ORIGINAL ARTICLE

Transperitoneal Surgery and Laparoscopic Ureterolithotomy for Recurrent large distal ureteric Stones.

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ABSTRACT

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Background: laparoscopic transperitoneal uriterolithotomy is a minimally invasive surgical procedure used to remove stones from the ureter. Purpose: To assess the safety, feasibility, and efficacy of laparoscopic transperitoneal ureterolithotomy (LTPU) in the treatment of recurrent distal ureteric stones in patients with previous open retroperitoneal uretrolithotomy - in whom another transperitoneal surgery was performed. **Methodology**: A prospective study was conducted at the department of Urology, Sohag University hospital. All patients with recurrent distal ureteric stones who attended our institute between January 2019 and March 2023 and scheduled for LTPU were consecutively included. Patients were followed postoperatively for subjective improvements. The statistical analysis was carried with SPSS software version 18 for windows. **Results**: A total of 44 patients (30 men and 14 women) were included in the study). No conversion to open surgery was needed in any of the patients. The mean operative time was significantly longer in these 11 patients who underwent LTPU on the same side of the previously mentioned transperitoneal surgeries than in patients with stones on contralateral side (149 $\pm$11 min vs. 88 $\pm$7 min, p < 0.05). No major complications occurred either intraoperative or postoperative. During the follow-up, one patient developed small distal ureteral stone (7 mm) which was managed successfully. **Conclusions**: Previous transperitoneal laparoscopic surgery in patients with previous open retroperitoneal ureterolithotomy seems to have no significant impact on transperitoneal ureterolithotomy for recurrent ureteric stones in these patients.

INTRODUCTION:

Ureteroscopy and shockwave lithotripsy (SWL) are currently the first line treatment for distal ureteric stones. However, laparoscopic management of distal ureteric stones is gaining popularity, especially in patients with large stone burden, high stone density, and ureteric strictures. It was not until 1979 when the first laparoscopic retroperitoneal ureterolithotomy (LRU) was performed by Wickham (1) followed by laparoscopic transperitoneal ureterolithotomy (LTU) in 1992 by Raboy et al (2). Ever since, publications emerged from all

over the worlds aiming to refine the technique, enhance surgical outcomes, and to minimize the rate of complications. Unlike proximal and mid-ureteric stones, the distal ureteric stones are accessed transperitoneally, especially in patients with previous open retroperitoneal ureterolithotomy because of formation of periureteric fibrosis that makes a retroperitoneal approach almost impossible in these patients (3).

Bilharziasis ranks second after malaria on the list of most important parasitic infestation worldwide. It affects more than 200 million people in 74 countries (4), and is endemic in many countries including Egypt, Kenya, and Brazil with a prevalence of 15-45% in Egypt (5-7). Notably, bilharzial ureteric lesions are limited to the lower half of ureter due to presence of anastomotic channels between the inferior mesenteric vein and the peri-ureteric/peri-vesical veins. Through these channels, *Schistosoma Haematobium* worms access the urinary system. The ureteric belharzial lesions include tubercles, ulcers, sandy patches and cysts (ureteritis cystica). Lower ureteric musculosa may be affected by fibrosis leading to partial obstruction; however, the proximal ureter undergoes dilatation hypertrophy that produces high pressure to overcome the distal obstruction (8).

Ureteric dilation with distal patency is a common radiologic and endoscopic finding in bilharzial ureters, which can be attributed to vesicoureteric reflux and/or impaired peristalsis due to edema and fibrosis of ureteral wall (9). This finding is a must-met criterion in performing laparoscopic ureterolithotomy to exclude presence of distal ureteric stricture, which necessitate ureteral reimplantation.

The small sample size, Retrospective design, Lack of control group and Heterogeneity of patients all of this become several shortcomings that need to be addressed to provide more reliable and accurate results.

