

# Retrospective audit for preoperative factors and clinical outcomes in patients undergoing bladder

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## Background

Five percent of urinary tract stones are found in the urinary bladder.<sup>1</sup> Bladder stones are responsible for 8% of urolithiasis related mortalities.<sup>2</sup> We have conducted a study and evaluated the effectiveness, safety and the outcome of transurethral cystolithotripsy using a rigid cystoscope under general anaesthesia.

## Methods

A retrospective study conducted at Mater Dei Hospital in Malta, from 2004 until 2020. Information obtained from medical records, information technology hospital system and department theatre list. 201 patients were included who all underwent cystolithotripsy with or without transurethral resection of prostate (TURP) or bladder neck incision (BNI). Approval to conduct the study was obtained after fulfilling all requirements requested by the University Research Ethics Committee of Malta, as well as obtaining approval of the CEO of Mater Dei Hospital in line with applicable hospital protocols.

## Results

The mean age was 65 years, ranging between 21 and 89. Overall, the procedure was well tolerated and there were no major peri-operative complications. The hospital stay ranged between 1 to 33 days with an average of 3 days. Follow up average was 4.3 years. The maximum period with bladder catheter was 18 days before a successful trial without catheter. The majority of patients remained catheter free in the long term with a minority still requiring conservative measures for the relief of lower urinary tract symptoms.

## Conclusion

Transurethral cystolithotripsy using a rigid cystoscope under general anaesthesia is a safe and effective technique for the treatment of different sizes of bladder calculi.

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## INTRODUCTION

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5% of urinary tract stones are bladder stones<sup>1</sup> and incidence peaks at 60 years.<sup>2</sup> The aetiology of bladder stones is typically multi-factorial.<sup>3</sup> They can be classified as primary, secondary or migratory.<sup>4</sup>

Primary bladder stones can occur in the absence of other urinary tract pathology, typically seen in children in areas with poor hydration, recurrent diarrhoea and a diet deficient in animal protein.<sup>5</sup> Secondary bladder stones occur in the presence of other urinary tract abnormalities, which include bladder outlet obstruction (BOO), neurogenic bladder dysfunction, chronic bacteriuria, foreign bodies (including catheters), bladder diverticula and bladder augmentation or urinary diversion. In adults, BOO is the most common predisposing factor for bladder stone formation and accounts for 45-79% of vesical calculi.<sup>1,6,7,8</sup> The prevalence of bladder stones is higher in males, with a reported male: female ratio between 10:1 and 4:1.<sup>1,2</sup>

Common associated symptoms with bladder stones are urinary frequency, haematuria (which is typically terminal) and dysuria or suprapubic pain, which are worse towards the end of micturition, symptoms may worsen on sudden movement and exercise. Detrusor over-activity is found in over two thirds of adult male patients with vesical calculi, however, recurrent urinary tract infections (UTIs) may be the only symptom.<sup>6,8</sup>

Detection of bladder stones using ultrasound (US) in adults has a reported sensitivity and specificity of 20-83% and 98-100%..<sup>9,8</sup> Computer tomography (CT) and cystoscopy have a higher sensitivity for detecting bladder stones than US in adults.<sup>9,10</sup> While cystoscopy allows for direct visualization of bladder stones and possible underlying disease such as bladder tumour, CT scan provides information on presence of upper urinary tract lithiasis..<sup>11,12</sup>

Treatment of bladder stones can be with open, laparoscopic, robotic assisted laparoscopic, endoscopic (transurethral or percutaneous) surgery or extracorporeal shock wave lithotripsy (ESWL).<sup>13</sup> Transurethral cystolithotripsy provides high stone-free rates (SFR) and appears to be safe, with a very low risk of unplanned procedures and major postoperative and late complications.<sup>13</sup>

Typically, bladder stones in men aged over 40 years are related to benign prostatic obstruction (BPO), the management of which should also be considered. Presence of bladder stones were usually an indication for a surgical intervention for BPO. However, this has been questioned by recent studies, in which medical management with an  $\alpha$ -blocker with or without 5-alpha reductase inhibitor after successful cystolithotripsy had a lower recurrence rate overall in comparison to the surgical approach including a combination of cystolithotripsy with TURP.<sup>14</sup>

Factors need to be addressed prior and post-surgery to ensure a successful outcome, like relieving obstruction, eliminating infection, meticulous surgical technique, accurate diagnosis, and post-operative care.<sup>1</sup>

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## MATERIALS AND METHODS

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This is a retrospective study conducted at Mater Dei Hospital in Malta, from 2004 until 2020. 201 patients were included who all underwent cystolithotripsy. All patients who underwent a transurethral cystolithotripsy with or without TURP/BNI between were also included.

