Original Article

Laparoscopic retroperitoneal pyelolithotomy and open pyelolithotomy: a comparative study

Laparoskopik retroperitoneal pyelolitotomi ile açık pyelolitotomi'nin kıyaslanması

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ABSTRACT

Objective: To compare the outcomes of laparoscopic pyelolithotomy and open pyelolithotomy at a single center in terms of operative time, blood loss, intra- and post-operative complications, analgesia requirements, hospital stay, convalescence and cosmesis.

Material and methods: This prospective randomized study was conducted in the Department of Surgery of the Government Medical College Srinagar between May 2008 and September 2010. Sixty patients underwent pyelolithotomy during this period, including both open pyelolithotomy (n=30) and laparoscopic retroperitoneal pyelolithotomy (n=30). All patients (age >14 yr) with large (>1.5 cm) renal pelvic stones who met the inclusion criteria were included in the study. The decision to perform open or laparoscopic pyelolithotomy was made randomly by a computer program.

Results: The majority of our patients in both study groups were in the 21-40 yr age group. The mean operative time was significantly less ($p<0.001$) in the open group than in the laparoscopic group (74.83 min vs. 94.43 min). The mean blood loss was less in the laparoscopic group than in the open group (73 mL vs. 103 mL); however, this difference was not statistically significant. In the laparoscopic group, both the resumption of oral intake (10.33 hrs vs. 15.60 hrs) and the drain removal (2.7 days vs. 3 days) occurred earlier, although these differences were not significant. Intraoperative complications occurred more frequently in the laparoscopic group (16% versus 6.66%); however, all of the complications were minor and were managed intraoperatively in the same sitting. There was no statistically significant difference in the postoperative pain scores or analgesia requirements, and postoperative complications were only slightly more frequent in the laparoscopic group in our study. The mean hospital stay in the open group was 5.2 days, while the mean stay of the laparoscopic group was 3.8 days ($p<0.03$). Patients in the laparoscopic group returned to their routine activities significantly earlier (1.78 vs. 3.83 wks) than did patients in the open group ($p<0.001$).

Conclusion: Laparoscopic retroperitoneal pyelolithotomy for upper urinary tract calculi is superior to open surgery because of the significantly reduced hospital stays and cosmetic outcomes of patients who underwent the laparoscopic surgery. Although the reductions of analgesia requirements and blood loss were not statistically significant in our study, the data still favored the laparoscopic procedure. Disadvantages of retroperitoneal laparoscopy include the decreased working space, the cost of equipment and the availability of a trained surgeon.

Key words: Laparoscopy; pelviureteric junction; pyelolithotomy.

ÖZET

Amaç: Tek bir merkezde yapılan laparoskopik pyelolitotomi ve açık pyelolitotomi sonuçlarını ameliyat süresi, kan kaybı, intra ve postoperatif komplikasyonlar, analjezi gereksinimi, hastanede kalış süresi, konvalesan ve kozmetik sonuçlar bakımından kıyaslamak.

Gereç ve yöntemler: Bu prospektif randomize çalışma Mayıs 2008 ve Eylül 2010 arasında Srinagar Hükümet Tıp Koleji Cerrahi Departmanında gerçekleştirildi. Bu dönem boyunca 60 hastaya piyelolitotomi yapıldı; açık piyelolitotomi (n=30) ve laparoskopik retroperitoneal piyelolitotomi (n=30). Dahil etme ve dışlama kriterlerine göre değerlendirildikten sonra büyük (>1.5 cm) böbrek pelvis taşları olan bütün hastalar

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(yaş >14) çalışmaya dahil edildi. Açık veya laparoskopik piyelolitotomi yapma kararı bir bilgisayar programının kullanıldığı randomizasyona dayanarak verildi.

