

## Case Report

# Subcutaneous Infection Resulting From the Migration of a Peripherally Inserted Central Catheter Into the Angular Vein



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## ABSTRACT

**Background:** Peripherally inserted central catheter (PICC) migration into smaller veins is rare, often recognized only when catheter dysfunction occurs or associated clinical complications manifest. This study aims to highlight subcutaneous tissue infections as an unusual complication of PICC migration in newborns.

**Case Presentation:** We report a case of a newborn male who experienced PICC migration into the angular vein after a prior successful repositioning. Factors contributing to this migration include anatomical variations in the venous system, left-sided catheter insertion, the need for mechanical ventilation due to persistent pulmonary hypertension of the newborn, and the potential influence of using a 2 Fr diameter PICC line.

**Conclusion:** Maintaining detailed documentation of the external catheter length and conducting regular imaging post-PICC placement is crucial, especially if the patient shows signs of catheter dysfunction or if unanticipated complications develop.

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## Introduction

**P**eripherally inserted central catheters (PICCs) play a vital role in infant care and necessitate long-term intravenous access. These catheters provide reliable medication administration, parenteral nutrition, and other essential therapies [1]. Despite their benefits, PICCs present several challenges. Catheter migration is one of the neonates' most frequently encountered complications [2]. The incidence of PICC migration in neonates ranges from 8% to 33%, with most migrations occurring within the first three days post-insertion [2, 3].

The use of highly flexible silicone PICCs and small-diameter PICCs is a catheter-related factor commonly associated with recurrent PICC migration. Additionally, short insertion length and use of the PICC for power catheter injections, changes in thoracic pressure, and vigorous movement of the upper extremities can contribute to catheter displacement [4]. Regular monitoring and imaging are strongly advised to ensure optimal catheter positioning during this critical window [2].

This study aims to present subcutaneous tissue infection as an atypical complication of PICC migration in newborns.

## Case Presentation

A male neonate was delivered via cesarean section at 39 weeks gestation. Following delivery, the infant exhibited a temperature of 36.9 °C, heart rate of 135 beats per minute, respiratory rate of 76 breaths per minute, blood pressure of 44/61 mm Hg, and oxygen saturation of 84%. An arterial blood gas analysis revealed metabolic acidosis. Immediate resuscitation efforts were initiated, including the placement of a tracheal tube due to critically low oxygen levels.

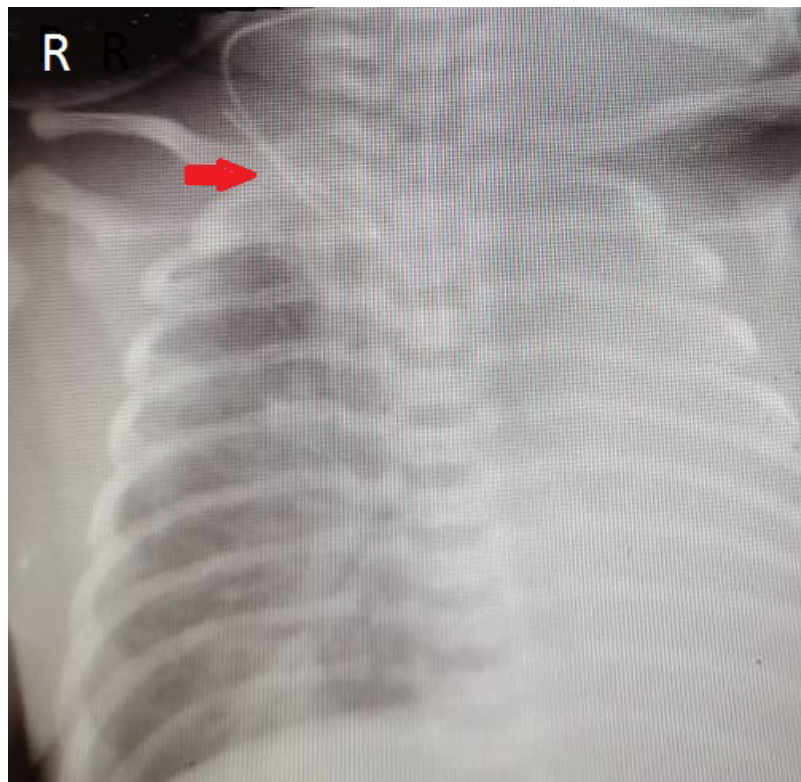
The echocardiographic evaluation suggested the presence of persistent pulmonary hypertension in the newborn (PPHN), prompting the administration of dopamine to support hemodynamics. The neonate required mechanical ventilatory support while receiving two doses of exogenous surfactant therapy and broad-spectrum antibiotic treatment. However, persistent tachypnea and ongoing oxygen desaturation necessitated transfer to a more specialized facility on day three of life for advanced care.

