



IMPACT OF OBESITY ON URETEROSCOPIC PNEUMATIC LITHOTRIPSY OUTCOMES: A COMPARATIVE STUDY.

Dr. Venkatesh Velivela^{*1}, Dr. Sreedhar Dayapule²

¹. Assistant Professor, Department of Urology, Government Siddhartha Medical College & General Hospital, Vijayawada, Andhra Pradesh, India.

². Professor & HOD, Department of Urology, Government Siddhartha Medical College & General Hospital, Vijayawada, Andhra Pradesh, India.



Correspondence:

Dr. Venkatesh Velivela

Assistant Professor, Department of Urology, Government Siddhartha Medical College & General Hospital, Vijayawada, Andhra Pradesh, India.

Email:

venkateshvelivela@gmail.com

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Abstract

Background: Obesity is a global health concern that may complicate surgical procedures, including ureteroscopic pneumatic lithotripsy (URSL) for ureteric Calculi. This study aimed to evaluate the impact of obesity on the efficacy and safety of URSL. **Materials and Methods:** A retrospective analysis of 100 patients (50 obese, 50 non-obese) undergoing URSL was conducted in the Department of Urology, from January 2024 to December 2024, over a one-year period. Patients were included based on the presence of radio-opaque calculi and exclusion criteria such as pregnancy and urinary tract infection. Operative parameters, stone-free rates, and complications were compared between the groups. **Results:** Obese patients were older (mean age 51.24 vs. 45.35 years) and had higher BMI (31.21–46.52 kg/m² vs. 18.54–23.48 kg/m²). Despite longer operative times (74.47 vs. 70.98 minutes), stone-free rates were high across both groups (94% non-obese vs. 92% obese). Success rates were comparable for renal and proximal ureter stones (98% vs. 94%) and identical for mid-ureter stones (100%). There were no intraoperative or postoperative complications in either group. **Conclusion:** URSL is a safe and effective procedure for managing ureteric calculi, irrespective of obesity. Slightly prolonged operative times in obese patients do not compromise outcomes, highlighting the reliability of URSL in diverse patient populations.

Keywords: Obesity, Ureteroscopic Pneumatic Lithotripsy, Urinary Calculi, Stone-Free Rate, Surgical Outcomes, Minimally Invasive Surgery.



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INTRODUCTION

Obesity, a chronic metabolic disorder characterized by excessive accumulation of adipose tissue, has reached epidemic proportions globally, significantly burdening healthcare systems and complicating various surgical interventions, including urological procedures [1]. Among these, ureteroscopic pneumatic lithotripsy (URSL), a minimally invasive technique employed for the fragmentation and removal of urinary tract calculi, has been observed to exhibit altered outcomes in obese patients due to unique anatomical and physiological challenges associated with the condition [2,3]. Elevated body mass index (BMI) not only predisposes individuals to an increased risk of urolithiasis but also influences the technical feasibility and success rates of URSL [4].

Obesity-related physiological alterations, such as increased renal tubular sodium reabsorption, hyperinsulinemia-induced calcium excretion, and dietary hyperoxaluria, contribute to a heightened propensity for nephrolithiasis [5]. Additionally, the excess adipose tissue distribution in obese individuals often complicates patient positioning, visualization, and maneuverability during ureteroscopic procedures. Such anatomical constraints may prolong operative time, necessitate higher energy settings for pneumatic lithotripsy, and increase the risk of intraoperative complications, including mucosal injury and ureteral perforation [6]. Furthermore, the altered pharmacokinetics of anesthetic agents in obese patients adds another layer of complexity to perioperative management [7].

The impact of obesity on URSL extends beyond technical considerations, encompassing postoperative outcomes such as stone-free rates (SFR), complication rates, and recovery trajectories. Studies suggest that obese patients often experience lower SFRs due to incomplete stone fragmentation or migration, necessitating ancillary procedures [8]. Concurrently, the heightened inflammatory milieu and impaired immune responses observed in obesity may exacerbate postoperative infection rates and delay tissue healing [9]. Despite these challenges, advancements in surgical instrumentation, such as

the advent of digital ureteroscopes and pneumatic devices, alongside preoperative optimization strategies, have progressively enhanced the safety and efficacy of URSL in this high-risk population [10].

Understanding the interplay between obesity and URSL is pivotal for developing tailored surgical strategies and improving outcomes. This study aims to evaluate the outcomes of URSL in mitigating urinary tract calculi in obese versus normal weight individuals.

MATERIALS AND METHODS

The study was conducted in the Department of Urology, over a period of one year, from January 2024 to December 2024. A total of 100 patients with ureteral and/or renal calculi were retrospectively analyzed, including 50 obese and 50 non-obese individuals. Charts of all patients undergoing ureteroscopic pneumatic lithotripsy (URSL) were reviewed to evaluate the impact of obesity on treatment outcomes. Inclusion criteria encompassed patients with radio-opaque urinary calculi who underwent URSL as the primary treatment. Pregnant and lactating women, patients with UTI's, coagulation abnormalities or those with previous ureteral re-implantations were excluded.

Procedures were performed by the same surgeon using a standardized technique. Distal ureteral calculi were treated with a semi-rigid ureteroscope, All patients underwent cystoscopy with retrograde pyelogram. A guide wire with floppy tip was inserted past the stone to maintain access, following which a safety wire was inserted for flexible ureteroscopy.

