10.5005/jp-journals-10033-1292

ORIGINAL ARTICLE

Comparative Study of Surgical Approaches for Renal Pelvic Stones in a Northern Rural Medical College

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ABSTRACT

Introduction: Retroperitoneal pyelolithotomy (RPL) can be used as an alternative to open pyelolithotomy (OP) when other modalities of stone removal fail. This procedure even has potential to replace noninvasive techniques in selective subsets of patients.

Aims and objectives: The aim of this study was to study the efficacy, safety, and outcome of retroperitoneal laparoscopic pyelolithotomy. The study compared the advantages and complications of RPL and OP.

Materials and methods: This study was conducted in the Department of Surgery, Maharishi Markandeshwar Institute of Medical Science and Research, Maharishi Markandeshwar University, Ambala, from January 2012 to December 2015. A total of 280 patients of solitary renal pelvic stone were selected, out of whom 160 who underwent RPL were considered in group I and 120 patients who underwent OP were considered in group II. The patients included were of age group 12 to 80 years, with unilateral and bilateral solitary renal pelvis calculus and stone size of 10 mm to 3 cm. Patients with recurrent or residual stones after pyelolithotomy, intractable urinary tract infection, and having extrarenal pelvis and any anatomical renal abnormalities were excluded from the study.

Results: In this study, mean age was 37.1 and 46.66 years in groups I and II respectively. Male to female ratio was 2.33:1. Mean operative time was 75.33 ± 16.90 and 65.83 ± 12.35 minutes respectively, in groups I and II respectively ($p < 0.001$). Pyelotomy closure time and Double-J (DJ) stent insertion time were 5.2 minutes (with standard deviation [SD] of 4.3) and 9.8 (with SD of 3.7) respectively, in group I as compared with 4.2 minutes (with SD of 2.7) and 6.1 (with SD of 2.9) in group II. Mean hospital stay was less in group I at 3.76 ± 0.85 days and, in group II, it was 5.36 ± 1.96 days ($p < 0.001$). Postoperative anesthesia requirement was 2.23 ± 0.62 days (339 ± 93 mg) and 5.36 ± 0.96 days (804 ± 144 mg) in groups I and II respectively ($p < 0.001$).

Conclusion: The RPL is a noninvasive and cost-effective method along with minimal scar mark. It has the advantages over OP of having fewer complications, less postoperative pain, better cosmesis, and less hospital stay.

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Keywords: Laparoscopy, Open method, Pyelolithotomy, Renal stone, Stone.

How to cite this article: Sharma BP, Singal R, Zaman M, Sandhu K, Yadav R, Grewal P, Mishra RK. Comparative Study of Surgical Approaches for Renal Pelvic Stones in a Northern Rural Medical College. World J Lap Surg 2017;10(1):1-7.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Treatment options for kidney stones are possible with noninvasive or minimally invasive approach including shock wave lithotripsy, ureteroscopy, or percutaneous nephrolithotomy (PCNL). There are considerable improvements in laparoscopic surgical techniques to the point that nearly any open surgery can be performed in a minimally invasive laparoscopic fashion.[1] For patients with ectopic kidney, the results of extracorporeal shock wave lithotripsy (ESWL) are only moderately successful and PCNL is difficult. Laparoscopic pyelolithotomy (LPL) is a viable alternative in such a situation. Lithiasis in kidneys that have some type of anatomical alteration is a particularly great challenge for the urologist, due to the fact that the abnormal anatomy prevents the use of the same disintegration or extraction access routes that are utilized in normal kidney units.[2]

The reports suggest that retroperitoneal laparoscopic pyelolithotomy (RLP), having procedural similarity to open pyelolithotomy (OP), is not only nephron sparing, but also nephron reviving and, consequently, could eventually become accepted as the procedure of choice in selected groups of patients with renal calculus disease.[3] Laparoscopic pyelolithotomy is the procedure of choice in certain conditions, i.e., the size of the stone, the need for concomitant open surgery, and inaccessibility to ESWL or PCN. Other indications are relative and include failure of stone clearance via PCN, ureteroscopy, or ESWL due to difficult extraction, stone composition (i.e., cystine), or anatomy (i.e., ectopic, pelvic, or horseshoe kidney). Pyelolithotomy is also indicated in combination with pyeloplasty without increasing morbidity or decreasing the success rate.[4]

AIMS AND OBJECTIVES

The aim of this study was to study the efficacy, safety, and outcome of RLP. The study compared the advantages and complications of retroperitoneal pyelolithotomy (RPL) done laparoscopically with classical pyelolithotomy or OP.

