

Comparison of Percutaneous Cystolithotripsy and Transurethral Cystolithotripsy for Treatment of Medium Size Bladder Stone: A Retrospective Study

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ABSTRACT

Introduction: Vesical calculus accounts for nearly 5% of urinary system calculi and is commonly seen in patients with Bladder Outlet Obstruction (BOO), chronic infection, and neurogenic bladder. Open cystolithotomy is an invasive surgery with a long postoperative period and with a high wound infection rate, so only best recommended for large stones. With recent advancements in endourological instruments, cystolithotripsy either by Percutaneous Cystolithotripsy (PCCL) or Transurethral Cystolithotripsy (TUCL) approach has become a safer treatment for medium size stone (2-4 cm).

Aim: To compare the outcome of PCCL and TUCL for medium size bladder stones in adult patients.

Materials and Methods: This retrospective study was conducted between January 2019 to December 2021 in the Department of Urology, Superspeciality Hospital, Shyam Shah Medical College, Rewa, Madhya Pradesh, India. Group I was PCCL (n=32) and

group II was TUCL (n=30). PCCL group was compared with TUCL group II for age, stone size, number of stones, operative time, mean urethral entries, postoperative hospital stays, peri and postoperative complications. Statistical analysis was performed using Chi-square and t-test. Differences were accepted to be statistically significant at p-value ≤ 0.05 .

Results: A total of 168 were treated for bladder stones in the Institute and 62 patients were included in the study. No residual stone was observed in any of the two groups. Complete stone clearance was achieved in both groups of patients. Mean operative time and the number of urethral entries were 46.75 ± 2.45 min and 1.06 ± 0.25 min in the PCCL group, and 59.67 ± 3.84 min and 2.87 ± 0.82 min in the TUCL group (p-value < 0.001).

Conclusion: The PCCL appears to be a better technique and preferable over TUCL in bladder stones of size between 2-4 cm.

Keywords: Bladder outlet obstruction, Endourological instruments, Haematuria, Open cystolithotomy

INTRODUCTION

Vesical calculus means "urolith in bladder", generally affects men, and accounts for nearly 5% of urinary system calculi [1]. They are rare in females and common causes includes; tight incontinence repair, cystoceles, and diverticula [2]. Primary stones are common in children, mainly in those getting low-protein, low-phosphorus diets (in endemic regions). They are frequently solitary and infrequently recur after treatment. However, secondary stones are generally detected in men aged >60 years [3]. Patients with BOO due to Benign Prostatic Hyperplasia (BPH), urethral stenosis, chronic catheterisation, chronic infections by urea-splitting organisms, and patients with neurogenic bladder caused by spinal cord injury or other neurological diseases are at particularly high-risk for bladder stone formation [3].

Variety of treatment modalities are available regarding the removal of bladder stones-open surgical, lithotripsy, percutaneous and transurethral [4-7]. There is no agreement, on which is the best method for minimally invasive treatment for bladder stones. The choice usually depends on the available equipment, surgeon's expertise, size and a number of stones, patient's co-morbidities, and need for concomitant treatment of BPH.

Transurethral surgery has become a commonly used procedure due to its high efficacy and low morbidity following the development of newer endoscopic and fragmentation equipment [8]. TUCL is time-consuming for larger calculi, and the manipulation has the potential to cause urethral injury. When the stone is too large or hard or if the patient's urethra is too narrow or surgically altered, complicating access to the bladder, the open or percutaneous suprapubic surgical approach is preferable [9].

Advances in PCCL include better visualisation and fragmentation of the stone and it avoids prolonged instrumentation of the urethra. The only disadvantage of this procedure, is the placement of a suprapubic catheter which increases morbidity and postoperative stay as well [10]. Despite several different treatment options, the successful treatment of bladder stone remains challenging, as the complication rates and operation time varies according to each treatment modality.

The present study was done to compare the efficacy of TUCL and PCCL in the treatment of bladder stones of size ranging from 2-4 cm in adult population. As secondary objectives, authors also aimed to compare both procedures regarding surgery time, length of hospital stay, and peri and postoperative complications.

MATERIALS AND METHODS

This retrospective study was conducted in the Department of Urology, Superspeciality Hospital, Shyam Shah Medical College, Rewa, Madhya Pradesh, India. All patients who underwent surgical treatment for bladder stones between January 2019 to December 2021, were evaluated retrospectively. The data obtained during this period was collected, tabulated, and analysed using Microsoft excel in the month of March 2022.

