Unusual vascular track for Neonatal Peripherally Inserted Central Catheter, Case report

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Abstract

A peripherally inserted central catheter (PICC) is one of the frequently done procedures in the neonatal intensive care unite (NICU). It is used to deliver medication and total parenteral nutrition (TPN) to the patient. However, in preterm newborns, achieving good vascular access sometimes becomes a challenge. In our report, we are describing our experience in achieving PICC in a preterm baby through an unusual vascular tract. The line inserted through one of the superficial abdominal veins went to the epigastric vein, proceeds to the internal thoracic vein (internal mammary vein), and then to the superior vena cava (SVC). Finally, it reaches the cavo-atrial junction. The line has been confirmed radiologically and used safely and effectively.

Keywords: Peripherally inserted central catheter, PICC, preterm

Introduction

A peripherally inserted central catheter (PICC) is one of the most commonly done procedures in neonatal intensive care units (NICU). It provides nutritional and medical support for very low birth weight or critically ill newborns. There are several methods to achieve central vascular access, PICC comparatively carries fewer complications and remains for a longer period of time. Finding a good vein for the PICC line is a challenge yet a very crucial step to achieve the first puncture success rate. However, difficulty in achieving vascular access is not uncommon especially in chronic patients who experienced multiple attempts during their prolonged stay at the hospital, achieving a successful PICC insertion becomes a challenge in these particular patients.

In this report, we describe our successful experience of PICC line insertion through an unusual site, using superficial abdominal veins as initial access. A description of the insertion site and tracking its vascular course is reported in detail.

The case

A preterm baby boy was born at 30 weeks of gestation, with a low birth weight, 1800 grams. His current corrected age is 2 months and the current weight is 3 kg at the time of reporting the case. The baby went through a stormy course perinatally and during his early life. He was diagnosed to have necrotizing enterocolitis (NEC) at three different times during his postnatal period. He had been operated on several times which were complicated with anastomotic leak and strictures which necessitated exploratory laparotomy. In addition, he developed a gangrenous left arm that underwent autoamputation that was attributed to iatrogenic arterial cannulation. Furthermore, he developed chronic lung disease and remained on chronic non-invasive ventilation. Sepsis was one of his major problems as he had multiple episodes of culture-proven sepsis in addition to persistent candidemia requiring antibiotics and antifungal treatment. Additionally, the baby had a metabolic bone disorder of newborn complicated by a fracture in the right humerus. He had conjugated hyperbilirubinemia possibly due to chronic total preantral nutrition (TPN) use which possibly led to cholestasis and jaundice. Furthermore, the baby developed cystic periventricular leukomalacia related to grade 4 intraventricular hemorrhage (IVH) and retinopathy of prematurity (ROP).

Due to his complex medical condition, the baby went through multiple venous accesses several times to continue his course of medical care at several stages of the treatment. Regarding the intravenous access, this baby had already several central and peripheral lines. He had multiple PICC lines and central venous catheters utilizing almost all of the commonly known accesses. Both internal jugular veins had been used for central lines on different occasions inserted in the operation room by pediatric surgeons and anesthesia teams resulting in complete occlusion. Most of the upper limbs (basilic, cephalic, axillary, and brachial veins) and lower limbs (greater and lesser saphenous and popliteal veins) veins were used. In addition, bilateral scalp veins were used for PICC lines. Additionally, the small veins in his hands and feet were mostly punctured. An interventional radiologist has been involved once in inserting a difficult central line in this baby.

Given his unfortunate presentation and chronic medical condition, he required a continuation of care but most of his intravenous accesses have been exhausted. We had achieved a successful PICC line insertion through an unusual site, no reported cases of such measure in literature.

Procedure method

Under complete aseptic technique, a 1 Fr PICC was used to access one of the superficial veins located in the midline of the anterior abdominal wall in epigastrium coursing slightly deeper probably into superior or inferior epigastric veins, then to the internal mammary vein (also called internal thoracic vein), and finally passed into superior vena cava. The post PICC insertion chest x-ray showed the catheter tip ended in the junction between right atrium and superior vena cava, exactly where it was supposed to be. There was a good backflow from the catheter and its position was confirmed radiologically by abdominal & chest radiographs (anterior-posterior and lateral views) (**Fig1)** which were checked with the interventional radiologist, the catheter was used effectively.

