Original Article

Outcome of Ureteroscopy with Holmium Laser for Renal Pelvis Stone Clearance

Shahid Ali, Maria Aslam and Muhammad Irfan Nazir

ABSTRACT

Objective: To determine the ureteroscopy outcome with holmium laser for renal pelvis stone clearance.
Study Design: Cross sectional study
Place and Duration of Study: This study was conducted at the Urology Clinic of Shalamar Hospital Lahore from July 2022 to July 2023.
Materials and Methods: 178 patients with renal pelvis stone were included in study. Prior to surgery all patients underwent a CT Scan KUB without contrast for assessment of stone size and location. All procedures were performed using rigid ureter scopes. Outcome were observed in terms of stone free status. IBM SPSS Statistics v27 was used for statistical analysis.
Results: Among 178 patients, 75.8% were males. The average patient age and stone size was 34.98±13.95 years and 20.31±4.50 mm. In our study, the first session's stone-free rate was 71.9% and the stone-free rate after the second session was 80%. We found significant mean difference of stone size with regard to stone-free status after the first session. We discovered a significant association of stone size with stone free status after the first session but not for gender and age group. We found significant mean difference of stone size with regard to stone-free status after the second session. We discovered no association for age, gender with stone free status after the second session.
Conclusion: Ureteroscopy with holmium laser is an efficient treatment for renal pelvis stones. It also found efficient for male, females, patient with age≤30 years and for patient with age above 30 years.

Key Words: Ureteroscopy, Renal Pelvis Stone, Renal Stone Treatment

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INTRODUCTION

The incidence of nephrolithiasis has continuously increased worldwide for a few years [1]. Furthermore, it is worth noting that the prevalence of renal pelvis stone disease tends to rise in correlation with aging [2]. Senile urolithiasis is classified as a form of complex renal pelvis stone disease, as it commonly occurs in individuals with many comorbidities, including chronic heart, lung, liver, and renal dysfunction or severe urinary tract infection[3]. Similarly, the majority of renal pelvic stones that traverse the renal stones and subsequently reach the renal pelvis are associated with significant discomfort[4]. The prevailing clinical manifestations of renal stones encompass discomfort, hydronephrosis, hematuria, back discomfort, fever, and other associated manifestations, necessitating prompt and efficacious surgical intervention[5].

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The implementation of safe, prompt, and effective treatment methods for renal stones can mitigate severe complications in kidney patients [6,7].
The management of renal stone poses significant challenges due to their potential to form massive stone loads to form one pelvic stone[8]. Percutaneous nephrolithotomy (PCNL) is widely regarded as the very effective first treatment approach for renal stones[9,10]. Nevertheless, the increased risk associated with multiple-tract PCNL and the relatively low stone-free rate (SFR) observed in single-tract PCNL pose challenges for urologists in determining the optimal treatment strategy for renal stones[11,12]. The unique anatomical configuration of the collecting system presents challenges in achieving access to all stones during single-tract percutaneous nephrolithotomy (PCNL)[13]. Hence, the utilization of multiple-tract percutaneous nephrolithotomy (PCNL) is necessary for the renal stone management[14]. Nevertheless, it is worth noting that the utilization of multiple-tract percutaneous nephrolithotomy (PCNL) presents an elevated risk of hemorrhaging and exhibits greater rates of complications when compared to single-tract PCNL[15]. The utilization of combination therapies, namely the combination of percutaneous nephrolithotomy (PCNL) with shock wave lithotripsy (SWL) or PCNL with flexible ureteroscopy (fURS) incorporating SWL or

fURS with holmium laser lithotripsy for the management of residual stone is more convenient[16].

The scientists are searching out the solution regarding the optimal approach for treating renal stones with enhanced safety and efficacy[17]. Shock wave lithotripsy (SWL) offers the benefit of being a non-invasive treatment option[18]. However, its efficacy is affected by multiple factors like composition and size of the stone, the patient's body habitus, and anatomical considerations[18,19]. These factors can potentially contribute to an increased rate of retreatment. Significant advancements in flexible ureteroscopy (fURS) and holmium laser lithotripsy techniques have facilitated retrograde access to the complete collecting system[14]. As a result, these procedures have emerged as primary treatment choices, particularly for stones ranging from 11 to 20 mm in size[20]. Furthermore, it has been observed that flexible ureterorenoscopy (FURS) can effectively manage intrarenal stones that exceed a size of 20 mm[21]. The presence of residual stone following the initial treatment session for renal stone with a single-tract approach[14,15]. The single-session laser approach has modernized the field of nephrology with a non-invasive method of stone removal[22]. It prevents blood loss and inflammation in patients, while it suits patients with cardiopulmonary or coagulopathic disorders[23]. Moreover, it reduces the prolonged hospital stays by eliminating painful procedures[24]. It is efficacious in removing one stone with a size of 11-12mm in a single session.

