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Case Series

Anaesthesia Section

Emergency Dynamic Central Venous Cannulation in Preterm Neonates- A Case Series

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ABSTRACT

Neonatal venous cannulation is one of the challenges faced by Anaesthesiologists in routine practice. Neonatal cannulation is extremely difficult and time consuming and it has become an inevitable procedure in neonatal intensive care unit, because of the small vessel diameter and sometimes it is impossible to differentiate between artery and vein. Routinely umbilical vein, scalp vein and peripherally inserted central catheters cannulation are done during initial neonatal period. Central vein cannulation is needed in sick neonates for nutrition, antibiotics, venous sampling, and inotropic support and enables haemodynamics monitoring. Even with the point of care ultrasound, neonatal cannulation is technically challenging in well-experienced hands. Cannulation in a preterm neonate is highly demanding and nightmarish for all intensivists. The present case series aimed to show the successful placement of ultrasound guided supraclavicular subclavian cannulation in a very low birth preterm (less than 1500 gm) in three septic neonates. All three cannulations were done bedside in Neonatal Intensive Care Unit (NICU) with close monitoring of heart rate, pulse oximeter and electrocardiogram. Venipuncture was done under ultrasound guidance. After identifying the anatomic landmarks, subclavian cannulation was done using Seldinger technique. Subclavian cannulation was preferred because of easy accessibility, comfortable fixation and low infection rate.

Keywords: Central line, Subclavian vein, Ultrasound

INTRODUCTION

Central Venous Cannulation (CVC) is regularly done in Neonatal Intensive Care Unit (NICU). Peripherally inserted central catheters are placed in the umbilical vein in neonates which can be retained only for ten days. Techniques such as tourniquet application, swabbing and tapping of the veins are used to make the veins prominent. Sick neonates warrant the placement of central venous cannulation. Normally femoral, Internal Jugular Vein (IJV) and subclavian veins are preferred for central vein cannulation [1]. Under landmark guidance, complications such as arterial puncture, pneumothorax and malposition of catheters are very common. With the advent of point-of-care ultrasound, all the above hindrances can be tackled well. The present case series, describes supraclavicular subclavian vein cannulation in three preterm neonates. There are numerous data supporting feasibility of subclavian cannulation in children and newborn [2,3]. But only few cases have been reported in preterm neonates. Subclavian Vein Cannulation (SVC) is preferred over internal jugular vein in infants because of short neck and diameter of the vein, which remains unaffected during hypovolaemia [4]. The choice of cannulation depends on the weight, chronological age, clinical status and patency of veins.

CASE SERIES

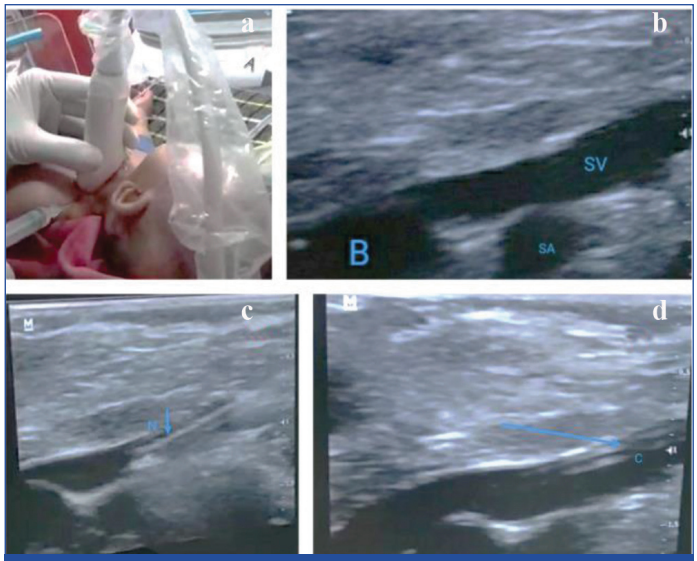
Case 1

Preterm neonate weighing 1 kg, 30 weeks of gestational age, meconium aspiration in sepsis was called for central line cannulation. The neonate was already intubated and mechanically ventilated and was on fentanyl infusion of 1 mics/kg. Electrocardiogram (ECG), pulse oximeter and temperature monitoring were used during cannulation. Consent for CVC was obtained from either of the parents. The procedure was performed by an Anaesthesiologist who had 15 years of experience in Ultrasound (USG guided paediatric cannulation). Portable ultrasound machine with linear probe 8-12 MHz (Mindray M6) and 5 cm footprint was used. Scout scan of both sides of the neck was performed and the patency of both subclavian veins was assessed, as the veins tends to collapse under probe pressure [Table/Fig-1a]. The neonates were placed in the supine position with the head turned to the right side and towel placed under the left scapula. After sterile preparation of the neck and probe, the USG probe was placed above the supraclavicular area in the transverse plane. The anatomical landmarks, IJV, subclavian artery and vein, pleura and surrounding structures were identified. The merging of subclavian with IJV was identified along the long axis. The probe was tilted posteroanteriorly to obtain a good view of entire length of target subclavian vein. Operator dominant hand was used for needle puncture and the probe was held with the non dominant hand. A 3 French, 5 cm, (21 gauge needle) self-dilator single lumen catheter was placed using the Seldinger technique, in which the desired vessel was punctured with needle, syringe was detached and guide wire was passed through the needle [5] [Table/Fig-1b-d].

