Transperitoneal Laparoscopic Ureterolithotomy and Ureteroscopic Laser Lithotripsy for Treatment of Proximal Ureteral Stones, a Comparative Study

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ABSTRACT:

BACKGROUND:

Laparoscopic as a minimally invasive treatment is continuosly gaining place in the treatment of urinary stones,mainly replacing open surgery,it is mostly recommended ror large impacted stones.

OBJECTIVE:

To compare the safety, efficacy, operative time, postoperative hospital stay, and complications rate of transperitoneal laparoscopic ureterolithotomy and ureteroscopic holmium laser lithotripsy for treatment of upper ureteral stones, equal to or larger than 15 mm in longest diameter.

PATIENT AND METHODS:

Forty-two patients with upper ureteral stones of 15 mm or larger in longest diameter were included in this study. Eighteen patients were treated by transperitoneal laparoscopic ureterolithotomy and 24 patients by ureteroscopy using semi-rigid ureteroscope with Holmium laser lithotripsy. Operative time, intraoperative complications, stone-free rate, postoperative complications, postoperative hospital stay and post-operative auxiliary treatment were compared in both groups.

RESULTS:

The mean stones size was comparable in both groups, it was 20.5 ± 6.8 mm in Ureteroscopy group and 20.3 ± 6.7 mm in laparoscopic group, (P. value > 0.05). The mean operative time was significantly shorter in ureteroscopy group, 46.3 ± 27.3 minutes compared to 66.4± 19.1 minutes in laparoscopic group. Regarding the Patients in laparoscopic group needed longer hospital stay with a mean time of 2.2 ± 0.4 days, while in ureteroscopy group, the meantime of hospitalization was 1.1 ± 0.45 days. The stone free rate in laparoscopic group was 100%, compared to 62.5% in ureteroscopy group giving a statistically significant difference, (P. value = 0.003), and the ancillary treatment was needed in 37.5% of patients treated by ureteroscope. Postoperatively in ureteroscopic group, three patients had gross hematuria, while only one Patients in laparoscopic group had pyelonephritis, however, no significant difference in frequency of post-operative complications between both groups, (P. value> 0.05).

CONCLUSION:

Transperitoneal laparoscopic ureterolithotomy has a higher stone-free rate, but longer operative time and hospital stay compared to ureteroscopic laser lithotripsy for the treatment of upper ureteral stone 15 mm or larger in longest diameter.

KEYWORDS: Laparoscopic,Ureterolithotomy, Laser lithotripsy

INTRODUCTION:

For large proximal ureteral calculi that are unlikely to pass spontaneously, an early intervention must be considered. Although there is consensus that ureteroscopy is the most efficient treatment for patients with distal ureteral stones, there is a debate regarding large proximal ureteral stones.[1,2] AUA (American Urological Association) and EAU (European Association of Urology) have recommended ureteroscopic lithotripsy (URS) or shockwave lithotripsy (SWL) as the first option, although percutaneous nephrolithotomy (PCNL) and laparoscopic ureterolithotomy (LU) may be the suitable option.[1-4]Laparoscopic and robotic ureterolithotomy have been described for proximal and mid-ureteral calculi, with success rates for stone clearance in selected cases of 93% to 100%.[5]

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Laparoscopic ureterolithotomy can effectively prevent the superior shift of stones to the renal pelvis and stone residual.[6]

The first ureteroscopic stone removal was reported in 1980 by Perez-Castro-Ellendt and Martinez-Pineiro, since that time, the advancement in the technology for endoscopic instrumentation has allowed the treatment modalities for ureteral stones to evolve, largely replacing open surgery and blind basketing.[7]

