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# Parenteral nutrition extravasation into the abdominal wall mimicking an abscess

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## Abstract

**Objectives:** Peripherally inserted central catheters (PICC) are used in the neonatal intensive care unit (NICU) setting for medication and nutrition administration. PICCs are easy to place and may remain inserted up to several weeks. Serious complications are rare. Cases of infection, dysfunction, thrombosis, malposition into other vessels, catheter migration, vessel erosion, perforation into pleura, pericardium, abdomen and even into the epidural space with extravasation have been reported [1, 2].

**Case presentation:** We present the case of a preterm infant with a right leg inserted PICC with the tip supposedly being placed in the external iliac vein with further catheter migration into the abdominal wall during the course of treatment.

**Conclusions:** Our patient developed extravasation of lipid infusion, which was initially misinterpreted as an abscess due to signs of local inflammation.

**Keywords:** case report; extravasation; parenteral nutrition; peripherally inserted central catheter; premature infant.

## Introduction

In the neonatal intensive care unit (NICU) peripherally inserted central catheters (PICC) are frequently used as

venous access lines especially in preterm infants. A new terminology was recently recommended by the *World Congress on Vascular Access Foundation*. The term PICC should be used exclusively for peripherally inserted central catheters that are placed in veins (of the arm) deeper than 7 mm whereas catheters placed more superficial (either on arms or legs) were defined as epicutaneo-caval catheters (ECC) [1]. However as these definitions have not found their way into daily practice, in this case report we refer to all peripherally inserted central catheters as PICCs. PICCs are characterized by easy insertion and their position should be controlled by X-ray or sonography after placement [2, 3]. In preterm infants, PICCs are mainly required for parenteral nutrition (PN). Compared to peripheral cannulas, adverse events do not occur more frequently in PICCs [4]. Peripheral catheter placement in upper limbs compared to lower limbs showed similar complication rates of 21–24%, nevertheless severe complications are rare [5]. Cases of infection, catheter dysfunction, thrombosis, vessel erosion or perforation, malposition, migration, lymphedema from thoracic duct obstruction, extravasation, perforation of pleura, pericardium, peritoneum into the abdominal cavity and even into epidural space have been reported [6–8]. Based on the current CARE Guidelines, we describe the case of a premature infant suffering from worsening edema of labia majora and the abdominal wall finally developing an abscess like formation due to catheter tip migration.

## Case presentation

A Caucasian girl was born by cesarian section due to preterm labor and amniotic infection syndrome at 26 weeks gestational age (birthweight 775 g). APGAR score 5/7/7. She initially required intubation, mechanical ventilation and a single dose of surfactant. On DOL 2 a PICC (28 G, Premistar®, VYGON GmbH & Co.KG, Germany) was placed in the right leg for medication and PN administration. For placement verification an X-ray was performed, showing the catheter's tip in the pelvic area - interpreted as external iliac vein. She was extubated and weaned to non-invasive ventilation on DOL 3. Within the next days, she developed a distended but soft abdomen as she experienced

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flatulence. One week later she developed edema of the abdominal wall and labia majora with signs of local inflammation. Therefore, antibiotic treatment with piperacillin/tazobactam was initiated although laboratory work-up showed no signs of infection and blood culture was sterile. The antimicrobial regime was switched to vancomycin and meropenem 4 days later due to lack of clinical improvement. Dosage of fluconazole was increased from prophylactic (a standard in preterm infants <1,000 g) to therapeutic due to suspicion of fungal superinfection because of whitish discoloration of the abdominal wall. Complete blood count (CBC) and C-reactive protein (CRP) remained in its normal range. Hence, vancomycin was stopped after five days and meropenem after 10 days. Afterwards, the edema did not vanish but remained stable. During the entire course, our patient remained stable suffering from flatulence and gastric residuals. There were no signs of necrotizing enterocolitis (NEC), neither on X-ray nor on ultrasound exam. Therefore, these symptoms were interpreted as slow adaptation to enteral nutrition and oral feeding was reduced which led to an increase in PN.

