



## Percutaneous or Transurethral Cystolithotomy for Bladder Lithiasis: Which is Safer? Cistolitotomia Percutânea ou Transuretral: Qual é Mais Segura?

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### Abstract

**Introduction:** Although the risk of urethral trauma while treating bladder stones is worrisome, evidence about the best treatment approach is scarce. The aim of this study is to compare the safety and efficacy of transurethral cystolithotomy and percutaneous suprapubic cystolithotomy in adults' bladder lithiasis treatment.

**Methods:** We retrospectively evaluated 120 patients (January 2012 to December 2017) who were surgically treated for bladder lithiasis with percutaneous suprapubic cystolithotomy (n= 20) and transurethral cystolithotomy (n= 100). Age, gender, calculi size, surgery duration, hospital stay, post-operative infections, haematuria, pain and urethral strictures were evaluated. Previous diagnosis of benign prostate hyperplasia and urethral strictures were also considered.

**Results:** Both groups were homogeneous according to the pre-operative variables evaluated, including calculi dimensions and simultaneous diagnosis. Median surgery time in percutaneous suprapubic cystolithotomy and transurethral cystolithotomy were 65 and 58 minutes, respectively (p= 0.043). Pain and haematuria were similar in both groups. Median hospital stay was 2.0 days in both groups. Median follow-up time was 13 months. In the transurethral cystolithotomy, three patients (3%) developed urethral stricture while none of the patients treated with PSC developed urethral strictures during the follow-up (p= 0.435).

**Discussion:** Percutaneous suprapubic cystolithotomy theoretically offers an advantage over transurethral cystolithotomy in terms of urethral trauma, although we did not observe a significant difference. However, it deserves to be considered, especially in patients with known urethral strictures that may hinder transurethral access. Further prospective studies with more patients may however confirm these theoretical advantages.

**Keywords:** Lithotripsy/methods; Treatment Outcome; Urinary Bladder Calculi/surgery; Urinary Bladder Calculi/therapy

### Resumo

**Introdução:** Apesar do risco de trauma uretral durante o tratamento de litíase vesical ser preocupante, há pouca evidência acerca do melhor método endourológico a usar. O objectivo deste estudo é comparar a segurança e eficácia da cistolitotomia transuretral e da cistolitotomia percutânea suprapúbica no tratamento de litíase vesical de adultos.

**Métodos:** Cento e vinte doentes submetidos a tratamento de litíase vesical entre Janeiro de 2012 e Dezembro de 2017 foram retrospectivamente avaliados. Destes, 20 foram submetidos a cistolitotomia percutânea suprapúbica e 100 a cistolitotomia transuretral. Sexo, idade, volume litíásico, duração da cirurgia, duração da estadia hospitalar e complicações (infecção, hematuria, dor e estenose da uretra) foram avaliados, assim como diagnósticos prévios de hiperplasia benigna da próstata e estenoses uretrais.

**Resultados:** Os grupos analisados não apresentavam diferenças significativas relativamente às variáveis pré-operatórias analisadas, incluindo volume litíásico e diagnósticos prévios. O tempo mediano de cirurgia na cistolitotomia percutânea suprapúbica e cistolitotomia transuretral foi de 68 e 58 minutos, respectivamente (p= 0,043) e o tempo médio de internamento foi de 2 dias em ambos os grupos. O tempo médio de seguimento foi de 13 meses. No grupo cistolitotomia transuretral, três doentes (3%) desenvolveram estenose da uretra pós operatória enquanto nenhum dos doentes no grupo cistolitotomia percutânea suprapúbica teve esta complicação (p= 0,435). A dor e hematuria foram semelhantes em ambos os grupos.

**Discussão:** A cistolitotomia percutânea suprapúbica oferece em teoria uma vantagem sobre a cistolitotomia transuretral em termos de risco de trauma uretral, embora neste estudo não tenha sido confirmada esta vantagem. De qualquer forma, merece ser considerada, principalmente em doentes com história de estenose da uretra que possa dificultar o procedimento transuretral. Estudos futuros prospectivos e com mais doentes são necessários para confirmar esta vantagem.

