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**Original Research Article**

## The efficacy, safety & outcomes of laparoscopic pyelolithotomy (retroperitoneoscopic pyelolithotomy) and its comparison with percutaneous nephrolithotomy

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E-mail: [dr\\_gauravagraval01@gmail.com](mailto:dr_gauravagraval01@gmail.com)**Abstract**

**Objective:** The aim of the study was to compare the safety, efficacy & outcomes of laparoscopic pyelolithotomy (RPPL) and its comparison with percutaneous nephrolithotomy (PCNL) for the management of single large (> 2.0 cm) renal pelvic calculus.

**Methods:** This study was performed from May 2009 to March 2011 at S.N. Medical College and Hospital, Agra (INDIA). It included two groups of patients with large renal pelvic stones; only patients with stones 2.0 cm<sup>2</sup> or greater were included. Group 1 included 18 patients treated by RPPL and Group 2 included 20 patients treated by the PNL. Differences between the two procedures were compared and analyzed.

**Results:** There was no difference between the two groups regarding patient demographics and stone size. The mean stone size in RPPL and PCNL group were 3.7 & 3.90 cm<sup>2</sup> respectively. There was one conversion to open surgery in RPPL group. The mean operative time was significantly longer in Group 1 (RPPL) 145.88 ± 35.54 vs. 76.2 ± 9.21 min  $p \leq 0.05$  respectively. The blood loss was in RPPL 180.25±63.28 ml as compared to in PCNL group 150.5 ± 34.06 ml (p value NS). The mean hospital stay was 4.5 and 3.5 day in RPPL & PCNL group respectively. There was no residual stone and no need of blood transfusion in post operative period in both groups.

**Conclusion:** Retroperitoneoscopic pyelolithotomy was associated with longer operating time, more invasive & less cosmetic, require more analgesia, had more blood loss as compared to PCNL. While patients undergo PCNL had shorter hospital stay & rapid return to normal activity & more cost effective as compared to RPPL.

**Keywords:** Laparoscopy, Retroperitoneoscopy Pyelolithotomy (RPPL), percutaneous nephrolithotomy(PCNL)

**1. Introduction**

With the advances in shock wave lithotripsy (SWL) and endourological procedures, such as percutaneous nephrolithotomy (PNL) and ureterorenoscopy (URS), the treatment of urinary stone disease has changed markedly. The indications for open renal surgery to treat renal calculi are limited to special situations; it is needed in only 0.47% to 5.4% of the time[1]-[4]. To treat renal calculi of 2.0 cm<sup>2</sup> or larger in diameter, PNL has been used successfully. With low complication rates, PNL has been accepted as first-line therapy. According to the guidelines, laparoscopic pyelolithotomy (LPL) is indicated when endoscopic procedures fail, if there is a complex stone burden, renal and anatomical abnormalities, or if there are indications for open surgery[5]. In centres with

established experience in advanced reconstructive laparoscopy, LPL can be a feasible alternative to PNL[9]. In this study, we compared PNL versus LPL in large pelvic stone and investigated the role of LPL in urosurgery[5].

**2. Methods**

From May 2009 to March 2011, 18 patients with large renal pelvic calculi (2.0 cm<sup>2</sup> or more) were treated with RPPL. In the same period, PNL was performed in 20 patients. An informed written consent was taken from each patient. All patients were documented prospectively in our database.

We tallied age, stone location and size. Preoperative complete blood count, serum creatinine,

platelet count, bleeding and coagulation profile and urine analysis were obtained from all patients. Radiological evaluation included intravenous urography (IVU) and ultrasonography (U/S), with the addition of non-contrast computed tomography (CT).