MATERIALS AND METHODS

The present prospective clinical study was carried out in the Department of Surgery, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Haryana, India, from January 2012 to December 2015. The study was approved by the ethical committee of Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana. A total of 280 patients of either sex and in the age group of 12 to 80 years were taken for the study. The results were compared in both techniques.

Patient Selection

The study was divided into two groups. Consent was taken from patients on whether they wanted to opt for open procedure or laparoscopic procedure. Group I consisted of 160 patients who underwent RLP. Group II consisted of 120 patients who underwent OP. All patients were between age group of 12 and 80 years and had unilateral and bilateral solitary pelvic stones (1–3 cm). Patients with multiple calculi, congenital or acquired anatomical abnormalities (which preclude RLP), associated bleeding diathesis, pregnancy, intractable urinary tract infection, intrarenal pelvis, and recurrent/residual stones following open surgery were excluded from the study.

Preoperatively, age, weight, height, detailed history, dietary habits, general physical examination, and previous history of surgery were noted and recorded on patient's proforma. Routine baseline investigations like hemoglobin, total leukocyte count, differential leukocyte count with platelet count, blood sugar, serum electrolytes, chest X-ray, electrocardiogram, urine routine, microscopy and urine culture and sensitivity, blood urea, and serum creatinine were done in patients. Radiological investigations done mandatorily were X-ray kidney, ureter, bladder (KUB), ultrasonography KUB, and intravenous pyelography (IVP) (Fig. 1). Additionally, plain computed tomography scan and diethylene triamine pentaacetic acid scan were done when required. All patients were given routine preoperative and postoperative antibiotics in injectable form (ceftriaxone 1 gm, amikacin 500 mg, and metrogyl 100 mL). The patient was placed in a lateral decubitus position, and the kidney bridge was elevated to flatten out the lumbar region.

The RLP was performed using the same technique as in several standard laparoscopic renal procedures. In general, three to four port placements were used.