Bulgular: Her iki çalışma grubunda hastalarımızın çoğunun 21-40 yaş grubunda olduğu gözlendi. Ortalama ameliyat süresi açık grupta laparoskopik gruptan anlamlı olarak daha kısaydı (74.83 dakikaya karşılık 94.43 dakika) (p<0.001). Ortalama kan kaybı laparoskopik grupta açık gruptan daha azdı (73 mL'ye karşılık 103 mL). Bununla beraber farklılık istatistiksel olarak anlamlı değildi. Oral alımın tekrar başlaması (10.33 saate karşılık 15.60 saat) ve drenin çıkarılması (2.7 güne karşılık 3 gün) fark anlamlı bulunmamış olmakla beraber laparoskopik grupta biraz daha erkendi. Ameliyat sırasındaki komplikasyonlar laparoskopik grupta daha çoktu (%16'ya karşılık %6.66) bununla beraber komplikasyonların tamamı minördü ve intraoperatif olarak giderildi. Ameliyat sonrası ağrı skorları ve analjezi gereksinimlerinde istatistiksel olarak anlamlı olmayan bir fark vardı. Ameliyat sonrası komplikasyonlar bizim çalışmamızda laparoskopik grupta daha fazlaydı. Açık grupta ortalama hastanede kalış süresi 5.2 gündü, laparoskopik grubun 3.8 gününe göre daha uzundu (p<0.03). Laparoskopik gruptaki hastalar rutin aktivitelerine açık gruptan çok daha önce döndü (1.78'e karşılık 3.83 hafta), bu durum istatistiksel olarak anlamlı bulundu (p<0.001).

Sonuç: Üst üriner sistem taşları için laparoskopik retroperitoneal piyelolitotomi, anlamlı olarak azalmış hastanede kalış süresi ve kozmetik sonuç bakımından açık cerrahiye üstündür. Analjezi gereksinimindeki azalma ve kan kaybı bizim çalışmamızda istatistiksel olarak anlamlı bulunmamış olmakla beraber yine de laparoskopik grup lehine çıktı. Maliyet, deneyimli cerrah gereksinimi ve küçük çalışma alanı retroperitoneal laparoskopinin dezavantajlarıdır.

Anahtar sözcükler: Laparoskopi; üreteropelvik bileşke; piyelolitotomi.

Introduction

Laparoscopic urology was established as a minimally invasive therapeutic method only after Gaur[1] described an innovative balloon dissection technique for retroperitoneoscopy. Since the first retroperitoneal laparoscopic pyelolithotomy (RLP) was reported by Gaur[2] and associates in 1994, few papers have been published in the medical literature on this subject. Given the amazing success of existing less-invasive alternatives, such as shockwave lithotripsy (SWL) and percutaneous nephrolithotripsy (PCNL), there have been few situations which require this procedure.

Laparoscopic pyelolithotomy, although uncommonly performed, may be suggested for patients who have renal anomalies, are poorly compliant, or have a large single renal-pelvic calculus.

Pyelolithotomy continues to be useful in the management of renal pelvic stones in areas where SWL and PCNL are not feasible because of a lack of equipment or expertise. Other indications for pyelolithotomy include minimally branched staghorn stones in the renal pelvis of complex collecting systems and excessive morbid obesity. Pyelolithotomy is also appropriate in patients who are undergoing major open abdominal or retroperitoneal surgical procedures for other conditions; the most common concomitant procedure is open pyeloplasty for ureteropelvic junction (UPJ) obstruction.

Material and methods

This randomized study was conducted in the Department of Surgery of the Government Medical College Srinagar between May 2008 and September 2010. After evaluation for inclusion and exclusion criteria, 60 patients underwent pyelolithotomy during this period, and the procedures consisted of open pyelolithotomy (n=30) and laparoscopic retroperitoneal pyelolithotomy (n=30). All patients (age >14 yr) with large (>1.5 cm) renal pelvic stones were included in the study, irrespective of sex and race, as shown in Table1. Patients with recurrent and residual stones, bleeding diathesis, pregnancy, and congenital anomalies that precluded retroperitoneoscopy were excluded from the study.

Upon admission, a detailed history was obtained from each patient. A general physical examination was performed, particularly noting build, height and weight. The general examination was followed by a systemic examination, recognizing any co-morbid illnesses. Each patient and his/her attendants were fully informed about the natures of both laparoscopic and open surgery and their associated complications, and written consent was obtained from the patient before surgery. Investigations performed included routine investigations, such as the complete blood count, coagulogram, urine examination, kidney function tests, serum electrolytes, ECG (electrocardiogram) and CXR (chest X-rays). Imaging studies examining the urinary tract included ultrasonography, X-ray KUB, (kidney ureters and bladder) and intravenous pyelography. The differential renal function was assessed with computerized isotope renography (DTPA renal scan) in selected patients. Preoperative prophylactic antibiotics (inj. Ceftriaxone 1 gm IV given an hour before intubation) were administered in all cases. A computer program randomly assigned each patient to undergo either an open or a laparoscopic pyelolithotomy.

