

ORIGINAL RESEARCH

Different Aspect of Transperitoneal Laparoscopic Pyelolithotomy for Management of Pelvic Stones Larger than 20 mm: a Cuasi-Experimental Study in Male Patients

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Received: July 2020; Accepted: July 2020; Published online: August 2020

Abstract: **Background:** We study different aspect of laparoscopic pyelolithotomy (LP) in patients with large renal pelvis stone regarding success rate, complications as well as the recurrence free status. **Material and methods:** From July 2015 to January 2019, 32 patients underwent LP for single large renal pelvis stone (≥ 2 cm). Patient characteristics, preoperative and postoperative hemoglobin, creatinine as well as possible complications based on Clavien classification were recorded. Stone free status was evaluated using computed tomography scan one month after the surgery. Any particle bigger than 4 mm was considered as significant residual stone. During the next one years after the operation, renal ultrasonography was performed for all patients every six month to find any stone recurrence. **Results:** Mean operation time was 134.55 ± 31.41 minutes. Patients were hospitalized 3.36 ± 1.13 days in the LP group. Patients showed hemoglobin decrease of 1.50 ± 1.05 ($P=0.2$). Stone free rate was 93.75% and Mean overall stone free status estimated to be 32 months. **Conclusion:** PCNL has been the treatment of choice for large renal pelvis stones; however, in expert hands, LP is an appropriate substitute with superior stone free rate, less bleeding and remarkably less stone recurrence.

Keywords: Stone; Renal pelvis; Laparoscopy; pyelolithotomy

Cite this article as: Pakmanesh H, Mirzaei M, Mohammad_Salehi S, Sharifian R. Different Aspect of Transperitoneal Laparoscopic Pyelolithotomy for Management of Pelvic Stones Larger than 20 mm: a Cuasi-Experimental Study in Male Patients. Mens Health J. 2020; 4(1): e13.

1. Introduction

Large renal pelvic stones were treated by PCNL (Percutaneous Nephrolithotomy) for over two decades, with ESWL also being used in certain cases. As time passed and technology advanced, open surgeries gradually declined and gave way to laparoscopic methods. PCNL and laparoscopy may be used as initial treatment for many renal pelvic stones. Studies suggest that PCNL produces higher stone-free rate than ESWL and PIRS do and is less invasive than open surgery and laparoscopy. Success rate in PCNL is about 94% and in

PIRS is about 75% (1). Consequently, PCNL is today considered as standard treatment for stones bigger than 2 cm in symptomatic patients (2). According to some studies, stone-free rate obtained by laparoscopic surgery is about 62% and 90%, which is comparable to PCNL (6-3). PCNL takes a shorter time (75 min) compared with laparoscopy which normally lasts over 2 hours. Technical problems in laparoscopy such as adhesion caused by previous surgical operations and pyelonephritis are less prevalent in PCNL. Technical problems of PCNL include renal puncture, incomplete fracture of stone and bleeding during and after surgery. Post-surgery bleeding is the most noticeable complication of PCNL and, while being self-limiting, needs embolization in certain cases (7,8). Among post-surgery complications of laparoscopy are urinary leak due to incomplete closure of renal pelvis and local inflammation. These complications often disappear

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spontaneously and are limited to prolonged hospitalization and retention of foley catheter (9). Since large stones cannot exit renal pelvis in their entirety and are normally removed after fracture, residual parts are likely to be left in renal pelvis and further PCNL treatment may be needed. Among the advantages of laparoscopy is the removal of entire stone and prevention of damage to renal parenchyma. From the above presumption we can conclude that laparoscopy not only offers a better stone-free rate but also causes less complications compared with PCNL (10). While a broad research has been conducted on PCNL, research on laparoscopy is scarce due to its unpopularity among urologists. Recent papers confirm the effectiveness of both PCNL and laparoscopy for renal pelvic stones while giving a higher point to laparoscopy (11). The effectiveness of laparoscopic pyelolithotomy for treatment of renal pelvic stone has been discussed in different studies, but no study has been conducted about reappearance of renal stones. The present study explores the results, complications, stone-free rate, and stone reappearance in patients with renal pelvic stone.

