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Laparoscopic pyelolithotomy: Is the retroperitoneal route a better approach?

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Objectives: To compare the outcome of laparoscopic pyelolithotomy (LP) using the transperitoneal and the retroperitoneal routes.

Methods: Demographics, intraoperative and postoperative clinical parameters were evaluated in 48 laparoscopic pyelolithotomies performed in patients with renal pelvic calculi of diameter >30 mm. The differences between the transperitoneal and retroperitoneal routes were analyzed.

Results: Twenty-seven LP were performed using the transperitoneal approach (TLP), and 21 using the retroperitoneal approach (RLP). Apart from weight, the patients’ demographics and stone size were similar in the two groups. Between the RLP and the TLP routes, the operative time was 112.1 versus 93.2 min (P = 0.01), mean time for oral intake was 1.9 versus 1.2 days (P < 0.01), and mean hospital stay was 5.2 versus 3.8 days (P < 0.01). The mean postoperative analgesic requirement (2.4 vs 2.2 days, P = 0.41), mean convalescence days (9.7 vs 10 days, P = 0.56), and mean estimated blood loss (57.2 vs 62.9 ml, P = 0.5) were similar between RPL and TPL respectively. The stone-free rate at 3 months follow-up was comparable (88.9% vs 90.5%, P = 0.86). The postoperative complications were not significantly different.

Conclusions: Compared with the TLP approach, RLP for large renal pelvic stone resulted in a shorter operative time, a shorter resumption time from weight, the patients‘ demographics and stone size were similar in the two groups. Between the RLP and the TLP routes, the operative time was 112.1 versus 93.2 min (P = 0.01), mean time for oral intake was 1.9 versus 1.2 days (P < 0.01), and mean hospital stay was 5.2 versus 3.8 days (P < 0.01). The mean postoperative analgesic requirement (2.4 vs 2.2 days, P = 0.41), mean convalescence days (9.7 vs 10 days, P = 0.56), and mean estimated blood loss (57.2 vs 62.9 ml, P = 0.5) were similar between RPL and TPL respectively. The stone-free rate at 3 months follow-up was comparable (88.9% vs 90.5%, P = 0.86). The postoperative complications were not significantly different.

Key words: kidney calcui, laparoscopy, peritoneal cavity, retroperitoneal space.

Introduction

Considerable debate exists as to what constitutes the optimal therapeutic approach for large renal stones. Open surgery, shock wave lithotripsy (ESWL),1 percutaneous nephrolithotomy (PCNL)2,3 and laparoscopy4 have been evaluated in terms of outcome for patients with large renal calculi. Each modality has its specific role in the treatment of large renal stones. Stone size, location and composition often affect the choice of therapy in achieving the highest stone-free rates with the least morbidity, in a cost-effective manner. Although the indications for laparoscopic surgery for renal pelvic stones are limited, few cases with medium to large renal pelvis stones are expected to benefit from it, for example, patients who failed percutaneous renal access with stone burden that warranted open intervention. Both transperitoneal laparoscopic pyelolithotomy (TLP) and retroperitoneal laparoscopic pyelolithotomy (RLP) approaches have been described earlier.4,5 We have been using both approaches in our practice. Each approach has its own advantages and disadvantages. In this retrospective study, TLP and RLP routes were evaluated and their outcomes were compared in a cohort of patients with >30 mm renal pelvic calculi.

Methods

From January 2002 to January 2008 all patients with renal pelvic stone(s) more than 3 cm in largest diameter, that would otherwise undergo an open procedure, were considered for laparoscopic pyelolithotomy (LP). Renal calculi <3 cm in largest diameter are managed in our unit routinely using ESWL or PCNL or both with or without double J ureteral stents. Written informed consent was obtained from each subject, and our Human Ethics Committee approved the study. Our overall indications for LP as a treatment modality were: failure of minimally invasive approaches such as PCNL or ESWL; stones that were neither amenable to ESWL nor were ideally suitable for PCNL and occasionally the patient’s preference for a quick one-stage procedure. The choice of the approach was solely dependent on the surgeon’s preference. Otherwise, retroperitoneal access was the preferred option if there was a history of prior abdominal surgery or renal surgery, previous exposure to radiation which might lead to bowel adhesions, absence of congenital anomalies such as ectopic kidneys or anteriorly crossing lower pole vessels, absence of abnormal body habitus (e.g. severe scoliosis) which might preclude standard access and results in abnormal kidney orientation or the presence of morbid obesity. Patients in this study were operated by a single surgeon (A. A.) who performed all the procedures to minimize the operator variability. All patients had symptomatic renal calculi. At presentation, patients’ assessment included urine cultures, renal ultrasound and intravenous urography. Positive urine cultures were noted and were treated prior to the planned procedure.

