CASE REPORT

A misplaced peripherally inserted central catheter presenting as contralateral pleural effusion

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SUMMARY

A preterm neonate born at 27 weeks, with a birth weight of 555 g, was on continuous positive airway pressure (CPAP) for apnoea of prematurity and initially received total parenteral nutrition (TPN) through the umbilical venous catheter. Peripherally inserted central catheter (PICC) was inserted in the left basilica vein on day 8 to continue TPN. The baby developed respiratory distress with persistent hypoxia after TPN was initiated through the PICC line. The baby required mechanical ventilation due to worsening of respiratory distress, and chest X-ray, as well as ultrasound conducted 12 hours, postinfusion of TPN revealed right-sided pleural effusion. On careful observation, we could trace the PICC in the right lung area. The PICC line was removed immediately and the baby improved over the next 18 hours and was extubated to CPAP within the next 48 hours. We report this case of contralateral pleural effusion secondary to malposition of PICC line in an extremely preterm neonate.

BACKGROUND

Peripherally inserted central catheters (PICCs) are commonly used in neonatal intensive care units to ensure reliable venous access for long-term parenteral nutrition and prolonged medications in extremely low birth weight infants. The procedure for PICC insertion is simpler and safe in experienced hands and has a lower complication rate than that of surgically placed central catheters leading to an increase in insertion rates of PICC lines in the last few years.¹ However, PICC line use may be associated with a wide spectrum of complications (infiltration, occlusion, thrombosis, misplacement, migration, infection, breakage, superficial abdominal abscess) including rare but acute life-threatening events such as pericardial effusion, cardiac tamponade and massive pleural effusion.¹⁻³ In such cases, timely diagnosis and adequate interventions are most important. Here, we report a case of an extreme preterm neonate developing contralateral pleural effusion causing respiratory distress secondary to misplacement of PICC line.

CASE PRESENTATION

A preterm neonate was born to a 31-year-old multigravida mother at 27 weeks of gestation with a birth weight of 555 g by a preterm vaginal delivery. Apgar scores were 6 and 7 at 1 and 5 min, respectively. She had hyaline membrane disease for which a single-dose surfactant (Neosurf) was administered

Figure 1 First chest radiograph after placement of the peripherally inserted central catheter. The course of the catheter can be visualised until the left axillary region pointed out with the arrow.

via intubation, surfactant therapy, extubation technique. She was continued on nasal continuous positive airway pressure (CPAP) immediately after surfactant administration. An umbilical catheter was inserted on the same day and total parenteral nutrition (TPN) was infused until day 6, and on day 8 PICC line was inserted in the left basilica vein up to 9 cm by a neonatology fellow. The catheter was 28 G radiopaque, polyurethane, single-lumen peripherally inserted central catheter (Premicath; Vygon, Montgomeryville, Pennsylvania, USA). The PICC was passed with an iris forceps through the introducer needle provided with the line until measured distance. It passed easily without resistance. A neonatology fellow checked the forward as well as the backward flow before fixing it. Transparent dressing (3M Tegaderm) was used for fixation so that the insertion site remains visible. In the first plain radiograph, the tip was well visualised up to the left scapular region (figure 1) but not beyond that. Lung fields were clear at that time and the baby remained stable for the next 6 hours. We started TPN through this line immediately after X-ray.

Six hours later, gradual deterioration started in the form of tachypnoea, intercostal retractions, frequent desaturation, increased oxygen requirement and tachycardia. Capillary blood gas at worsening showed mixed acidosis (pH=7.16,

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Figure 2 Chest radiograph after clinical deterioration shows diffuse haziness in the right lung along with obliteration of cardiophrenic angle (arrows showing endotracheal tube and PICC line). PICC, peripherally inserted central catheter.

$PO_2=46$ mm Hg, $PCO_2=67.2$ mm Hg, $HCO_3=16.9$ meq/L). Due to clinical worsening, CPAP was changed to nasal intermittent mandatory ventilation (NIMV) and antibiotics were started. However, the baby had recurrent apnoea on NIMV and required intubation followed by invasive mechanical ventilation. Chest X-ray showed white out right lungs either due to consolidation or suspect extravasated TPN (figure 2). TPN was discontinued and chest ultrasound showed 6 mm pleural effusion on the right side while the left was normal. On ultrasound, we could not trace the PICC line. An experienced neonatologist performed targeted neonatal echocardiography at the bedside but could not locate the tip of PICC in any of the vessel or pericardium. There was no pericardial effusion. After this, we removed the PICC line and continued TPN through the peripheral line. On careful retrospective observation of previous chest radiographs, we could trace the course of PICC line and found its tip reaching in the right lung area (figure 3). We could not tap pleural fluid to do the biochemical analysis as it was very small in amount.