After being discharged, the patients were called for follow-up at 1 wk, 4 wk, 12 wk, and 6 mo.

Information on gender, age, body mass index, co-morbidities and past surgical history was recorded. The procedure used, the circumstances of the surgery, the operative time, any intra- & post-operative complications and the length of the hospital stay were recorded. Pain was evaluated by a visual analog scale and by the number of analgesic doses required.

The collected data were described as means and percentages. MS Excel, SPSS Minitab and Java Stat Software were used for data analysis.

Laparoscopic retroperitonel pyelolithotomy

The patient was initially in the supine position supine to allow for intravenous access, the induction of general anesthesia, endotracheal intubation, and bladder catheterization. The patient was later moved into a right or left lateral position, depending on the side of the patient on which the operation was performed. The foot end of the table was lowered. A 1.5 cm incision was made below the tip of the 12th rib along the mid-axillary line, which served as the location for the middle trocar and was primarily used for the camera port. A hole was created from the skin to the muscle into the retroperitoneal space using a blunt hemostat. An index finger was inserted through the incision and performed a blunt dissection, creating space and sweeping the peritoneum anteriorly. The full working space was then created with a balloon dissector. The balloon was inflated with 800-1000 mL of air and kept in place for a minimum of 5 minutes to achieve hemostasis. After the removal of the balloon, 2 working ports, 11 mm and 5 mm in size, were inserted under finger guidance, one in the renal angle just below the 12th rib at the lateral border of the sacrospinalis muscle, and the other was inserted 11 mm above and anterior to the anterior superior iliac spine. Finally, a Hasson's cannula was secured at the primary port site, and a 30 degree telescope was advanced. The CO_2 inflation was performed through one of the ports, and the retropneumoperitoneum was created. The fourth 5 mm port was placed above the iliac crest for the retraction of perirenal fat. Once inside the retroperitoneal space, the ureter was identified by its characteristic peristalsis and the arborization of its vessels anterior to the psoas muscle and was traced up to the uretropelvic junction, taking care not to injure any of the lower polar vessels. The pelvis was carefully mobilized. Pyelotomy was performed using an endoknife or endoscissors. The stone was removed with a right-angled dissector. Those stones which had migrated into calyces were retrieved under nephroscopic guidance. On the occasion that a stone was impacted in the renal pelvis, it was broken using a lithoclast and then retrieved in a piecemeal manner. A preplaced double-J stent was advanced over the guidewire. The pyelotomy was then closed with interrupted 3-0 or 4-0 polyglactin910 (Vicryl) sutures intracorporealy. A drain was placed through the most dependent port, followed by the relaxation of retropnuemoperitonuem, the removal of the trocars and the closure of the port sites. A Foley's catheter was then placed, if one had not been placed at the beginning of the procedure.

Results

Symptoms

In the laparoscopic and open groups, complaints of flank pain were reported in 27 and 30 patients, respectively; hematuria was reported in 10 and 8 patients, respectively; and recurrent urinary tract infections (UTI) were reported in 9 and 14 patients, respectively.

Intra-Operative details

The mean operative time was substantially less in the open group than in the laparoscopic group (74.83 min vs. 94.43 min), and this difference was statistically significant ($p<0.001$). The mean blood loss was less in the laparoscopic group than in the open group (73 mL vs. 103 mL), although this difference was not statistically significant. There were no major intra-operative complications in either group. Minor intra-operative complications (from the Clavien classification of surgical complications) in the laparoscopic cohort included an inadvertent opening of the peritoneum in 2 patients, stone migration in one patient, the inability to locate the stone in one patient and the inability to negotiate the DJ stent in one patient. All of these procedures were completed laparoscopically and without much difficulty. A Veress needle was inserted into the peritoneal cavity of those patients who experienced an inadvertent opening in their peritoneum to maintain adequate space and pressure in the retroperitoneum. The patient who experienced stone migration into the calyx was managed by localizing the stone using a flexible nephroscope, and the procedure was completed laparoscopically. The patient whose stone could not be located despite an adequate dissection was switched to the open surgery group and was finally managed by open pyelolithotomy with double-J stenting. The patient for whom it was not possible to negotiate the stent from above was managed by stenting the ureter retrogradely using a cystoscope. In the open group, there were only two intraoperative complications: stone fragmentation and stone migration. These cases were managed by thorough NS washes and using a rigid nephroscope for stone localization, respectively. These parameters are depicted in Table 2.

