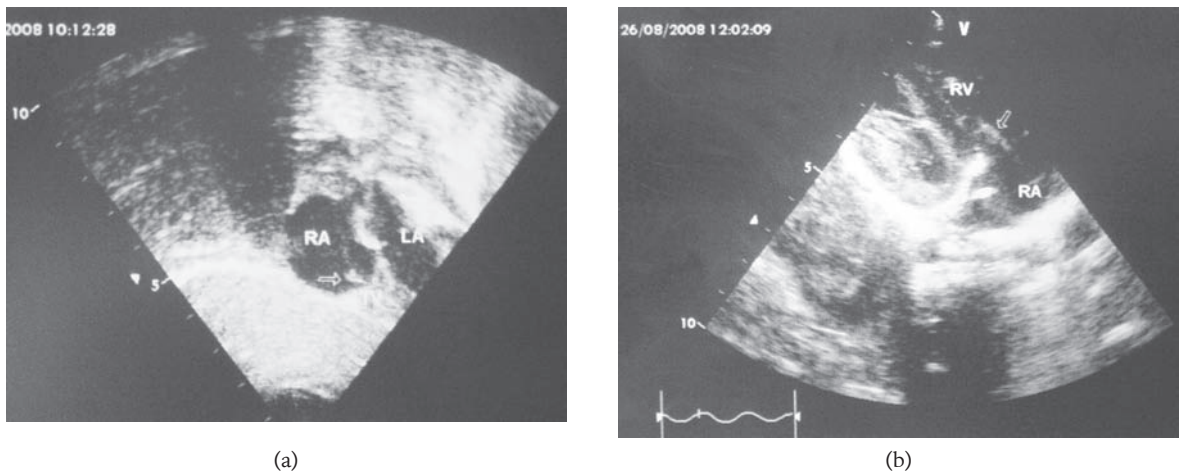


Fig. 2. Two-dimensional echocardiographic views in subcostal positions. a) Case 1, the distal end of the catheter fragment was at the right atrium (RA) above the tricuspid valve. b) Case 2, the distal end of the catheter fragment was at the right ventricle (RV), passing through the tricuspid valve (arrow indicates intracardiac catheter fragment).