Best to our knowledge there is very limited local literature available on holmium laser outcome for renal pelvis stone clearance so current research was conducted to identify stone free status among patient undergoing holmium laser for renal pelvis stone. Our findings will be helpful in determining utilization of holmium laser ureteroscopy in terms of its efficiency and safety to treat renal pelvis stone.

MATERIALS AND METHODS

178 patients with renal pelvis stone visiting at urology clinic at shalamar hospital Lahore were enrolled in the current study from July 2022 to July 2023. Prior to surgery all patients underwent a CT Scan KUB without contrast for assessment of stone size and location. All procedures were performed using rigid ureter scopes. We have used 4.7FR (Richard Wolf), 6FR (Richard wolf) and 8FR (Richard wolf) ureteroscopes depending on the Ureters accommodation capacity. The Jeena Surgical Holmium Laser was used at an energy level of 0.8-1J, 20-80Hrtz. Dusting mode was set and at the end of the procedure the pop-corning effect was also utilized. Suction was attached to the ureteroscope and all dust and pieces were suctioned. Double J stent was placed at the end of the procedure for each patient. The operative time limit was essentially fixed at 60 to 90 minutes. Following surgery 4 to 6 weeks periods were given to residual fragments and dust to pass out then plain x-ray or CT scan was done followed by double J stent removal and rigid uretroscopy to assess the need of the second session of holmium laser. Outcome will be measured as stone free status.

Statistical Analysis: Data analyses were done by IBM SPSS Statistics version 27. Descriptive statistics were reported for quantitative and qualitative variables. Effect modifiers were controlled through stratification to see the effect of these on outcome variables by fisher exact/ chi-square test. Mean comparison was done by independent t-test. Binary logistic regression was used to determine the odds ratio. P-value< 0.05 was considered as significant.

RESULTS

178 patients were included in study out of with 75.8% were males. The mean patient age, stone size and procedure time was 34.98±13.95 years, 20.31±4.50 mm and 71.09±9.65 minutes. The first sessions and second session stone-free percentage were 71.9% and 80% as presented in Table-1. There was a significant mean difference in stone size with regard to stone-free status after the first session (p=0.000). We discovered a significant association of stone size (p=0.000) with stone free status after the first session (p=0.000) and significant mean difference for stone size (p=0.000) with regard to stone-free status after the second session (p=0.000). Detailed results are shown in Table-2 and Table-3.

We found male patients less likely than female patients to be stone-free after the first session (OR=0.988, p=0.976). Additionally, we discovered that patients under the age of 30 had a higher likelihood of being stone-free than patients above the age of 30 (OR=1.473, p=0.260). Table-4 presents specific odds ratios for stone-free status following the first and second session.

Table No. 1: Descriptive statistics of study population (n=178)

	n (%)
Gender	
Male	135 (75.8)
Female	43 (24.2)
Age(years)	
Mean± std. dev	34.98±13.95
Group	
≤30 years	76 (42.7)
>30 years	102 (57.3)
Stone Size (mm)	
Mean± std. dev	20.31±4.50
Group	
<20 mm	101 (56.7)
≥20 mm	77 (43.3)
Operation Time (min) ; mean± std. dev	71.09±9.65

Stone Free after first session	
Yes	128 (71.9)
No	50 (28.1)
Stone Free after second session (n=50)	
Yes	40 (80)
No	10 (20)

Table No. 2: Comparison of stone free status after first session according to demographic factors

	Stone free status after first session n (%)		P-value
	Yes	No	
Gender			
Male	97 (75.8)	38(76)	0.976
Female	31 (24.2)	12(24)	
Age(years)			
Mean± std. dev↕	34.79±14.60	35.46±12.25	0.760
Group			
≤30 years	58 (45.3)	18 (36)	0.259
>30 years	70 (54.7)	32 (64)	
Stone Size (mm)			
Mean± std. dev↕	18.56±3.71	24.80±3.03	0.000*
Group			
<20 mm	97 (75.8)	4 (8)	0.000*
≥20 mm	31 (24.2)	46 (92)	