Venipuncture was done using a 21 gauge needle. As the venous pressure is low in a preterm neonate, spontaneous backflow was not possible, so 2 mL syringe with a needle was used. Once the position of the needle in the vein was confirmed by sonoimage, guide wire was passed using the dominant hand without resistance. A self-dilating catheter was passed over the guide wire and sutured at the appropriate length. Postcannulation lung sliding was confirmed using a linear probe on the left side, to rule out pneumothorax.

Case 2

Preterm neonate of 34 weeks, weighing 1 kg, early sepsis and the baby was provided spontaneous ventilation on oxygen supplementation through nasal prongs called for neonatal cannulation. Neonate was sedated with midazolam 0.05 mg/kg. Right IJV cannulation was already attempted and failed. As the scout scan on left side of the neck was clear, left supraclavicular subclavian cannulation was done using the same technique as



[Table/Fig-1a-d]: Case 1: Sonoimage of the subclavian cannulation. (a) Demonstration of probe position and site of needle puncture. (b) Anatomy of subclavian vein and brachiocephalic vein. (c) Long axis view of needle in the vein. (d) Long axis view of catheter in the vein SV-subclavian vein, SA-subclavian artery, (blue arrow) N-needle trajectory, B-Brachiocephalic vein, C-catheter.

described above [Table/Fig-2]. As the neonate was tachypnoeic and spontaneously breathing placement of central line was really challenging.

Case 3

Preterm neonate of 32 weeks, 1.2 kg, intubated for meconium aspiration was called for central line cannulation for i.v. antibiotics and fluids. Scout scan of both right and left side was done and patency of both subclavian veins were assessed. As the sonoanatomy on left side was clear, left subclavian cannulation was done, using the Seldinger technique, as described in case 1. [Table/Fig-3].

[Table/Fig-2]: Case 2: Neonate with left sided CVC catheters (spontaneously breathing neonate). **[Table/Fig-3]:** Case 3: Neonate with left sided CVC catheters (intubated neonate). (Images from left to right).

DISCUSSION

With the advent of point-of-care ultrasound, CVC has replaced peripheral venous cut down as short-term venous access in children [6]. USG-guided preterm neonatal cannulation must be performed only by experienced hands. The small vessels, short neck and hypovolemia with added sepsis make the cannulation extremely difficult in preterm neonates. Paediatricians prefer subclavian cannulation in NICU, but an intensivist prefer subclavian cannulation because of expertise in the technique and proficiency in using ultrasound in daily anaesthesia practice.

The right subclavian vein is preferred to the left, because it passes directly from the innominate vein into the SVC and the risk of pneumothorax or damage to the thoracic duct is less [7,8]. Absence of valve, large diameter, ability to retain the cannula in supraclavicular fossa are the added advantages of subclavian cannulation. Breschan et al., stated that left Brachiocephalic Vein (BCV) is larger than right and shorter length and sharper angle of right BCV makes ultrasound imaging and needle advancement difficult [9]. Left BCV is apparently larger that the right in preterm babies [10].

In the above three cases, doing left-sided cannulation was comfortable because the scout scan was very clear on the left side. The mean age in the present study was 30 to 34 weeks of gestational age, mean weight 1.2 to 1.5 kg and mean attempts were two and the median time taken was 4-6 minutes. The use of doppler USG aided in precise identification of the target, fine control of needle adjustment reduced the number of punctures and was less time-consuming compared to the landmark technique [11,12]. Studies have proven that Central Line Associated Bloodstream Infections (CLABSI) are less under USG guidance central line placement which gives an added advantage in preterm neonate [13]. The challenges faced during the cannulation was absence of hockey stick probe. The presence of a paediatric probe would have definitely reduced the time taken for cannulation. Final position of the central line catheter at superior vena cava right atrial junction, using the Echo probe was not assessed.

Extreme tachycardia, varying subclavian diameter and tachypnoeic neonates were the limitations of the present study. Holding the linear probe immobile in a small area of the neck and threading the guide wire was really demanding. The calibre of veins was reduced because of hypovolaemia.

CONCLUSION(S)

Use of point of care USG in preterm neonatal cannulation reduces the complications associated with cannulation and is very useful for precise placement of CVC during difficult cannulation.

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