Longlines in neonatal practice – Its emerging need in special newborn care unit

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ABSTRACT

Background: Longlines are commonly used in neonatal practice in the West. Its correct placement is important to avoid complications such as extravasation of fluids into pleural, pericardial, and subcutaneous compartments which may prove fatal in some neonates. **Objective:** The objective of the study was to review the indications, insertion characteristics, post-insertion care, and complications of longlines in sick neonates and to emphasize its use in managing extremely low birth weight (ELBW) and very low birth weight (VLBW) babies at special newborn care unit (SNCU) level. **Materials and Methods:** A prospective cross-sectional observational study of all longline insertions during January 2014–June 2019 in the SNCU of a medical college of the Eastern State was undertaken. The indications, number of attempts at insertion, procedure time, and duration of longline stay, number of dressing change, complications and cause of removal were noted and the study variables were analyzed. **Results:** A total of 312 neonates were included; of them, 140 were ELBW and 172 were VLBW babies. Successful insertion of longlines in the first attempt occurred in 294 (94.23%) neonates. 16 (5.12%) neonates required second attempt, while only 2 (0.64%) required third attempt. The average time taken for the procedure was 30 min–1 h and average duration of longline stay was 18.3 days. Low complication rates were recorded such as occlusion in 24 (7.69%) cases, dislodgement in 3 (0.96%), migration in 4 (1.28%), sepsis in 15 (4.8%), and profuse bleeding at insertion site in 1 (0.32%) neonates. **Conclusion:** Longline is a safe, effective, and reliable method of providing prolonged IV access in sick small neonates, especially ELBW and VLBW babies. Longlines can be recommended for routine use at SNCU level.

Key words: *Extremely low birth weight, Longlines, Neonates, Special newborn care unit, Very low birth weight*

Longlines or peripherally inserted central venous catheters (PICC) are commonly used in neonatal practice in the West. In India, the use of longlines is restricted to neonatal intensive care units of higher centers. Maintaining reliable and long-term peripheral venous access is difficult both for patients and their physicians [1]. It becomes more difficult in extremely low birth weight (ELBW) and very low birth weight (VLBW) neonates and also in fragile surgical newborns [2].

The longline is a fine silastic or polyurethane tube 20–30 cm long that is threaded into one of the newborn's peripheral veins, usually in the upper or lower limbs, to reach a point where the vein becomes much larger, usually just outside the heart [3]. It is essential for long-term venous access, administration of total parental nutrition, hypertonic solutions, inotrope infusions, antibiotics, etc., [4,5].

Correct placement of longline is very important to avoid complications such as extravasation of fluids into pleural, pericardial, and subcutaneous compartments which may prove fatal in some neonates [6,7]. The present study aims to review the indications, insertion characteristics, post-insertion care, and complications of longlines in sick neonates and to emphasize its use in managing ELBW and VLBW babies at Special Newborn Care Unit (SNCU) level.

MATERIALS AND METHODS

A prospective cross-sectional observational study was done of all longline insertions during the period January 2014–June 2019, in the SNCU of a peripheral medical college of an Eastern State. Ethical clearance was obtained from the Institutional Ethical Committee. Before insertion, written informed consent was obtained from the parent or a legal guardian. The study included only the neonates who were hemodynamically stable before the insertion. The neonates, who were hemodynamically unstable or moribund clinically, were excluded from the study.

Technique of Longline Insertion

Two types of longlines were used in our SNCU. Vygon® Premicath (size 1 Fr) longlines were used typically for ELBW neonates and Vygon® Nutriline (size 2 Fr) longlines were used for VLBW neonates. Both types used were single lumen catheters and made up of polyurethane. All longline insertions were performed without midazolam or anesthetic sedation. The neonates, who showed a lot of movement or cried during the procedure, were calmed down by putting sterile gauze soaked in table sugar solution in the mouth.

Longlines were inserted through long saphenous vein in lower extremity in 290 cases. Few (22 cases) were inserted through brachial vein in upper extremity. During insertion, full aseptic preparation was taken and manufacturer's guidelines were strictly followed.

Post-insertion Care

After insertion of longline up to a desired length, hemostasis was secured at the entry point. The area was cleaned and dried before applying non-irritant, transparent adhesive (Tegaderm) dressing. A BD cannula or a three-way adaptor was connected to the longline and care was taken to secure these devices. Heparinized normal saline (1 unit/ml) was in at the rate of 1 ml/h infusion until chest X-ray confirmation of longline tip position at appropriate place was performed. Checking for blood return is not generally performed on longlines to confirm their position before use. Confirmation of longline position could only be undertaken by performing a chest X-ray.

Following confirmation of satisfactory position, administration of IV fluids, parental nutrition, hypertonic solutions, and medications were started. We used heparinize IV fluid and parental nutrition solution at the rate of 0.5 unit/ml. Regular longline inspections were done and whenever any blood, fluid soakage, or lifting of dressing were seen, dressing was changed immediately. Longline tip was sent for culture-sensitivity routinely after removal.

Data Collection

Patient profile, indication of insertion, number of attempts at insertion, time taken for the procedure, number of dressing changes required during indwelling period, and lifespan of long line and complications such as occlusion, dislodgement, migration, sepsis, and bleeding at insertion site were noted. All data were entered in Microsoft Excel sheet and frequencies were determined.

RESULTS

A total of 312 neonates who required longline insertions were included in the present study; of which, 140 were ELBW and 172 were VLBW neonates. As shown in Table 1, 212 newborns were delivered by lower uterine caesarian section and 100 were by normal vaginal delivery. The number of male neonates (180) was higher than the number of female neonates (132).