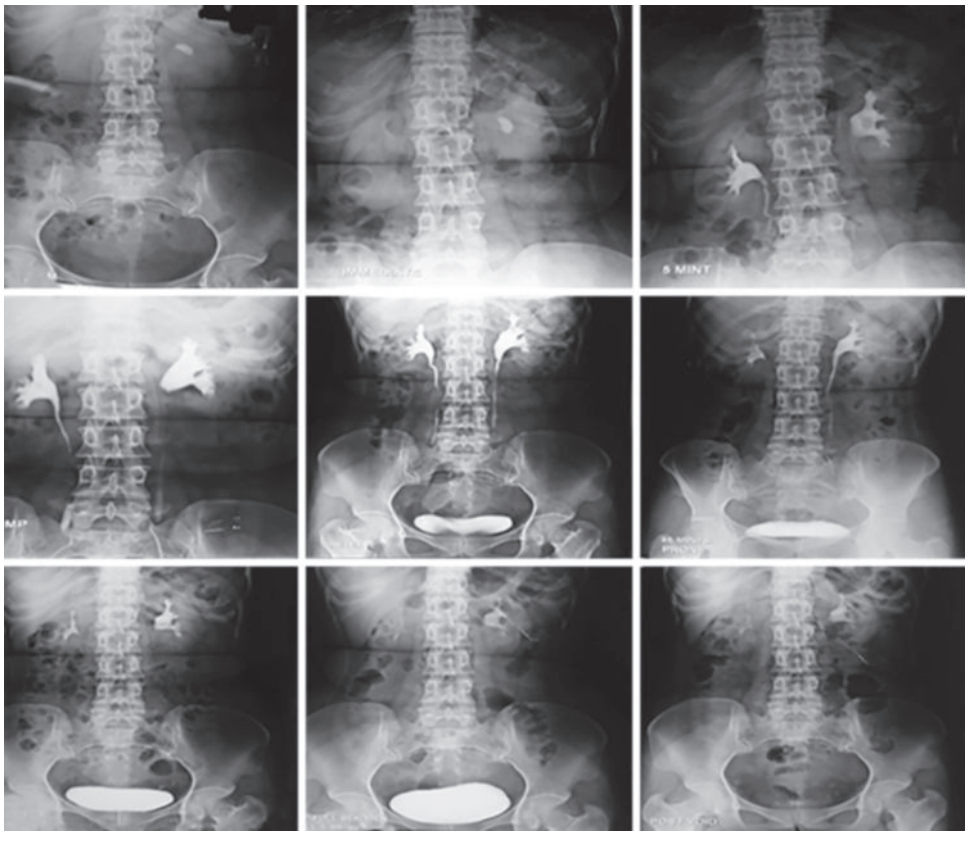

Fig. 1: Intravenous pyelography with a stone in pelvis of left kidney

Fig. 2: Landmarks for port placement for left LPL

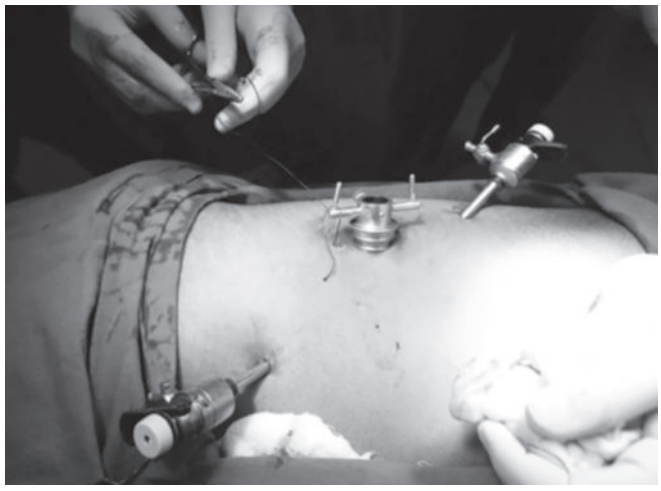

Fig. 3: Position of ports for performing left LPL

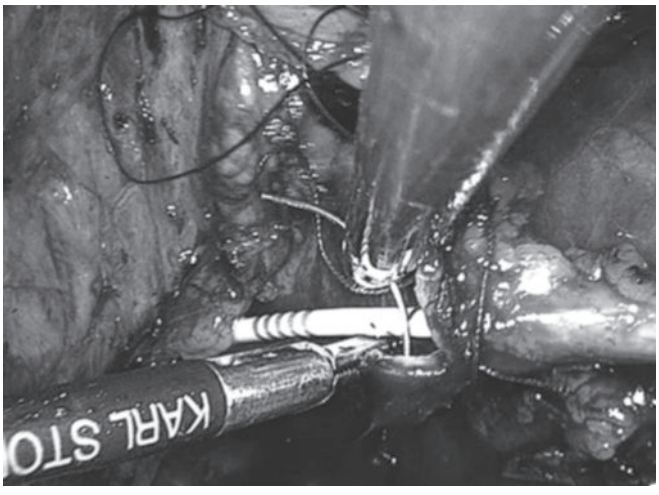

Fig. 4: Placement/insertion of DJ stent in renal pelvis and closure of pyelotomy being carried out laparoscopically

Fig. 5: Postoperative scar in a patient who underwent laparoscopic RPL at our medical center

The 1st port of size 1.5 cm was at renal fossa at the upper border of the erector spinae muscle (in the middle of the lower coastal rib and the coccyx) (Fig. 2). The balloon was inflated with water and kept inflated for 3 minutes to achieve adequate dissection and hemostasis. The 2nd port was established in the renal angle of size 5 mm (Fig. 3). The third port of 5 mm was made above the iliac crest, which was converted into an 8 mm port to insert the cold knife for pelvic incision. The renal pelvis was incised with endoscissor/cold knife.

The stone was grabbed with an endograsper or artery forcep, whichever was easier to hold the stone. The stone was pulled out of renal pelvis and kept near to the ureter. The ureteric stent was placed and the pelvis was closed with absorbable 4-0 vicryl suture (Fig. 4).

Cystoscope was inserted through the lower 5 mm port site and under evidence of cystoscope, the pelvic stone was removed through the 10 mm port incision site.

The patient was discharged on the 3rd or 4th day of surgery according to the condition of the patient. Drain was removed as soon as the drainage became minimal (<20 mL). Stiches were removed on the 10th postoperative day of the surgery (Fig. 5) X-ray KUB and ultrasound KUB were done to rule out retained stone postoperatively. All the patients were followed up for 6 months, initially at 15 days and thereafter 1 month and then at 3 and 6 months. At the end of the study, the data were collected and analyzed using appropriate statistical methods. The p-value ≤ 0.05 was taken as the cutoff point for statistical significance.