Surgical technique

Patients were placed in the lithotomy position and a double J ureteric stent of an appropriate size was inserted. The patients were then moved to the full-flank position and the table was flexed.

Transperitoneal approach

The pneumoperitoneum was established using a Veress needle positioned along the midclavicular line in the transtubercular plane. After the abdomen was fully insufflated, three ports were placed, namely a 10-mm (5-mm for right-sided stones) operating port at the position of the Veress needle, a 5-mm (10-mm for right-sided stones) operating port between the xiphoid process and umbilicus, and a 10-mm camera port along the edge of the rectus sheath at the level of the midline port.
Throughout the procedure, the abdominal pressure was maintained at or below 16 mm Hg as appropriate. The line of Toldt and renocolic ligaments were divided and the colon was reflected medially to provide clear exposure of the kidney. The proximal ureter was identified by following the medial edge of the psoas muscle. The ureter was traced superiorly to identify the renal pelvis, which was then freed from the adjacent structures using sharp and blunt dissection. The ureteropelvic junction and the renal pelvis was clearly defined. In patients with intrarenal pelvis, subparenchymal (space of Gil-Vernet) dissection may be required to better expose the renal pelvis. The dissection begins along the upper ureter and proceeds superiorly in the avascular plane underneath the inflammatory tissue. Peripelvic fat was mobilized and then incised, and excess adipose tissue was removed. After placing two stay-sutures of 3/0 polyglycolic acid, a transverse incision was made in the renal pelvis. To avoid the risk of subsequent scarring, the incision must not extend through or into the ureteropelvic junction. Typically, when crossing vessels over the lower part of the renal pelvis were identified, the posterior aspect of the kidney was mobilized to gain access to the renal pelvis from behind. The pyelotomy was then started from the inferior border of the renal pelvis, close to the renal substance, and extended posteriorly away from the vessels. After pyelotomy was created, the upper portion of the renal pelvis was held open by non-crushing graspers and the stone(s) within the renal pelvis was (were) removed using the stone forceps. The stone(s) was (were) placed in a specimen retrieval bag and discarded. Smaller stones, if present, were flushed using irrigation fluid and removed from the renal pelvis. After the calculi had been removed, every attempt was made to close the pyelotomy. The renal pelvis tends to retract within the renal sinus after pyelotomy, thus causing difficulty in pyelotomy closure. If the exposure and access to the pyelotomy were favorable, it was closed by intracorporeal suturing using standard curved needles on a 3/0 polyglycolic acid suture, otherwise, it was deliberately left open. After completing the closure of the pyelotomy, a 5-mm suction drain was passed through the most lateral port and placed in the peripelvic tissues, under endoscopic guidance.

**Retroperitoneal approach**

The retroperitoneal space was developed using a balloon dissection technique through a 10–15-mm incision, 2 cm below and posterior to the tip of the 12th rib, as described by Gaur. This port was used for the camera. Two other working ports were then inserted using guidance provided by the index finger placed in the retroperitoneum, about 7–8 cm on either side of the camera port, along a line inferior and parallel to the costal margin. The 10-mm port was used for the right hand and the 5-mm port for the left hand. Optionally, a 5-mm fourth port along the anterior axillary line 3–4 cm above the medial port is used for retraction and dissection (Fig. 1). The dissection proceeded towards the medial margin of the psoas muscle to identify the ureter, and then followed the same principles that we used for the transperitoneal approach. Figure 2 shows an example of a staghorn calculus removed by retroperitoneal pyelolithotomy.

**Postoperative care**

In the two groups, the urethral catheter was removed the morning after the operation, and if the amount of fluid coming from the drain was minimal, then the drain would also be removed at the same time. The double J stents were removed 4 weeks postoperatively. The patients were evaluated after 3 months postoperatively, using renal ultrasound and intravenous urography.

The following data about each patient were collected, analyzed and compared between the two groups of patients: patients’ demographics, preoperative stone characteristics, urine culture results, proportion of patients in whom the pyelotomy was closed, number of open conversions, operative time, estimated blood loss, mean postoperative anal-
gesia requirement in days, mean days for oral intake, mean days of hospital stay, mean convalescence days, postoperative urine leak, drain time, postoperative complications, and stone-free status.