Two days after the antibiotic treatment was stopped the abdominal wall edema worsened. The abdominal wall had turned hyperemic, hyperthermic and the right lower quadrant was bulging. The protruding area showed a yellow and white colored fluid shimmering through the skin (Figure 1). Abdominal palpation was painful. Ultrasound exam was performed, revealing an encapsulated hypoechoic formation surrounded by hyperemic tissue. Clinical presentation and ultrasound findings suggested abscess formation in the abdominal wall. Antibiotic treatment with vancomycin and meropenem was restarted and the abscess was incised. Initially a significant amount of white and yellow colored fluid was drained but turned completely white fast. Laboratory analysis confirmed extravasated PN. PN was immediately stopped. CBC, CRP and Interleukin-6 maintained in the normal range. An ultrasound exam was performed to detect the PICC's pathway, but the catheter could not be identified clearly and the PICC was removed. The next morning edema of the abdominal wall and labia majora had completely vanished. At the incision site healed without any complications within the next days.

## Discussion

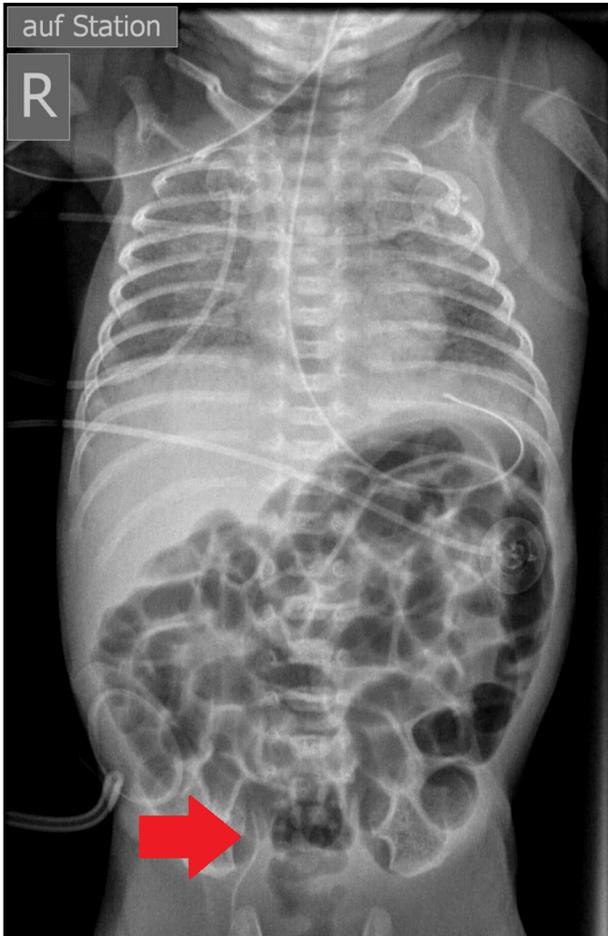
To our knowledge, this is the first case of extravasation of PN into the abdominal wall due to PICC tip migration. Initially correct placement of the PICC was assumed because of intrapelvic tip location with a straight pathway



**Figure 1:** Suspected abscess, later identified as lipid infusion extravasation.

(Figure 2) on X-ray in the anterior-posterior view. Afterwards we suppose catheter migration into a superficial abdominal vein showing a curved route in the follow-up X-ray as a sign of dislocation (Figure 3).

Although complication rates in PICC insertion and maintenance are low, severe complications such as infection, dysfunction, thrombosis, malposition into other vessels, vessel erosion, perforation into pleura, pericardium, abdomen and even into the epidural space are described [6]. As published in the ESPGHAN/ESPEN/ESPR Guidelines in 2018 “a reliable venous access is of paramount importance when considering parenteral nutrition” [9]. Therefore, PICCs or tunneled central venous catheters (CVCs) are recommended in neonates for PN during hospital stay. For central venous catheters placed via femoral veins, the optimal position is underexplored. The correct PICC tip position is the inferior vena cava above the renal vein, which would be equivalent to the tip being projected above the first lumbar vertebra on X-ray representing the only position which should be considered central [9, 10]. Additionally, it must be taken into account that X-ray solely provides a two-dimensional image, lacking one dimension where dislocation still might happen. Ultrasound seems beneficial in localizing a catheter's pathway adding the missing third dimension. In our case an X-ray with anterior-posterior view, as it is standard at our department, was performed to check the catheter's position. A sonographic approach might have been of advantage especially during placement. Over the past years ultrasound starts to gain popularity at the NICU in assessing catheter position. If the catheter is big enough, ultrasound is able to depict the catheter directly inside blood vessels and show the tips position in real time if



