



A Comparative study between Retroperitoneoscopic pyelolithotomy and Percutaneous nephrolithotomy in the management of solitary large renal pelvic calculi

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Abstract

Background: Percutaneous nephrolithotomy (PCNL) is considered gold standard for single large renal pelvic calculi. In this laparoscopic era Retroperitoneoscopic pyelolithotomy (RP) can be considered in selected such patients. The purpose is to compare both modalities in patients with single large renal pelvic calculi.

Materials and Methods: Between September 2015 and February 2017, 80 patients with the diagnosis of solitary renal pelvic calculi of size >2 cm with extra renal pelvis were admitted. Out of which 40 patients underwent RP and 40 patients underwent PCNL. Demographic, preoperative, and postoperative data were collected compared between two groups.

Results: Demographics and mean stone size of two groups were similar. Mean drop in haemoglobin level was significantly lower in the RP (0.52 vs 1.32 g/dl). The mean postoperative hospital stay RP vs PCNL (5.28 vs 4.33 days) was almost similar. Although the operative time in RP group was significantly higher compared to PCNL group (159.13 vs 127.87 min), duration of last 10 cases of RP were similar to PCNL group. Blood transfusion rate (7.5% vs 27.5%), stone free rate (100 vs 92.5%) and postoperative fever rate (10 vs 22.5%) were significantly lower in RP group. None required ancillary procedure for residual fragments in RP group compared to 7.5% in PCNL group.

Conclusion: Retroperitoneoscopic pyelolithotomy can be considered as safe, effective and suitable alternative for conventional PCNL in patients with solitary large renal pelvic calculus with extra renal pelvis. It reduces the post operatively morbidity significantly compared to conventional PCNL.

Keywords: Retroperitoneoscopy, pyelolithotomy, PCNL, large renal calculus.

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) remains the gold standard procedure in the management of large

renal calculi. However the risk of certain intra operative and post operative complications viz hemorrhage, arteriovenous fistula and pseudo aneurysm still exist despite latest advances in

percutaneous approaches ^[1]. Another concern is the effect of PCNL in renal function. Based on most recent studies, the change in renal function after PCNL was not significant ^[2-5]. A study by Nouralizadeh *et al* showed immediate decline of renal function post PCNL and improvement after 72 hours ^[6]. Another study by Bilen CY *et al* showed significant deterioration in renal function post PCNL at earlier stages and slow improvement on long term in chronic kidney disease patients ^[7]. Hence the effect of renal function post PCNL needs to be further studied and clarified taking into account the patient's preoperative renal function also. Worldwide conventional PCNL is still used in majority of centers for the management of urolithiasis. Comparing conventional PCNL with other surgical treatment in this laparoscopic era wherever feasible may give an alternative option minimizing and ruling out the existing few complications. We compared both modalities viz Retroperitoneoscopic pyelolithotomy (RP) and Percutaneous nephrolithotomy (PCNL) in patients of large single renal pelvic calculi with extrarenal pelvis done in our centre.

MATERIALS AND METHODS

Study population

The study population included 40 patients who underwent RP and 40 patients who underwent PCNL during the period from September 2015 to February 2017. All patients had been diagnosed and confirmed preoperatively to have large single renal pelvic calculi more than 2 cm with extra renal pelvis based on imaging. All the cases were conducted in a single tertiary care centre by a single surgeon.

Methods

Basic demographic, clinical and radiological details were analyzed for the study population. Patients were subjected to thorough pre operative anesthetic check up and optimized for surgery. All Retroperitoneoscopic pyelolithotomy were performed using a four port balloon dissecting technique as previously described with modification

in retroperitoneal space creation alone. Under general anesthesia patient was placed in full flank position (as shown in figure 1). Camera port inserted using open technique and retroperitoneal space created using Gaur's balloon technique as described previously ^[8]. We used a custom made balloon using excised glove finger tied to suction catheter. We placed the custom made balloon in retroperitoneal space, inflated with 500 ml normal saline left in place for 10 minutes. Following camera port, other ports were serially inserted. Once renal pelvis and uretero-pelvic junction exposed, an incision was made on the renal pelvis, depending on the location and shape of the stone (as shown in figure 1). Stones were removed from renal pelvis using grasper and delivered via an Endobag (as shown in figure 2). After suction-irrigation of renal pelvis with normal saline, a double J ureteral stent was passed through renal pelvis to the bladder. Finally, pelvis was closed using a 4-0 absorbable polyglactin suture in a running fashion.

