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Spontaneous intraurethral catheter knot requiring perineal urethrotomy in a neonate: A case report with review of management and prevention

Akshay Patil, Parag Janardhan Karkera, Pradnya Suhas Bendre
Department of Pediatric Surgery, Bai Jerbai Wadia Hospital for Children, Parel, Mumbai, India

ABSTRACT

Infant feeding tubes are routinely used as urethral catheters in neonates and children. Although considered safe, it can lead to significant morbidity if the catheter knots in the bladder. We report a case of a spontaneous urinary catheter knotting in a neonate. It required a perineal urethrotomy for successful removal. A lateral oblique radiograph to characterize the complexity of knot helps in its management. Training of staff involved in the insertion, maintenance or removal of the catheters is essential to decrease catheter related complications.

Key Words: Intraurethral catheter, spontaneous knot, neonate, urethrotomy.

Dr. Parag Janardhan Karkera
Department of Pediatric Surgery, Bai Jerbai Wadia Hospital for Children, Parel, Mumbai, India
E-mail: drpaggy@gmail.com
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Introduction

Urethral catheterization is a common ward procedure in pediatric hospitals and intensive care units. The common indications for urethral catheterization are urine collection for urine analysis, urine output monitoring in post-surgical and critically ill cases and radiological evaluation of the lower urinary tract. Infant feeding tubes (IFT) are commonly used for this purpose. Common complications of catheterization include urethral trauma, urinary tract infection, bladder perforation and catheter knotting. Catheter knotting, a rare complication is seen in children 2 years of age or younger following the use of feeding tubes as urethral catheters. The incidence of knotting is reported to be 0.2 per 100,000 catheterizations [1]. We report a case of catheter knotting where knot was impacted in urethra and its successful removal by perineal urethrotomy.

Case report

A neonate at day 6 of life had red color spotting of the diapers with suspected hematuria. The baby was born at full term by normal vaginal delivery with birth weight of 2.80kg.The antenatal ultrasound scans were normal with no urinary tract anomalies. Pediatric nephrology reference was taken who advised an ultrasonography of the urinary tract and urine analysis. Ultrasonography (US) of the urinary tract was normal. The baby was

catheterized with 8 Fr. IFT inserted by a new junior resident in neonatal intensive care unit (NICU) up to 20 cm and was left in situ for a few hours for urine collection. The urine analysis was normal. His hemoglobin was 13.5gm/dl, total leucocyte count was 8000 cell/mm^3, with adequate platelets and normal coagulation profile. Later, attempted withdrawal of the IFT failed. Multiple attempts including traction with force were made before a pediatric surgery consultation was asked, almost 10 hours after the insertion of the catheter. On clinical examination by the surgeons, the IFT was found impacted at the mark of 8 cm at the external urethral meatus. A knot in the IFT was palpable in the perineum which was later confirmed by radiography. A lateral oblique radiograph taken to access the position of IFT and the reason for its unsuccessful withdrawal revealed a knot probably in the bulbar urethra (Fig.1).

Fig. 1. Lateral X-ray pelvis showing knotted IFT probably in the bulbar urethra.

After 12 hours of initial catheter insertion, baby was shifted to the operation theatre to attempt catheter removal under anesthesia. Attempts of removal on gentle traction failed. The IFT was found snugly impacted in the urethra with no movement of the IFT either out of the meatus or back into the bladder. A stiff guide wire insertion to unlock the knot was attempted, which failed. The neonatal urethra was too narrow to accommodate a cystoscope besides the IFT to aid in removal. A suprapubic cystotomy was not attempted, in view of the impacted IFT knot in the urethra rendering even suprapubic cystoscopic removal not possible. Eventually, decision to make a mini, midline perineal urethrotomy incision for IFT retrieval was taken. The bulbar urethra was opened and the knot was removed (Fig.2) through the midline incision while the distal end of IFT was cut and withdrawn from external meatus.

Fig. 2. The knotted IFT after removal.

Urethra was repaired over 6 Fr all silicon Foley`s catheter with vicryl 6-0 continuous sutures and surrounding fascio-cutaneous tissue was used for buttressing urethral closure. (Fig. 3A). The baby voided in a good stream after catheter removal on post-operative day-10. A small urethra-cutaneous fistula (Fig. 3B) with trickling of urine was noted whenever the child voided on immediate follow-up. The fistula healed spontaneously by 3 months after surgery (Fig. 3C).

Figs. 3. A. Midline perineal urethrotomy after repair. **B.** Urethro-cutaneous Fistula at 1 month. **C.** Healed wound after 3 months follow –up.

