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ORIGINAL ARTICLE

Comparative Analysis of Cystolithalopexy and Percutaneous Cystolithotripsy in Senior Pediatric Population Aged 6 to 15 Years

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ABSTRACT

Background and Objectives: To compare cystolithalopexy and percutaneous cystolithotripsy in children 6 to 15 years based on complications.

Methodology: The study includes 100 patients under the age of 6 to 15 years age, split into two groups called Group-A (45) and Group B. (55). Included were those patients with stones that were smaller than 20 mm in size (on average, 14 mm). Patients in Group-A received cystolithalopexy therapy utilizing a ureteroscope and a pneumatic lithoclast assisted by a Dormia basket. Patients in Group B received percutaneous cystolithotripsy therapy.

Results: The age range of the 100 male pediatric patients ranged from 6 to 15 years (mean age 8 years). The average length of stay in the hospital was 2.5 days for patients in Group A and 3 to 8 days for patients in Group B. Patients in Group-A exhibited higher rates of urinary tract infections (8%) and urethral injuries (22%), residual stones (1%), enlarged bladders (2.2%), urinary retention (4.4%), and fever (13.33%). While in Group B, 18% of the members experienced urinary tract infections, 5% wound infections, 4% hematuria, 7% bladder size enlargement, and 27% fever. In each Group, urine retention was 7%.

Conclusion: Pediatric male patients with vesicle calculus respond substantially better to cystolithalopexy because it requires less invasive surgery, leaves no scar, and has fewer complications.

Keywords: Bladder Calculus, Comparison, Cystolithalopexy, Ureteroscope, Pneumatic Lithoclast, Dormia basket, percutaneous cystolithotripsy.

INTRODUCTION

At least in wealthy industrialized nations, bladder calculus has magically disappeared. However, in the past, bladder calculi were more common in the west, and those who tolerated the disease were willing to risk their lives to find relief. Before the 1800s, the only available treatment was lithotomy, sometimes known as "Stone Cutting," a highly uncomfortable technique with a high fatality rate (Soliman and Rizvi 2017). The most frequent location for stone development in children is in the urinary bladder, which is classified as primary idiopathic, endemic secondary, and migrating. In Pakistan, a bladder calculus is a widespread issue. It is the most common disorder among low-income individuals and has a high frequency during childhood and adolescence. Depending on the availability of skills and equipment, bladder calculi are treated using a variety of techniques, such as open vesicolithotomy, extracorporeal or endow corporeal lithotripsy, endoscopic cystolitholapaxy or cystolithoclasty via an antegrade or retrograde approach. In the majority of patients, especially in youngsters, ESWL is the first line of treatment. (Faizan et al., 2020).

Since ancient times, urolithiasis has been a common clinical issue. Urinary calculi were present as long as 7000 years ago, and possibly longer, according to anthropological history. A stone older than 7000 years was discovered in the pelvis (and likely bladder) of an Egyptian mummy (Ullah et al., 2007). Urolithiasis with urinary bladder calculi makes up around 5% of cases (Schwartz and Stoller 2000), The invention of endourological fiber-optic equipment and extracorporeal shockwave lithotripsy (SWL) has drastically altered the treatment choices for vesical lithiasis (Papatsoris et al., 2006). For the treatment of bladder calculi, a variety of methods have been employed, including open cystolithotomy, transurethral cystolitholapaxy (TUCL), SWL, and percutaneous cystolitholapaxy (PCCL) (Aron et al., 2003; Bülow and Frohmüller 1981). However, the best course of action for treating bladder stones is still debatable (Papatsoris et al., 2006). Despite being limited to young patients with narrow urethras, TUCL has progressively grown to be as popular as open cystolithotomy (Agrawal et al., 1999). According to Aaron et al. (2003) and Bülow and Frohmüller (1981), PCCL, which employs the concepts of percutaneous nephroscope stone removal under fluoroscopic guidance, is a well-proven procedure with great efficacy, particularly when treating big or numerous bladder stones. Although primary vesical stones in children are uncommon in affluent nations, they are regularly observed there. (Thalut et al., 1976).

After a comprehensive evaluation of the urinary system to rule out intravesical blockage as a hidden cause of vesical stone development, the standard treatment for these patients is cystolithotomy. Significant modifications in the treatment of stone disease have been made since the development of endourology. However, due to the tiny urethral caliber in pédiatrie patients, transurethral treatment of bladder stones in children is not offered in the majority of urology centers. (Schulze et al., 1976).

