

Pericardial Effusion and Superficial Abdominal Abscess as Complications of Malposed PICC Line in a Preterm Neonate: A Case Report

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ABSTRACT

In neonatal critical care units, peripherally inserted central catheter lines are frequently used to provide venous access for continuous parenteral nutrition and medications in newborns. In this case report, a male neonate weighing 1270 grams was on Continuous Positive Airway Pressure (CPAP) for hyaline membrane disease and initially received Total Parenteral Nutrition (TPN) through a Peripherally Inserted Central Catheter (PICC) in the left long saphenous vein on the second day. The baby developed tachycardia, respiratory distress requiring mechanical ventilation, and erythematous swelling over the paraumbilical region. A diagnosis of pericardial effusion and superficial abdominal abscess secondary to a malposed PICC line in a preterm, very low birth weight neonate was made. Suspecting a misplaced line, it was immediately removed, and the patient showed improvement over the next 24 hours. Within the next 48 hours, the patient was extubated to CPAP. Therefore, daily inspection by an expert, as well as confirmation of the central line tip, will aid in preventing delays in detecting complications.

Keywords: Abdominal distension, Catheter and Cardiac tamponade, Low birth weight, Periumbilical region

CASE REPORT

A male neonate, weighing 1270 grams, was delivered by a multigravida mother at the gestational age of 30 weeks by an emergency Lower Segment Caesarean Section (LSCS) in view of bleeding per vaginam and placenta previa. The patient's APGAR score at one minute was four, and at five minutes, it was six. He was admitted to the Neonatal Intensive Care Unit (NICU) due to respiratory distress with a Silvermann Anderson score of 6 [1]. The heart rate was 165 beats per minute, and the respiratory rate was 70 cycles per minute. There was no relevant antenatal or family history. Proper antenatal care was provided with no maternal high-risk factors.

The baby was placed on CPAP for hyaline membrane disease, diagnosed based on bilateral homogenous ground glass opacities on X-ray. Initially, TPN was administered through a PICC. After 12 hours of PICC line insertion, swelling, redness, and tenderness over the skin were observed in the periumbilical region, which later formed a tract along the course of the PICC line. The neonate remained on CPAP, and empirical antibiotic therapy (ampicillin 50 mg/kg every 12 hours and gentamicin 5 mg/kg/day) was initiated for five consecutive days. A single dose of surfactant NEOSURF 5 mL/kg (Bovine Lipid extract Surfactant suspension) was administered, and the Intubation-Surfactant-Extubation (INSURE) method was used as the X-ray indicated bilateral widespread air bronchogram with confluent alveolar shadow, revealing grade 3 respiratory distress syndrome. The PICC line for TPN infusion was secured on the same day by a paediatric resident. A 28G single lumen polyurethane PICC line was secured in the long saphenous vein of the left lower limb, which passed through easily without resistance. The position of the tip in the lower Inferior Vena Cava (IVC) was confirmed by a supine plain X-ray radiograph [Table/Fig-1].

The patient remained stable for the next six hours but later developed abdominal distension, persistent tachycardia (174 bpm), tachypnea (82 cpm) with intercostal and subcostal retractions. The baby was intubated, started on second-line antibiotics (meropenam 20 mg/kg/dose every 12 hours and vancomycin 15



[Table/Fig-1]: Supine X-ray showing the course of the PICC line.

mg/kg/dose every 12 hours), and received inotropic support. After 12 hours of PICC line insertion, swelling, redness, and tenderness over the skin were observed in the periumbilical region [Table/Fig-2], which later formed a tract along the course of the PICC line [Table/Fig-3]. Ultrasonography revealed a collection of pus in the subcutaneous plane on the anterior abdominal wall. A bedside focused neonatal echocardiography conducted by an expert neonatologist showed poorly contracting chambers surrounded by pericardial fluid suggestive of pericardial effusion; however, the tip of the PICC line could not be identified [Table/Fig-4]. The PICC line was removed.

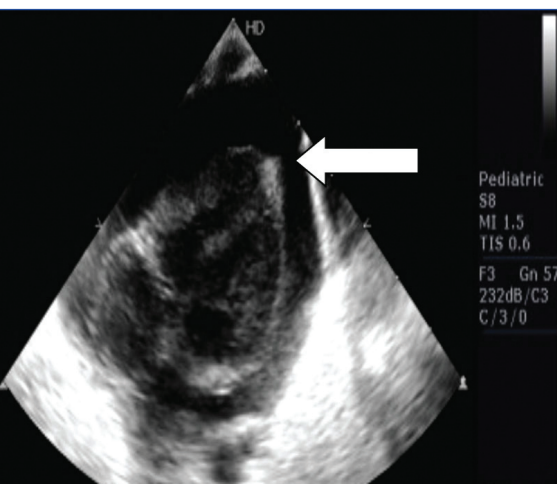
Paediatric surgeon's opinion was sought, and the pus from the subcutaneous plane was drained. The discharged fluid had a bloody tint and was yellowish-white in appearance. Gram



[Table/Fig-2]: Swelling and erythema over the periumbilical region.



[Table/Fig-3]: Formation of tract over the course of PICC line.