All procedures were performed under general anesthesia in an operating theatre, with all patients having an overnight stay. Stones were fragmented using a mechanical pneumatic lithotripsy, after which stone fragments are evacuated through the cystoscope sheath, without contact with the urethral urothelium, thus the procedure is associated with a minimal chance of postoperative urethral injury. The use of laser lithotripsy was not intentionally excluded, no patients had laser lithotripsy were within the time period of our audit.

Treatment with an alpha blocker, 5-alpha reductase inhibitor (5-ARI) or a combination of both were administered in case of persisting lower urinary tract symptoms (LUTS).

Patients who had bladder neck contracture were managed, in the same session, by bladder neck incision, while those with benign prostatic hyperplasia were managed with a TURP procedure during either the current or a later organized session. A urinary catheter was inserted at the end of each procedure.

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## RESULTS

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Pre-operative and post-operative data of 201 patients were analyzed. Range of age was between 21 and 89 with a mean of 65 years old. These patients were followed up for an average of 4.3 years.

Prior to cystolithotripsy, 17% of total patients suffered from retention. 3.4% had a pre-operative post void residual (PVR) of more than 500mls. Of these patients, 20 were catheter free at last follow up, 14 required long-term catheter. On average of PVR in patients who had previous TURP/BNI, concurrent TURP/BNI, subsequent TURP/BNI, No TURP/BNI was 200mL, 51mL, 161mL, 173mL respectively.

There is a lack of consensus about what constitutes a significantly elevated post-void residual volume, and there is conflicting data.<sup>15,16</sup> This is especially that there is no standard calculation for measuring

**Table 1** Mean age, prostate size, hospital stay, TWOC, residual preoperatively, residual post TWOC, residual at last follow up

| Variables                               | Values |
|---|--------|
| Mean age (years)                        | 65     |
| Mean prostate size (mL)                 | 51     |
| Mean hospital days (days)               | 3      |
| Median TWOC (days)                      | 1.19   |
| Median residual preoperatively (mL)     | 141    |
| Mean residual post successful TWOC (mL) | 47     |
| Mean residual at last follow up (mL)    | 38     |

bladder volume exists, and measurement modalities produce different bladder volumes.<sup>17,18,19</sup>

PVR in adults less than 50mL is adequate bladder emptying, and over 200mL indicates inadequate emptying.<sup>20</sup> While in elderly, 50-100 ml PVR is considered normal.<sup>21,22</sup>

Patients per-operatively had an average of 86.7mL/min/1.73m<sup>2</sup> of their estimated glomerular filtration rate (eGFR). Of these 7.4% had a eGFR of less than 60mL/min/1.73m<sup>2</sup>.

The diagnosis of bladder stones was based on either cystoscopy, or ultrasound or computer tomography findings. Only 126 patients underwent ultrasound prior to surgery, hydronephrosis was evident in 13.5% of the 126 individuals.

Basic characteristics like mean age, prostate size, hospital stay, trial without catheter (TWOC) and mean residual at last follow up are shown in Table 1.

At presentation, one third of patients (31.4%) had one or more of the following comorbidities, diabetes,

**Table 2** Comorbidities of patients at time of presentation

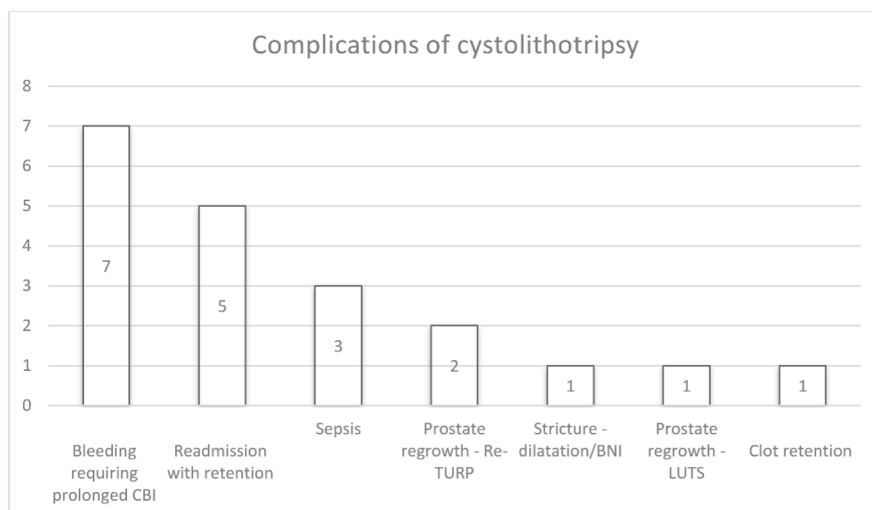
|   |    |
|---|----|
| Diabetes  | 37 |
| Known prostate cancer                           | 8  |
| CVA with deficit                                | 3  |
| Parkinson's                                     | 2  |
| Other neurological disease                      | 7  |
| Diabetes and CVA with deficit                   | 2  |
| Diabetes and other neurological disease         | 1  |
| Diabetes and known prostate cancer              | 1  |
| CVA with deficit and other neurological disease | 1  |
| Pelvic surgery and other neurological disease   | 1  |