2. Methods

This is a quasi-experimental study on men with renal pelvic stone bigger than 2 cm in urology clinic of Kerman University of Medical Sciences. First the procedure was explained to patients and their consents were obtained. We selected 32 qualified male patients with single renal pelvic stone bigger than 2 cm. Qualification requirements were the age between 18 and 65 and renal pelvic stone bigger than 2 cm. Exclusion criteria were the records of open surgery in the same side, intrarenal renal pelvis, irreparable coagulation disorder, morbid obesity, positive urine culture, and any type of contraindication for laparoscopy. The qualified patients went through medical history, clinical examinations, laboratorial evaluations, coagulation profile, liver function tests, UC, UA, BS and CBC as well as radiological evaluation of stones via CT tomography, sonography and simple abdominal image (KUB, US, CT). Laparoscopy procedure has been fully explained in different papers. First a brief prep of intestine was done and thereafter general anesthetization was performed. NG tube was placed during surgery. After anesthetization, patient was placed in lateral decubitus position and foley catheter was fixed. A 10 mm trocar was fixed in navel area and two 5 mm trocars were fixed in lower abdominal area lateral to the right abdominal muscle under ribs. Pneumoperitoneum was made with a fixed pressure of 12 mm Hg and capnometry was controlled. Toldt line was cut and colon was pushed into medial after dissection. Once upper part of ureter and renal pelvis came into vision, longitudinal or transverse incision of pyelotomy on renal pelvis was done with a distance from connection point between ureter and renal pelvis. Then the stone

was removed from renal pelvis by grasper and the sample was taken at the end of surgery using a special bag. Stent jj was fixed and the renal pelvis was stitched with vicryl suture 4-0 and floppy was brought on it from the sides of the kidney. Drain was fixed and the wound was restored. The complications and results during and after surgery were recorded. Complications were assessed and recorded based on Calvin Classification (7). Examination of complications varies depending on the type of complication and may range from clinical examination to paraclinical diagnosis. The patients came back after one month bringing along sonography and KUB and, in the case of non-ureteral stones, CT Scan for the removal of jj stent and investigation of stone-free rate. Stone-free requirement was the absence of stone or stones smaller than 4 mm. Patients who failed to meet this requirement underwent complementary treatment. Thereafter, patients were examined in the intervals of six months, one year, two years and three years for checking stone reappearance. Reappearance requirement was the observance of any stone bigger than 4 mm in the kidney which had undergone the surgery. The normality of data produced by this study was analyzed by SPSS.24. In all tables, data are shown in the form of Mean \pm SEM. Sampling was performed with due observance of moral principles and university's articles of association and written consents, the form of which is attached hereto, were obtained from the patients.

3. Results

The participants were 32 men with an average age of 45 and BMI of 23.61 kg/m. 3 patients had PCNL history, 5 patients had ESWL history, 3 patients had TUL history, and 1 patient had previously undergone open surgery in the same kidney. Out of the patients undergoing laparoscopic pyelolithotomy, 2 patients had horseshoe kidney, 4 patients had single kidney, and 1 patient had polycystic kidney. The average size of stones in their biggest dimension was 25.66 mm. 12 patients had left renal pelvic stone and 20 patients had stone in the right side. Surgery duration was 134.55 min and hospitalization duration was 3.36 days in average.

The patients' hemoglobin decreased by 1.50 units and there was no increase in creatinine (Table 1). 93.75% of patients were stone-free after laparoscopic surgery. After six months and one year from full treatment, 3 and 4 patients suffered stone reappearance, respectively. The average time of reappearance was about 32 months.

Surgical complications are shown in Table 2. As regards rare complications, one case of death was reported in which the patient suffers a drop in consciousness level. According to investigations, hydrocephaly was confirmed, and the patient underwent ventriculostomy. Finally, the patient was diagnosed with cerebellar tumor and died one week later due

to brain hemorrhage. Autopsy did not show any sign of hematoma around the kidney. One patient suffered heart complications (angina), who was moved to CCU and recovered. There was also one case of omentum release from drain which was locally fixed in place and was sutured and stitched. There was no case of UPJ obstruction.

4. Discussion

From 25 years ago when the first laparoscopic surgery for stone removal took place, a large number of laparoscopic surgeries were reported (12). But this surgery gradually lost its popularity among urologists as it required high skill, was invasive, and was lengthier than PCNL (13). Today, however, laparoscopy is proposed as a replacement to PCNL and, even in certain cases, as treatment (14). Only few studies have analyzed the efficiency of laparoscopy in the treatment of single renal pelvic stones in comparison with PCNL treatment (15,16). In this paper we examined laparoscopic pyelolithotomy in the treatment of renal pelvic stones bigger than 2 cm. Meria carried out laparoscopy by transperitoneum method and Al-Hunayan performed the same by retroperitoneum method, both reporting a similar surgery duration (15,16). It should be noted that while average laparoscopy duration in our study was lengthy (135 min), similar studies have reported a longer average duration (14-16). The duration reported by Sheng Li and coworkers is far shorter than that in our research and other studies (17). We should bear in mind that surgery duration is influenced by many factors including surgery method, skill of surgeon and surgery team, and availability of suitable equipment. Li and coworkers utilized retroperitoneum method and reduced surgery duration by removing stone without fracture (17). In our study, likewise, renal pelvic stones were removed fully and entirely.