All the PCNL were performed by conventional technique as described below. Under general anaesthesia, in lithotomy position 6 French (F) ureteric catheter was inserted using a cystoscope. Then in prone position desired calyces were punctured using bulls eye method, under fluoroscopy guidance. Alkens dilator used for tract dilation up to 30 F and pneumatic lithotripter was applied to break the calculi. A 20 F nephrostomy tube was inserted into the calyceal system at the end of the surgery.

Perioperative management was carried out in similar fashion in both groups to facilitate better comparison. Third generation cephalosporin was used as prophylactic antibiotics. For Retroperitoneoscopic pyelolithotomy, drain was removed when the output was less than 30ml and Foleys catheter removal on post operative day 2. The ureteral stent was removed 4 weeks postoperatively. For PCNL, on third post operative day nephrostomy tube was removed and if no urinary leakage was observed at the site of surgery, ureteric catheter was also withdrawn on next day. Study parameters included were perioperative

outcomes like Stone size, Body mass index, Mean operative time, Post operative hospital stay, Drop in Haemoglobin level post operatively, requirement of blood transfusion, Incidence of post op fever, need of ancillary procedure like ESWL (Extracorporeal shockwave lithotripsy) for residual fragments. Success rate (Stone free rate) was defined as absent residual fragment or residual fragments less than 4mm on imaging on follow up. Patients were followed up clinically and radiologically after 4 weeks of surgery.

FIGURE 1: Incision in Renal Pelvis over the Stone



FIGURE 2: Stone Extraction Using Grasper



Statistical Analysis

Data was entered according to the variables onto spreadsheets of Microsoft Office Excel 2007 and the variables were analyzed using standard analytical techniques. The associations between study variables were analyzed using Chi-square test and student’s t test. ‘p’ values < 0.05 were considered significant.

RESULTS

Patient characteristics comparing Retroperitoneoscopic pyelolithotomy and PCNL were shown in Table 1. Mean patient ages were 42.25 years in Retroperitoneoscopic pyelolithotomy compared to 47.98 years in PCNL. Out of 40 patients 28 were

males and 12 were females in RP group. Out of 40 patients 34 were males and 6 were females in PCNL group. Out of 40 patients 14 had left sided disease and 26 had right sided disease in RP group. Out of 40 patients 23 had left sided disease and 17 had right sided disease in PCNL group. Mean patient BMI (Body Mass Index) was 26.73 in Retroperitoneoscopic pyelolithotomy compared to 26.05 in PCNL. Mean stone size was 2.48 cm in Retroperitoneoscopic pyelolithotomy compared to 2.68 cm in PCNL.

TABLE 1: Comparison of patient characteristics between Retroperitoneoscopic Pyelolithotomy (RP) group and Percutaneous nephrolithotomy (PCNL) group.

	RP group (n=40)	PCNL group(n=40)
Patient age-in years (mean ± Standard deviation)	42.25 ± 12.25	47.98 ± 11.45
Male/Female patients	28/12	34/6
Left/Right sided disease	14/26	23/17
BMI -Body Mass Index (mean ± Standard deviation)	26.73 ± 1.76	26.05 ± 2.17
Stone size -in cm (mean ± Standard deviation)	2.48 ± 0.59	2.68 ± 0.61

Perioperative data comparing Retroperitoneoscopic pyelolithotomy and PCNL were shown in Table 2. The mean operative time in Retroperitoneoscopic pyelolithotomy was 159 minutes compared to 127 minutes in PCNL. The mean drop in hemoglobin post operatively was 0.40 g/dl in Retroperitoneoscopic pyelolithotomy compared to 1.4 g/dl in PCNL. Post operative blood transfusion was required in 10% (4/40) of patients in PCNL compared to none in Retroperitoneoscopic pyelolithotomy. Incidence of post operative fever in Retroperitoneoscopic pyelolithotomy was 2.5% (1/40) compared to 12.5% (5/40) of patients in PCNL. The mean duration of hospital stay was 3.78 days in Retroperitoneoscopic pyelolithotomy compared to 4 days in PCNL. The mean analgesic requirement in terms of morphine equivalent doses was 28.43 mg in Retroperitoneoscopic pyelolithotomy compared to 24.81 mg in PCNL. The mean day of oral intake was 2.20 days in Retroperitoneoscopic pyelolithotomy compared to 2.10 days in PCNL. The mean day of ambulation

was 2.13 days in Retroperitoneoscopic pyelolithotomy compared to 1.55 days in PCNL. The success percentage was 100% in Retroperitoneoscopic pyelolithotomy compared to 95% (38/40) in PCNL. 2 patients out of 40 (5%) in PCNL group required ancillary procedure ie ESWL for the treatment of residual stone fragments, whereas none required any type of ancillary procedure in RP group. Success rate and need for ancillary procedure did not show statistically significant difference between the two groups. Incidence of post operative fever, duration of hospital stay and day of oral intake also did not showed statistically significant difference between two groups. Other perioperative data like operative time, drop in hemoglobin, blood transfusion requirement, analgesic requirement and day of ambulation showed statistically significant difference between Retroperitoneoscopic pyelolithotomy group and PCNL group ('p' values shown in Table 2).