Upon admission to the tertiary care center, the infant was intubated, exhibiting an arterial oxygen saturation of 86% and a heart rate of 178 beats per minute. Physical examination revealed diminished breath sounds bilaterally. Pink discharge emanating from the tracheal tube was considered, and blood traces present in both the exchange and suction tubes were resolved, leading to improved oxygen saturation levels. Neurological assessment showed hypotonia and diminished reflexes, while other systemic evaluations were within normal parameters. Empirical antibiotic therapy was initiated with vancomycin, meropenem, and amikacin. Furthermore, milrinone and sildenafil were introduced along with ongoing dopamine therapy.

At six days of age, the infant's challenging venous access and requirement for intravenous nutrition necessitated the placement of a flexible PICC (2 Fr) into the left superficial temporal vein, secured at a depth of 16 cm by the nurse. A subsequent chest x-ray revealed that the catheter was twisted and did not advance into the superior vena cava (SVC) (Figure 1). Consequently, it was removed and reinserted later by the physician. An anterior-posterior chest radiograph confirmed proper PICC tip placement within the SVC, which was later verified using echocardiography.

Four days later, the patient was extubated and transferred to a DUOPAP mask for respiratory support. However, during the subsequent examination, the physician observed a 5 mm circular area of swelling and erythema at the inner canthus of the left eye, likely due to pressure from the facial mask. Consequently, the mask was discontinued, and supplemental oxygen was delivered via an oxygen hood.

Three days later, reevaluation indicated exacerbation of edema at the inner canthus, with cellulitis affecting the medial canthus. This region showed a white center and firm consistency, although eye movements remained unimpaired. An ultrasound revealed increased echogenicity and thickening of the subcutaneous fat without any fluid collection. Blood and wound cultures were obtained, the treatment regimen was adjusted to include topical mupirocin and empirical antibiotics were changed to amphotericin B, meropenem, and linezolid. Upon receiving the culture results, the blood culture was negative, while the wound secretion culture grew coagulase-negative *Staphylococcus*, which was sensitive to linezolid and vancomycin.

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**Figure 1.** Following the insertion of the PICC, the chest x-ray revealing the tip of the catheter twisted and not progressed into the SVC (red arrow)

PICC: Peripherally inserted central catheter; SVC: Superior vena cava.

The following day, an assessment revealed worsening swelling and necrosis in the medial canthus, accompanied by mild proptosis. This raised concerns regarding orbital cellulitis or potential necrotizing fasciitis. Consequently, antibiotic therapy was continued, and metronidazole was added to the regimen.

Despite ongoing antibiotic treatment, the patient exhibited no significant improvement until the tenth day. Hence, surgical debridement was performed, which resulted in the drainage of 2 CC of purulent material. Cultures and smears were obtained from these sites for microbiological analysis. Postoperatively, a CT scan demonstrated that the PICC catheter tip was improperly positioned within the inner canthus of the left eye, correlating with the observed wound. The PICC was subsequently removed, and a right angiocath was placed for ongoing medication.

Two days after the PICC was removed, a marked reduction in swelling around the left eye, cessation of discharge, and significant clinical improvement at the lesion site were observed. A follow-up CT showed no evidence

of abscess formation. Topical mupirocin treatment was continued during the recovery period.

By day twenty-five, the examination demonstrated appropriate granulation tissue formation around the lesion margins. The child exhibited substantial clinical improvement and no longer required supplemental oxygen. Consequently, all medications were discontinued, facilitating safe discharge planning.