In order to allow for interpretation of our learning experience, the study period was divided into three equal phases (Table 3). Mean operative times for each group during the three phases were calculated.

Convalescence was defined as the period needed for complete recovery. Drain time was the time from the surgery till the drain was removed. Urine leak was considered to be present when the drain contained >30 cc of urine the morning after the surgery. Patients were classified as failures if their 3-month postoperative radiological imaging demonstrated evidence of residual stones.

All statistical analyses were performed with statistical software (SPSS for Microsoft Windows, version 14.0; SPSS, Chicago, IL). Continuous variables, were expressed using mean ± standard deviation and were compared between transperitoneal and retroperitoneal groups using the Student’s independent-samples t-test or the Mann–Whitney U-test when approximately normally or non-normally distributed respectively. The categorical variables between these two treatment groups were compared using the Z-test for proportion. The relationship between the patient’s weight and the duration of the operation was evaluated using Spearman’s correlation test. Exact P values were reported and P values of <0.05 were considered statistically significant.

Results

Twenty-one procedures were performed via the retroperitoneal approach and 27 via the transperitoneal approach. Eighteen patients had no previous stone treatment. Of the 30 patients who had previous stone treatments, five had previous open surgery, 16 had failed PCNL and the stone burden warranted open treatment, four had abnormal body habitus and/or kidney location or orientation and five had failed ESWL and PCNL. LP was successfully performed in 44 patients with 2 open conversions per group because of failure to progress in three patients (due to very dense adhesions resulting from multiple infections in one case and previous multiple stone treatments in two cases) and uncontrolled bleeding in one patient. There were no significant differences in general demographic variables, between the transperitoneal and retroperitoneal groups, with respect to patient age (38.7 ± 11.6 vs 40.7 ± 11.5 years, P = 0.54), percentage of American Society of Anesthesiologists Class ≤ II (100% vs 100%), mean stone size (37 ± 13.0 vs 35 ± 12.6 mm, P = 0.8) and the number of patients with positive urine infection (Table 1). The mean weight of the RLP group was significantly higher (86.1 ± 6.9 vs 81.2 ± 7.8 kg, P = 0.03). Although this difference is statistically significant, the 4.9 kg difference in the mean weight might not be clinically significant when it comes to choosing between the two approaches.

Due to the difficult suturing angle and exposure in 12 patients with an intrarenal pelvis, the pyelotomy was left open, five from the TLP group and seven from the RLP group. The TLP was significantly less-favorable, compared with the RLP, in terms of the mean duration of surgery (112.1 ± 22.4 vs 93.2 ± 25.4 min, P = 0.01), mean time for oral intake (1.9 ± 0.6 vs 1.2 ± 0.4 days, P < 0.01), and mean hospital stay (5.2 ± 1.6 vs 3.8 ± 0.5 days, P < 0.01) (Table 2). Table 3 shows that the duration of surgery for both approaches during the second and third phases of our study are not statistically significantly different. The two approaches were similar with respect to the mean postoperative analgesia requirement (2.4 ± 0.8 vs 2.2 ± 0.6 days, P = 0.41), mean convalescence days (9.7 ± 2.1 vs 10 ± 2.1 days, P = 0.56), mean estimated blood loss (57.2 ± 24.8 vs 62.9 ± 32.8 ml, P = 0.5), and mean stone size (37 ± 13.0 vs 35 ± 12.6 mm, P = 0.6). As the bodyweight increased, the duration of surgery significantly increased in the two groups (119.5 ± 16.6 vs 96.0 ± 24.9 min and r = 0.67, respectively). The positivity of the preoperative positive urine cultures did not affect the overall length of hospital stay (4.8 ± 1.5 vs 4.0 ± 1.9 days, P = 0.1). Postoperative complications occurred in six (22.2%) patients in TLP group and three (14.3%) patients in the RLP group. Three patients (11.1%) in the TLP group had prolonged ileus, two patients (7.4%) had urinary tract infection, and the remaining one patient (3.7%) had peritonitis. Peritonitis in this last patient was secondary to a stone that slipped into the abdominal cavity, which was not recognized at the time of surgery. The patient underwent laparotomy and an

