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# Iatrogenic acute cardiac tamponade during percutaneous removal of a fractured peripherally inserted central catheter in a premature neonate

Zou Minghui, MD, Cui Hujun, MD, Ma Li, MD, Chen Weidan, MD, Cui Yanqin, MD, Chen Xinxin, MD *

*Department of Cardiovascular Surgery, Guangzhou Women and Children's Medical Center, No. 9 Jinsui Rd, Guangzhou 510623, PR China*

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ABSTRACT

Acute cardiac tamponade (ACT) is a life-threatening complication associated with a peripherally inserted central catheter (PICC) in premature neonates. We present a case of ACT in a 4-day-old male infant. On the second admission day, a PICC was inserted. After 2.5 months, chest radiography showed PICC fracture, and its distal portion had migrated into the right pulmonary artery. Percutaneous removal through cardiac catheterization was attempted. However, right ventriculography demonstrated intrapericardial spillage of contrast agents, and iatrogenic ACT was confirmed. Cardiopulmonary resuscitation (CPR) was immediately started with open-chest cardiac massage. Further surgical exploration revealed right atrial appendage perforation. After 25-min CPR, the patient restored spontaneous circulation, and removal of the foreign bodies was performed. The post-operative course was uneventful. PICC fracture is an uncommon complication, but may be life-threatening. Precaution should be taken to avoid ACT during removal of a broken PICC. Once the tamponade is diagnosed, immediate interventions are mandatory.


## Introduction

A peripherally inserted central catheter (PICC) is widely used in clinical settings[1–4] and has unique advantages in premature neonates, such as decreased pain caused by repeated venipuncture and infusion of high-concentration total parenteral nutrition. In most cases, use of PICC is relatively safe, but some complications may occur, such as catheter occlusion, catheter leakage, phlebitis, venous embolism, and infection,[5,6] as well as cardiac tamponade,[7] arrhythmia,[8] and catheter fracture,[9] which are rare.

Acute cardiac tamponade (ACT) is an urgent condition in a hospital setting. Most cases result from traumatic pericardial effusion, postoperative status of cardiac surgery, aortic dissection, and hemopericardium caused by cardiac rupture after myocardial infarction or iatrogenic factors.[10] Iatrogenic ACT is not rare, and the most common causes are interventional therapies such as percutaneous interventions, radiofrequency ablation, or cardioversion. A previous report included two cases of central venous catheter-associated ACT.[11]

The patient in the current report was a premature neonate who had a fractured PICC that drifted to the pulmonary artery resulting in iatrogenic ACT.

## Case report

A four-day-old infant male was admitted in the neonatal intensive care unit in our hospital on June 15, 2014, because of a low response at 4 days and jaundice at 2 days after premature delivery. The infant was born to a gravida 1, para 1 (G1P1) mother at a gestational age of 32 weeks and 1 day and weighed 1460 g at birth. On the second day of hospital admission, a 1.9 Fr × 65-cm single-lumen PICC (Becton, Dickinson and Company, NJ) was inserted through the median cubital vein of the patient. The broken distal portion of the PICC was approximately 25 cm, and the external portion was 6 cm. In the following days, the patient was administered routine PICC line care and rechecked with regular chest radiographs (CXR), which showed no displacement of the PICC line or PICC-related complications. At 2.5 months, a routine physical examination showed a bloodstain on the site of puncture. The PICC was fractured about 0.3 cm above the disc, and the broken end was not around the elbow. A CXR indicated that the PICC had drifted

*Abbreviations:* ACT, acute cardiac tamponade; BP, blood pressure; CPR, cardiopulmonary resuscitation; CXR, chest radiograph; ECG, electrocardiogram; HR, heart rate; OCCM, open-chest cardiac massage; PICC, peripherally inserted central catheter.

* Corresponding author. Tel.: +86 20 38076172; fax: +86 020 38076180.
*E-mail address:* zingerchen@126.com (C. Xinxin).

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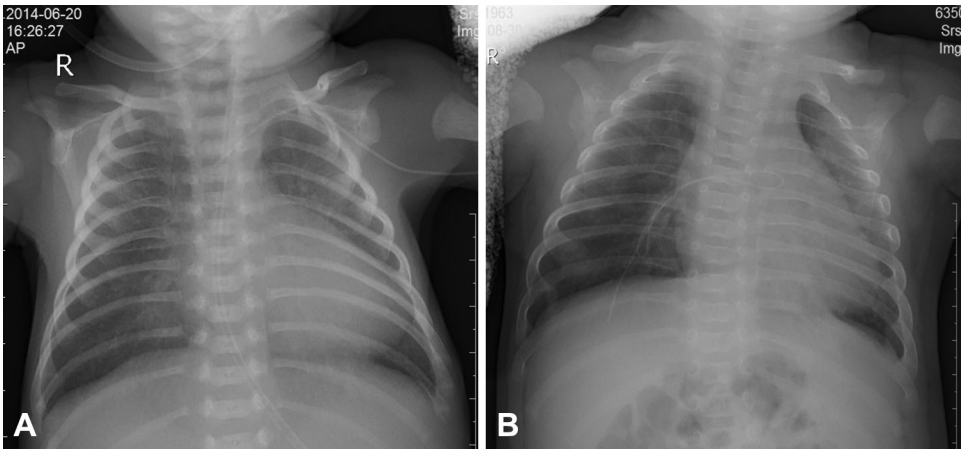