### 2.1 Technique of PCNL

The excretory urogram or retrograde pyelogram was done to determine the relationship of the stone to the collecting system and to determine the optimum access tract. The retroperitoneal location of the kidney permits access through a posteriolateral "window". Access was performed under fluoroscopic control. The procedure was done under general anaesthesia. An 18-gauge needle was placed through the flank into the kidney at the point where access was desired. A guide wire of 0.035 or 0.38 size was passed through the needle. The tract is enlarged by passing serial dilators co-axially over the guide wire. Dilatation proceeds under fluoroscopic control & 30 Fr Amplatz sheath was passed over the last dilator, to provide direct access to the collecting system. The nephroscope was passed through the sheath to visualize the inside of the collecting system. The stone was removed after fragmentation of stone with lithoclast. The pieces were removed as they were broken up. The stones free status was confirmed on fluoroscopy. At the end of the procedure, a nephrostomy tube of 12 fr was placed. After 48 hours, a nephrostogram was obtained. If there are no leaks, the nephrostomy tube was clamped. If the patient tolerates this procedure, the tube was removed and the patient is discharged from the hospital. The postoperative stone-free rate was determined at 3 months postoperatively, using a spiral CT. The procedure was considered successful if the patient was stone free.

### 2.2 Technique of retroperitoneoscopic pyelolithotomy

A preliminary cystoscopy with retrograde pyelogram was performed. A guide wire was placed in pelvis and a stent placed just below the pelvis; Provision of C-arm help to locate the position of calculus intraoperatively. The procedure was performed under general anaesthesia in a standard flank position. A transverse skin incision (2cm) was made just posterior to the tip of the 12<sup>th</sup> rib. Finger dissection was performed in the retroperitoneum to create a working space for placement of the balloon dilator. After balloon dissection of retroperitoneal cavity, a Hassan trocar was inserted and secured with the preplaced stay sutures. A carbon dioxide pneumoretroperitoneum was established and a rigid laparoscope was inserted. One 10 mm trocar for the surgeon's right hand and two 5 mm trocars were inserted under endoscopic view. Ureteric dissection

was performed proximally, until the renal pelvis was exposed. A vertical incision about 2 cm was made at the lower part of the dilated renal pelvis and then the calculus was extracted. The mucosa was sutured with 3 stitches of 4-0 vicryl using an RBN needle. A tube drain was left in place through lower port if necessary.

We tallied the data of patients with renal pelvic stones managed with LPL and PNL (Table 1). Statistical significance was calculated by using the Student 't' test, chi-square test after ensuring that data fulfilled test criteria. Also, the evaluation of data was done by using mean (average), standard deviation and a standard test to compare the mean of both groups. A p value < 0.05 was considered significant

### 3. Results

The mean patient age was 40 years and 41.2 years in the LPL and PNL groups, respectively ( $p \leq 0.2934$ ). The mean stone size was  $3.7 \pm 0.55 \text{ cm}^2$  (range: 2-4cm) and  $3.90 \pm 0.60 \text{ cm}^2$  (range: 2-4.5cm) in the LPL and PNL groups, respectively ( $p \leq 0.333$ ). We also compared perioperative parameters (Table 2). The mean operation time was significantly prolonged in the LPL group than in the PNL group,  $145.88 \pm 35.54$  minutes (range: 90-200 min) versus  $76.2 \pm 9.21$  minutes (range: 60-90 min) ( $p \leq 0.05$ ).

**Table 1: Preoperative patient characteristics**

	LPL	PNL	p value
<b>No. procedure</b>	18	20	N/A
<b>Mean age <math>\pm</math> SD</b>	40	41.2	0.2934
<b>Sex</b>	12(males) and 6 (females)	14(males) and 6(females)	N/A
<b>Stone size <math>\pm</math> SD</b>	$3.7 \pm 0.55 \text{ cm}^2$	$3.90 \pm 0.60 \text{ cm}^2$	0.3336

LPL: laparoscopic pyelolithotomy; PNL: percutaneous nephrolithotomy; SD: standard deviation; PUJO: pelvi-ureteric junction obstruction; N/A; not applicable

In the PNL group the complication rate was 25%. Two patients (10%) had high-grade fever, Bleeding occurred in 1 patient (5%). The first patient bleeds early on postoperatively and was managed conservatively by occlusion of the PNL tube for 6 hours and there is no need of blood transfusion. In the LPL group, the complication rate was 33.33%; three patients had high-grade fever (16.66%) and one patient (5.5%) had urinary leakage and one patient had minor bleeding which manage conservatively. The mean blood loss was  $180.5 \pm 63.28 \text{ mL}$  (150-300) in the LPL group as compared to in the PNL  $150.5 \pm 34.06 \text{ ml}$  (75-200) group and were not statistically significant ( $p \leq 0.0755$ ). The hospitalization period was longer in the LPL group,  $4.5 \pm 2.47$  days versus  $3.5 \pm 1.33$  days but not significant ( $p \leq 0.1284$ ).