cardiac vascular accident, Parkinsonism other neurological diseases, known prostate cancer, and pelvic radiation therapy, the rest of the patients had at least one or more of the following as shown in Table 2.

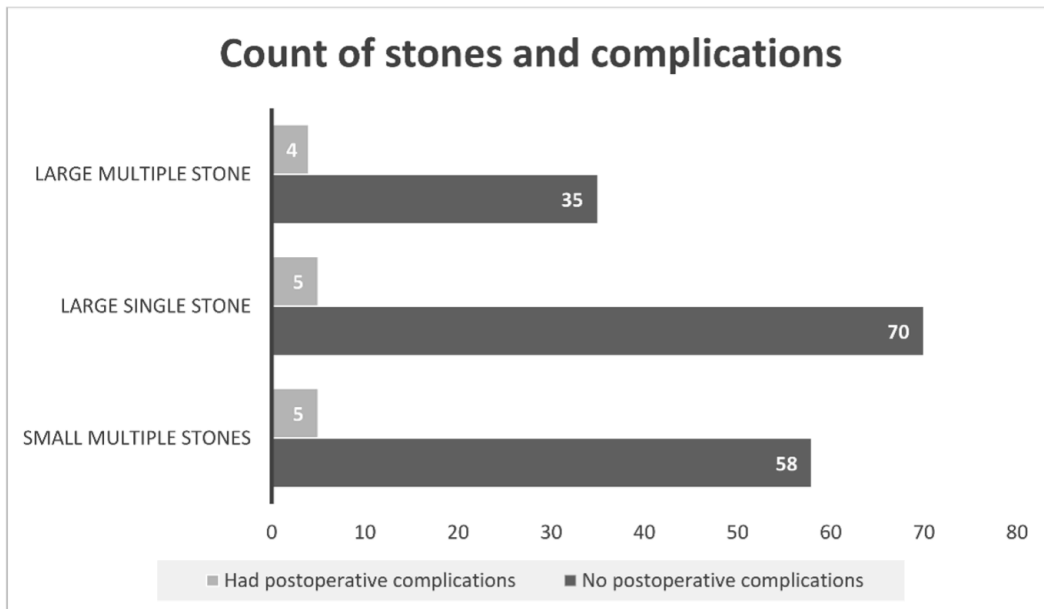
The effectiveness of surgical treatment for bladder outflow obstruction was assess by a successful TWOC and change in uroflowmetry and post-voiding residual volume on bladder sonography. TWOC was successful in 85.5% of patients with an average of 1.19 attempts. Average duration with a bladder catheter postoperatively was 3 days. Preoperative and postoperative average flow rate at uroflowmetry were 8mL/s and 19mL/s respectively.

Complications were observed in 10%, most of these events occurred within 9 days of the operation. The majority of complications were mild in nature as classified by the Clavien Dindo classification of severity (Figure 1).

There was no perioperative deaths. The two patients who required a transfusion had concurrent TURP. One post-op bladder neck stenosis was recorded. 5.9% of total patients had positive cultures



**Figure 1** Complications of cystolithotripsy



**Figure 2** Correlation between count of stones and complications

preoperatively, however none had infective post-operative complications. No major intraoperative complications, such as bladder perforation, were detected.

With regards to stone burden, 35.6% had small multiple stones, 42% had large single stones, 22% had large multiple stones. The correlation between stone count and complications are shown in Figure 2. The complication rate was highest in large multiple stone removal: 11.4%, lowest in large single stone: 7.1%, where in small multiple stone percentage was 8.6%.