Post-operative details

There was no significant difference in the timing of the return of bowel function, the resumption of oral intake or drain removal between the open and the laparoscopic groups, as shown in Table 2.

Post-operative complications

There were a total of 12 postoperative complications: 7 in the laparoscopic group and 5 in the open group. Three patients in the open group developed superficial wound infections, which were managed by a short course of empirical antibiotics against *Staphylococcus aureus*. One patient experienced a severe wound infection which necessitated skin-stitch removal, twice daily dressing and a broad spectrum antibiotic. The patient was subsequently scheduled for secondary suturing after discharge. Another patient who developed a wound infection experienced a prolonged urinary leak, which was managed by keeping both the drain and the indwelling catheter in place until the leak ceased. In the laparoscopic cohort, 7 complications occurred. One patient developed surgical emphysema, which was managed conservatively; 3 patients developed port site infections, which required daily dressings, and the remaining 2 experienced prolonged urinary leaks with port site infections, which were managed in the same way as in the open group. A patient who

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Table 1. The distribution of patients according to sex, body mass index, age and affected side of the body between the laparoscopic and open groups

Sex	Laparoscopic		Open	
	No.	%	No.	%
Male	19	63.34	12	40.00
Female	11	36.67	18	60.00
Body Mass Index	**Laparoscopic**		**Open**	
	No.	**%**	**No.**	**%**
21-24.99	13	43.34	13	43.34
25-29.99	14	46.67	11	36.67
>30	3	10.00	6	20.00
Age (Years)	**Laparoscopic**		**Open**	
	No.	**%**	**No.**	**%**
<20	1	3.33	1	3.33
20-40	16	53.33	18	60.00
41-60	12	40.00	10	33.33
> 60	1	3.33	1	3.33
Affected Side	**Laparoscopic**		**Open**	
	No.	**%**	**No.**	**%**
Right	14	46.67	16	53.34
Left	11	36.67	9	30.00
Bilateral	5	16.67	5	16.67

Table 2. Comparison of operative parameters between the open and laparoscopic groups

		Open Group	Laparoscopic Group	p value (chi-square test)
Operative Time (min)	Median	74.83	94.33	<0.001 (Sig)
	Range	45-123	55-187	
Blood Loss (mL)	Median	103	73	> 0.05 (NS)
	Range	50_180	45-130	
Oral Intake (hrs)	Median	15.60	10.33	>0.05 (NS)
	Range	12-30	8-84	
Drain Removal (days)	Median	3.3	3.6	>0.05 (NS)
	Range	2 _11	2_20	
Blood Transfusion (mL)		Nil	Nil	
Intra-Op Complications	Major	Nil 0%	Nil 0%	> 0.05 (NS)
	Minor	02 (6.66%)	05 (16%)	
Conversions		NA	01 (3.33%)	

had a prolonged ileus was managed by Ryle's tube suction, and oral intake was started on the 4th post-operative day. These complications are depicted in Table 3.

Hospital stays and postoperative analgesia requirements

The length of the hospital stay was shorter in the laparoscopic group than in the open group (3.8 vs. 5.13 days; p<0.03). Postoperative pain was quantified using a visual analogue scale (VAS score) and the total quantities of analgesic and diclofenac sodium (i.m) used in the postoperative period. The laparoscopic pyelolithotomy group had generally low VAS scores, and fewer analgesics were used, as shown in Table 4.

Follow up, patient satisfaction and convalescence (the average period required to return to normal activity in weeks)

Patients undergoing laparoscopic surgery rated their overall satisfaction higher. The mean period of convalescence in the open and the laparoscopic groups was 3.83 weeks and 1.73 weeks, respectively; this difference was statistically significant (p<0.001), as shown in Table 5. We defined resumption of office work as the end of the period of convalescence.

Costs and Cosmesis

The laparoscopic surgery was significantly more costly due to the use of disposable trocars. However, considering the relatively short hospital stays, lower morbidity rates and shorter convalescences, the overall costs associated with the laparoscopic surgery are expected to be less than those associated with the open surgery. Laparoscopic pyelolithotomy is cosmetically superior to open pyelolithotomy. In laparoscopic pyelolithotomy, the average scar size was 3.5 cm (range 3-3.5 cm), while in open pyelolithotomy, the average scar size was 15 cm (range 9-17 cm). This difference was statistically significant (p<0.001).