Inclusion criteria: Patients aged above 18 years of either sex having bladder stones of size 2-4 cm [8], were treated either via PCCL or TUCL were included in the study.

Exclusion criteria: Patients with larger bladder stones >4 cm, stone size <2 cm in whom TUCL is the ideal treatment, patients with kidney, prostate, urinary bladder, penile or testicular malignancy, urethral

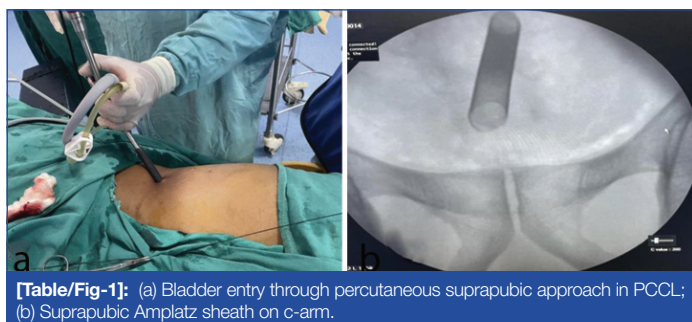
stenosis/stricture or disruption, and urinary infection, patients who needed prostatectomy or Transurethral Resection of the Prostate (TURP) due to significantly high prostate volume and body mass index ≥ 30 kg/m² neurogenic bladder dysfunction subjects with the history of pelvic radiotherapy, radical prostatectomy etc., were excluded from the study.

A total of 62 patients were included in the study, group I was PCCL group (n=32) and group II was TUCL group (n=30).

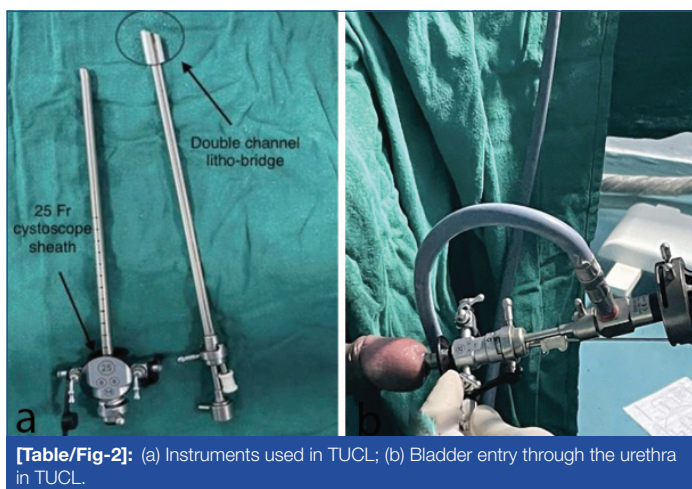
Study Procedure

Technique: All patients received prophylactic antibiotics 24 hours prior to surgery. Cystourethroscopy was performed primarily after administering spinal anaesthesia to the patient. Pneumatic lithoclast was used to splinter the stones in both groups.

In group I (n=32), cystoscopy was performed using 19 F cystoscope. Suprapubic puncture was made and the guidewire was passed, and the tract was dilated to place 28 F Amplatz sheath suprapubically. A 26 Fr Nephroscope was inserted through the sheath and the stone was fragmented and then retrieved. A suprapubic catheter was placed through the Amplatz sheath. Suprapubic catheter was removed on the first postoperative day, while per urethral catheter was removed on the second postoperative day [Table/Fig-1].



In group II (n=30), 25 F cystoscope sheath was placed transurethraly and stone was visualised. The stone was fragmented with a pneumatic lithotripter by using a litho-bridge into smaller pieces and subsequently retrieved using an ellik evacuator. The Foley's catheter was placed at the end of the procedure. The catheter was removed on the first postoperative day (if there was no haematuria) [Table/Fig-2]. Antibiotics were administered for seven days postoperatively and postoperative X-ray KUB was done on the first postoperative day to ascertain clearance of the stone.



The groups were compared for age, stone size, number of stones, operation time (operative time for additional procedure was not included), mean urethral entries, postoperative stay, complete stone clearance, additional procedure performed, perioperative complication like haematuria and urethral injury and postoperative complications like wound dehiscence, urine leakage, and stricture urethra.