The current standard for some rigid ureteroscopes is tip diameters of < 8 Fr., rigid URS can be used for the whole ureter. However, technical improvements, as well as the availability of digital scopes, also favor the use of flexible ureteroscopes in the ureter.[8]Laparoscopy is a minimally invasive treatment that is gaining a place in the treatment of urinary stones, mainly replacing open surgery.[9] Skolarikos et al.[10] have tried to identify the level of evidence and grade of recommendation supporting the laparoscopic approach of stone extraction. The highest level of evidence (IIa) was found for laparoscopic ureterolithotomy. It is technically feasible and has lower postoperative morbidity compared to open ureterolithotomy. It is mostly recommended (grade B) for large impacted stones or when endoscopic ureterolithotripsy or shock wave lithotripsy have failed.[11]When expertise is available, laparoscopic ureterolithotomy can be performed for large proximal ureteral stones as an alternative to URS or SWL.[12,13] These more invasive procedures have yielded high SFRs and lower ancillary procedure rates.[14-16] A recent systematic review showed no difference in the post-operative phase for stented or unstented laparoscopic ureterolithotomy.[8]

PATIENTS AND METHODS:

Forty-two patients with upper ureteral stones (above the level of sacroiliac joint) of 15 mm or larger in longest diameter confirmed by native Computed Tomography-were included in this study. Patients were distributed to two groups randomly based. Eighteen patients were treated by transperitoneal laparoscopic ureterolithotomy and 24 patients by ureteroscopy using semi-rigid ureteroscope with Holmium laser lithotripsy. Ureteroscopic group patients were managed under spinal anesthesia. The patients were placed in lithotomy position, after identification of ureteral orifice an 8/9.8 Fr ureteroscope (Richard Wolf) was advanced to the ureter by the assistance of flexible-tip hydrophilic guidewire using the tenting technique. Holmium laser (Quanta-Q1DNA, Litho-Italy) was used to fragment the stone. After complete stone fragmentation, 5 Fr double J ureteral stent inserted, and Foley's catheter inserted to the bladder. Double J stent was removed 2 weeks later if the patient was stone-free and without complication. Laparoscopic group patients were managed under general anesthesia. The patients were placed in the lateral flank position, and 10 mm port was inserted about 10 cm lateral to the umbilicus (in linea semilunaris) by open method, insufflation of peritoneal cavity done by Carbone dioxide gas to 12 mmHg pressure, then camera was inserted through the port and visualization of abdominal organs done to exclude any iatrogenic injury. The other three ports (5 mm diameter each) were inserted in a diamond shape, under direct vision. First port subcoastally in midclavicular line. Second port was inserted in anterior axillary line just below the level of umbilicus and last port was inserted few centimeters above the iliac bone. Medialization of ipsilateral ascending or descending colon done by blunt and sharp dissection and bipolar diathermy was used for hemostasis. Identification of the ureter and incision of ureter at level of stone by monopolar hook then stone extraction was done as shown in figure (1, A and B). Insertion of 5 Fr DJ stent from site of ureteral incision as shown in figure (1, C). Closure of ureteral incision by interrupted suturing using 4/0 rounded needle vicryl suture material. Tube drain was inserted through 3^{ed} port incision and deflation of peritoneal cavity and closure of 10mm port site in two layers and the 5mm port site, in a single layer. Double J stent will be removed 4 weeks later if patient was stone free and without complications. Data of the 24 cases in URS group and 18 cases in laparoscopic group were entered, managed and analyzed using the statistical package for social sciences version 25, (SPSS 25) for windows. Chi square test used to compare both groups in categorical variables, student's t test (two independent mean values of a continuous variable between both studied groups.