Discussion

Age of the patient

The ages of the patients in the laparoscopic group ranged from 18 to 70 yr, with a mean of 38.53 yr. The ages of the patients in the open group ranged from 18 to 62 yr, with a mean of 38.42 yr. The age difference between the groups was not statistically significant (p>0.05). Gaur, Pujani et al.[7] reported a similar age distribution in their study, with a mean of 39.12 years. Jagdish Chander et al.[12] reported a mean age of 33.74 years (18-60 yrs) in the group used in their study. Thiagarajan Nambarajan et al.[13] reported a mean age of 51 yr in their study.

Operative time

There was a significant difference between the average operative times. In our study, the mean operative time for the laparoscopic group was 94.43 min, which was substantially longer than that of the open group, which was 74.83 min (p<0.05). Alaa el-ghomeni et al.[5] reported an operative time of 135 min

Table 3. Post-operative complications

Complication	Open pyelolithotomy n=30	Lap. pyelolithotomy n=30
Sup. Wound infection	3	3
Hematoma/Collection	0	0
Prolonged leak	1	2
Fever	0	0
Prolonged Ileus	0	1
Pneumonia/atelectasis	0	0
Subcutaneous emphysema	0	1
Lumbar Hernia	1	0
Total	5 (16.66%)	7 (23.0%)

Table 4. Post-operative pain estimated by the VAS score and analgesia requirement

	Open group (n=30)	Lap. group (n=30)	p value (Chi-Square)
VAS score (mean) Day 01	6.92	4.34	0.682
VAS score (mean) Day 02	5.1	2.78	0.543
VAS score (mean) Day 03	3.01	1.26	0.437
Diclofenac used, mg Inj + oral (mean)	150 (50-325)	65 (50-100)	0.283

Table 5. Follow up, recurrence and patient satisfaction

	Open group (n=30)	Lap. group (n=30)	p value (Chi-Square)
Follow up (months)			
Mean	8.3	7.5	0.324 (NS)
Range	4- 15	4-12	
Lost to follow up	-	-	0.246 (NS)
Patient satisfaction score	7.0	8.9	

for laparoscopic pyelolithotomy. Hemal, Kumar et al.[6] reported an operative time of 108.2 min. for laparoscopic pyelolithotomy. Soares et al.[11] reported an operative time of 140 (66-260) minutes in their study. Adel Hunayun et al.[16] reported an operative time of 112.1 minutes for laparoscopic pyelolithotomy in their study. The reduced operating times in our study can be attributed to the surgeon's expertise and to the number of years that have passed since the publication of many of these studies.

Blood loss

In the laparoscopic retroperitoneal pyelolithotomy group, the blood loss was significantly less than that of the open group, which is consistent with the literature. The laparoscopic pyelolithotomy group had a mean blood loss of 73 mL. compared to 103 mL in the open pyelolithotomy group. This is an important consideration, as most of the female patients in our study were anemic. Hemal et al.[10] reported an average estimated blood loss of 173.14 mL for laparoscopic pyelolithotomy. Micali Moore et al.[4] reported an average estimated blood loss of 132.9 (20-350) mL in their study. Brandan Kamer et al.[14] reported an average blood loss of 50 mL. Adel Hunayun et al.[11] reported blood loss of 57.2 mL.

Intra-operative complications

In our study, a total of 5 (16%) minor intra-operative complications occurred in the laparoscopic retroperitoneal pyelolithotomy group. Two patients had a breach in the peritoneum where a Veress needle was used to let the air out of the peritoneal cavity; the breach was closed surgically. There was stone migration in 1 patient, and the stone was located using a flexible nephroscope. The stone was retrieved from the middle calyx, and the procedure was completed laparoscopically. In 1 patient, the stone could not be located despite extensive dissection; an open procedure was performed instead of the laparoscopic procedure, and the patient was managed JJ stenting. In 1 patient, it was not possible to negotiate the stent from above; instead, a cystoscope was used to stent the area retrogradely. There were 2 (6.66%) minor intra-operative complications in the open group: stone fragmentation and stone migration. These patients were managed by thorough NS washes and the use of a rigid nephroscope for stone localization, respectively. The intra-op complication rate in our study is similar to the complication rates reported in the literature. Goel et al.[6] reported a complication involving injury to a patient's colon with a calculous pyonephrosis that had dense adhesions in their study of laparoscopic pyelolithotomy.