STATISTICAL ANALYSIS

The data collected was entered and analysed using IBM Statistical Package for the Social Sciences (SPSS) version 21.0. Continuous variable like age, number of stone, stone size, operation size, mean urethral entries, and postoperative stay were presented as mean±Standard Deviation (SD) and Student's t-test were used to test the association. Categorical variables like sex, residual stone, and additional procedure performed were expressed as frequencies and percentages, and Chi-square test was used to test the association. Differences were accepted to be statistically significant at p-value ≤ 0.05 .

RESULTS

A total of 168 were treated for bladder stones in the institute. A total of 62 patients that met inclusion and exclusion criteria were included in the study. No residual stone was observed in any of the two groups.

Two patients in group I and four patients in group II had multiple stones. Stone sizes were 3.19 ± 0.63 cm and 2.88 ± 0.65 cm subsequently in group I and group II. No statistical significance was found in both groups regarding the age, number of stones and stone size [Table/Fig-3]. Statistical significance was observed in operating time: Group I (46.75 ± 2.45 min) and group II (59.67 ± 3.84 min) [Table/Fig-4]. Most common complication which was observed in our study was haematuria, six patients in group I and eight patients in group II had haematuria [Table/Fig-5].

Characteristics	Group I (PCCL)	Group II (TUCL)	p-value using Chi-square test
No. of patients	32	30	-
Age (years+SD)	52.44±17.92	53.13±16.58	0.875
Sex (Male/Female)	26/6	27/3	-
Number of stone	1.06±0.25	1.13±0.35	0.354
Stone size (cm+SD)	3.19±0.63	2.88±0.65	0.058
Diabetes mellitus	6 (18.8%)	6 (20%)	0.806
Hypertension	8 (25%)	10 (33.3%)	
Diabetes mellitus+Hypertension	4 (12.5%)	2 (6.7%)	
No co-morbidity	14 (43.8%)	12 (40%)	

[Table/Fig-3]: Comparison of clinical data of both groups.

Characteristics	Group I (PCCL)	Group II (TUCL)	p-value using Student's t-test
Operation time (min)	46.75±2.45	59.67±3.84	<0.001
Mean urethral entries	1.06±0.25	2.87±0.82	<0.001
Postoperative stay (days)	3.63±0.71	2.13±0.82	<0.001
Additional procedure	18 (56.3%)	18 (60%)	0.837
Trans Urethral Resection of Prostate (TURP)	10 (31.3%)	8 (26.7%)	0.781
Visual Internal Urethrotomy (VIU)	4 (12.5%)	6 (20%)	0.576
Bladder Neck Incision (BNI)	4 (20%)	4 (13.3%)	0.947

[Table/Fig-4]: Comparison of operative data of both groups.

Complications	Group I n (%)	Group II n (%)	Total N (%)	p-value using Student's t-test
Wound dehiscence	4 (12.5)	0	4 (11.1)	0.047
Haematuria	6 (16.8)	8 (26.7)	14 (38.9)	0.461
Stricture urethra	0	4 (13.3)	4 (11.1)	0.0344
Urethral injury	0	2 (6.7)	2 (5.6)	0.1398
Urine leakage	12 (37.5)	0	12 (33.3)	0.0002
Total	22 (68.8)	14 (46.7)	36 (100)	0.0804

[Table/Fig-5]: Comparison of complications observed in both groups.

Mean duration of follow-up was 16.2 (4-25) months and 15.6 (3-32) months in PCCL and TUCL groups, respectively. Urethral stricture

developed in four patients in the TUCL group, two in the bulbar and two in the penile urethral segment.

DISCUSSION

According to present study PCCL is safer and faster associated with minimal urethra related complication and has a shorter intraoperative time as compared to TUCL method. All endoscopic operations aim to achieve complete stone-free state in the shortest possible time, with shorter hospital stay and minimal complications associated with it. According to Aron M et al., PCCL has fewer complications than TUCL and less morbidity than that of open cystolithotomy [5]. According to some studies, PCCL is faster and non inferior to the TUCL in terms of safety and stone-free rate [5,11-14].

Tzortzis V et al., concluded that PCCL can be safely and effectively performed under local anaesthesia, and it might also prove useful when prolonged urethral instrumentation should be avoided [15]. Toricelli FC et al., noted that transurethral approach or percutaneous approach was equally effective for bladder stone of size of 2-4 cm [16].