Figure 1: frontal (a) and lateral (b) views show the course of the inserted PICC from the anterior abdominal wall above the umbilicus to right chest wall (black arrowheads), its tip was confirmed to be at cavo-atrial junction both frontal and lateral views (white arrowheads). (Interventional radiology consultant review)

Discussion

Although it is used extensively in NICU, inserting PICC in a neonate sometimes becomes a challenge especially in chronic patients like the one we discussed in this case report. In addition to small and fragile peripheral veins of the preterm and low birth weight neonates in such cases, multiple venipuncture attempts are usually expected for continuation of treatment due to their prolonged hospital stay. Several attempts are needed usually before access is successful, leavening few good venous sites for additional trials.

The success rate from the first attempt, or what so-called “one puncture” success rate estimated to be77.77% while the overall total puncture success rate is reported to be 99.65% in the literature. (1)

Our Unit is level III NICU with about 40 beds connected to cardiac center for cardiac cases. Surgical cases as well are transferred to our hospital for treatment. High-frequency oscillatory ventilation (HFOV) and Inhaled nitric oxide (iNO) is used in our unit.
Our guideline is to resuscitate newborns from 23 weeks of gestation and above. The weight criterion for resuscitation is made to be 550 grams and above. However, borderline cases are evaluated by the most senior consultant in the team and appropriate decision is made with case-to-case bases.

This patient was a total challenge to the NICU team as all of his usual intravenous access sites had been used.

In this reported case, the PICC line is optimal for a continuation of care although finding a good insertion site, unfortunately, was difficult even with extensive evaluation for possible vascular access. In general, the PICC line is preferably inserted through the arms (basilic, cephalic, brachial, and axillary veins), legs (greater and lesser saphenous, and popliteal veins), or through the scalp (temporal and posterior auricular veins).(2, 3)However, in this described patient, most of his peripheral venous sites were consumed due to previous

attempts, so the decision was made to try from any visible veins on the abdominal wall. In the literature review, there is no previous reported attempt of similar access up to the date. The procedure was done by skilled neonatologist with good experience in PICC insertions at different access sites, with the help of pediatric specialist and an experienced NICU PICC nurse. Complete antiseptic environment was insured before and during the procedure, Infectious control team was around during the procedure. The attempt was successful using the classical way of PICC insertion with an introducer. Complete measures have been taken and 1 Fr size PICC was inserted. The PICC tip was confirmed by two X-ray views (anterior-posterior and lateral) and by good backflow prior to fixation. We don't usually perform real-time ultrasonography (US) for confirmation of the PICC tip position.

The interventional radiologist was consulted to review the course of the catheter, he agreed that the tip was in optimal position after review of the radiographs and the catheter was used safely, catheter's tip was at the junction of superior vena cava and right atrium. The catheter course of our case report was unusual, passing from the midline of the anterior abdominal wall superiorly. We believe that this path follows the course of internal thoracic vein that drains into superior vein cava. This can be attributed to occlusion of part of SVC or innominate vein related to multiple venous access that resulted in prominent internal thoracic vein as a collateral vein.

Experts advise to keep PICC line tip outside the cardiac silhouette to avoid endocardium and epicardium injury and complications, but it's important as well to keep the tip *near* the heart to ensure it is being *central*. One study reported that the complications of non-central line is 8 folds more than the complications of central line. (4) Generally, it is advised to keep the tip of the PICC line in the inferior third of the superior vena cava in upper extremities PICC insertions. While in lower limbs PICC lines insertion, it is advised to keep the tip of the PICC line in the inferior vena cava at the level above L4/L5 vertebral bodies or above the iliac crest line, but of course not in the heart.(5) Another approach has been reported is that the PICC line tip should remain 1 cm away from the heart in preterm, and 2 cm away from the heart in term babies.(6)

A recent study reported complications in 20.8% of PICC lines. The most common complications included accidental dislodgement (4.6%), followed by infection (4.3%), occlusion (3.7%), local infiltration (3.0 %), leakage (1.5 %), breakage (1.4%), phlebitis (1.2%), and thrombosis (0.5%).(7) Rare complications might include cardiac arrythmia, pericardial effusion and pericardial tamponade.

In our patient, the line was used for almost 20 days for both IV medication administration and TPN. A low dose heparin infusion was used to maintain the line patency. The team encountered no significant complication from the line.

Conclusion

Our case demonstrated an unusual site for a PICC insertion, through superficial abdominal veins to epigastric vein to internal thoracic vein and internal jugular vein to superior vena cava and right atrium. The catheter was used safely and effectively to deliver medications, fluids and TPN to the patient. Confirmation of catheter's tip position is important prior to use the line. The indication of PICC line should be questioned on a daily basis to reduce incidence of associated complications.

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