The aim of the current study was to assess the safety, feasibility, and efficacy of LTPU in the treatment of recurrent distal ureteric stones in patients with previous open retroperitoneal uretrolithotomy - in whom another transperitoneal surgery was performed.

PATIENTS AND METHODS

This was a prospective study. All patients with recurrent distal ureteric stones who attended our institute between January 2019 and March 2023 were consecutively included. A total of 44 patients (30 men and 14 women) were included in the study. Group A (study Group) included 22 patients and group B (control group) included 22 patients. Inclusion criteria were adult patients with recurrent, large (> 2.5 cm), radio-opaque stones in the distal part of a bilharzial ureter. Bilharzial affection of the ureter was suspected when one or more of the following criteria were met: 1-history of repeated antibilharzial treatment, 2- presence of bilharzial ova in urine analysis, 3- spindle-shaped lower ureteral stricture on intravenous urography (IVU), or 4- presence of ureteritis cystica on ureteroscopy. Exclusion criteria were patients with non-excreting ipsilateral kidney on IVU or raised serum creatinine. The patients were divided into 2 groups: group A (study Group) included patients with previous transperitoneal surgery close to the pelvic portion of the ureters, while group B (control group) included patients with no previous transperitoneal surgery.

Patient preparation

X-ray of kidney-ureter-bladder (KUB) was performed prior to the procedure to confirm stone position. All procedures were done under general anesthesia, in lithotomy position. Patency of the ureter distal to the stone was confirmed by retrograde ureterography. A 7 Fr ureteral catheter

was left just distal to site of impaction. A urethral catheter to which the ureteral catheter was anchored and a nasogastric tubes were inserted to evacuate the bladder and decompress the stomach respectively. The patient was repositioned in supine position with the stone side is laterally tilted to 45° - ensuring that head level is higher than legs to avoid upward migration of the stone because the ureters were dilated proximal to the stone due to bilharzial affection.

Surgical technique

Pneumoperitoneum was created through open approach (Hasson technique) at the subumbilical crease in thin patients, and at the lateral border of ipsilateral rectus abdominis muscle at the level of umbilicus in obese patients. A 10-mm camera port (port 1) was inserted - through which a 0° telescope was introduced. Inspection of peritoneal cavity was performed before introduction of other ports to assess peritoneal adhesions from the previous surgery. A 12-mm working trocar (port 2) was inserted at the midclavicular line, 5 cm below the umbilicus, and another 5-mm (port 3) was inserted in the 5cm above the first trocar again at the midclavicular line.

Adhesolysis was done using either fine laparoscopic electrocautery hook or scissor with the lowest power of coagulation. Incision of parietal peritoneum was done medial to sigmoid colon (on the left side) or cecum (on the right side). Incision was decided to take place at an apparently fresh proximal area to avoid the adhesions from previous open retroperitoneal ureterolithotomy and then dissection proceeded distally to the site of stone impaction. Ureter was easily identified due to the marked dilatation proximal to the stone which can be palpated by atraumatic Endo-grasper giving a gritty sensation and sometimes the stone may produce obvious bulge.

Laparoscopic Babcock forceps was applied proximal to the stone to prevent upward migration. A longitudinal ureterotomy over the stone was done using laparoscopic scalpel. The stone was delivered and kept inside a finger of a surgical glove. The ueretral catheter was pulled proximal to the ureterotomy site and the later was closed using interrupted 4-0 polyglactin sutures. The stone was extracted through port 1, and finally, a tube drain (20 Fr. Nelaton catheter) was introduced through port 2 under direct vision.

Ethics:

The study was conducted according to the principles of World Medical Association Declaration of Helsinki 'Ethical Principles for Medical Research Involving Human Subjects' and an informed consent forms were completed by all patients.

Statistical analysis:

All data were collected, tabulated and statistically analyzed using Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) software version 18. Continuous variables were analyzed using Independent *t*-test (for normally distributed data) and Mann-Whitney U test (for non-normally distributed data) and categorical data were compared using chi square and Fisher's exact tests. A 5% significance level was used for all tests.

