

## Percutaneous cystolithotripsy in children and its outcome: A single center experience

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### ABSTRACT

**Background:** Pediatric bladder stone disease is very common in certain regions of India. Traditionally, pediatric surgeons have been managing this by open surgeries. **Aim:** The aim of the study was to manage vesical calculus in children by percutaneous cystolithotripsy (PCCL). **Materials and Methods:** All the children up to 18 years of age suffering from vesical calculus were operated by PCCL. Cystoscopy performed first to assess the stone burden. 18 Fr angiocath needle was used to puncture the bladder under vision and 0.035 guide wire was passed. Tract was dilated using single-step screw dilator; a 20 French Amplatz sheath was passed over the screw dilator and nephroscope was introduced. Lithotripsy was done using pneumatic lithotripter. Per urethral Foley catheter was placed and suprapubic puncture site was suture closed. **Results:** A total of 74 patients were operated in the past 3 years with an age range was 1–18 years with female preponderance. Complete clearance was achieved in all patients while the average duration of surgery was 30 min with range of 15–50 min. All the patients were operated under regional anesthesia and were discharged the next day. Among the study population, three patients had superficial wound infections at the puncture site which was managed conservatively. **Conclusion:** PCCL is a good option for managing vesical calculus in children. It has minimal morbidity and very small scar as compared to open cystolithotomy. Even in recurrent stones, it can be effectively performed, and in fact, it is easy to learn and reproducible.

**Key words:** Bladder calculus, Endoscopic removal, Pediatric stone

Bladder calculus is a common lower urinary tract problem in children. Bladder stones are more often found in children from developing countries and are thought to be related to malnutrition in the absence of anatomic abnormality. Most commonly, these are secondary stones formed in the renal system initially and then migrate down. However, there can be primary stones also if there are anatomical abnormalities such as diverticulum and posterior urethral valve [1-4]. It is believed that probably the diet which is low in animal protein and phosphorus, in addition to Vitamin A deficiency, is contributory [5-7]. Bladder stones from children in the developing countries are most often composed of ammonium acid urate [1-3]. In contrast, among children from industrialized nations, bladder stones are most often found with spinal cord injuries or congenital abnormalities such as spina bifida. Very often these children have undergone augmentation cystoplasty and/or manage their bladders by clean intermittent catheterization. It has been reported that 50% of these children with reconstructed bladders will develop bladder stones in their lifetime [8-10].

Open suprapubic cystolithotomy has been the standard surgery for this pathology [11,12]. However, these patients

can have high chances of recurrence of this disease and each subsequent open procedure becomes difficult technically. Transurethral cystolithotripsy is an alternative although not ideal, in pediatric population. Small urethral caliber limits effective treatment of large bladder stone burdens. There has been individual improvisation for the minimally invasive procedures for vesical calculus without any standardization like using laparoscopic instruments for stone retrieval [1,2]. With the advent of endourology, endoscopic management of vesical calculus is the good option in the armamentarium of surgeons. The main aim of this study was to manage vesical calculus in children by percutaneous cystolithotripsy (PCCL).

### MATERIALS AND METHODS

This was a progressive clinical study in which all the children up to 18 years of age and those diagnosed to have vesical calculus on ultrasonography were operated by PCCL. The study was carried out at a rural tertiary care center in North Maharashtra area of India from March 2014 to October 2017. Children with stone

size >4 cm were excluded from the procedure. The included diagnosed and operated children had routine hemogram, renal function tests, and X-ray of the kidney, ureter, and bladder region as a part of pre-operative evaluation.

Regional anesthesia was used in all the children. First cystoscopy was done to rule out urethral pathology and to assess the stone burden (Fig. 1). Bladder was filled by irrigation of the cystoscopy; 2 cm above the pubic symphysis and slightly off the midline puncture site was chosen. Under vision, 18 Fr angiocath needle was put into the bladder (Fig. 2) and 0.035 terumo guide wire was passed (Fig. 3), a 20 Fr screw dilator was used to dilate the tract over the guidewire. The 20 Fr Amplatz sheath was passed over the screw dilator and then the cystoscope was removed. 19 Fr nephroscope was passed through the Amplatz sheath, stone visualized, and clearance was achieved by graveling the stone using pneumatic lithotripsy (Fig. 4). All the fragments were removed and complete clearance confirmed after which per urethral Foley catheter of appropriate size was placed (Fig. 5) and Amplatz sheath was removed. The puncture site was suture closed (Fig. 6) and compression dressing was given at the end of the procedure. All the patients were allowed orally after 4 h of surgery and were discharged next day on oral antibiotics after removal of catheter.