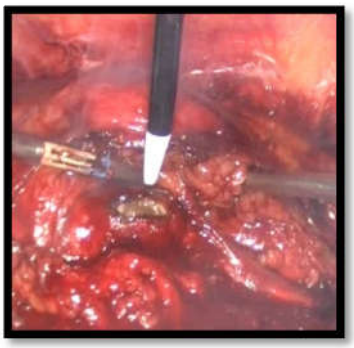

Figure1:A Laparoscopic ureteral incision

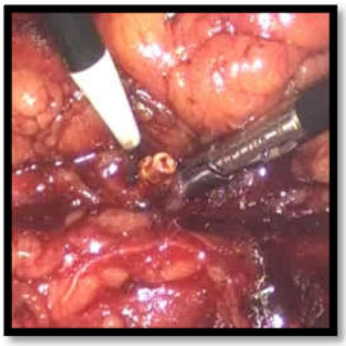

Figure1:B Laparoscopic stone extraction

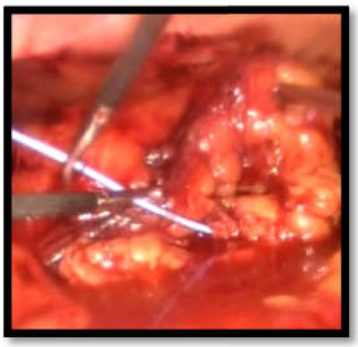

Figure1:C Laparoscopic double J stent insertion

RESULTS:

Patients age and gender distribution between both groups was statistically insignificant, (P. value > 0.05) and no significant differences had been reported regarding the side of stones between both groups, similarly, no significant difference in the mean size of stones between both groups, the mean size was 20.5 ± 6.8 mm in URS group and 20.3 ± 6.7 mm in laparoscopy group, (P. value > 0.05).As shown in table (1) the mean operative time was shorter in URS group, 46.3 ± 27.3 minutes compared to 66.4± 19.1 minutes in laparoscopic group with statistical significance (p. value 0.008). All Patients in laparoscopic group had achieved complete stone removal giving a stone free rate of 100%, compared to 15 patients in URS group giving a stone free rate of 62.5%. which was a statistically significant difference, (P. value = 0.003). Regarding drain amount and time of removal in laparoscopic group, 16 patients had few amount (< 50 ml) and 2 patients had 150 – 200 ml, the fluid from drains was serous, not urine in all patients, the drain removal time ranged between 36 – 72 hours. Patients in laparoscopic group needed longer hospital stay and spend longer time to discharge with a mean of 2.2 ± 0.4 (range; 1.5 – 4) days, from other point of view, in this group,11patients discharged within 2 days, 6 patients after 3 days and only one patient discharged after 4 days, in URS group, 22 patients discharged after one day, and only one patients after 2 days and another one patient discharged after 3 days, with a mean discharge time of 1.1± 0.45 days. Comparison of mean DJ removal time between the studied groups revealed that DJ removed after 28 days in all cases of laparoscopic group while it removed with a mean time of 25.9 ± 9.7 days in URS group with a range of 14 – 90 days. Nonetheless, the difference in mean DJ removal time was statistically insignificant between both groups, (P> 0.05). The ancillary treatment was used in URS group, where medical treatment was applied for 6 cases, ESWL and Medical treatment in two cases and further URS in one case while 15 cases did not need furthermore these ancillary treatments. There were significantly more frequent intra-operative complications among patients in URS group (9 patients, 37.5) compared to those in laparoscopic group (0.0%), (P. value<0.05). Those 9 patients in the URS group had intra-operative complications; including 5 patients with complete stone retropulsion and 4 patients with incomplete fragmentation and part retropulsion. Postoperatively, in URS group only 3 patients (12.5%) had gross hematuria, while only one patient in laparoscopic group developed pyelonephritis; however, there was no significant difference in frequency of post-operative complications between both groups, (P. value> 0.05) as shown in table (2).

Table 1: Mean values of operative time, hospitalization period, double J stent removal time, and stone free rate of the studied groups.

	Group				t-test (*statistic*)	P. value
	URS group (no. = 24)		Laparoscopic group (no. = 18)			
Variable	Mean	SD	Mean	SD		
Operative time	46.3	27.3	66.4	19.1	2.67	0.008 sig
Hospitalization period	1.1	0.45	2.2	0.4	5.39	0.001 sig
Double J stent removal time	25.9	9.7	28.0	1.00	0.451	0.602 Not significant
Stone free rate	62.5	--	100.0	--	--	0.003 sig
sig: significant, t: student t test						

Table 2: Frequency distribution of intra-operative and post-operative complications in both studied groups.