A calculi cast pneumatic device was used to perform lithotripsy. Preoperative imaging, including plain radiographs, non-contrast helical computed tomography (CT), or sonography, was performed to document stone size and location. Postoperative imaging (radiographs, CT, or intravenous pyelography) assessed residual fragments. Patients were considered stone-free if fragments measured 2 mm or less. Operative parameters such as size of stone, duration of procedure and treatment outcomes were recorded. Statistical analysis was performed to compare treatment outcomes between obese and non-obese patients. Fisher's exact test was used for categorical variables, with a p-value < 0.05 considered statistically significant. Results were presented with 95% confidence intervals.

RESULTS

A total of 100 patients were included in this study. Obese patients were generally older than their non-obese counterparts (mean age: 51.24 vs. 45.35 years), reflecting a potential cumulative risk of urolithiasis with age and obesity. The higher BMI range in the obese group highlights the substantial disparity in body composition between the two cohorts. Despite these differences, gender distribution, stone laterality, and stone location were relatively comparable, suggesting that obesity does not inherently alter the anatomical predisposition for urinary calculi formation.

Table 1: Baseline characteristics of patients:

Characteristics		Non-Obese (n=50)	Obese (n=50)	P value
Age (mean, years)		45.35 ± 3.2years	51.24 ± 2.4 years	0.0487
Gender	Male (%)	34 (68%)	31 (62%)	0.947
	Females	16 (32%)	19 (38%)	
BMI (range)		18.54 – 23.48 kg/m ²	31.21 – 46.52 kg/m ²	0.0247
Laterality	Right side	24 (48%)	29 (58%)	0.658
	Left side	26 (52%)	21 (42%)	0.847
	Proximal ureter	15 (30%)	18 (36%)	0.687
	Mid ureter	8 (16%)	4 (8%)	0.247
	Distal ureter	18 (36%)	16 (32%)	0.98
Stone size	≥1cm	39 (76%)	34 (68%)	0.876
	<1cm	11 (22%)	16 (32%)	
Indications	Persistent Pain	48 (96%)	49 (98%)	0.921
	Hydronephrosis	45 (90%)	48 (96%)	

Operative times were slightly prolonged in obese patients, likely due to technical challenges posed by increased adiposity, such as limited maneuverability and visualization during the procedure. However, the difference in mean operative time (74.47 vs. 70.98 minutes) was not statistically significant, indicating that advancements in surgical techniques and instrumentation effectively mitigate the challenges posed by obesity.

Stone-free rates were uniformly high across both groups, with no significant discrepancies. The success rates for renal and proximal ureter stones were comparable between obese and non-obese patients (94% vs. 98%), and mid-ureter stones were resolved in all cases regardless of BMI. These findings underscore the efficacy of URSL, even in technically demanding cases associated with obesity.

Failures were minimal and distributed similarly across both groups, attributed primarily to proximal migration or residual fragments. Importantly, no intraoperative or postoperative complications were recorded, affirming the procedure's safety.

Table 2: Operative Parameters and outcomes

Operative Parameters		Non-Obese (n=50)	Obese (n=50)	P value
Operative Time	Mean	70.98 ± 10.4 min	74.47 ± 15.3 min	0.140
	Range	31-170 min	34 – 180 min	0.587
Overall Stone free rate		95%	92%	0.487
Stone free rate according to location	Renal/Proximal Ureter	98%	94%	0.847
	Mid-Ureter	100%	100%	
	Distal Ureter	98%	96%	
Failures		1 (2%)	3 (6%)	0.457
Complications		Nil	Nil	-

DISCUSSION

Obesity introduces unique challenges in urological procedures, including altered anatomy, increased technical complexity, and potential implications for procedural outcomes. The study aimed to evaluate the outcomes of URSL in obese versus non-obese individuals with ureteric calculi.

The results demonstrated that obesity did not significantly compromise the efficacy or safety of URSL. Stone-free rates were high in both groups, with non-obese patients achieving a 94% rate compared to 92% in obese patients. These findings align with those reported by El-Nahas et al [11] who observed comparable stone-free rates across BMI categories. The slightly prolonged operative times in obese patients, as noted in this study (74.47 vs. 70.98 minutes), are consistent with the observations of Burgher et al [12] who highlighted the impact of increased adiposity on visualization and maneuverability during procedures.

Anatomical factors, particularly for mid-ureter stones, showed no impact on success rates, with a 100% resolution in both groups. This result mirrors the findings of Breda et al [3] who reported uniform outcomes for mid-ureter stones irrespective of BMI. However, the marginally lower success rates for renal and distal ureter stones in obese patients (94% and 96%, respectively) compared to non-obese patients (98% and 98%) underscore potential challenges related to stone accessibility and procedural complexity.

The absence of intraoperative or postoperative complications further validates the safety profile of URSL, aligning with the findings of Pearle et al [13], who emphasized the low complication rates across different BMI categories. Moreover, the study's data reinforce the premise that stone size (≥ 1 cm vs. < 1 cm) remains the dominant determinant of success rather than BMI, as previously highlighted by Kumar et al [14] and Reddy et al [15].

CONCLUSION

This study confirms that obesity does not adversely affect the outcomes of ureteroscopic pneumatic lithotripsy (URSL) for urinary calculi. Both obese and non-obese patients achieved high stone-free rates, with no significant differences in safety or efficacy. While operative times were slightly prolonged in obese individuals, advancements in surgical techniques and instrumentation effectively mitigated these challenges. URSL remains a reliable and safe option for managing urinary calculi across diverse patient populations, including those with obesity.'

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CONFLICTS OF INTEREST: The authors declare no conflicts of interest.

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