[Table/Fig-4]: Echocardiogram showing an apical four-chamber view suggestive of pericardial effusion.

DISCUSSION

The rates of PICC line insertion have increased over the past several years as securing a PICC line is simple, safe, and associated with decreased complication rates compared to surgically implanted central catheters [2]. However, using a PICC line can lead to a variety of issues, such as thrombosis, occlusion, infiltration, migration, misplacement, breakage, superficial abdominal abscess, and infection [3]. These issues can also include uncommon but serious acute life-threatening situations like cardiac tamponade, pericardial effusion, as well as massive pleural effusion [4,5]. The most crucial factors in such situations are prompt diagnosis and appropriate treatments. The position of PICC line tips must constantly be verified. While fluoroscopic placement is ideal, it cannot be performed at the bedside and is expensive [6]. The most popular and practical approach is a single anteroposterior radiograph. Serious complications, including extravasations and sepsis, might result from improper positioning. It is uncommon for central line extravasation and migration to result in a superficial abscess [7,8], as reported in this case.

There are dangers associated while using PICC lines in newborns that must be kept in mind. Mispositioning issues have been documented in the past. PICC extravasation has been linked to reports of pericardial effusion, as well as fluid leaking into the renal pelvis, peritoneal cavity, subdural space, retroperitoneal area, and pleural cavity [9,10]. Soft-tissue extravasations have been recorded less often. Acute abdomen and TPN ascites in newborns have both been linked to IVC catheter extravasations. Similar to index patient's presentation, the description of Baker J and Imong S regarding lower limb peripheral intravenous catheter's extravasation presenting as abdominal wall abscess is accurate [7].

The cause of such a catastrophic complication is multifactorial. In general, a mechanical or chemical assault may be the reason. The mechanical placement of the catheter tip is a key factor in the formation of effusions. Chronic friction and erosion may arise as the catheter's tip comes into contact with the heart or vascular wall during insertion. A subacute pericardial effusion can result from continuous mechanical stimulation of the catheter tip because infants have a tiny right atrium, a thin atrial and vascular wall, and a fast heart rate [11]. In index patient, the PICC was likely misplaced in the abdomen in a superficial vein while it was initially believed to be in the long saphenous vein. This emphasises the necessity of ensuring the PICC's ideal location at all times. High rates of mispositioning are caused by blind insertion of peripheral venous catheters using anthropometric measurements and anatomical landmarks [9].

Literature reveals that limb movement, neck position, and forceful flushing during insertion may change the position of the tip of the PICC line. PICC lines inserted via the basilic vein can move toward the heart with arm adduction, while those inserted via the cephalic vein may migrate away from the heart. The misplaced catheters may be repositioned using these locations. PICC catheters should be securely fastened to prevent misplacement, and a clear dressing should be applied to the insertion site to monitor any changes in the PICC's length. Every day, the length of the catheter left exposed should be checked and recorded in the nursing chart [12].

Similar to the present case, Zarkesh MR and Haghjoo M reported a case of a 10-day-old neonate who, on the 10th day post-NICU admission, suddenly developed hypotonia, apnoea, hypoxia, hypotension, and bradycardia [13]. Resuscitation and ventilation support were immediately initiated, and inotropic drugs were also administered. Emergency echocardiography showed severe pericardial effusion with tamponade. The PICC line was removed, and urgent pericardiocentesis was performed. Iyer VH et al., reported cardiac tamponade in a 29-week-old preterm neonate who

staining and culture tests were negative for any organisms. The sample aspirated from the location had a high triglyceride estimate (825 mg/dL), indicating that the fluid being extravasated was TPN. The extravasation and mispositioning of the PICC line were considered. Within the next 24 hours, the baby showed significant improvement and was weaned off to CPAP, although the extravasation resulted in a full-thickness small scar that later healed well. The baby was discharged on the 18th day of life and was on full feeds. As part of the patient's neonatal follow-up, his developmental progress will be monitored.

developed a sudden onset of deterioration in the form of a swinging heart rate, fluctuation in blood pressure, as well as desaturation, and recovered after emergency intubation, administration of inotropic agents, and fluid aspiration from the pericardial space using an echocardiography-guided tap [14].

It is possible that a single plain X-ray may not be sufficient to locate the central line. In one series, radiopaque contrast injection increased detection rates to 93.5%, whereas conventional X-rays were not able to detect approximately 50% of these line tips [10,15,16]. According to Odd DE et al., radiopaque contrast increased the frequency of central line tip site recognition from 39 to 55% [17]. With a saline flush of the line at 0.1 mL/s, Groves AM et al., reported simple identification of the tip of the peripheral intravenous line using colour Doppler ultrasonography [18]. To locate the site of the central line tip, bedside ultrasonography with color Doppler or contrast injection may be employed [2].

CONCLUSION(S)

The unexpected and sudden onset of haemodynamic instability without an apparent cause in any neonate with a PICC in situ should raise suspicion for pleural or pericardial effusions. Timely analysis through bedside ultrasound and immediate aggressive intervention are crucial. In conclusion, daily inspection by experienced personnel, as well as confirmation of the central line tip, will aid in the prevention of delays in the detection of complications.

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