RESULTS

A total of 44 patients (30 men and 14 women) were included in the study. Patients' demographics and stone characteristics are shown in table 1. The mean age of the patients in group A was 38.7±13 years (range 18-64) while it was 40.1±12 years (range= 19-62) in group B. Mean stone size of group A was 3.5±0.4 cm while that of group B was 3.3±0.5 cm (Figure 1). In group A, 10 stones were on the left side while 12 were on the right. In group B, 12 stones were on left side

and 10 were on the right. Preoperative IVU revealed marked hydronephrosis in 40 patients (21 in group A and 19 in group B). All patients of both groups had previous open retroperitoneal ureterolithotomy. All patients of group A had previous transperitoneal surgery: open appendicectomy in 11 patients, laparoscopic appendicectomy in 8, and laparoscopic ovarian cystectomy in 3 patients (Table 1).

The operative and postoperative data are shown in table 2. No conversion to open surgery was needed in any of the patients. The mean operative time in group A was significantly longer than in group B (125±11 min vs. 89.6±9 min respectively, $p < 0.05$). Fourteen patients needed single dose of IV morphia 10 mg, 5 patients needed 2 doses, and 3 patients needed three doses in group A. No major complications occurred either intraoperative or postoperative. Two patients in group A and 1 in group B developed postoperative high grade fever (clavien grade II) that was controlled by empirical intravenous antibiotics for 48 hours. Nineteen patients in group A had previous appendicectomy (11 open and 8 laparoscopic appendicectomy) (Table 1). In 10 of these 19 patients, the stones were located on the right side (figure 2). Two stones were located on the opposite side (right) of previous ovarian cystectomy and one stone was on the same side of ovarian cystectomy (left) (figure 2). The mean operative time was significantly longer in these 11 patients who underwent LTPU on the same side of the previously mentioned transperitoneal surgeries than in patients with stones on contralateral side (149±11 min vs. 88±7 min, $p < 0.05$) (Table 3). Two patients in group A and 1 patient in group B developed post operative ileus which necessitated a delay in oral intake to 48 hours to insure a full return of intestinal sound and passage of flatus. Three patients in group A with recognized serosal injury of small intestine were treated with laparoscopic oversewing of the injury. All these 3 injuries occurred on the same side of previous open appendicectomy due to dense adhesions.

Small bowel ischemia was noticed intraoperatively in 2 patiens of group A due to thermal injury during electrocautery dissection and were successfully observe postoperative.

Indefinite vascular injury occurred in 2 patients of group A upon dissection through heavy adhesions of the previous transperitoneal surgery which was managed successfully by ligature. Patients were reviewed in the outpatient clinic at 2, 4, 6 and 12 months for follow up to assess relief of obstruction, stone recurrence and/or UTI. One patient in group A developed small distal ureteral stone (7 mm) which was managed successfully by ureteroscopic extraction after failure of medical expulsive therapy followed by insertion of 6 Fr ureteric catheter for 5 days.

DISCUSSION

SWL and ureteroscopy are the first choice lines of treatment for ureteric stones. However, in some occasions, these approaches fail to deal with large impacted ureteric stones. According to the European Urology Guidelines, laparoscopic ureterolithotomy should be offered for treatment of these stones [10].

Distal ureter can be identified during laparoscopic ureterolithotomy at its crossing with the iliac vessels, and can be dissected towards its distal end from there [11]. Laparoscopic Ureterolithotomy is associated with lower hospital stay, lower need for analgesia, time to convalescence, and better cosmesis compared to open ureterolithotomy [12, 13].

Laparoscopic ureterolithotomy can be performed using either retroperitoneal or transperitoneal approache. In the current study, we preferred to use the transperitoneal approach because of 1- the suspected retroperitoneal adhesions around the distal part of the ureter as a result of previous open uretrolithotomies [14], 2- the retroperitoneal space narrows as dissection proceeds distally

which makes negotiation and movement of the instruments difficult and the lower ureter becomes unapproachable [3].