**Palavras-chave:** Cálculos da Bexiga Urinária/cirurgia; Cálculos da Bexiga Urinária/tratamento; Litotricia/métodos; Resultado do Tratamento

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## Introduction

Bladder stones account for 5% of urinary lithiasis in the western population.<sup>1-3</sup> Patients with bladder outlet obstruction (BOO) due to benign prostatic hyperplasia (BPH), urethral stenosis, chronic catheterization, 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.<sup>4,5</sup> BOO is esteemed to be the etiological factor of more than 75% of the bladder lithiasis.<sup>5</sup>

Historically, open cystolithotomy (removing bladder stones by open surgery) was the only treatment for bladder stones. However, it is an invasive surgery with long post-operative recovery period and high surgical wound infection rates.<sup>6,7</sup> With the invention of extracorporeal shockwave therapy, a less invasive alternative became available, although with modest efficacy in big stones.

More recently, with the improvement of endourologic instruments and expertise, the transurethral approach, being minimally invasive and effective, became the gold standard technique for bladder stones removal.<sup>7</sup> The transurethral cystolithotomy consists on fragmenting the stone and removing the debris through the urethra with a rigid operative cystoscope. The percutaneous suprapubic technique is also a first line therapy and approaches the stone via a suprapubic puncture and dilation of the puncture tract. Both these techniques have shorter hospital stay and complication rates than open surgery.<sup>3,6</sup>

There is still not enough information regarding the best minimally invasive approach for bladder stones since studies comparing these two techniques are scarce. The main objective of this study is to compare the efficacy of the transurethral cystolithotomy (TUC) and the percutaneous suprapubic cystolithotomy (PSC).

As secondary objectives, we aim to compare both procedures regarding surgery time, length of hospital stay and peri-operative complications. We also used a small questionnaire to assess the surgeons' preferences in our department and their reasons for their preference.

## Methods

All patients who underwent surgical treatment for bladder stones between January 2012 and December 2017 were enrolled in this study. Data was collected retrospectively from the hospital's electronic archives. The minimum follow-up time was 12 months. All patients had a follow-up ultrasound performed 3-6 months after the procedure. Patients with bladder lithiasis originating from foreign bodies and patients with no electronic data were excluded. Various surgeons performed the surgeries and the technique was chosen by each surgeon based on their preference.

The patients were divided in two groups according to the technique used for treatment of the bladder stones. The variables that were collected were: age, gender, previous diagnosis of BPH or prostate carcinoma, prostate size, calculi size (< 3 cm; 3-5 cm and > 5 cm or multiple stones), duration of procedure (from the start of the surgery to the final clearance of stones, excluding other simultaneous procedures), performance of transurethral resection of the prostate (TURP) or other procedure at the same surgical time, hospital stay after surgery, peri-operative complications (pain, hematuria infection), evaluated through the Clavien Dindo Scale<sup>8</sup> and long term necessity of treatment for urethral stenosis.

The statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. A descriptive analysis was performed on all variables. To compare TUC and PSC, Shapiro-Wilk test was used to assess data's normal distribution. Normality assumption could not be assumed, therefore to compare the two procedures a non-parametric test, Mann-Whitney U-test was used to compare hospital stay, surgical time, peri-operative complications and number of urethral stricture surgeries. A Pearson's Chi-squared test and Fisher's Exact test were used to compare the categorical variables' distribution across groups of surgical procedure. A *p*-value of less than 0.05 was considered statistically significant and the confidence interval used was 95%.

Parallel to this evaluation, we made a simple and anonymous questionnaire that was applied the urologists and residents of the department. This questionnaire inquired about the preferred technique and the reasons for that preference (Annex I).

## Results

A total of 120 patients that met the inclusion and exclusion criteria were included in this study (*n* = 120). The mean follow-up time was 13 months (12-17 months range). TUC was performed in 100 of them (83.3%), while PSC was performed in the remaining 20 (16.7%). The majority of the patients were males (*n* = 109; 90.8%), and the ages were comprised between 25 and 92 with a mean of  $67.4 \pm 13.4$  years. Seventy two of the 109 male patients had a previous diagnosis of BPH with obstructive symptoms and nine were previously diagnosed with prostatic carcinoma. In the male population, the average prostatic size was  $52.9 \pm 26.6$  g. In 65 of the male patients (59.6%), all of them with BPH, TURP was performed simultaneously. The remaining 7 patients with BPH declined a TURP, because of the risk of retrograde ejaculation or fear or erectile dysfunction, even after being assured of the negligible risk of the latter. The nine patients with prostatic carcinoma had no clinical symptoms of obstruction and had a normal fluxometry, thus not being eligible for TURP.