Chi-Square/Fisher exact test was applied.
↕Independent t-test was applied.
*Significant at 0.05 level

Table No. 3: comparison of stone free status after second session according to demographic factors (n=50)

	Stone free status after second session n (%)		P-value
	Yes	No	
Gender			
Male	29 (72.5)	9 (90)	0.416
Female	11 (27.5)	1 (10)	
Age(years)			
Mean± std. dev↕	35.70±11.71	34.50±14.91	0.785
Group			
≤30 years	14 (35)	4 (40)	1.000
>30 years	26 (65)	6 (60)	
Stone Size (mm)			
Mean± std. dev↕	23.90±2.61	28.40±1.50	0.000*
Group			
<20 mm	4 (10)	0 (0)	0.571
≥20 mm	36 (90)	10 (100)	

Chi-Square/Fisher exact test was applied.
↕Independent t-test was applied.
*Significant at 0.05 level.

Table No. 4: Odds ratio for Stone free after first session and second session

	Stone free status after first session (n=178)		Stone free status after second session (n=50)	
	p-value	Odds Ratio (95% CI)	p-value	Odds Ratio (95% CI)
Gender				
Male	0.976	0.988(0.460-2.123)	0.270	0.293(0.033-2.590)
Female®	1			1
Age(years)				
≤30 years	0.260	1.473(0.751-2.891)	0.769	0.808(0.195-3.349)
>30 years®		1		1
Stone Size (mm)				
<20 mm	0.000	35.984(11.992-107.974)	0.999	NA
≥20 mm®				1

®Reference group, CI; confidence interval
Binary logistic regression was applied.

DISCUSSION

The renal stone disease incidence is increasing as the prevalence of other related disorders is increasing including coagulopathic disorders, cardiopulmonary disorders and diabetes. As the cases are continuously increasing, they are required to treat the medical cases to save human lives. So, there are different treatment methods including surgical procedures, percutaneous nephrolithotomy with shock wave lithotripsy or PCNL with flexible ureteroscopy (fURS) incorporating SWL or fURS with holmium laser lithotripsy. However, multiple issues arise during nephrotomy due to loss of blood, inflammation, prolonged hospital stays and post-operative complications. Therefore, different lithotripsy-based methods are encouraged due to short hospital stays, reduced blood loss, reduced inflammation and economical procedure for the patient. In this study, we have used holmium laser ureteroscopy to treat renal pelvis stone mainly made up of different salts. This procedure is totally applied on 178 patients

which includes 135 (75.8%) male patients and 43 (24.2%) female patients. These results are in conjunction with the Chen et al as they also found majority males patients than females[14]. The mean age is lower than Europe and America[6] but it is possible in Pakistan due to reduced expectancy rate. However, renal stone disease is more common in patients aged above 30 years all over the world as we find out in our study. The size of the stone is 20.31±4.50 mm which is also reported by with minute differences[7,8]. The size of renal stone in 101(56.7%) patients is less than 20mm while 77(43.3%) have stone size more than 20mm. These results are not supported by the different study because they find out less percentage of patients with the stone size of more than 20mm[19–21]. But they have more developed public health infrastructures and awareness than Pakistan as follow medical checkups routinely. The mean operation time in our study is supported by other studies[12,13] and its operation time is less than SWL and nephrolithotomy. After the holmium laser ureteroscopy procedure, 128(71.9%) patients have found significant results with all the stone melted and dismantled during the procedure. These results are highly appreciable and in conjunction with another study while better with another study[17] due to efficient procedure. After the second session the remaining size of stone melted with the laser in 80% of patients.

The stone clearances after the first session in male patients are 75.8% while 76% patients required second session to fully clear the stone. This was due to the increase size of stone in the patients and not cleared in the first session. In contrast, the stone was cleared in 24.2% of female patients in the first session and only 24% of women required second session of ureteroscopy. Our findings suggest that gender does not have a statistically significant influence on stone clearance after the first and second session of ureteroscopy as depicted by other studies [9,20].

CONCLUSION

Ureteroscopy with holmium laser is an efficient treatment for renal pelvis stones with stone free rate of 71.9% and 80% after first session and second session respectively. It also found efficient for male, females, patient with age≤30 years and for patient with age above 30 years.

Author's Contribution:

Concept & Design of Study:	Shahid Ali
Drafting:	Maria Aslam¸ Muhammad Irfan Nazir
Data Analysis:	Muhammad Irfan Nazir
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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