In our center, the average hospitalization duration for laparoscopy surgery was shorter than that in other studies, which may be explained by the higher experience of our center in laparoscopy surgery compared with other centers. Another reason might be the use of individual sutures rather than continuous suture in the restoration of renal pelvis, which minimizes the possible damage to renal pelvis while maneuvering for swing and prevents the sutures from loosening due to move from one edge of renal pelvis. Among all patients undergoing the surgery, there was only one case of urinary leak which seems to be due to the use of this method. No open conversion was reported in our study, while Al-Hunayan reported one case (1.8%) of conversion due to damage to vessels during dissection around the renal pelvis, which was not controllable through laparoscopy (16). The rate of conversion in Sinha's and Sharma's studies is about 20% and in Goel's and Hemal's studies is 12.5% (13,18). The absence of conversion in our study may be explained by

proper choice of patients and high skill of surgeon.

Among surgical complications, fever was the most reported one. No severe complication was reported in our study. Some people had heart complications and were recovered in CCU. Also, there was one case of death which took place after surgery due to the increased ICP and cerebellar tumor.

Only two patients had residual stone. Among the reasons for high stone-free rate in laparoscopy we can mention the removal of stone in its entirety which, in contrast to PCNL, prevents it from being scattered in the system. The results of our study were in line with other studies in terms of reduction of residual stones in laparoscopic surgery (13, 19, 20). Two patients underwent ESWL treatment, who were found stone-free at the end of surgery.

Patients underwent follow-up after treatment for six months to one year. The results indicated an average reappearance time of 32 months. Although other studies have reported the cases of successful treatments and complications, our study is distinguished due to long-term follow-up. After the lapse of 6 months, 3 patients had stone bigger than 4 mm. After one year, 4 patients suffered stone reappearance in urinary system.

5. Conclusion

While PCNL is the first choice for patients with renal pelvic stone and laparoscopy is an optional treatment, it seems that laparoscopy produces better results in terms of complications, stone-free rate and stone reappearance in long term. Therefore, in centers with laparoscopy equipment and skilled surgeons, laparoscopy can be an effective treatment for patients suffering renal pelvic stone bigger than 2 cm without laparoscopy contraindication. However, further clinical study is needed to compare these two methods.

6. Appendix

6.1. Acknowledgements

None.

6.2. Author contribution

All the authors have the same contribution.

6.3. Funding/Support

None.

6.4. Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.



Table 1: Data of laparoscopic pyelolithotomy surgery by gender

Patients' Information	Lap (n=33)	Percentage
Average Age	44.79	–
BMI (Kg/m ²)	23/61	–
Stone Details		
Laterality	–	–
Left	12	37.50
Right	20	62.50
Stone Size (mm)	25.66	–
Stone Treatment History		
PCNL	3	9.38
ESWL	5	15.63
TUL	3	9.38
Open stone surgery	1	3.13
Surgical Findings		
Average Duration (min)	134.55	–
Hospitalisation Duration (day)	3.36	–
Changes in Hemoglobin (g/dl)	1.50	–
Changes in Creatinine (mg/dl)	0.01	–
Post-operation Management		
Stone free rate (1 month)	30	93.75
Stone free rate (6 month)	29	90.63
Stone free rate (1 year)	28	87.50
Complementary Treatment		
ESWL	2	6.25
PCNL	0	0

Table 2: Laparoscopy complications based on Clavien classification

Complications of Surgery	Lap (n=33)	Percentage
No side effects	24	75
Grade 1		
Fever	5	15.63
Grade 2		
Blood Injection	1	3.13
UTI	0	0
Grade 3a		
Urinary Leak	0	0
Herniation of mesocolon during drain removal	1	3.13
Grade 3b		
Collection around the kidneys	0	0
Grade 4		
Heart-related	1	3.13
Grade 5		
Death	1	3.13

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