Conversion rate

Of all the laparoscopic procedures, one was converted to an open procedure, while the rest were completed successfully. Thus, the conversion rate in our study was 3.34%. This is much lower than the rate that is reported in the literature. Goel, Hemal et al.[10] reported a conversion rate of 12.5% (2/16) in their study. The reasons for laparoscopic-to-open conversions included the migration of the stone into the calyx and the presence of dense adhesions in perirenal area. In our study, we encountered similar situations. In the case of the stone migration, the stone was located using a flexible nephroscope, and the procedure was completed laparoscopically. This, however, required the use of another camera system. Micali Moore et al.[4] reported a conversion rate of 11.76% (2/17) in their study. Similarly, Gaur et al[7] (2001) reported a conversion rate of 16.3% (7/43) in their study.

Post-operative complications

The post-operative complications were mostly wound-related in both groups. Out of a total of 12 post-operative complications, 7 occurred in the laparoscopic group and 5 occurred in the open group. Three patients in the open group developed superficial wound infections, and of these, one patient suffered a severe

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wound infection. Another patient who experienced a wound infection had a prolonged urinary leak. One patient developed a lumbar hernia in a late postoperative complication. In the laparoscopic cohort, seven complications occurred. One patient developed surgical emphysema, which was managed conservatively; 3 patients developed port-site infections; 2 had prolonged urinary leaks with port-site infections; and one patient had a prolonged ileus. Micali Moore et al.[4] reported a postoperative complication rate of 17% (3/17) for laparoscopic pyelolithotomy in their study, which included a prolonged ileus in 2 patients and a urinoma in 1 patient. The nature of the complications was similar to that of our study. Goel et al.[10] reported a post-operative complication rate of 12% (2/16),which included a prolonged urinary leak in 1 patient and port-site infection in 1 patient. Jagdish Chander et al.[12] reported port-site infection in 2 patients and subcutaneous emphysema in 3 patients in a study including 56 patients who were subjected to laparoscopic pyelolithotomy.

Removal of the drains

In our study, drain removal occurred at an average of 3.6 days after surgery for the laparoscopic pyelolithotomy group and 3.3 days after surgery for the open pyelolithotomy group. In a study conducted by Branden A Kramer et al.[15], drains were removed on the first postoperative day following laparoscopic pyelolithotomy in all of the 5 studied patients. This is much faster than in our study. The time prior to drain removal in a study conducted by Jagdish Chander et al.[12] ranged from 2 days to 7 days. The drain was removed during first 48 hours in most patients (61%). The drain was removed when the drainage decreased to less than 25 mL. In our study, we removed the drain when the drainage decreased to less than 30 mL/day.

Oral intake

The resumption of oral intake was achieved within an average of 10.33 (8-84) hrs and 15.6 (12-30) hrs in the laparoscopic and open pyelolithotomy groups, respectively. Adel al-hunayan et al.[16] reported a mean time for the resumption of oral intake at 1.2 days (28.8 hrs) for 21 patients who underwent laparoscopic pyelolithotomy. In a study conducted by Gaur et al.[9] on 3 patients with staghorn renal stones, all the patients tolerated food on the evening following surgery.

Hospital stay

Factors such as reduced postoperative pain and early ambulation resulted in shorter hospital stays. The mean hospital stay in the open group was 5.13 days, which was significantly longer than that of the laparoscopic group, which was 3.8 days. Our results were corroborated by the findings of the study conducted by Sinha et al.[3], which reported an average hospital stay of 3.6 days for patients who underwent laparoscopic pyelolithotomy. Similar results were reported by Goel et al.[6] in their study, in which the hospital stay for laparoscopic pyelolithotomy patients was 3-4 days. Soares et al.[11] reported that, in their study, the average hospital stay was 3 days (range 1-10) for laparoscopic pyelolithotomy patients.

In conclusion, laparoscopic retroperitoneal pyelolithotomy for upper urinary tract calculi is superior to open surgery in terms of the significantly reduced hospital stay, fewer requirements and good cosmetic outcomes associated with this technique. Laparoscopic retroperitoneal pyelolithotomy has a low rate of conversion to open surgery and acceptable overall complication rates. The accumulated follow-up data, collected to compare the efficacy of laparoscopic retroperitoneal pyelolithotomy with open pyelolithotomy, has shown that these techniques are equally effective.

Conflict of interest

No conflict of interest was declared by the authors.

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