![Fig. 2](image-url)  (A) Preoperative intravenous urography demonstrates a large staghorn calculus. (B) A laparoscopic view towards the posterior aspect of the left kidney. The upper pole of the kidney is at the right side of the view. The picture demonstrates the staghorn stone held with a Maryland grasper after removal from the kidney. (C) The large staghorn stone, reconstructed, after retrieval.
Table 1  Demographics and preoperative patient details of the two study groups

<table>
<thead>
<tr>
<th></th>
<th>Transperitoneal</th>
<th>Retroperitoneal</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>21</td>
<td>17</td>
<td>NS</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>4</td>
<td>NS</td>
</tr>
<tr>
<td>Mean age in years ± SD</td>
<td>38.7 ± 11.6</td>
<td>40.7 ± 11.5</td>
<td>NS</td>
</tr>
<tr>
<td>Mean weight in kg ± SD</td>
<td>81.2 ± 7.8</td>
<td>86.1 ± 6.9</td>
<td>0.03</td>
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<tr>
<td>ASA score ≥ II</td>
<td>27</td>
<td>21</td>
<td>NS</td>
</tr>
<tr>
<td>Solitary stone (%)</td>
<td>21 (77.8)</td>
<td>16 (76.2)</td>
<td>NS</td>
</tr>
<tr>
<td>Multiple stones (%)</td>
<td>3 (11.1)</td>
<td>3 (14.3)</td>
<td>NS</td>
</tr>
<tr>
<td>Staghorn stone (%)</td>
<td>3 (11.1)</td>
<td>2 (9.5)</td>
<td>NS</td>
</tr>
<tr>
<td>UTI (%)</td>
<td>8 (38.1)</td>
<td>6 (28.6)</td>
<td>NS</td>
</tr>
</tbody>
</table>

ASA, American Society of Anesthesiologists; NS, not significant; SD, standard deviation; UTI, urinary tract infection according to urine culture.

Table 2  Perioperative patient details of the two study groups

<table>
<thead>
<tr>
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<th>Transperitoneal</th>
<th>Retroperitoneal</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean operative time in min. ± SD</td>
<td>112.1 ± 22.4</td>
<td>93.2 ± 25.4</td>
<td>0.01</td>
</tr>
<tr>
<td>Mean EBL in ml ± SD</td>
<td>57.2 ± 24.8</td>
<td>62.9 ± 32.8</td>
<td>NS</td>
</tr>
<tr>
<td>Mean stone size in mm ± SD</td>
<td>37 ± 13.0</td>
<td>35 ± 12.6</td>
<td>NS</td>
</tr>
<tr>
<td>Pyelotomy closure (%)</td>
<td>22 (81.5)</td>
<td>14 (66.7)</td>
<td>NS</td>
</tr>
<tr>
<td>Open conversion (%)</td>
<td>2 (7.4)</td>
<td>2 (9.5)</td>
<td>NS</td>
</tr>
<tr>
<td>Mean postoperative analgesia days ± SD</td>
<td>2.4 ± 0.8</td>
<td>2.2 ± 0.6</td>
<td>NS</td>
</tr>
<tr>
<td>Mean days to oral intake ± SD</td>
<td>1.9 ± 0.6</td>
<td>1.2 ± 0.4</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Mean days hospital stay ± SD</td>
<td>5.2 ± 1.6</td>
<td>3.8 ± 0.5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Mean convalescence days ± SD</td>
<td>9.7 ± 2.1</td>
<td>10 ± 2.1</td>
<td>NS</td>
</tr>
<tr>
<td>Stone free (%)</td>
<td>24 (88.9)</td>
<td>19 (90.5)</td>
<td>NS</td>
</tr>
</tbody>
</table>

EBL, estimated blood loss; NS, not significant; SD, standard deviation.

Table 3  Mean operating time in minutes (±standard deviation) for the transperitoneal approach and the retroperitoneal approach RLP showing overall total and for each phase of our experience

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Period</th>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
<th>Total</th>
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<tr>
<td></td>
<td></td>
<td>n</td>
<td>n</td>
<td>n</td>
<td></td>
<td>n</td>
</tr>
<tr>
<td>TLP</td>
<td></td>
<td>113.8 (± 25.3)</td>
<td>10.9 (± 20.1)</td>
<td>11.8 (± 20.9)*</td>
<td>5</td>
<td>112.1 (± 25.4)</td>
</tr>
<tr>
<td>RLP</td>
<td></td>
<td>126.0 (± 17.9)</td>
<td>88.10 (± 18.1)</td>
<td>83.10 (± 23.0)*</td>
<td>9</td>
<td>93.20 (± 22.4)</td>
</tr>
<tr>
<td>P value</td>
<td></td>
<td>0.38</td>
<td>0.04</td>
<td>0.04</td>
<td>0.01</td>
<td></td>
</tr>
</tbody>
</table>