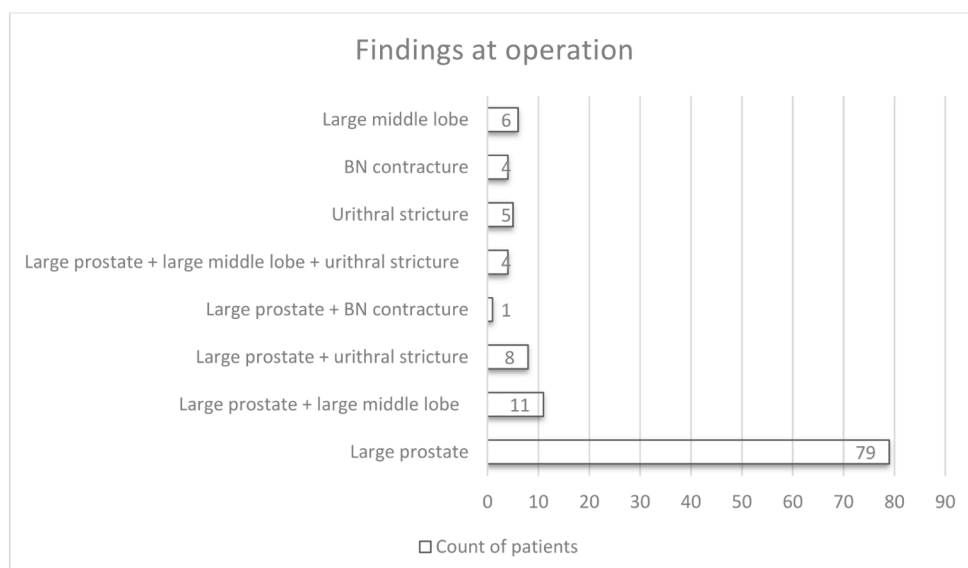
Recorded findings at operation like enlarged prostate, enlarged median lobe, urethral stricture, and bladder neck contracture are shown in figure 3. 5.9% of patients had these anatomical obstructive findings (Figure 3).

31% of patients received pharmacological therapy preoperatively, while the percentage rises slightly up to 32% postoperatively. Detailed numbers of types of medications used in Table 3.

44% of patients did not undergo a TURP/BNI at any point within the duration of the study, while the rest had a TURP/BNI previously 5.4%, concurrently 28.8% or subsequently 21.3% to cystolithotripsy.

## DISCUSSION

The results of this retrospective review of cystolithotripsy for bladder stones carried out at our institution show that this is an effective and safe procedure. Peri-operative complications were uncommon and mostly Clavien grade 1 or 2. Most of these adverse events occurred in patients who also



**Figure 3** Findings at operation

**Table 3** Medications used preoperatively and postoperatively

| Drug                     | Count of drug pre-op | Count of drug post-op |
|--------------------------|----------------------|-----------------------|
| Tamsulosin + Dutasteride | 44                   | 50                    |
| Tamsulosin               | 5                    | 5                     |
| Dutasteride              |                      | 4                     |
| Doxazocin                | 3                    | 4                     |
| Alfuzosin                | 4                    | 2                     |
| Finasteride              | 0                    | 1                     |

underwent resection of the prostate for associated bladder outflow obstruction and can be attributed to this part of the procedure rather the endoscopic removal of bladder stones per se. As expected the complication rate was highest in large multiple stone removal and lowest in large single stone removal.

Cystolithotripsy was associated with short hospital stay and TWOC within approximately 1 day in our subset of patients. In those patients who also underwent bladder outflow surgery, PVR drastically decreased post-operatively This was also mirrored by uroflowmetry, which showed an improvement in lower urinary tract function with maximum flow rate doubling post operatively.

A significant proportion of patients undergoing surgery for bladder stones in our cohort did not present with retention or else had significant chronic retention on pre-operative sonography. This is not in keeping with classical teaching, which attributes bladder stone formation to high bladder post voiding residuals and urinary stasis. Having said that, more than half of the patients were found to have an anatomical abnormality causing obstruction to flow, mostly an enlarged prostate but also bladder neck contractures or urethral strictures. One may hypothesize that intermittent incomplete bladder emptying, which is not always detected on ultrasound, may be the cause for bladder stone formation. Furthermore, patient who underwent cystolithotripsy with TURP and later on diagnosed at

cystoscopy with prostate re-growth, were considered for re-intervention.

Our review comes with numerous limitations, mostly a selection bias inherent to a retrospective review, a heterogeneous group of patients (some patients underwent cystolithotripsy alone, others had a combined operation including bladder outflow surgery), incomplete data entry because of poor documentation, and selection bias with regards to long term outcomes as patients who do well after the procedure are not followed up long term.

Despite these limitations, this is the only review of a common urological procedure in a local population and will help with counselling of patients planned to undergo bladder stone fragmentation and removal.

#### SUMMARY BOX

- Cystolithotripsy, with or without bladder outflow surgery, performed at a local institution is a safe and effective way of dealing with both bladder stones and bladder outflow obstruction if indicated. Although this is not a prospective, randomized controlled trials comparing different treatment options, the data obtained will help proper consenting and decision making in the local urology clinic.

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