Regarding calculi size, 36 patients had calculi  $\leq 3$  cm



**Table 1:** Distribution of gender, calculi size, co-existence of prostate disease, other procedures and TURP at the time of treatment across the two groups

		PSC (n= 20)	TUC (n= 100)	p value
Gender	Male	19 (95%)	90 (90%)	0.689
	Female	1 (5%)	10 (10%)	
Calculi Size	≤ 3 cm	3 (15%)	33 (33%)	0.117
	3-5 cm	8 (40%)	21 (21%)	
	≥ 5 cm or multiple	9 (45%)	46 (46%)	
Prostate disease (n= 109)	None	7 (40%)	21 (21%)	0.390
	BPH	10 (50%)	62 (62%)	
	Carcinoma	2 (10%)	7 (7%)	
Other procedures	No	16 (80%)	82 (82%)	0.761
	Yes	4 (20%)	18 (18%)	
TURP	No	12 (60%)	43 (43%)	0.164
	Yes	8 (40%)	57 (57%)	

(30%), 29 had calculi between 3-5 cm (24.2%) and 55 had calculi over 5 cm or multiple stones (45.8%). Complete stone clearance, confirmed on the follow-up ultrasound, was achieved in all patients ( $p= 0.897$ ). The mean length of hospital stay was  $1.6 \pm 0.7$  days. No major peri-operative complications occurred in any patient and only five (4.2%) presented a deviation from the normal post-operative course. All these were cases of hematuria and were classified as category 1 in the Clavien Dindo Scale. These patients were managed conservatively but there was an increase in hospitalization time to an average of  $4.0 \pm 1.1$  days.

#### OUTCOME ANALYSIS OF THE COMPARISON BETWEEN TRANSURETHRAL CYSTOLITHOTOMY AND PERCUTANEOUS SUPRAPUBIC CYSTOLITHOTOMY

Gender, stone size, previous diagnosis of BPH and other procedures and TURP performed simultaneously were similarly distributed across both groups (Table 1).

The median age, length of hospital stay and surgery time distribution across groups are reported in Table 2. There were no differences regarding age and hospital stay between both groups. However, the median surgery time was significantly

superior in the PSC group than in the TUC group (65 and 58 minutes, respectively) ( $p= 0.043$ ).

Regarding peri-operative complications (excluding stricture) there were no differences between both groups (10% in PSC group and 3% in TUC group;  $p= 0.890$ ).

In the TUC group, three of the patients developed symptomatic urethral stricture. Two of them needed one visual internal urethrotomy (VIU) during the long term follow-up and one of the three patients required two VIU. No patient was submitted to urethroplasty. In the PSC group, there were no reported cases of urethral stricture. However, there was no significant statistical difference between necessity of VIU across procedures ( $p= 0.435$ ).

#### SURGEONS' PREFERENCE

The questionnaire was applied to 15 doctors of our department, 10 urologists and five residents. Four doctors (27%) preferred the TUC while six (40%) preferred the PSC and five (33%) stated no preference.

When questioned about the advantages of the TU, the absence of scars and the greater ease of the procedure were the most chosen factors (47% each). Only one doctor (7%) pointed



**Table 2:** Medians and ranges of age, length of hospital stay and surgery time across both groups

	PSC (n= 20)	TUC (n= 100)	p
Age (years)	67 (38-87)	70 (25-92)	0.903
Length of hospital stay (days)	2 (1-4)	2 (1-6)	0.218
Surgery time (minutes)	65 (28-180)	58 (16-128) (n= 88)	0.043

out the quickness as the greatest advantage and none of the inquired doctors favored the price of this procedure. The most chosen disadvantage of this technique was the instrumentation of the urethra (80%).

As for the PSC, 11 (73%) doctors thought that the lower operative time was one of the advantages. A large number of the inquirers (eight doctors – 53% each) also pointed out the absence of urethral instrumentation and the large caliber sheath as advantages of the PSC. The difficulty of the extraction of stones against gravity was the most chosen disadvantage (67%).