We have contrasted the new adaptive approach with the two most often used traditional procedures, percutaneous cystolithotripsy, and cystolithalopexy, to provide the children with bladder calculus with the maximum benefits of a cystoscopic treatment.

PATIENTS AND METHODS

From January 2021 to April 2022, one year, a comparative study was carried out using prospective data collection in the Department of Urology, Teaching Hospital Pediatric Urology Unit Institute of Kidney Disease Hayatabad Medical Complex, Peshawar.

One hundred pediatric male patients were enrolled in this study, which was approved by the teaching hospital's ethical review committee for the pediatric urology unit institute of kidney disease in Hayatabad Medical Complex, Peshawar.

Patients with bladder stone loads of P30 mm were examined between January 2021 and April 2022 in a prospectively kept database for patients who received PCCL.

Every patient underwent a thorough preoperative evaluation that included a thorough medical history review, a physical examination, laboratory investigations such as urine analysis, urine culture, and sensitivity testing, preoperative laboratory assessment, and imaging tests such as abdominopelvic ultrasonography (US) and plain abdominal radiographs of the kidneys, ureters, and bladder (KUB). All patients received an explanation of the surgical procedure's specifics before providing their informed permission. Male patients with ages below 6 and above 15 as well as all female patients were disqualified from our study. Male pediatric patients with single calculi smaller than 20 mm in diameter and aged 5 to 15 years were included in this investigation.

Surgical Procedure: Patients with sterile urine received a preventive preoperative antibiotic injection; those with bacteriuria were treated by the results of the culture and sensitivity tests. The treatments were carried out while sedated intravenously and under caudal or spinal anesthesia. Urethrocystoscopy was first carried out while the patient was in the lithotomy posture, and the bladder was filled with ordinary saline to facilitate suprapubic access. Endoscopic observation of the anterior bladder wall revealed continuous intravesical guidance for the percutaneous approach. The cystoscope aids in preventing damage to the rectum and posterior wall of the bladder by continuously guiding the puncture and dilatation during the percutaneous approach. Additionally, the assistant surgeon can keep an eye on each stage of the PCCL to prevent guidewire slippage or loss of the tract and sheath, as well as to use it to point the nephroscope at missed stones. The cystoscope was only left in place when it was necessary to create an access point for the percutaneous tract and to suction, the stone fragments out at the end of the treatment.

64 male youngsters under the age of 18 received primary vesical stone treatment between January 2021 and April 2022. At diagnosis, the average age was 8.6 years. The patients have received at least a year's worth of care (mean 7.5 years). Patients' modes of presentation varied (Table 1). Plain radiography, intravenous urography, ultrasonography, and urethrocystoscopy were used to diagnose primary vesical stones during or before surgery. The largest diameter of the radiopaque vesical stones in all of the patients ranged from 0.8 to 2 cm (mean 1.2 0.7 cm).

The patients were divided into two groups based on the method used to remove the stones. Group I included 45 children who underwent cystolithotomies, while Group II contained 55 patients who underwent endourologic procedures. In 11 individuals, the endourologic procedures were transurethral, while in 16, they were suprapubic. The age of the patients and stone size at the time of diagnosis was the key determinants of categorization into two groups. Cystolithotomy is preferred for patients under the age of 10 to remove stones larger than 1.5 cm. However, for smaller stones in the same age group, suprapubic cystolithapaxy is advised. Older boys with stones under 1 cm used the transurethral approach. Table 2 provides a summary of the patients' ages, average stone sizes, and fragmentation techniques. Incisions for cystolithotomies were made halfway between the symphysis pubis and the umbilicus, measuring 3 to 4 cm in length.

RESULTS

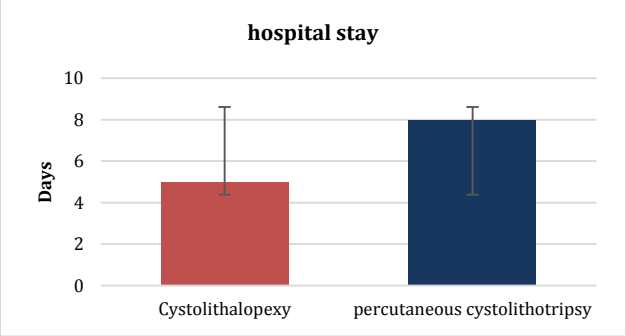
A hundred pediatric male patients with bladder calculi were hospitalized in the pediatric urology unit at the institute for the renal disease at Hayatabad Medical Complex in Peshawar from January 2021 to April 2022. All of the patients were male and ranged in age from 6 to 15 years (average age, 8.5 years) with a single urinary bladder stone smaller than 20 mm. Most of the patients included in our study were from the KP province, with a small number coming from a few other regions in Pakistan.