Table 2 shows specific indications for insertion of longlines, number of attempts, and number of dressing change. A total of 158 (50.64%) neonates required longline insertion for prolonged IV fluid therapy and 110 (35.25%) neonates for parental nutrition and 32 (10.25%) received prolonged antibiotics for 3 weeks or more. A total of 12 (3.84%) neonates required longline insertion for infusion of >12.5% glucose for effective management of refractory hypoglycemia.

Successful insertion of longline in the first attempt occurred in 294 (94.23%) neonates. 16 (5.12%) neonates required second attempt, while only 2 (0.64%) required third attempt. The average time taken for the procedure was 30 min–1 h and average duration of longline stay was 18.3 days. After initial dressing post-insertion, dressing needed to be changed further for 1 time in 28 (8.97%) neonates, 2 times in 10 (3.2%), and 3 times in 12 (3.84%) neonates.

Table 1: Patient profile

Parameter	Number
Birth weight–Extremely low birth weight/very low birth weight	140/172
Maturity–Preterm/term	280/32
Gender–Male/female	180/132
Place of BIRTH–Inborn/outborn	152/160
Mode of delivery–Lower uterine caesarian section/normal vaginal delivery	212/100

Table 2: Longline data

Variables	Number (%)
Indications for insertion	
Prolonged IV fluid	158 (50.64)
Parental nutrition	110 (35.25)
Refractory hypoglycemia	12 (3.84)
Prolonged antibiotics	32 (10.25)

The overall incidence of complications following longline insertion was significantly less. Occlusion of longline occurred in 24 (7.69%) neonates, accidental dislodgement occurred in 3 (0.96%), and migration occurred in 4 (1.28%) neonates. Sepsis was proven in 15 (4.8%) neonates and there was profuse bleeding at insertion site in 01 (0.32%) neonate only. Premature removal of longline was needed in the 47 (15.06%) complicated cases. In 265 (84.93%) neonates, longlines were removed electively after the completion of targeted therapy. Of the 47 complicated cases, 42 neonates (89% of total complicated cases) succumbed after developing progressive worsening in clinical condition.

DISCUSSION

Longline was first introduced in clinical practice in 1975 and has gained popularity in recent years [4,8]. Many studies have documented the safety and the ease of insertion of longlines in neonates [4,9]. It can be inserted by trained nursing personnel [10]. The present study also finds the greater ease and higher success of insertion, showing a success rate of 94.23% in first attempt. Other studies have shown a success rate of 90–92% in a first attempt [2,4].

The mean duration of stay of longlines in the present study was 18.3 days, which was significantly higher compared to a study by Ragavan *et al.*, where 10.03 days was reported as the mean indwelling time [2]. A study, conducted using silastic PICC for central hyperalimentation, reported average life span of 24.8±15.9 days [11]. The average life span of longlines in neonates was reported as 2–4 weeks [12]. Several studies show that there is no limit as to the duration of leaving the catheter *in situ* [9,13,14]. In the present study, 84.93% of longlines were removed electively after the completion of targeted therapy, while only 15.06% of longlines required premature removal.

The major complications encountered during insertion and post-insertion are occlusion, accidental dislodgement, migration, and sepsis. The position of longlines is important because incorrect placement may be associated with complications [3]. There are a number of case reports where longline migration has caused pericardial effusion and tamponade [15-17]. Even death has been reported in neonates due to cardiac tamponade related to longlines [18,19]. In the present study, longline migration occurred in 1.28% neonates and accidental dislodgement occurred in 0.96% cases. Although the occurrence rate was low, both proved fatal eventually.

It is vital that all longline placements should be confirmed as accurately as possible. There are studies showing poor intra and interobserver reliability when plain radiographs are used to assess longline tips. Some studies suggest that contrast should be routinely used in assessing longline position in the neonate, as it helps in better identification of catheter malposition [20]. Other modalities such as two-view radiographs, echocardiography, computed tomography radiography, transthoracic ultrasonography, horizontal beam technique, and lateral radiographs are also used [21-24]. In the present study, longline positions were checked by plain chest X-ray only.

Catheter occlusion rates reported for longlines have ranged from 1.5% to 15%, while it was 7.69% in the present study [25]. IV fluids and parental nutrition solutions were infused as heparinized fluids (at 0.5 units/ml) to reduce the incidence of occlusion from thrombus formation in longlines. Although the chances of arterial puncture and bleeding are reported to be much less with longlines, the present study documented one neonate with profuse bleeding on 1st post-insertion day, who required immediate removal of longline.

Longlines are often used for extended periods of time, and there is a high risk of bacterial colonization and consequent bacteremia. Incidence of catheter-related sepsis associated with longline usually occurs late, beyond 4th week [4]. Studies have reported its lower incidence (2%) as compared to other central venous devices (3–20%) or peripheral venous catheters (4.6–9%) [9]. In the present study, proven sepsis was seen in 4.8% neonates. Due to the resource-limited setting of our SNCU, priority of insertion was given to the most needy and vulnerable group, i.e., ELBW and VLBW neonates only, which is the major limitation of the study.

CONCLUSION

It is evident that longline is a safe, effective, and reliable method of providing prolonged IV access in tiny newborns, especially ELBW and VLBW neonates. Junior doctors and nursing personnel working in SNCU must be trained to achieve competency on longlines. Its use should be recommended for routine use in SNCUs, catering to the needs especially of large number of ELBW and VLBW neonates.

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