Upon patient request (not routinely), 100 mg tramadol equivalents were given postoperatively to both groups. Analgesia was needed only for  $2.2 \pm 0.9$  days (range: 1.5 -3.5) and  $2.4 \pm 0.9$  days (range: 1.5-3.5) in the PNL and LPL groups, respectively.

#### 4. Discussion

PNL is the preferred treatment to manage renal stones that are 2 cm or greater[15]. Although LPL was first described in the early 1990s, it did not gain popularity among urologists because of its long learning curve and the already well established PNL technique[16]. Recently, successful laparoscopic management of renal stones has been described; however, the indications have not yet been defined

and outcomes have not been compared with established techniques, such as PNL[17][18]. In the current study, LPL was evaluated as a surgical monotherapy to manage renal pelvic stones and compared with PNL.

In our study, the preoperative data of both groups were homogenous with no statistically significant difference regarding age, sex and stone size. The operative time ranged from 90 to 200 minutes (mean  $145.88 \pm 35.54$  minutes), which was longer than Al-Azaby study (135 minutes)[19]. It is also longer than the time reported by Al-Hunayan *et al*[18] (112.1 minutes) and but shorter than Nouralizadeh *et al*[20](177 minutes, range: 110-240).

**Table 2: Comparison of perioperative and postoperative data in patients undergone LPL and PNL**

Procedure	LPL	PNL	p value
Mean operative time	$145.88 \pm 35.54$ min	$76.2 \pm 9.21$ min	$\leq .05$
Estimated blood loss(ml)	$180.5 \pm 63.28$ mL	$150.5 \pm 34.06$ ml	$\leq 0.0755$
Postoperative hospital stay (d)	$4.5 \pm 2.47$ days	$3.5 \pm 1.33$ days	$\leq 0.1284$
Postoperative analgesia (d)	$2.4 \pm 0.9$ days	$2.2 \pm 0.9$ days	N/A
Blood transfusion (%)	Nil	Nil	N/A
Complications (%)			
Intraoperative	Nil	loss of tract (1)	
Postoperative	High-grade fever (3) Urinary leakage(1) conversion to open (1)	High-grade fever (2) Bleeding per PCN (1)	

**LPL:** laparoscopic pyelolithotomy; **PNL:** percutaneous nephrolithotomy; **SD:** standard deviation; **PUJO:** pelvi-ureteric junction obstruction; **N/A;** not applicable

This difference was also observed by Goel and Hemal[16] showed that operating time was more & significant in patients, who underwent RPPL (142.2min) as compared to PCNL(71.6min). Micali *et al*[34], also found longer operating time in patients, who underwent laparoscopic transperitoneal pyelolithotomy (129min) as compared to PCNL (75min).In our study we found similar result. Gaur *et al*[23] reported a mean operative time of 116 minutes for LPL, compared with 152 minutes for PNL (*p* value not stated). The longer time of LPL in our study was usually related to the long learning curve of LPL as well as the time needed for intracorporeal suturing and delivery of the stone. The mean operative time of LPL in our study, however, was acceptable and average in relation to many studies[20][24][25].

An intrarenal pelvis was difficult to dissect because of limitation of space and difficulty in retracting the renal parenchyma to expose the renal sinus. Moreover applying intra corporeal suture in such a pelvis was more difficult. Sometimes the presence of stone gives rise to lots of adhesions in the peripelvic area making dissection difficult.

When compared with PNL, one outstanding advantage of LPL is that it is harmless to the parenchyma[26]. Therefore the risk of bleeding is

higher in PNL related to the access localization and dilation technique. Bleeding is the most important and frequent complication in PNL. In general, they are managed conservatively. Meria *et al*[20] compared PNL with LPL and found significant venous bleeding in 3 of the 16 patients managed with PNL and the estimated blood loss was more significant in the PNL group (70 vs. 210 mL). But in our study the mean blood loss was more in the LPL group ( $180 \pm 63.28$  mL vs.  $150.5 \pm 34.06$  ml), which was similar to Goel and Hemal[16] study (173.1 vs.147.9 ml), with no need for blood transfusion in all the cases.