**Figure 1:** Cystoscopy to assess the stone burden and to rule out any associated pathology



**Figure 2:** Puncture site with angiocath needle *in situ* under cystoscopy guidance

## RESULTS

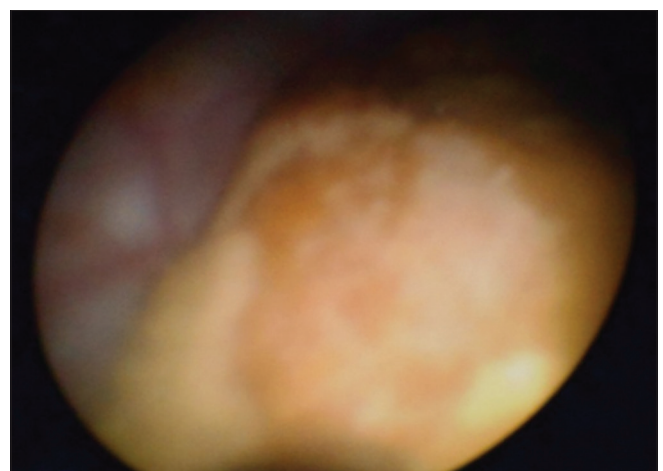
Total 74 children were operated by PCCL from March 2014 to February 2017 at a single centre and by a single surgeon with the same technique. The age group was 1–18 years. In the study population, 45 patients were female and rests were male children. The average duration of surgery was 30 min with the range of 15–50 min. The duration of surgery was influenced by the hardness and size of the stone. The average calculus size was 2 cm in our series while the maximum size of the stone removed by this technique was 4 cm in diameter. Stones larger than 4 cm diameter were not operated by this technique and they all underwent open suprapubic cystolithotomy. None of the present series of patients had augmented bladder. Three patients had superficial puncture site infection which was managed by conservative treatment. All these three patients had stone size of 4 cm diameter.

## DISCUSSION

Open suprapubic cystolithotomy has been the standard treatment modality for vesical calculus. However, pediatric patients with vesical calculus have higher chance of recurrence of the disease in their lifetime [11,12]. Open surgery in recurrent stones becomes increasingly difficult because of the fibrosis and reduced bladder

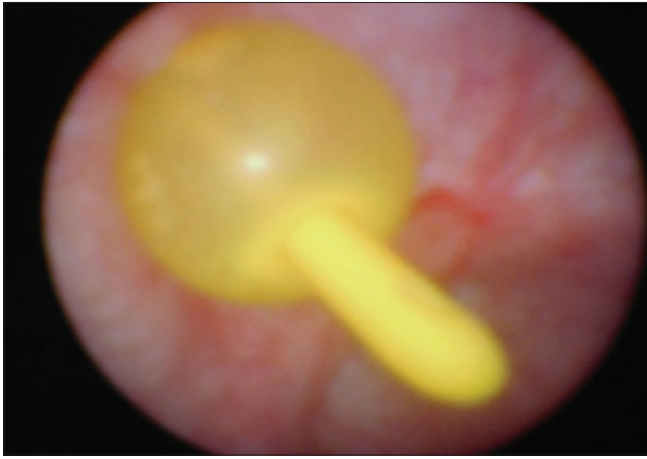


**Figure 3:** Placement of terumo guide wire into the bladder



**Figure 4:** Nephroscopic view of stone just before pulverization





**Figure5: Post procedure placement of per urethral foley's catheter**



**Figure6: Closure of port site**

capacity due to cystitis. Also, with the advent of increased number of enterocystoplasties, wherein development of recurrent vesical calculus is well documented, open surgery can have more morbidity and increased chances of wound infection [13-16]. There has been a constant search of minimally invasive procedures for the management of bladder stones. Few techniques have been mentioned like using laparoscopic trocar for suprapubic puncture and removal of stones or using endotracheal tube for access have been described [5,6]. However, these techniques are not standardized and are individual improvisations for few selected cases [2-4].

