Section: General Surgery

Original Research Article

ASSESSMENT OF PERCUTANEOUS NEPHROLITHOTOMY WITH PNEUMATIC LITHOTRIPSY AND HOLMIUM LASER: A HOSPITAL BASED STUDY

Manoj Dua[1], Aditya Periwal[1], Nishant Khurana[1], Sourabh Aggarwal[2], Raghav Tantia[1]

[1]Assistant Professor, Department of General Surgery, Dr SS Tantia Medical College, Sri Ganganagar, Rajasthan, India.
[2]Assistant Professor, Department of General Surgery, Dr SS Tantia Medical College, Sri Ganganagar, Rajasthan, India.

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Corresponding Author:
Dr. Sourabh Aggarwal
Email: doctor.tantia@gmail.com

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Abstract

Background: Renal stones are calculi (stone fragments) that form in the kidneys. They can be either renal or ureteral. These are common and can occur at any age, but they tend to occur most often in middle-aged women and elderly men. The exact cause of a renal stone is often not known but there are various factors that may increase the risk of developing a kidney stone. Aim of the study was to compare the effectiveness of Percutaneous Nephrolithotomy Utilizing Pneumatic Lithotripsy and the Holmium Laser. **Materials and Methods:** Study was carried out during the months of March - July 2022. 100 patients with single and double renal stones who had not undergone any surgery or had any other illnesses were randomly divided into two groups based on the type of lithotripter to be used i.e. pneumatic (n = 50) or laser (n = 50). Results were compared. **Result:** The present study yielded similar results across both the study groups with no significant difference. **Conclusion:** PCNL in terms of stone free rate with both the modalities has good prognosis while a slight more risk of complications was observed in Holmium laser group.

INTRODUCTION

Worldwide, 5–15% of people have urolithiasis.[1] Kidney stones, especially large ones, can be more dangerous for people with a solitary kidney. They can cause urinary tract infection, anuria, renal failure, or sepsis. Therefore, patients having multiple stones in solitary kidney require aggressive treatment. Management of stones, in this cohort is really a challenging task and safe surgical treatment for complete removal of stones and to preserve renal function is critical. Given that the PCNL procedure is less intrusive than open procedures, it can remove stones with less morbidity, more palliative in postoperative period, with early recovery, and reduced costs.[2,3]

Stones are broken via mechanical vibration in pneumatic lithotripsy. As compared to laser lithotripsy, it may have a lesser risk of ureteral perforation, but it is linked to a greater chance of stone pushback into the renal pelvis.[4]

The stone-free rate varied depending on stone size, according to a previous study.[5]

MATERIALS AND METHODS

Patients having history of undergoing upper third ureteral stone removal using ureteroscopic lithotripsy with pneumatic lithotripter or laser were included in the study. Individuals with acute renal failure, radiolucent stones, urinary tract infections, lack of follow-up, concomitant middle or lower third ureteral stones, or patients with radiolucent stones were all excluded from the study. Comparison was done patient between the two groups for variables like patient age, stone size and load (based on KUB or computed tomography), stone upward migration, double J stent insertion rate, stone free rate, and secondary intervention rate for residual stones.

Statistical Analysis

Pneumatic and laser lithotripsy groups were compared using the Student t test and the Chi-squared test. Statistical significance was defined as a p value less than 0.05.

RESULTS & DISCUSSION

A standard formula was used to compute the stone size. [S = π l w (where l = length, w = width, and π=

3.14)] [6] was used to compute the stone sizes assessed using the KUB analysis. Patients' mean age, mean body weight, gender ratio were comparable across the pneumatic and laser groups. There was no significant difference among the two groups. (p>0.05) [Table 1]

Complications (including pelvic perforation, haemorrhage needing transfusion, and high fever), and hospital stay were not substantially different between the two groups. Nonetheless, there was a substantial difference between the two groups' rates of stone-freeness. Stone freeness was regarded a residual stone <4mm in situ. Between the two lithotripsy techniques, there was no discernible difference in renal function at any point during the perioperative period. [Table 2]

In their 2007 study, Hammad Afzal Malik et al. discovered a significant difference (p value <0.05) between the Pneumatic (83%) and Laser (87%) groups in terms of stone clearing rate as well as residual stone: Laser (13%) and Pneumatic (17%) group.[7]

During the past two decades, there has been a revolution in the treatment of big renal calculi, and open operations have mostly been supplanted with less invasive procedures. Extracorporeal shock wave lithotripsy (SWL) is the preferred treatment for small upper urinary tract calculi, while PCNL is the preferred method for bigger or more complicated calculi. [8]

By using a 99mTc-DMSA renal scan seven days after surgery, Cass et al. discovered an 8% drop in the mean split function of the treated side; this decrease was 4.8% one month later, confirming the functional alterations' mainly reversible character.[9]

Degradation of renal function during PCNL is a significant problem, especially when treating large renal calculi. Nevertheless, it is yet unclear how PCNL may affect renal function. The PCNL procedure and its outcomes are well understood clinically, but there is a dearth of quantitative data on how this method impacts renal function. There aren't many research looking at people who have had PCNL or learning more about the effects of holmium laser and pneumatic lithotripsy on renal function.[10]

In a similar study a significant difference was found in terms of stone-free, success rate, clinically insignificant residual fragments(CIRF)and failure rates between the pneumatic and laser groups (p<0.001)[11] whereas similar number of postoperative complications were observed among the two groups in this study.

It is hoped that further high-quality, multicenter RCTs with large sample sizes would be done in the future to verify the accuracy of the pertinent results.

Table 1: Demographic characteristics and Stone parameters of the study participants.

		Pneumatic	Holmium laser	Test Value	p value
Number of patients		50	50	NA	NA
Mean age (years) ± SD		49.4 ± 10.5	51.6 ± 11.6	t = 0.9942	0.332
Gender (male: female)		29:21	35:15	NA	0.779
Body weight (kg)		73.1 ± 9.4	72.7 ± 10.3	t = 0.2028	0.839
Stone size (mm^2)		195.6 ± 43.9	199.5 ± 46.2	t = .4327	0.6662
Stone location	Pelvis	8	7		
	Upper calyx	14	18		
	Middle calyx	16	17		
	Lower calyx	12	8		

Table 2: Comparison of Operative parameters among the two different group of study participants.

Parameter	Pneumatic Technique	Holmium laser	Test Value	p value
Operation time (minutes)	54.9 ± 13.2	59.7 ± 12.3	t= 1.8818	<0.05
Stone-free rate (%)	88 %	94 %		>0.05
Receiving post-operative ESWL	3	1		NA
Post-operative complications	7	8		>0.05
Ureteral perforation	1	2		
Bleeding requiring transfusion	1	1		
High Grade fever (≥39 °C)	4	6		
Hb drop (number of patients) (>0.5 g\dl)	11	13		>0.05
Duration of stay post-operative (in days)	5.5 ± 1.7	5.9 ± 1.5	t=1.2476	>0.05

CONCLUSION

The use of PCNL in conjunction with both the procedures for the treatment of renal calculi produces favorable results. In this study, certain outcome markers showed significant heterogeneity.

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