**Fig. 1.** Chest radiograph (CXR) of the patient. **A**. Posteroanterior CXR showing that the end of the PICC is at a normal site in the superior vena cava. **B**. The rechecked posteroanterior CXR revealing that the fractured end of the PICC has shifted into the right lower pulmonary artery.

into the right pulmonary artery, but the patient did not show any manifestations of pulmonary embolism. After consultation with the Department of Vascular Interventions, we decided to remove the broken part of the PICC through cardiac catheter intervention. During the surgery, the patient presented circulatory instabilities, and right heart ventriculography suggested intrapericardial spread of contrast agents. An electrocardiogram (ECG) showed a heart rate (HR) of 130 beats/min, blood pressure (BP) of 85/72 mm Hg, and saturation of peripheral oxygen at 95%. After considering all these data, the patient was diagnosed with ACT. However, over just a 3-min period, the patient's HR dropped drastically below 90 beats/min, and BP fell below the lower detection limit of the ECG monitor. Cardiopulmonary resuscitation (CPR) was immediately started, and a cardiovascular surgeon simultaneously performed an open-chest cardiac massage (OCCM). Pericardiotomy was performed immediately, after which a large amount of blood ejected out of the pericardial cavity. Further surgical exploration indicated a perforation on the right atrial appendage, and the region was sutured to stop the bleeding. After 25-min OCCM, the patient showed return of spontaneous circulation, with HR of 135 beats/min and BP of 75/50 mm Hg. Blood gas analysis indicated a pH of 7.25, $PO_2$ of 120 mm Hg, hematocrit of 15%, and a base excess of −13.2 mmol/L. The patient was transferred to the operating room for the removal of the broken part of the PICC from the pulmonary artery. After removal, the proximal portion of the broken PICC was 25 cm. The surgery was successful, and the patient recovered well (Figs. 1 and 2).

## Discussion

A PICC is an ideal for middle- and long-term intravenous infusion in premature neonates because of its advantages in terms of simplicity and a high success rate, long retention time, and easy fixation. A PICC may be retained for one year without complications; a PICC can be used for 390–575 days.[12,13] However, during the insertion and maintenance of PICC, some related risks pose a threat to premature neonates, including in vivo fracture of PICCs, which is regarded as a severe complication. Chow et al reported that among 1650 cases of PICC, 11 experienced PICC fracture, and the related risk factors included duration of placement, line blockage, and leakage at the insertion site.[9] Some other studies reported problems while catheter washing with high-pressure water, non-standardized fixation procedures, use of scissors during replacement of accessory tapes, and inappropriate extubation that led to PICC fracture.[14] As a result, the fractured PICC, similar to a thrombus, flows in the bloodstream to the heart chambers or pulmonary arteries, where it causes acute and severe complications. In these patients, the fractured PICC should be immediately removed. Because of its less

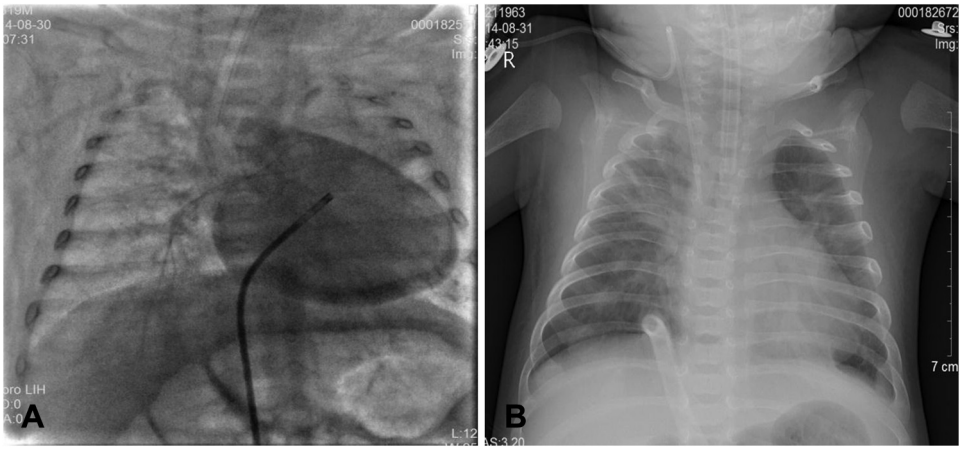


**Fig. 2.** **A**. Cardiac catheter interventional therapy showing flow of the contrast agents in the pericardial cavity, indicating cardiac rupture. **B**. On the first day after surgery, a posteroanterior CXR showing no part of the catheter remaining in the lung or mediastinum.