Bilharziasis is caused by *schestosoma haematobium* when human body comes in contact with contaminated water in endemic areas in Africa and Asia. Once penetrated the human skin, the parasite migrates to their ultimate destination in the pelvic venous plexus and start to deposit their eggs in the lower urinary tract [15]. Eggs deposition takes place in the periureteric and/or suburothelium and also between muscle layers. Consequently, the immune response to egg deposition finally results in variable degrees of mural and/or periureteric fibrosis [16, 17].

Up to 50% of ureters in patients with urinary bilharziasis develop strictures [18, 19] which leaves us with another 50% of distally patent ureters that enable us to conduct this study. Moreover, Bilharzial ureters tend to be atonic with limited peristalsis [20]. In the current series, none of the patients had ureteric stricture, distal to the site of impaction of the stone as confirmed by the retrograde ureterography and testing of distal ureteric patency.

To our knowledge, this is the first study to evaluate the feasibility and efficacy of LTPU in patients with previous open retroperitoneal ureterolithotomy and previous transperitoneal surgery. Seifman et al [21] investigated the impact of previous open abdominal surgery on surgical outcomes in patients undergoing transperitoneal renal/adrenal laparoscopic procedures. The authors reported greater major complication rates, and consequently, longer hospital-stays. Parsons et al [22] reported an increase in operative time and hospital stay in patients who underwent a laparoscopic urological procedure at the same site of a previous open abdominal surgery.

In the current series, the mean operative time was significantly higher in group A than in group B. Also the operative time of patients who had had LTPU on the same side of the previous transperitoneal surgery was longer than those who had LTPU done on the opposite side of the previous transperitoneal surgery, actually the later had an operative time very close to those who had no previous transperitoneal surgery (88±7 min and 89.6±9 min respectively; p= 0.9) (Table 4). The same was not true for other surgical outcomes including blood loss, postoperative hospital stay, analgesic request, and time passed before patients returned to their normal daily activities which were all of insignificant difference. Vascular injury occurred in 2 patients on the right side were appendicectomy took place due to dense intraperitoneal adhesions. Postoperative complications including fever and urinary leakage were observed more in group A than in group B, but again with no statistical difference noted between both groups. Therefore, it seems that Previous transperitoneal laparoscopic surgery in patients with previous open retroperitoneal ureterolithotomy seems to have no significant impact on transperitoneal ureterolithotomy for recurrent ureteric stones in the current series except on operative time.

Table 3 summarizes the surgical outcomes of the current series compared to previous reports. The mean operative time in the current series was 110 minutes and the mean hospital stay was 3.1 days in the study group (group A). These outcomes are in keeping with previous reports [23-25]. None of our patients necessitated conversion to open surgery. Feyaerts et al reported 3 conversions in their series. We think that testing the distal patency was of value and enabled us to avoid unnecessary conversions in the current study. The mean time of postoperative urinary intraperitoneal leakage was relatively short in our series – up to 3 days. This can be due to careful testing of the distal ureteric patency, stenting of the ureters and closure of the ureterotomy in all of our patients. No major complications were noted in any of our patients, we believe that careful assessment of the abdominal wall adhesions of pervious laparoscopic surgeries and tackling the ureter at a relatively fresh surgical field above the level of periureteric scar tissue of the previous

open ureterolithotomiy played pivotal rule in achieving complete stone clearance with minimal complication rate.

CONCLUSION

Previous transperitoneal laparoscopic surgery in patients with previous open retroperitoneal ureterolithotomy seems to have no significant impact on transperitoneal ureterolithotomy for recurrent ureteric stones in these patients.