OBSERVATIONS AND RESULTS

The average age of patients in the RPL group was 37.1 ± 12.29 years and average age in the OP group was 46.66 ± 10.39 years. Male to female ratio was 2.33:1.

From Table 1, in group I, 112 (40%) of the cases were completed within 61 to 70 minutes and 140 cases (50%) were completed in >70 minutes. Hence, it was found that the maximum number of cases [140 (50%)] were completed in >70 minutes. Whereas in group II, similarly,

Table 1: Time taken for completion taken for completion of whole procedure (operative time)

	Group I		Group II	
Time (minutes)	*No. of patients*	*Percentage*	*No. of patients*	*Percentage*
30–40	0	0	8	3.33
41–50	0	0	48	16.66
51–60	28	10	112	40
61–70	112	40	65	23.33
>70	140	50	48	16.66

112 (40%) of the cases were completed within 51 to 60 minutes and 65 cases (23.33%) took 61 to 70 minutes; hence, most of the cases, i.e., 112 (40%), were completed within 51 to 60 minutes. Only eight cases took less than 40 minutes. The mean operative time for group I for completion of whole procedure was 75.33 ± 16.90 minutes and in group II, the mean time was 65.83 ± 12.35 minutes. Mean operative time was more in LPL group as compared with OP group, with significant difference at <0.001.

Table 2 shows perioperative and postoperative data of study population. Similarly, estimated blood loss ($p < 0.001$) and blood transfusion ($p > 0.05$, NS) needs were found to be less in LPL group as compared with OP group.

With regard to immediate complications noted in both the groups, 8 patients presented with intraoperative bleeding, 5 with stone migration, 10 with surgical emphysema, and 15 with difficulty in accessing renal pelvis; with regard to late complications, 5 patients reported with prolonged leak in group I, as compared with 8 patients of renal parenchymal injury, 8 each with bleeding and stone migration, 4 with difficulty in accessing renal pelvis, 8 with superficial wound infections and immediate complications, 4 with wound gapping, and 8 with prolonged leak in group II as shown in Table 3.

From Table 4, it is observed that total need of analgesia in terms of days (given in form of Inj diclofenac 75 mg im twice daily) was significantly less in group I as compared with group II, which were 2.23 with SD of 0.62 (339 ± 93 mg) and 5.36 with SD of 0.96 (804 ± 144 mg) respectively.

Table 3: Postoperative observations: Details of complications in both groups

	Complications	*RPL (n = 160)*	*Open (n = 120)*	*p-value*
Immediate	Renal parenchymal injury	0	8	0.150
	Ureteric injury	0	0	
	Bleeding	5	8	0.553
	Stone migration	5	8	0.553
	Surgical emphysema	10	0	0.150
	Difficulty in accessing renal pelvis	15	4	0.300
	Fever	0	0	
	Superficial wound infection	0	8	
Late	Wound gaping	0	4	0.150
	Prolonged leak	5	8	0.553
	Lumber hernia	0	0	

Table 2: Comparison of parameters between both groups

Procedure	*LPL*	*Open*	*p-value*	*Exact p-value*
Mean Operative Time (min)	79.33 ± 16.90	61.83 ± 12.35	<0.001	0.0001
Estimated Blood Loss (mL)	40.7 ± 20.9	100.4 ± 50.8	<0.001	0.0001
Blood Transfusion (%)	0	2	>0.05	0.150

DISCUSSION

Patloo et al[5] concluded that RPL for renal pelvic calculi is superior to open surgery because of the significantly reduced hospital stay, cost-effectiveness, and better cosmetic outcomes of the patients. Although the reduction in analgesia requirement and blood loss is not statistically significant, laparoscopic surgery is better than open surgery. Wang et al[6] studied the effectiveness and safety of LPL and PCNL as surgical management for solitary renal pelvic calculi larger than 2 cm. Patients managed with laparoscopy have more advantages, such as less blood loss, less postoperative pain and fever, a lower incidence of infection, and a higher stone-free rate. Sensitivity analysis indicated that all results were the same except that the stone-free rate showed no significant difference between the two groups. They concluded that LPL and PCNL were effective and safe for large renal pelvic calculi, but LPL seems to be more advantageous.