Cystolithotripsy is another minimally invasive procedure for bladder stones. However, the diameter of the pediatric cystoscope is smaller and it is not possible to remove large concretions by cystoscopy as the small urethral diameter serves as a major hurdle. This procedure loses all the advantage once the stone size becomes more than the size of the scope. Another major disadvantage with cystolithotripsy is that the size of stone gravel is irregular and in pediatric patients due to narrow caliber of urethra, all the fragments cannot be removed per urethra every time. Moreover, the repeated passage of scope every time to retrieve the fragments can cause more damage to the urethra. Hence, we strongly recommend PCCL which can easily overcome these obstacles.

With the advancement in endourology and availability of small size nephroscopes, PCCL has natural advantage over cystolithotripsy and open cystolithotomy. There is no need to incise the bladder unlike open procedure, so there is minimal damage to the bladder wall.

All the steps of PCCL are under vision and hence no blind technique and are no collateral damage. The procedure is extraperitoneal just like open surgery. Another important advantage of PCCL over surgery is the Amplatz sheath, which is slightly larger than nephroscope size. It allows easy removal of large fragments and also allows drainage of irrigation fluid and hence, does not cause overdistension of bladder in spite of having continuous saline irrigation. Having a fixed Amplatz sheath also makes repeated entry of nephroscope absolutely non-traumatic and chances of damage to the bladder wall or to the urethra are none due to repeated scope insertion. Since the Amplatz sheath entry is by dilatation of the fascia and bladder wall and not by cutting it, after removal of sheath, the bladder

wall and fascia easily approximate sealing the entry point. This prevents post-procedure urinary extravasation. The size of scar in PCCL is equal to the diameter of the Amplatz sheath which in our series was 20 Fr, that is, 7 mm which concludes as another major cosmetic advantage. PCCL involves the cystoscopic evaluation of the bladder before procedure to diagnose associated urethral pathology like posterior urethral valve.

Salah *et al.* reported on their experience with cystolithotripsy in 155 children from Pakistan and Yemen with a mean age of 4.5 years and average bladder stone burden of 2.3 cm (range 0.7–4cm). All the children were treated successfully and safely using a 26 Fr nephroscope through a 30 Fr sheath placed through a 1 cm suprapubic incision [1]. As compared to this study, we have achieved clearance of similar range of the stone sizes using smaller scope of 19 Fr and smaller incision of 7 mm only. Gan *et al.* reported on their experience using a 16 Fr peel-away sheath with a ureteroscope to treat bladder stones with an average size of 1.4 cm in 15 boys [2].

PCCL is quite useful in patients with bladder augmentation cystoplasty and having recurrent bladder stones wherein, open surgery can be having more morbidity [5]. Moreover, it is easily reproducible at all the pediatric surgical centers and can be effectively performed using regular pneumatic lithoclast. Potential complications during this procedure recorded in literature are posterior bladder wall perforation, extravasation of urine from the puncture site, superficial wound infections, and vesicocutaneous fistula formation [1,2,17,18]. There were no major complications in our series; however, we had superficial wound infection as complications in three patients. The rate of complications in our series is comparable to described in literature. All these patients had stone size of 4 cm diameter. Probable cause of infection could be due to associated cystitis with large bladder calculus. All these patients were managed conservatively and responded well. Our series is so far largest pediatric PCCL at a single center in India with successful application and easy reproducibility.

## CONCLUSION

PCCL is good and effective procedure for management of vesical calculus in children. It can be used for moderate to large size

calculi. PCCL is easily reproducible at all the pediatric surgical centers and can be effectively performed using regular pneumatic lithoclast. However, it cannot be recommended for management of massive bladder calculi due to technical difficulty.

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