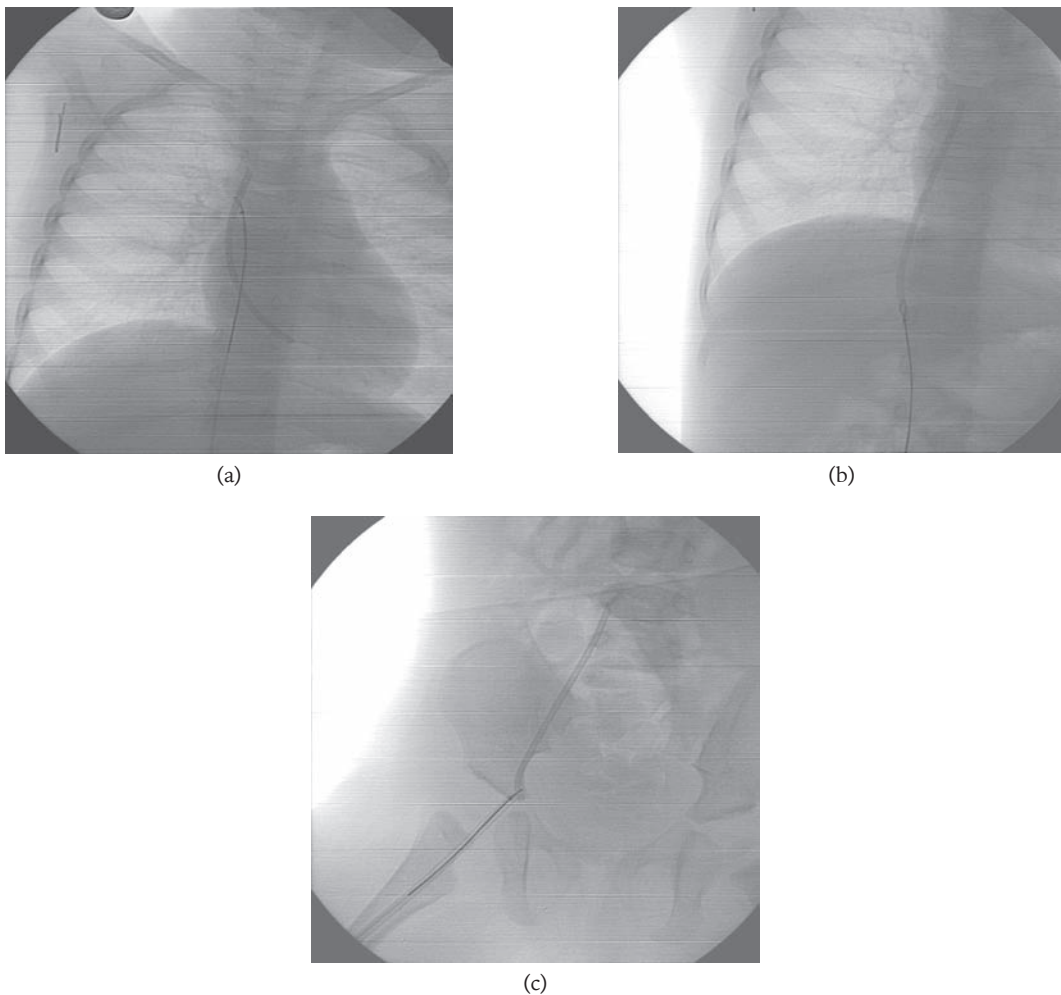


Fig. 3. Angiographic views during percutaneous transcatheter retrieval. a) The proximal tip of the catheter fragment was encircled with Amplatz Goose Neck™ snare. b) The distal tip of the catheter was captured with the snare. c) The catheter fragment and snare were pulled back until reaching the distal end of the femoral sheath.

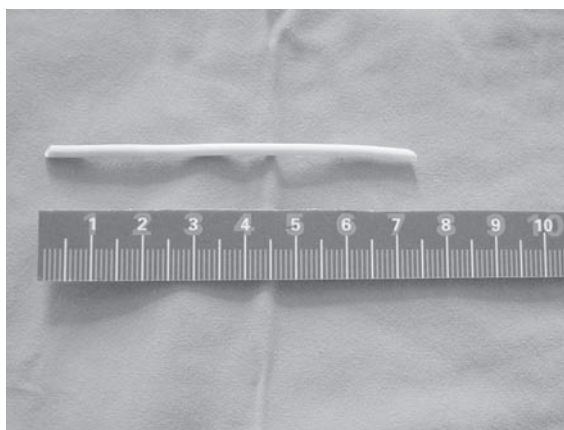


Fig. 4. Case 2: the retrieved 7.5 cm catheter fragment.

patients⁶⁻⁸. In children, few cases have been reported, and the exact incidence is unknown¹⁻⁵. Techniques for non-surgical retrieval of embolized foreign materials include loop-snare technique, helical basket, biopsy and bronchoscopic forceps, and hook guidewire^{9,10}. The use of baskets and forceps is limited in smaller patients as the required sheath size is large, baskets can not be guided, and forceps are unacceptably traumatic because of their rigid construction. Snare devices have been the most commonly preferred and widely used devices since the 1990s because of their safety, availability, flexibility, and simplicity of use. The loop-snare technique has high success and low complication rates¹⁰. Cheng et al.⁸ used loop-snare device in 71% (65/92) of the cases during percutaneous retrieval of CVC fragments in 92 adult cancer patients, and they reported a 3.3% complication rate and a 98% success rate.

Dislodgement of CVCs is caused by angulation or distortion at the anastomosis site of port and catheter, severing of the catheter during insertion and removal, improper catheter position, and fatigue of the catheter. The most common cause of catheter fracture is improper procedure handling. A pinch-off mechanism (compression of the catheter between the clavicle and the first rib) has been postulated for the deformed, fractured catheter resulting from repeated wear and tear of the surrounding musculoskeletal system^{8,11}. The most common complications of percutaneous retrieval technique were reported to be local hematoma formation and arrhythmias in adult patients^{8,10}. Bessoud et al.³ reported 95% success rate and no complications in the retrieval of 100 embolized catheters.

With early designs of loop-snare devices, the retrieval procedure was difficult, as the snares had a loop oriented in the same axis of the introducer catheter. In our cases, as the free ends of the catheter fragments were accessible, we used snare instead of pigtail or multipurpose catheter. The new nitinol Amplatz Goose Neck™ snare, which has increased strength and is oriented at a right angle to the introducer catheter, facilitated easy capturing when deployed¹⁰. No complications were observed during our experience. Our patients had no underlying conditions (neutropenia, anemia, thrombocytopenia, immunodeficiency). We suggest gentle and smooth retraction of the snare and catheter fragment from skin incision at the distal tip of the femoral sheath, if they could not be introduced together into the sheath. Use of a femoral sheath with a larger size than catheter French size may be preferred. Ketamine sedation may be preferred during the retrieval procedure.

Regardless of the low incidence, catheter fracture with embolization may cause fatal complications^{3,9}. Catheter fragments should be removed in most instances, and percutaneous transcatheter retrieval using loop-snare should be the technique of choice as it is safe and successful. Many children with dislodged and embolized CVCs have underlying conditions that make them poor candidates for surgical retrieval. Surgery under general anesthesia, thoracotomy and cardiopulmonary bypass increase morbidity and mortality. Therefore, percutaneous transcatheter technique for retrieval of embolized catheter fragments can be chosen before resorting to surgery.

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