## Discussion

There is actually no consensus on which is the best approach for minimally invasive treatment for bladder stones. The choice usually depends on the available equipment, surgeons' expertise, size and number of stones, patients' comorbidities and need for concomitant treatment of BPH. TUC is still the most commonly used procedure to manage bladder lithiasis.<sup>9</sup> This is most probably explained by the fact that most patients have concomitant BPH and, if the patient needs TURP for BPH, the transurethral access will have to be used anyway in the surgical procedure.

The TUC is perceptibly associated with a risk of urethral injury, which is more probable the longer the procedure lasts.<sup>10,11</sup> As this study shows, three patients in the TUC group had urethral stenosis that required VIU, which is in accordance with the available literature on TUC.<sup>4</sup> Further studies should compare different diameter cystoscopes and its relationship with urethral stenosis.<sup>12</sup> Regarding this complication, PSC poses no threat since there is no instrumentation of the urethra. However, in this study there was no statistically significant difference between both groups regarding urethral stenosis, which may be explained by the small number of patients in the PSC group.

There is very limited availability of literature regarding PSC. In a recent review by Cicione *et al.*,<sup>13</sup> only four studies were retrieved, with only half of them comparing PSC with TUC. All of these studies agree that the percutaneous road is faster and non-inferior to the transurethral route in terms of safety and stone free rate.<sup>4,14-16</sup> This study provides further evidence of

the non-inferiority of the percutaneous access in the treatment of bladder lithiasis regarding stone-free rate, surgical length of the procedure of the PSC was significantly superior than in the TUC. This may be due to the lower experience of the surgeons with this technique, as well as the fact that this technique demands an extraction of fragments against gravity, which may take longer. However, the absolute difference in the means of time is not very significant (7 minutes).

There may be a selection bias in our study since each surgeon chose his preferred technique, which led to a big difference in sample size of both procedures. Furthermore, PSC has only been introduced recently in our department, and so the surgeons' expertise in this technique may be lower than in TUC. Also, due to the retrospective nature of this study, there was missing data in the surgical time of the older cases. Because of these limitations some results may be exacerbated or attenuated which can explain the differences between this study and the available literature. A prospective randomized trial to compare both procedures could shed some light on the advantages or disadvantages of each.

Additionally, with this study, we could assess that there is not an obvious preferred technique in our department. Roughly one third of the inquired doctors preferred the TUC, one third preferred the PSC and one third stated no preference. The advantages of the TUC (absence of scar and ease of procedure) and the PSC (lower operative time, large caliber sheath and absence of instrumentation) were well known by the surgeons. Also, the greatest disadvantages were easily identified (urethral instrumentation in the TUC and difficulty of the procedure in the PSC).

For now, this study highlights the idea that PSC is a safe procedure and that it is non-inferior to TUC in the management of bladder stone disease. With this in mind, surgeons have one more option in the surgical armamentarium for treatment of bladder stones, especially when the transurethral route is not the best choice (e.g. history of urethral stenosis) or the patient does not wish to be submitted to a TUC.

## Conclusion

PSC and TUC are both minimally invasive procedures that appear to be safe and efficient. PSC's major advantage over



TUC may be the decrease in urethral trauma and subsequent urethral stricture. Additional prospective studies, with greater sample size and random distribution between groups, are warranted to acquire new robust evidence and allow the medical community to define the best approach for cystolithiasis. ●

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## Annex I

The following questionnaire aims to evaluate the surgeons' preference on endoscopic options for the treatment of bladder stones.

### Select the option that best adapts your current status:

- Resident
- Assistant / Graduate Assistant
- Consultant / Director

### Regardless of the need of TURP, which is your current favourite procedure for bladder stones?

- Transurethral
- Percutaneous
- Either

### Which of these do you value most in the transurethral route? (you may choose more than one option)

- Quickness
- Technical ease
- Price
- No scar
- Gravity favouring the drainage of fragments

### Which of these do you value most in the percutaneous route? (you may choose more than one option)

- Quickness
- Technical ease
- Price
- No urethral instrumentation
- Larger caliber of the sheath and instruments