*P > 0.05 compared with phase 2. RLP, retroperitoneal laparoscopic pyelolithotomy; TLP, transperitoneal laparoscopic pyelolithotomy.


abscess was found, which was drained and a stone was found within it. The patient had an uneventful recovery after this procedure. In the RLP group, one patient (4.8%) had transient fever, one (4.8%) had urinary tract infection, and one (4.8%) had bleeding. Seven patients (25.9%) from the TLP group and eight patients (38.1%) from the RLP group had urine leak. The overall mean drain time was 1.7 ± 1.3 days (1.6 ± 1.2 days and 1.9 ± 1.4 days for the TLP and RLP groups, respectively). It is worth pointing out that the mean drain time was 1.1 ± 0.4 days and 3.6 ± 1.1 days in the groups of patients in whom the pyelotomy was closed and left open, respectively (P < 0.01). We believe the reason behind the short mean drain time in the latter group was the fact that the renal pelvis was intrarenal in all cases. In the TLP group, the leak was well drained and no patient leaked urine into the abdominal cavity. The success rate after 3 months follow up of the two groups was comparable (88.9% vs 90.5%, P = 0.86) between the RLP and TLP, respectively (Table 2).

Discussion

This study was designed to assess whether the transperitoneal and the retroperitoneal approach for LP exhibits significant differences in the clinical outcomes. We have shown that RLP was associated with sig-
nificantly shorter duration of surgery, mean time for oral intake, and mean hospital stay; while it was equivalent in mean postoperative analgesia requirement in days, mean convalescence requirement in days, estimated mean blood loss, urine leak, and success rates. Although complications were present in the two groups, RLP access complications were fewer and less severe.

As shown in Table 3, more RLP procedures were performed during the later stages of our study which might bias our results, but, nonetheless, the same table also shows that the mean operating time for RLP and TLP during the second and third phases of our study were not statistically significantly different. In other words, our learning experience has reached a plateau after the first phase of the study, and, if experience bias is present, then, it should have small effects on the results.

Although laparoscopic management of urolithiasis was first demonstrated by Wickam, its role as a therapeutic option in the treatment of renal stones is still not clearly defined, partly because PCNL and ESWL are well-established, effective and better treatments, which are associated with low complication rates, whereas open surgery has traditionally been the alternative when these measures fail. Open surgery is gradually being replaced by laparoscopy, and over the past few years, a growing number of reports have appeared that have demonstrated the efficacy of LP, especially in patients who require concomitant pyeloplasty, those with stones in an ectopic or horse-shoe kidney. Initially, we used LP as a salvage procedure but as we gained more experience, we considered it a viable option as a primary treatment for patients with solitary large renal pelvis stones, as illustrated in Figure 2. This is because treating such stones with PCNL may take a long time and consume much-needed operating room time in our busy unit and ESWL may be required afterwards for residual fragments. While using LP, such stones can be removed in one operative session.

The surgical exposure in the transperitoneal route for LP is familiar to the majority of surgeons. Also, a much larger working space is available and there are various established anatomical landmarks for performing the surgery effectively. Nambirajan et al. conducted a prospective randomized study, comparing transperitoneal and retroperitoneal laparoscopic nephrectomy. They concluded that there was no difference between the two approaches in relation to the patient morbidity or the technical difficulty of the procedure. However, our experience is different from theirs. We found that the retroperitoneal approach is better in aspects relating to the speed of postoperative recovery. We found that the direct access to the kidney pelvis that was facilitated by the retroperitoneal approach, allows us to replicate the open surgical techniques better, without the need for bowel manipulation and thus results in a decreased potential for postoperative ileus and bowel injury. The blood lost during retroperitoneal procedures does not come into contact with the bowel and, if urine leakage occurs, it would be contained within the retroperitoneum. Blood and urine are known to irritate the bowel and increase the duration for the recovery of full bowel function.