Haggag et al[7] investigated whether LPL could be used to manage large renal pelvic stones, generally considered excellent indications for PCNL. They included two groups with large renal pelvic stones 2.5 cm or greater. Group I included 40 patients treated by PNL and group II included 10 patients treated by LPL. There was a statistically significant difference between the groups regarding mean estimated blood loss (65 ± 12.25 *vs* 180 ± 20.74 mL), mean hospital stay (2.3 ± 0.64 *vs* 3.7 ± 1.4 days), rate of postoperative blood transfusion (0 *vs* 4.8%), and stone-free rate (80 *vs* 78.6%). The mean operative time

Table 4: Postoperative analgesia required in both groups

	LPL	*Open*	*p-value*	*Exact p-value*
Postoperative Analgesia (days)	2.23 ± 0.62	5.36 ± 0.96	<0.001	0.0001
Postoperative analgesia (mg) (Inj. Diclofenac 150 mg per day)	339 ± 93	804 ± 144	<0.001	0.0001

was significantly longer in group II (LPL)[13] (1 ± 22.11 *vs* 51.19 ± 24.39 minutes). They concluded PNL is the standard treatment in most cases of renal pelvic stones; LPL is another feasible surgical technique for patients with large renal pelvic stones.

Qin et al[8] assessed a retroperitoneal laparoscopic technique for treatment of complex renal stones. Seventy-five patients, including 53 men and 22 women with a mean age of 47.8 years, underwent retroperitoneal laparoscopy. They completed the procedure successfully in 73 cases, while 2 cases were converted to open surgery. The operative time was 85 to 190 minutes with a mean of 96 minutes. After the operation, seven patients experienced urinary leakage. They concluded that the procedure is safe for sparing the nephron, less bleeding, short hospitalization, and quick postoperative recovery.

Agarwal[9] compared the safety, efficacy, and outcomes of LPL with PCNL for the management of a single large (>2.0 cm) renal pelvic calculus. It included two groups: Group I included 18 patients treated by LPL and group II included 20 patients treated by PNL. The mean stone size in the LPL and PNL groups was 3.7 and 3.90 cm^2 respectively. There was one conversion to open surgery in the LPL group. There was no residual stone and no need of blood transfusion in the postoperative period in both groups. They concluded that retroperitoneoscopic pyelolithotomy (RPPL) was associated with longer operating time, more invasive and less cosmetics; required more analgesia; and had more blood loss as compared with PNL.

In a study conducted by Patloo et al[5] to compare RLP with OP, mean operative time was significantly less ($p < 0.001$) in the open group than in the laparoscopic group (74.83 *vs* 94.43 minutes). In a study by Yanev et al,[10] mean operative time for laparoscopic surgery was 88 minutes. In Farooq Qadri et al's study,[11] mean operative time for laparoscopic surgery was found to be 88 minutes. Leonardo et al[12] found that the mean operative time in laparoscopic surgery group patients was 85 minutes. Karami et al[13] found mean operative time of 82 minutes for laparoscopic surgery. Mean operation time was 85.48±15.11 minutes. Except for one stone migration and one conversion to open surgery, all the ureteral stones were extracted laparoscopically (94% success rate).[14] In our study, the mean duration of surgery in group I was 79 minutes (with SD of 16.90) and in group II, it was 61.83 minutes (with SD of 12.35). These results were statistically significant with approximate (approx.) difference of 18 minutes (Table 5).

In group I, pyelotomy closure time and DJ insertion time were 5.2 minutes (with SD of 4.3) and 9.8 (with SD of 4.3) respectively. In group II, pyelotomy closure time and DJ insertion time were 5.2 minutes (with SD of 4.3) and 9.8 (with SD of 4.3) respectively. It was found that pyelotomy closure time was more in group I as compared with group II, and time taken for DJ stent insertion was also more in group I as compared with group II.

Table 5: Comparison in mean operative time in various studies

Various studies	*Mean operative time for laparoscopic procedure (min)*
Yanev et al[10]	88
Qadri et al[11]	88
Leonardo et al[12]	85
Karami et al[13]	82
Nasseh et al[14]	85.5
Qin C et al[8]	96
Patloo et al[5]	74.83
Present study	79 ± 16.90

Estimated Blood Loss

In a study conducted by Patloo et al[5] to compare RLP with OP, the mean blood loss was less in the laparoscopic group than in the open group (73 *vs* 103 mL). Qin et al[8] found average estimated blood loss in their study to be 80 mL in a study of laparoscopic retroperitoneal management of stone. Al-Hunayan et al[15] found average blood loss of 57.2 mL in their study of patients who underwent RLP. In our study, estimated blood loss was found to be 40.7 mL (with SD of 20.9 mL) in group I and 100.4 mL (with SD of 12.35 mL) in group II, and this difference of estimated blood was statistically significant. Blood transfusion was not required in any patient of group I, but required in two patients of open group (Table 6).