Conflict of interest: None

ABBREVIATIONS USED:

kidney-ureter-bladder (KUB)

Ureteroscopy (URS) and shockwave lithotripsy (SWL)

Laparoscopic retroperitoneal ureterolithotomy (LRUL)

laparoscopic retroperitoneal ureterolithotomy (LRU)

urninary tract infection (UTI)

intravenous urography (ivu)

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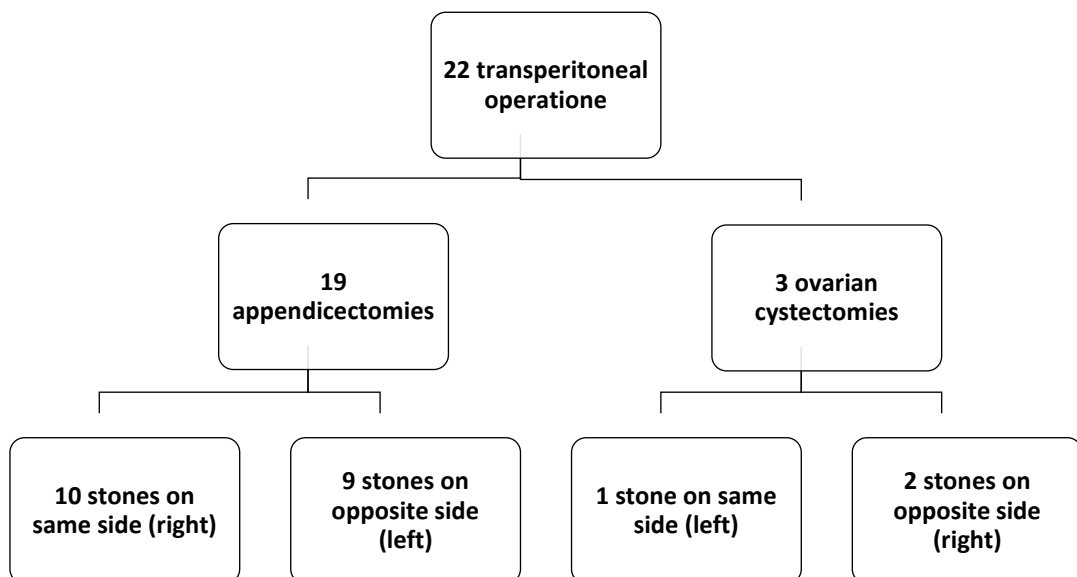Figure 1 – PUT (A) and IVU (B) of large stone in the distal part of left ureter

(A)   (B)
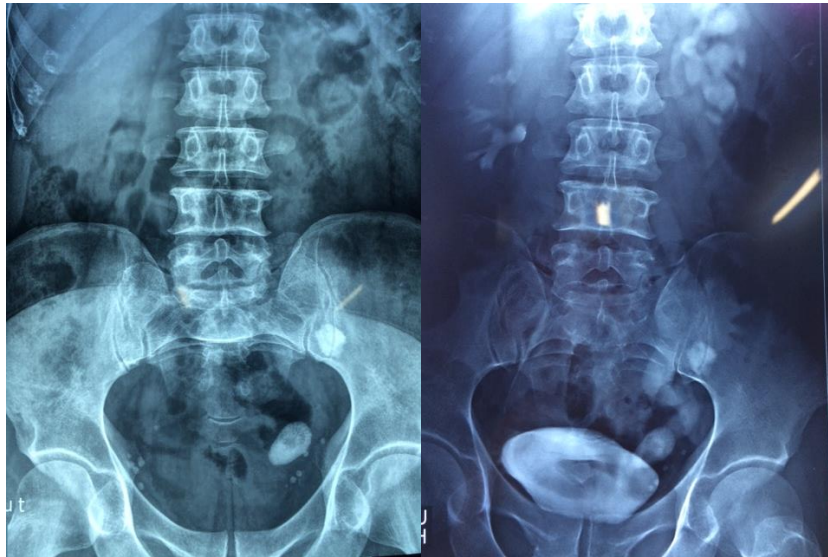
Figer 2: Stone side in relation to the previous transperitoneal surgery in