In a study by Wollin TA et al., percutaneous suprapubic cystolithotripsy was done through either a 30 F or a 36 F cystotomy tract. Fragmentation and removal were performed with a 26 F rigid nephroscope and the pneumatic Swiss Lithoclast. Suprapubic and urethral catheters were placed postoperatively in all patients [17]. In present study, percutaneous puncture was done under 21 Fr cystoscopically guided, and tract was dilated up to 30 Fr and same sized Amplatz sheath was placed. Next 26 Fr rigid nephroscope and the pneumatic lithoclast were used to fragment the stone and extract them achieving 100% stone clearance. Similar study was done by Demirel F et al., [14].

Akmal M et al., used percutaneous technique under ultrasound guidance and serial dilatation by dilators then Amplatz sheath for this purpose. In the present study, we used percutaneous technique under direct cystoscopic guidance and then serial dilatation by dilators then Amplatz sheath was placed [18]. In present study, mean operative time for PCCL procedure was shorter as compared to TUCL and the difference were statistically significant. Similar observations were observed in various studies conducted by other authors [Table/Fig-6] [10,19-21].

Study	Place of the study and sample population	PCCL (minutes)	TUCL (minutes)
Present study	Rewa, India 62 patients	46.75±2.45	59.67±3.84
Singh KJ and Kaur J, 2011 [10]	Amritsar, India 67 patients	46±7.3	69.2±16.3
Shahat AA et al., 2022 [19]	Egypt, 100 patients	13	21.5
Karkee RJ et al., 2022 [20]	Nepal, 100 patients	57.5±14.2	34.1±7.6
Sakhaei S et al., 2019 [21]	Iran, 124 patients	31.85±6.47	47.30±4.27

[Table/Fig-6]: Comparison of mean operative time of present study with other studies [10,19-21].

Prolong duration of surgery in TUCL group could be explained by requirement of further fragmentation of stone to retrieve it, due to lesser lumen and less visibility issue along with risk of bladder mucosa injury. Another problem noted in TUCL group was urethral re-entries needed to be done whenever the cystoscope slides out of the bladder, while fragment evacuation using ellik's evacuator as compared to PCCL group. Finally, due to the placement of suprapubic catheter in patients of the PCCL group, the postoperative stay was prolonged whereas it was significantly shorter in the TUCL group. The above results were statistically significant. Karkee RJ et al., also had similar observations, in their study mean duration of hospital stay was 1.9±0.8 days in TUCL group and 2.7±0.9 days in PCCL group [20].

In present study, early complication which was observed in both groups was haematuria, 26.7% of patient in TUCL group and 16.8%

of patient in PCCL group experienced haematuria, so in the present series haematuria was frequently associated with TUCL group but this difference was not statistically significant. According to Gupta R et al., haematuria was most commonly seen in patient who had undergone treatment with the percutaneous method (31.25% in PCCL group) than transurethral method (23.33% in TUCL group). In their study, this could be due to use of nephroscope via resectoscope outer sheath [22].

In the present study, complication specific to transurethral method was urethral injury and urethral stricture later on. Two patients out of 14 develop urethral stricture in present study. In another similar comparative study, Aron M et al., reported one patient out of 19 patients and Tugcu V et al., reported three patients out of 38 patients developed urethral stricture [5,12]. In their study, same as present study, none of the patients in PCCL group developed urethral stricture [5,12]. Complication specific to percutaneous method was wound dehiscence and urine leakage from the wound. In the PCCL group (n=22), re-catheterisation was performed in 12 patients due to urine leakage. This finding was not consistent with other studies. Al-Marhoon MS et al., reported 1/27 patient in their series and Yağmur I et al., also reported urine leakage in only one case in PCCL group (n=24) [23,24].

In present study, wound dehiscence was observed in 12.5% of patients in PCCL group. In a study conducted by Obaid AT, 20 patients were enrolled in PCCL group and none of the patient in the group, experience wound infection [25].

Limitation(s)

It was a retrospective study. There was no randomisation among the study population. Surgeries were performed by different surgeons.

CONCLUSION(S)

In PCCL, the use of a nephroscope and wider lumen of the Amplatz sheath facilitates better vision, easier fragmentation, faster extraction of even larger bladder stone fragments with minimal urethra-related complications, and a shorter intraoperative time as well. It thus, appears to be a better technique and preferable over the TUCL in bladder stones of size between 2-4 cm.

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