Discussion

Catheter knotting is a stressful situation to both the parents of baby and the treating doctors because of its iatrogenic etiology. Guidelines for catheter insertion, maintenance and removal are not always available in many NICUs. Although, urethral catheterization increases the risks of neonatal urinary tract infection, it is generally considered a useful and safe alternative for urinary collection in the NICU [1,2]. IFTs are enteral tubes that are commonly used as they are easily available and are cheap .Knots within the urethra are rare, but have been reported in both children and neonates [3, 4, 5]. Catheter knots in urethra are usually those that are formed in the bladder and slip into urethra while manipulation of catheter. The most plausible explanation for knot formation relates to the length and depth of catheter insertion. With decompression of the bladder, the catheter tip loops through a coil of catheter, particularly if a long length of catheter has been inserted. As the catheter is retracted, the coil tightens, cinching into a knot [4].

A newborn male urethra measures 5 cm which increases to 8 cm by 3 years of age and 17 cm by adulthood, while a female urethra measures 2.18 cm at birth and increases to 2.54 cm by 5 years and 3.78 cm in adulthood. So, catheter insertion lengths of ≤ 6 cm and ≤ 5 cm in male and female urethras respectively have been suggested to prevent catheter knots [6]. Misjudgments are due to lack of data on the urethral length related to body size and due to the common recommendation to insert the catheter "only as far as necessary to obtain urine flow" which in case of an empty bladder or of a false passage may lead to an excessive insertion length and increased trauma.

The predisposing factors for catheter knotting are elasticity, smaller size, excessive insertion of the catheter (e.g., catheters <10 Fr. in size and insertion length more than 10 cm) and over-distended bladder [7]. Use of 4 Fr. IFTs recommended in preterm neonates for catheterization are speculated to be more prone to knotting because of their flexibility [8]. A pre-catheterization bladder ultrasound scan to assess bladder volume helps to avoid excessive length of catheter to be inserted blindly into bladder after significant urinary volume retrieval.

In our case, where only a urine sample was required for diagnostic purpose, a pre-

catheterization ultrasound to look for full bladder before catheter insertion and measured insertion of the catheter up to 6cm would have ensured a safe, uneventful retrieval.

In cases needing longer duration of catheterization, secure fixation of IFTs to glans or the prepuce (in neonates) with sutures or with use of adhesive dressings to anterior abdominal wall, helps to prevent inadvertent removal or advancement into the bladder [1]. Double diaper drainage system can also be used for this purpose.

Our case is unusual because the catheter knot was impacted in the bulbar urethra in a neonate catheterized for urine sampling. As seen in our case, a plain radiograph, especially a lateral abdomen and pelvic film, helps to evaluate the position and configuration of the catheter. We recommend a single lateral oblique view covering the bladder and urethra. Although, Ultrasonography can also be used to detect the catheter tip and associated complications (hematoma, perforation etc.), it is operator dependent and may not easily available at all times at all health centers [8].

The various techniques described to manage this situation include manual removal (under anesthesia) after gentle but sustained traction [9], insertion of a guide wire to assist traction under fluoroscopy [10], percutaneous endoscopic removal of catheter via suprapubic tract [11,12] or an open surgical intervention(suprapubic cystotomy / urethrotomy / meatotomy).

Sustained traction holds the risk of urethral injury and is not beneficial when the knot is bulky. Guide-wire manipulation is useful only at the early stage of knot formation when the knot is not tight enough at the 'open-loop stage' and exposes baby to radiation hazard. Percutaneous endoscopic removal is helpful when the knot is in the bladder or lying loose in the urethra. In our case, this option wasn't feasible because the knot was impacted in the urethra. The simplest and safest is suprapubic cystotomy if conservative maneuvers fail, when the knot is in the bladder.

In our case, the knot was too bulky and impacted in urethra, so a perineal urethrotomy was done. Although, this option results in opening a neonatal urethra, but we think surgically planned urethrotomy and meticulous closure is better than blind forcible traction which may cause immeasurable urethral trauma or stricture.

To summarize, measured length of catheter insertion as per age, ideally with a pre-catheterization ultrasound, with or without fixation of catheter depending on the duration of catheter requirement, will prevent most complications. A Lateral oblique bladder-urethra X-ray helps to detect the presence and position of the catheter knot. Surgical treatment may vary from gentle traction to open urethrotomy depending on the severity of knot formation and its position. Hence, if "Prevention is better than cure" then, regular orientation or teaching programmers of the resident doctors and nursing staff should include awareness about urethral length in neonates and children and the complications of routine catheterization. This will aid to minimize such adverse events.

Compliance with ethical statements

Conflicts of Interest: None.

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Consent: Informed and written consent were taken from patient and her parents to publish this case report.

ORCID iD of the author (s)

Akshay Patil / 0000-0003-4161-7675

Parag J Karkera / 0000-0001-7628-9144

Pradnya S Bendre / 0000-0003-3881-5961

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