Goel et al[16] evaluated the role of RPPL for the management of renal pelvic calculus and its comparison with PCNL for solitary renal pelvic stone and found two conversions – one because of stone slippage and the other because of dense adhesions around the renal pelvis with conversion rate of 12.5%. Farooq Qadri et al[11] found a conversion rate of 2.4%; three patients were converted due to dense adhesion around the ureter. Agarwal[9] compared the safety, efficacy, and outcomes of laparoscopic pyelolithotomy (RPPL) with PCNL for the management of single large renal pelvic calculus (>2.0 cm). There was one conversion to open surgery in the RPPL group due to adhesions around the pelvis, and conversion rate was 5.55%. In the present study, 11 cases in the laparoscopic arm had to be converted to the open technique. Conversion rate was 6.67% (11 cases out of 160 cases

Table 6: Comparison of estimated blood loss in different studies

Studies	*Blood loss (mL)*
Qin C et al[15]	80
Al Hunayan et al[16]	57.2
Patloo et al[5]	73
Present study	40.7 ± 20.9

converted). There was failure to dissect the pelvis in both cases, and, hence, it was difficult to locate the site of calculus. Despite optimal port placement according to projected site of the calculus (from preoperative KUB X-ray and IVP), dissection was not possible and conversion was inevitable. On converting, the pelvis was found to be enveloped by peripelvic adhesions.

Chander et al[17] evaluated the role of RPPL in the management of renal calculi and found peritoneal rent in five cases, superficial wound infection in two cases, and prolonged leak in one patient. Yanev et al[10] in their study of retroperitoneal surgeries found subcutaneous emphysema in five cases (13.51%). Dongol et al[18] in their study for retroperitoneoscopic management of renal stones found three patients with peritoneal rent, two patients with port site superficial wound infection, and one patient with prolonged leak. In our study, with regard to immediate complications noted in both the groups, 8 patients presented with intraoperative bleeding, 5 with stone migration, 10 with surgical emphysema, 15 with difficulty in accessing renal pelvis; with regard to late complications, 5 patients reported with prolonged leak in group I as compared with 8 patients of renal parenchymal injury, 8 each with bleeding and stone migration, 4 with difficulty in accessing renal pelvis, 8 with superficial wound infections as immediate complication, 4 with wound gapping, and 8 with prolonged leak in group II (Table 3).

Agarwal[9] observed analgesia requirement in terms of days in a study conducted in laparoscopic group; it was 2.4 ± 0.9 days. In a study conducted by Chander et al,[17] analgesia required was 102 ± 47.7 mg of diclofenac. Haggag et al[7] found out in their study that postoperative analgesia requirement was 2.4 ± 0.9 days. In terms of postoperative analgesia requirement, it was observed that total need of analgesia in terms of days (given in form of Inj. diclofenac 75 mg im twice daily) was significantly less in group I as compared with group II, which was 2.23 (with SD of 0.62) and 5.36 (with SD of 0.96) respectively. In terms of dose of diclofenac required, it was found that significant difference was present in laparoscopic (339 ± 93 mg) and open (804 ± 144 mg) groups; analgesia required was less in the laparoscopic group.

Shamim and Iqbal[19] conducted studies in patients who underwent OP and found mean hospital stay of 5.37 days. Basiri et al,[20] in their study, found a similar hospital stay of 3.4 days in the RLP group of 30 patients. Ghanghoria et al[21] found that the mean hospital stay in the laparoscopic group was 4.4 days. Chander et al[17] evaluated the role of RPPL in the management of renal calculi and found an average hospital stay of 3.12 days. In this study, postoperative hospital stay was compared in both groups. The hospital stay in group I was 3.76 days (with SD of 1.55) and in group II, it was 5.36 days (with SD of 1.96).

CONCLUSION

In conclusion, we would like to state that among the two approaches, namely RPL and OP, RPL is a safe, simple, and effective minimally invasive procedure with fewer complications, less postoperative pain, better cosmesis, and a lesser hospital stay period. It can provide an alternative to OP in almost all the cases.

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