We started LP using the transperitoneal route, similar to the procedure followed at many other centers. However, after successfully treating a few cases, we realized that this procedure was not the optimal approach under all clinical conditions. When access to the posterior aspect of the kidney is needed to make the pyelotomy, for example, in patients with anteriorly crossing lower pole vessels, the procedure becomes technically more difficult. Besides, after opening the collecting system, potentially infected urine or loose stones might spill over into the general peritoneal cavity, and this might lead to avoidable complications like intraperitoneal abscess formation as seen in one of our patients. These limitations led us to seriously evaluate the retroperitoneal technique. We now prefer the retroperitoneal approach for most cases. Anatomical landmarks, such as the psoas muscle, Gerota’s fascia, and the diaphragm, facilitate operator orientation in the retroperitoneum and improve the clinical outcome. The identification of these anatomical landmarks may be improved and operating time could be shortened with careful and adequate balloon dissection of the retroperitoneal space, early in the procedure. Our data and other published reports suggest that experienced surgeons can overcome these limitations to achieve statistically equivalent outcomes with either approach. Therefore, the preferred approach for LP will depend, to some extent, on previous experience and training. Experience reduces complications, the duration of the procedure, and may lead to improved success rates. For example, any difficulties with orientation and limited space can be multiplied by suboptimal trocar positioning. By analyzing the angles and distances between the working ports, the camera and needle position, optimal trocar positioning, and suture technique can be obtained. It is important to be competent with the two approaches because this allows treatment to be tailored to each individual patient.

Although our study demonstrates similar success rates for both approaches, certain clinical conditions should be kept in mind. The RLP may be especially useful in patients with prior abdominal surgery or radiation, as convalescence and recovery of bowel function are not prolonged in this approach. Conversely, the TLP approach is the access of choice in patients with prior retroperitoneal renal surgery. Morbidly obese patients require special consideration. From our experience with morbidly obese patients, we found that the perinephric fat tends to get pushed away (by gas pressure) from the operative site when the patient is in the full-flank position, making access to the kidney from the back a more natural choice. Thus, we believe that in obese patients, the retroperitoneal approach may be technically simpler than the transperitoneal approach.

Of particular interest were the differences in the complications in our TLP and RLP patients. Some of the complications (e.g. prolonged ileus) in TLP patients could be attributed to dissection in the peritoneal cavity, or the presence of blood or urine around the bowel. Urine leak is known to be one of the most common complications following surgery that involves opening of the collecting system, such as partial nephrectomy, with a mean reported incidence of 6.5%. In our patients, 31.3% had urine leakage, which resolved over a mean of 1.7 days. The short urine leakage time in this series may be partly due to the fact that we placed double J stents routinely before the start of the procedure. Most of our patients had had their renal pelvis stones for a long time, giving rise to pyelitis, dense peripelvic adhesion, and swelling. This makes the dissection to properly expose the renal pelvis difficult and bloodier, a condition that was responsible for most of our conversions during the initial period of our series.

Although severe complications in RLP surgery are certainly uncommon, the management of some of these complications can be a daunting task. A new port may be added easily in the TLP approach, whereas limited space and visibility during the RLP procedures limits additional port access and other options. Therefore, the potential benefits of the RLP approach could be lost in patients with certain complications. Surgeons using the RPL approach must, therefore, be conversant with the management of complications associated with this route.

This work has some limitations. First, our small sample size will only detect large differences between the RLP and TLP groups. Second, we did not record subjective intraoperative findings, such as tissue quality or difficulty of dissection. Third, we did not specifically evaluate the anatomy of the renal pelvis as an independent variable. A stone in a
kidney with an extrarenal pelvis is easier to remove than a stone in a kidney with an intrarenal pelvis. Dissection of an intrarenal pelvis is difficult because of its location within the renal sinus. Moreover, the pyelotomy incision tends to retract behind the renal substance making intracorporeal suturing more difficult. As none of our patients were selected for a specific approach on the basis of renal pelvis anatomy, the anatomy in the two groups is quite likely to be similar. The other limitation of our series is that it is not randomized. The choice of the surgical approach used was based on the patients’ characteristics (e.g., prior abdominal surgery), kidney anatomy (e.g., pelvic kidney) and the surgeon’s preference.

**Conclusion**

LP performed by transperitoneal or retroperitoneal routes seems to provide similar success rates. The retroperitoneal approach, although technically more challenging, allows direct access to the posterior aspect of the renal pelvis, avoids extensive dissection and consequently results in quicker postoperative recovery. The ability to perform RPL can be improved with better orientation inside the retroperitoneal space and with increasing experience. Our findings are preliminary. Further studies, ideally randomized trials involving cases amenable to either approach, are needed to evaluate long-term outcomes.

**References**