The study sought to determine, based on many characteristics and complications, which surgical procedure is best for individuals with bladder stones.

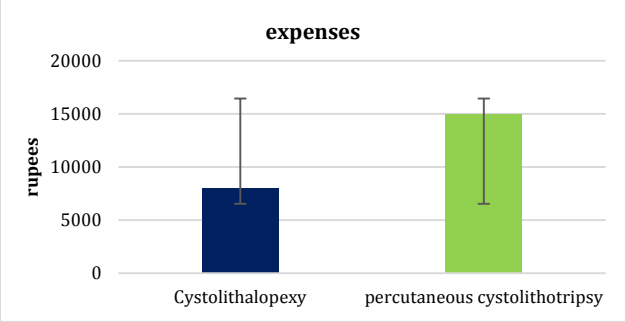
The patient's bladder stones were surgically removed using the techniques of cystolithalopexy and percutaneous cystolithotripsy, and the patients were then monitored for a year to watch for complications following the surgical removal of the stones. The complications that were noted were the size of the bladder, the reformation of the stones, infection at the location of the surgery and in the urinary tract, as well as problems urinating. The difficulties were noted during interviews and an ultrasound examination.

45 patients were in Group A, while 55 were in Group B. Mean and standard deviation for Groups A and B are 2.5 0.5802 and 4 1.2616, respectively. Because the p-value is less than 0.05, table-ANOVA I's findings were judged to be significantly different across groups. When compared to individuals who had open vesicolithotomies (18%), patients undergoing cystoscopic procedures experienced fewer postoperative problems (10%). Ten patients in Group A (22%) suffered urethral injuries that required catheterization for five days to treat. Even though the initial segment of the ureteroscope, the cystoscopic instrument used for cystolithoclasty in pediatric male patients, has a caliber of 7.5 Fr, there was still a potential for urethral damage during the treatment.

(A)



(B)



(C)

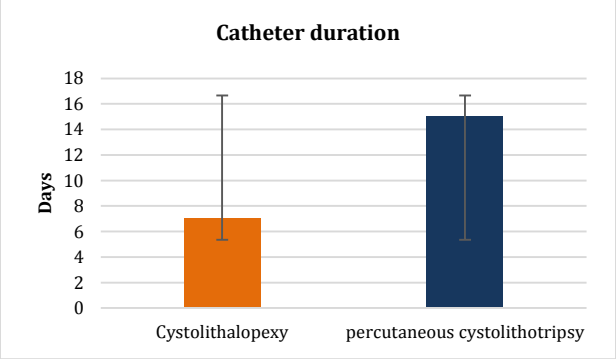


Figure-1: Comparison between the treatment Groups-A (Cystolithalopexy) and B (percutaneous Cystolithotripsy). (A) hospital stay (B) Comparison of expanses (C) Catheter duration

After the removal of the Foley catheter, two patients (4%) experienced urine retention, and an inspection revealed that they had leftover stone fragments. Urinary tract infections occurred in two patients (4%) and were treated with injectable antibiotics and analgesics. One patient (2%) in Group B experienced a wound infection that was treated with injectable antibiotics. One patient (1%) suffered hematuria, five patients (9%) experienced urine retention, and catheterization was maintained for a further several days. Infection in the urinary tract occurred in 10 patients (18%). Fever and urinary tract infection co-occurred in two patients (21%) who were successfully treated with antipyretics and injectable Patients in Group-A spent an average of 3.5 days in the hospital,

whereas those in Group B stayed between 2 and 8 days (an average of 4.5 days). In the days following surgery, urethral catheterization was performed. (average 2 days) both from 3-5 days (on average 4 days) in patients in Group-A and Group B. Average costs were noted to be 8000 rupees in Group-A and 15,000 rupees in Group B. As a result of their shorter hospital stays, Group-A had lower costs than Group B. Stone-free rates in Groups A and B were 98% and 94%, respectively. When the postoperative complications of both Groups A and B were compared, it was found that there was a significant difference (P-value 0.05) between them in terms of three parameters, including hospital stay, post-operative urethral catheterization, and hospital expenses, but not in terms of stone-free rate or stone-free survival.; As may be seen from Figure II, Groups A (cystolithalopexy) and B (percutaneous cystolithotripsy) were compared. Four problems in Group A, including urinary tract infection, wound infection, fever, hematuria, and uncontrolled bleeding, showed a substantial decline (P-value 0.05). While Group-B patients fared much better in cases of two sequelae, such as urethral damage and urine retention.