We had one conversion (10%) in our study due to adhesions & one patient develop urinary leakage. Urinary leakage developed due to inflammatory local conditions making incomplete pelvis closure. But in our study it was lesser as compare to Sinha *et al*[29] study had 20% conversion rate to open surgery and 2 patients developed prolonged urinary leakage. These complications due to the same reasons were also reported by Micali *et al*[15] and also by Harmon *et al*[35] in 1996 in their study. Meria *et al*[20], Sinha and Sharma[29] and Holman *et al*[30] reported that urinary leakage after the procedure developed in 12.5% (2/16), 10% (2/20) and 7% (1/15) of patients respectively. However retroperitoneoscopic approach

has unique advantage as urinary collection is limited to retroperitoneum these complications resolved spontaneously but increased the hospital stay. The patients with past history of renal surgery/retroperitoneal surgery have significant perinephric adhesion. These factors do not play important role in PCNL and making it treatment of choice in such situations. Because of all these limitations the laparoscopic approach cannot be applied universally in all cases of renal stone disease.

There was a higher incidence of postoperative fever (3 patients) in the RPPL group in comparison with the PCNL group (2 patients) which managed conservatively. While hematuria was present only in one patient of PNL group, the duration of convalescence following PCNL was shorter as compared to RPPL, however this difference was not statistically significant in our study.

There was no residual stone in our study in both groups. The stone-free rate achieved in the current study was due to proper selection of cases, the intact removal of the stone in contrast to PNL in which disintegration of the stone done by the pneumatic lithotripter. Meria *et al*[20] reported an insignificant difference in the stone-free rate between LPL (88%) and PNL (82%). Tefekli *et al*[26] also reported their experience with LPL in 26 patients with solitary pelvic stone in comparison with matched group of PNL; their stone free rate was 100% and 88.4%, respectively. In our study, we preferred the retroperitoneal approach to achieve the renal pelvis. The retroperitoneal approach allows direct access to the posterior aspect of the renal pelvis, avoids extensive dissection, avoids urine and blood leakage into the peritoneal space and consequently results in quicker postoperative recovery.

Although LPL appears to be more invasive because three or four trocar punctures are needed compared with PNL in which only a single hole is made, in PNL there is transgression of the renal parenchyma with its potential of various complications, such as nephron damage and bleeding[22]. On most occasions, laparoscopy is nephron sparing, namely, pyelolithotomy compared with PNL[31]. There is agreement about the role of laparoscopy in stone surgery by many authors, but in special situations, such as those associated with pelvi-ureteric junction obstruction, stone in the pelvic kidney and caliceal stones[22][24][32]. Recently, Salvado *et al*[33] believe that this technique can be considered in cases of a large stone burden in different locations of the kidney. A pelvic stone associated with ureteropelvic junction obstruction was managed laparoscopically by Ramkumar *et*

*al*[36] in 19 patients. They showed the feasibility and the effectiveness of LTP with concomitant pyeloplasty. In their series the stone free rate & pyeloplasty success rate was 90%. It was also successfully done in ectopic kidney by Hoenig *et al*[37], and in pelvic kidney by Turk *et al*[38]. So laparoscopic approach is feasible in patients with congenital anomalous kidney or in patients where concomitant laparoscopic procedure is indicated such as pyeloplasty.

## 5. Conclusion

Although laparoscopic surgery has gained a great acceptance as a standard management in many urological disorders, it will continue to play an extremely small role in the management of patients with nephrolithiasis. In addition, future improvements in endoscopic technology and the skills of contemporary urologists are likely to further narrow its application. Furthermore, LPL is associated with longer operating time, longer recuperation, more invasive, less cosmetic and requires more skills when compared to PNL. Laparoscopy is not suitable in patients with dense peripelvic adhesions, intrarenal pelvis or a history of previous abdominal surgery. However, LPL may be indicated in special situations, like ectopically located, congenitally anomalous kidneys or in patients where concomitant laparoscopic procedure is indicated, such as pyeloplasty. It can also be indicated in patients who have failed SWL, PNL and URS because LPL is potentially harmless to the renal parenchyma and is associated with less blood loss.

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