## Discussion

In this case, an infection of the subcutaneous tissue developed. Ultrasound assessment was conducted on the sixth day following PICC implantation due to facial swelling, which showed increased echogenicity and thickening of the subcutaneous fat, suggesting inflammatory changes. On the subsequent day, pronounced swelling and necrosis at the medial canthus heightened the clinical suspicion of orbital cellulitis or necrotizing fasciitis. Orbital cellulitis and necrotizing fasciitis affecting the head and face in infants encompass a range of infrequent yet potentially critical skin and soft tissue in-

fections. In both clinical cases, bacterial cultures usually revealed gram-positive cocci, predominantly from the genera *Streptococcus* and *Staphylococcus*. Nevertheless, there may also be mixed infections, including gram-negative and anaerobic infections [5-7]. Our patient's blood culture was negative, while the wound secretion culture showed coagulase-negative *Staphylococcus*. However, the gradual onset of symptoms and lack of systemic signs of sepsis were inconsistent with the diagnosis of necrotizing fasciitis. As a result, empiric antibiotic therapy using a combination of antibiotics was initiated to comprehensively target aerobic and anaerobic bacteria while addressing toxin production and resistant *Staphylococcus aureus*. This treatment was sustained for six days. Nevertheless, owing to inadequate improvement, the patient ultimately required surgical debridement.

Following surgical debridement, computed tomography (CT) scan was performed to assess ethmoid sinusitis, the most prevalent etiology of orbital cellulitis [6]. During imaging, an incidental finding revealed misplacement of the PICC catheter tip in the inner canthus area of the left eye.

Fortunately, based on clinical assessment, the patient did not require continued use of the PICC line. After removal, there was prompt improvement in symptoms, and the local infection resolved.

We believe that migration of the PICC catheter to the angular vein and its penetration into the subcutaneous tissue are the underlying causes of this complication. The angular vein is situated at the anterior aspect of the eye socket and is positioned between the superior portion of the nose and eye. It drains blood from the medial canthus of the eye, various regions of the nose, and upper lip. It continues to traverse the face as the facial vein, which is responsible for draining blood from facial structures. The facial vein ultimately joins the internal jugular vein, which merges with the subclavian vein to form the brachiocephalic vein. The left and right brachiocephalic veins converge to form the SVC [8, 9].

In the present case, the initial attempt was unsuccessful because the PICC was twisted and failed to advance into the SVC. Studies suggest that approximately 5% of PICC placements via the left side may lead to initial misplacement [10]. However, physicians often choose this route when devices or complications on the right side limit access.

Spontaneous migration of a PICC from the SVC into smaller veins is a rare but significant complication associated with PICC placement. Anatomical variations and conditions associated with elevated right atrial pressure or increased intrathoracic pressure have been reported to contribute to this migration [4, 11]. Given the malpositioning during the initial PICC placement, the possibility of anatomical variation should be considered. Moreover, our patient required mechanical ventilatory support for the PPHN. In PPHN, elevated resistance in pulmonary circulation can result in right ventricular overload, which subsequently leads to an increase in right atrial pressure [12]. In addition to the left-sided approach, the small diameter of the 2 Fr PICC, fluctuations in intrathoracic pressure arising from mechanical ventilation, and elevated right atrial pressure due to the PPHN were potential risk factors for catheter migration. While a short PICC line could contribute [4], it seems less probable in our case, as its position was verified within the SVC through echocardiography and x-ray at the time of insertion. However, we cannot completely dismiss this possibility during the hospital course, as changes in PICC length may occur due to head movement during care administered by the nurse, especially considering the neonate's neck muscle hypotonia. The lack of additional imaging beyond chest x-rays in subsequent days further complicates our ability to definitively rule out a shortened PICC line.

Patients often remain asymptomatic after migration of a PICC line until they present with catheter dysfunction or complications, which may also be incidentally identified during radiographic evaluation. Potential complications include venous perforation, thrombosis, hemorrhage, infection, pleural effusion, and mediastinal effusion [1, 4]. Evaluating the functionality of a PICC before each use is essential for ensuring safe catheter operation, with blood withdrawal from the PICC serving as the primary assessment method. If insufficient blood withdrawal raises concerns about possible migration of the PICC tip, a chest x-ray can be used to confirm the correct positioning [13].

## Conclusion

The use of PICC in neonatal intensive care units is a widely accepted practice. Catheter migration is a potential complication associated with PICC lines. Obtaining periodic images following PICC placement is essential if a patient exhibits signs of catheter dysfunction or related complications. Furthermore, we advise thorough documentation of the external catheter length and imaging in cases where unexpected complications arise.

## Ethical Considerations

### Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

### Funding

There were no ethical considerations to be considered in this research.

### Authors' contributions

All authors contributed equally to this research.

### Conflict of interest

The authors declared no conflicts of interest.

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