**Figure 2:** First X-ray anterior posterior view with the catheter projected in the external iliac vein.

used while placement [1]. In our experience, on ultrasound a small catheter with guide wire in place (i.e. the above-mentioned *Premistar*®) is easier to identify than after removal of the guide wire. A further advantage is that the infant is not exposed to radiation compared to conventional X-ray. Nevertheless, real time ultrasound guided placement of PICCs has not yet become a standard method among neonatologists [1]. A presumably limiting factor may be time and resources. It takes time to train staff in ultrasound based tip locating [1]. Furthermore, performing PICC placement with real-time guided ultrasound tip placement requires the availability of two physicians, which are not always available at any time.

There is lack of evidence concerning methods of catheter (CVC or PICC) position imaging (X-ray or ultrasound) and follow-up. Therefore protocols for catheter insertion and use are recommended [9]. *Paulson* et al. recommended checking the catheter position 1–2 days after



**Figure 3:** Latest X-ray with the catheter being located in a superficial abdominal vein.

insertion and every two weeks aiming to detect catheter migration. A PICC is supposed to be placed in the inferior vena cava when inserted in the lower limbs [3]. This was not the case in our patient, as the primary location of the catheter's tip confirmed by X-ray was assumedly the ipsilateral external iliac vein, so it should have been considered a peripheral venous access. Nevertheless, after carefully considering all risks and benefits we decided to leave it in place and treat it as a central venous access as PN had low osmolarity, placing a new PICC would have meant a relevant amount of stress and risk for infection in our preterm infant. We hypothesize that during the course of treatment, with raising osmolarity of the PN and consecutive damage of the venous wall, the tip moved through the superficial epigastric vein into the abdominal wall. The dislocation might have been assumed earlier by the later curved pathway of the catheter as shown in Figure 3. This X-ray was performed with the intention to rule out NEC so

we focused on other areas of the image and this sign was missed.

In case of vessel perforation or erosion, edema might appear as a sign of extravasation of fluid into the surrounding tissue [10]. The abdominal wall edema in our case was not directly associated with an extravasation in the abdominal wall, because the tip was supposed to be inside a vessel of the abdominal cavity. Additionally, there was local reaction with edema, skin inflammation and hyperthermia, which was interpreted as local infection, but probably caused by tissue irritation through the PN. As our patient never developed pathologic inflammation markers and the edema remained stable, the PICC was not removed. No clear reason for this clinical finding was identified, so even rare etiologies such as pathologic lymphatic drainage were taken into account, but the unusual pathway of the PICC as a possible discrete sign of mispositioning was not perceived.

### Take home message

Dislocation of PICC into the superficial abdominal veins with extravasation is extremely rare. Extravasation in this area may mimic erysipelas or even abscess when caused by PN lipid infusion. When clinical manifestation, laboratory work-up and radiographic findings are not concordant, other reasons of edema of the abdominal wall should be considered, especially extravasation. We should be aware of possible complications in all kind of procedures even if they are considered as “low risk” and performed in everyday practice. Establishing real-time ultrasound guided PICC placement may help to identify its right position straight away.

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**Author contributions:** Dr. Pramhofer und Dr. Sailer conceptualized the case report, collected the patient’s family’s consent, drafted the initial manuscript, and reviewed and revised the manuscript. Dr. Nöhammer and Dr. Csillag conceptualized the case report, reviewed and revised the manuscript. Dr. Kargl and Dr. Wiesinger-Eidenberger conceptualized the case report and

critically reviewed the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work. All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

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**Informed consent:** Informed consent was obtained from all individuals included in this study.

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