In the next 18 hours, the baby showed rapid improvement and was extubated to CPAP within 48 hours. Repeat chest X-ray 24 hours after the removal of the PICC line showed clear lung fields, suggesting the resolution of the effusion (figure 4). Sepsis workup was negative and antibiotics were discontinued on day 4 (48 hours after extubation).

OUTCOME AND FOLLOW-UP

The baby was growing well, reached full feeds on day 13 and has been discharged on full spoon feeds.

DISCUSSION

Pleural effusion/infusothorax secondary to malposition of PICC line is relatively rare, but known complication in the neonates. Recently, Bashir *et al* reported an incidence

Figure 3 Chest radiograph (focused and zoomed) showing the course of the PICC line (marked with arrows). PICC, Peripherally inserted central catheter.

of PICC-related pleural effusion as 0.4 per 1000 catheter days.⁴ Contralateral pleural effusions are reported but rarely compared with ipsilateral effusion.¹ Pleural effusion in preterm neonates presents as tachypnoea, increased work of breathing, increased oxygen requirement, tachycardia which ultimately progress to hypoxia, recurrent apnoea and respiratory failure. The progression of symptoms depends on the rapidity as well as the amount of accumulation of fluid. In our case, diffuse haziness in the right side was due to TPN extravasation as it cleared rapidly after stopping TPN as well as repeated chest X-ray after 12 hours was clear. In the first X-ray, we could not localise the tip of the catheter though we located it in subsequent X-rays on the right side of the chest. During removal, we noted that the catheter's length was the same as after insertion, suggesting that it had been misplaced at the time of insertion itself. A similar case of misplacement during insertion has been reported previously also.¹ So, to avoid this complication, some authors suggest using real-time ultrasound-guided PICC line insertion by experienced neonatologists as it is shown to decrease the catheter insertion duration as well as fewer manipulations when compared with the conventional technique.⁵

Small amount of contrast medium may facilitate visualisation of the catheter trace by radiography.⁶ It was reported that PICC line can cause perforation of vascular structures to reach cavities (pleural, peritoneal and pericardial ones), which happened in our case.¹ Studies have shown that limb movement, neck position and forceful flushing while insertion may change the position of the tip of the PICC line.⁷ With the adduction of the arm, PICC lines that are placed via the basilic vein can migrate towards the heart, whereas those placed via the cephalic vein moved away from the heart.⁷ These positions

Figure 4 Chest radiograph obtained 24 hours after removal of the PICC line shows rapid resolution of haziness in the right lung. PICC, peripherally inserted central catheter.

may be used for repositioning of the displaced catheters. PICC catheters should be well fixed to avoid misplacement and the insertion site should be covered with a transparent dressing to identify alterations in the length of the PICC. The length of the catheter left outside should be monitored daily and documented in the nursing chart.

After placement of the PICC in upper extremities, the tip of the catheter must be confirmed outside the cardiac silhouette but within lower one-third of superior vena cava near the

junction of the right atrium.^{8,9} Recently, with the advent of targeted neonatal echocardiography, the use of ultrasound for placement of PICC's as well as subsequent follow-up is being used.¹⁰ However, if the position of the catheter tip remains unclear on echocardiography, a chest X-ray with contrast medium must be used. In the case of unexplained clinical deterioration while using PICC line, displacement must be considered and must be evaluated appropriately with the help of ultrasound and chest radiography to make early diagnosis and interventions.

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Learning points

- Tip position of peripherally inserted central catheter (PICC) lines must always be confirmed before starting infusion. The catheter tip may be localised on ultrasound or chest radiograph.
- In case of sudden, unexplained deterioration of the patient while PICC line in situ, malposition or misplacement of the catheter tip should be suspected and be evaluated promptly for timely diagnosis and intervention.
- Limb movements and routine nursing activities are known to cause displacement of PICC lines, so the length of catheter left outside should be monitored and documented on a daily basis.

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