patients of group A

Table 1. Patient demographics and stone characteristics of both groups

Variable	Mean±SD (range) or n (%)		P value
	Group (A)	Group (B)	
Age (years)	38.7±13 (18-64)	40.1±12 (19-62)	0.67
Gender:			
Male	16 (72.7)	14 (63.3)	0.72
Female	6 (27.3)	8 (36.4)	
Laterality (right/left)	12/10 (54.5/45.5)	10/12 (45.5/54.5)	0.23
Stone size (cm)	3.5±0.4 (2.5-5)	3.3±0.5 (2.5-5)	0.86
Hydronephrosis	21 (95.5)	19 (86.4)	0.67
Previous surgery (%)			
Open ureterolithotomy	22 (100)	22 (100)	
Open appendicectomy	11 (50)	None	
Laparoscopic appendicectomy	8 (36.4)	None	
Laparoscopic ovarian cystectomy	3 (13.6)	None	

Table 2. Operative and postoperative data of group A and B.

Variable	Mean±SD or n (%)		P value
	Group A	Group B	
Operative time (min)	125±11	89.6±9	<0.05 *
Blood loss (mL)	79.8	60.8	0.65
Analgesic requests			
1	14 (63.7)	16 (72.7)	

2	5 (22.7)	4 (18.2)	
3	3 (13.6)	2 (9.1)	
Hospital stay (days)	5.1±1.2	5±0.95	0.4
Resumed oral intake (h)	22h ∗	17h ∗	0.3
Small intestine serosal injury	3 (13.6 %)	0 (0%)	0.23
Postoperative ileus	2 (9.1)	1 (4.5)	0.65
Small intestine ischemia	2 (9.1)	0 (0%)	0.48
Postoperative fever	2 (9.1)	1 (4.5)	0.77
Postoperative urine leakage (days)	3.2±1	3±0.9	0.56
Return to normal activities (days)	8±1.7	7±1.1	0.73
First mobilization (h)	6.4±0.65	6.3±0.65	0.9
Stone recurrence	1 (4.5)	0 (0)	0.34
Vascular injury	2 (9.1)	0 (0)	0.1
Total follow-up (months)	9.9±1.7 (7-12)	9.7±1.4 (6-12)	

∗Median was used

Table 3: stone site in relation to previous transperitoneal surgery

	Group A		
	LTU on same side of the previous transperitoneal surgery	LTU on opposite side of the previous transperitoneal surgery	P Value
Operative time	149±11 min	92±7 min	< 0.05
Intestinal serosal injury	3	0	0.21
Intestinal ischemia	2	0	0.4
Vascular injury	2	0	0.4

Table 4. Other centers experience with TPUL

Series	N	Mean stone size (cm)	Mean operative time (min)	Post operative urine leakage (days)	Mean hospital (day) (range)	Conversion to open surgery	Ureterotomy closed (n)	Ureteric stent (n)
Skrepetis et al (2001)	18	NA	130	1-10	3.2	No	Yes (18)	Yes (5)
Feyaerts et al (2001)	24	11.5 a	107	0	3.8 (2-10)	3	Yes (23)	Yes (17)
Abolyosr (2007)	11	2.8	85.2	0-9	3.8 (2-10)	No	Yes (11)	No
Nasser et al (2007)	104	1.75	137.3	NAb	5.86	1	NA	Yes (52)

Abbas et al (2008)	50	2.24	127.8	NAc	5.8	2	Yesd	Yes (32)
Khalil et al (2015)	13	1.6	116.2	NA	5.4	No	Yes (9)	Yes (13)
Nour et al (2015)	51	2.7	92.1	NA	2.7	1	Yes (51)	Yes (51)
Current study	22	3.1	125	1-6	5.1	No	Yes (22)	No

a Median was used

b minor leakage occurred in 45.2% of patients of TPUL.

c urine leakage for more than 3 days in 16% patients of TPUL.

d closure only in patients with long ureterotomy.