	URS group (no. = 24)		Laparoscopic group (no. = 18)		P. value
Intra-operative Complications	No.	%	No.	%	
• Complete stone retropulsion	5	20.8	0	0.0	0.0131 Signifent
• Incomplete fragmentation and part retropulsion	4	16.7	0	0.0	
• Blood transfusion	1	4.1	1	5.5	
• Ureteric perforation	1	4.1			
Postoperative Complications					
Gross hematuria	1	4.1	0	0.0	0.162 Not significant
Pyelonephritis	0	0.0	1	5.6	
Ureteric stricture	1	4.1	1	5.5	
Urine leak			2	11	

DISCUSSION:

Although a number of impacted upper ureteral stones can be managed well by URS or ESWL, LU seems to be an alternative when removing impacted ureteral stones larger than 15 mm .(17-18)

Patients age, gender distribution, stones laterality and mean stone size for both studied groups were comparable and no significant differences had been reported, so that there was no concern regarding selection bias.

The mean operative time was shorter in URS group, 46.3 ± 27.3 minutes compared to 66.4± 19.1 minutes in laparoscopic group, similarly, Choi et al[19] found that operative time was significantly longer in laparoscopic ureterolithotomy, but Kumar et al,[12] found that the mean operative time was

comparable in both groups. Longer operative time needed in the laparoscopic group might be attributed to the especial preparations needed for this type of operation and in part due to the initial experience of the surgeon in such type of operations, another fact that some patients in the URS group had stone retropulsion resulting in shorter operative time.

The stone-free rate is significantly higher in patients treated by laparoscopic ureterolithotomy in all studies that comparing LU with other modalities for treatment of large upper ureteric stones,[12,13,19] similarly in this study all patients in laparoscopic group had achieved a stone free status giving a rate of 100%, the high Stone free rate in LU group because the stone had been removed in one piece. While in URS group 15 patients achieved complete stone fragmentation initially giving a stone free rate of 62.5%. which was a statistically significant difference.

In LU tube drain always inserted and the drain removal time ranged between 36 – 72 hours, the drain regarded as burden to patient, while in URS group no drain was required.

Regarding the discharge time, in this study, patients in laparoscopic group needed longer hospital stay with a mean time of 2.2 ± 0.4 days, while in URS group, the meantime for discharge to home was 1.1 ± 0.45 days. The longer hospital stays in laparoscopic group are due to, in part, longer recovery time needed from general anesthesia and the tube drain which lead to delay in bowel movement. Similar results also were reported in five of six randomized controlled trials studied in a meta-analysis.[13]

In current study comparison of mean DJ removal time between the studied groups revealed that DJ was removed after 28 days in all cases in laparoscopic group while it was removed with a mean time of 25.9 ± 9.7 days in URS group with a range of 14 – 90 days. The difference in mean DJ removal time was statistically insignificant between both groups. The double J stent kept for 4 weeks in laparoscopic ureterolithotomy to allow time for healing of the ureteral incision, while in the ureteroscopy group DJ stent was usually removed after 2 weeks if complete stone fragmentation was done, but if ancillary treatment was needed DJ stent was kept for a longer duration. Choi et al[19] also found that DJ removal time was significantly shorter in URS group.

The need for additional ancillary treatments for patients in URS group was 37.5%, specifically, medical stone dissolvent treatment applied for 6 patients, ESWL and medical treatment in two patients and further URS in one case, while no additional ancillary treatment needed in laparoscopic group, in Kumar et al[12] study ancillary treatment was needed in 50% of patients treated by ureteroscopy.

In present study the intra and postoperative complications as in table (2), there was no significant difference in frequency of post-operative complications between both groups, (P. value> 0.05), similarly, Choi et al[19] show slightly more complications in URS group, but also the frequency of complications was statistically not significant.

CONCLUSION:

Transperitoneal laparoscopic ureterolithotomy achieves higher stone-free rate than ureteroscopy without the need for ancillary procedures with no significant difference in frequency of post-operative complications for management of large upper ureteric stones. Even though transperitoneal laparoscopic ureterolithotomy resulted in longer operative time, longer hospital stays, and need for general anesthesia instead of spinal anesthesia compared to ureteroscopic management of those stones.

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