Table 1: Characteristics of Patients According to Type of Treatment

TREATMENT GROUP	MEAN AGE	MEAN STONE SIZE	TYPE OF LITHOTRIPSY	OPERATION TIME
I (45) CYSTOLITHALOPEXY	0.9 ± 0.6	1.4 ± 0.6		1- 2 hours
II (55) PERCUTANEOUS CYSTOLITHOTRIPSY	3.8 ± 1.6	1.2 ± 0.4	Swiss Lithoclast Ultrasound	2-3 hours

Table 2: Complication of Patients According to Type of Treatment

Treatment group	Complications in Number of patients					
	Bladder size	Urine retention	fever	Uncontrolled bleedings	UTI	Urethral injury
(45) Cystolithalopexy	Enlarged (1)	2	6	3	4	10
(55) Percutaneous cystolithotripsy	Enlarged (4)	5	15	14	10	4

DISCUSSION

Bladder stones are hard built up of minerals that form in the urinary bladder. In under developed countries bladder stones are common in children due to environmental factors and malnutrition. The other causes in the children include anatomical abnormalities, genetic predisposition and metabolic abnormalities. Low protein diet, high carbohydrates diet and chronic deyderation also predispose to bladder calculi. In adults the usual causes of stone bladder are bladder outlet obstruction such as benign prostatic hyperplasia and stricture urethra. The other causes of bladder stone include neurogenic bladder, foreign bodies and bladder diverticula. Bladder stone may be found incidentally during evaluation of the patient with obstructive and irritative symptoms. Recurrent urinary tract infections are common with stones and UTIs are the risk factors for stone formation in urinary bladder. Small bladder stones may pass spontaneously but large stone, causing symptoms and retention of urine definitely required some form of surgical treatment. Several management options for the bladder stone include cystolitholapaxy, percutaneous cystolilthotomy and open cystolithotomy. The decision making for these different modalities depends upon the size, composition, location of stone, previous stone treatment, previous lower urinary tract surgery, patient morphology, age, concomitant medical condition, cost effectiveness and risks associated with the procedure.

Cystolitholopaxy with stone crushing forceps or optical stone punch/lithorite has been in the practice since 1800's.The stone is crushed manually with procedure, repeated several times until small fragments are produced which can be evacuated by Ellic evacuator (Smith and O'Flynn 1977). This is also very useful procedure where combined TUR-P for benign prostatic hyperplasia and litholopaxy for bladder stone is required (Richter et al., 2002; Papatsoris et al., 2006).

Despite its efficacy, litholpaxy has certain contraindications like small capacity bladder, stone lager than 2.5 cm, hard stones, stones in children and inadequatel urethra (Bhatia and Biyani 1994; Mebust 1992).

Kaur et al (1990) performed cystolitholapaxy in 45 patients over a period of 03 years. The overall success rate was 91%. They found that associated anomalies like enlarged prostate, stricture urethra and bladder neck contracture could also be dealt along with the procedure. The common complications associated with the procedures were burning micturation and mild hematuria in few patients (HASHMI et al., 2014).

Marikar YM, Nair N et al(2009) also conducted study on 60 patients using different methods for bladder stones retrival and found litholapaxy a feasible, convenient and safe method for treatment of bladder stones. The patients tolerated the procedure well and the results were comparable in different modalities (Marickar et al., 2009).

kamaal et al (2011) conducted study on 67 patients. They performed different endoscopic techniques for removal of bladder stones. The techniques used were 01) Trasurethral removal of bladder stone using nephroscope, 02) transurethral removal of bladder stone through stone punch and 03) percutaneous removal of bladder stones through nephroscop. Although superior results were obtained in group 03, the patients were completely cleared of stones in group 02 patients using stone punch for bladder stones (Kamal 2011).

CONCLUSION

The results concluded that cystolithalopexy method of removing bladder stones is more efficient than the percutaneous cystolithotripsy in senior pediatric population aged 6 to 15 years. The result is based on the different parameters such as recovery time, complexity during procedure, bladder size enlargement, urine retention, uncontrolled bleedings, urethral tract infections, operation time and expenses.

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