TABLE 2: Comparison of perioperative outcome data between Retroperitoneoscopic Pyelolithotomy (RP) group and Percutaneous nephrolithotomy (PCNL) group.

	RP group	PCNL group	'p' value*
Operative time-in minutes (mean \pm SD)	159.43 \pm 19.86	127.23 \pm 19.29	< 0.001
Drop in Haemoglobin-in g/dl (mean \pm SD)	0.40 \pm 0.49	1.4 \pm 0.54	< 0.001
Blood transfusion requirement (in percentage)	0	10 (4/40)	0.04
Incidence of Post operative fever (in percentage)	2.5 (1/40)	12.5 (5/40)	0.09
Mean duration of hospital stay-in days (mean \pm SD)	3.78 \pm 0.80	4.00 \pm 0.59	0.15
Mean Analgesic requirement (mean \pm SD in terms of morphine equivalents-mg)	28.43 \pm 5.11	24.81 \pm 4.05	0.001
Mean day of Oral intake (mean \pm SD)	2.20 \pm 0.40	2.10 \pm 0.30	0.21
Mean day of Ambulation (mean \pm SD)	2.13 \pm 0.33	1.55 \pm 0.50	<0.001
Requirement of Ancillary procedure (in percentage)	0	5 (2/40)	0.152
Success rate(in percentage)	100 (40/40)	95 (38/40)	0.156

* 'p' values calculated using student's t test for quantitative variables and chi square test for qualitative variables -values less than 0.05 were taken as significant. SD- standard deviation

DISCUSSION

Various newer modalities of treatment are available in managing renal stones till date. PCNL, first described by Fernstrom et al in 1976 is an acceptable treatment across world for managing large renal stones of size more than 2 cm^{[9]; [10]}. Although rare PCNL has its own complications like hemorrhage, arteriovenous fistula and pseudo aneurysm which increases the post operatively morbidity significantly. Effect on renal function post PCNL is controversial in few studies^{[6];[7]}. Despite the latest advances in PCNL these complications still exist. In majority of the centers worldwide where the modified PCNL equipments are not available, conventional PCNL is the standard of care in managing urolithiasis.

In the current era of laparoscopy, based on various studies retroperitoneoscopic approach is preferred in treating various urological conditions^{[11];[12]}. Retroperitoneoscopic approach in the management of urolithiasis has several advantages like direct access to renal pelvis, less dissection, minimal blood loss, removal of stone intact, shorter convalescence, nil nephron damage and the morbid complications of PCNL are negligible. Retroperitoneoscopic approach has the disadvantages of long learning curve, less working space, limited field of vision and altered anatomical orientation of structures. In our center we routinely prefer retroperitoneoscopic approach in treating various conditions like pelvi-ureteric junction obstruction, ureterolithotomy, Retrocaval ureter etc. In our study, pre operative patient characteristics like age, BMI, side of stone, stone size were analyzed and did not show any statistically significant difference between RP group and PCNL group. This ensured the reliability in comparing the perioperative outcome between two arms. Regarding the operative time, PCNL took less duration with mean of 127 min compared to 159 min in RP group which was statistically significant in concordance with previous study by Meria *et al*^[9]. Operative time in RP group of our study was similar to various other studies^{[9]; [13]; [14]}. Even though the mean operative time was higher, the time taken for

last 10 cases in RP group was much shorter than initial 30 cases owing to the learning curve factor. Regarding the drop in hemoglobin post operatively, RP group showed significantly lower values compared to PCNL group. Lesser dissection due to proper selection of cases with extra renal pelvis, compression effect of Gaur's balloon technique for retroperitoneal space creation were the reasons for lesser blood loss in RP group. Recently evolved smaller caliber PCNL equipments cause less blood loss but this complication still exist which is negligible in case of Retroperitoneoscopic pyelolithotomy. In agreement with this, none required blood transfusion in RP group in our study compared to 10% (4/40) in PCNL group which was statistically significant. None of our cases in RP group were converted to open, as compared to previous studies of high conversion rate 20% and 12.5%^{[15]:[16]}. All 80 patients included in this study were cases with extra renal pelvis and ruled out any aberrant anatomy before randomization into groups. In our study, post operative hospital stay was similar between two groups (3.78 days versus 4 days) suggesting that the shorter convalescence in RP group was comparable to that of PCNL. Regarding post operative fever, RP group showed lower value of 2.5% (1/40), compared to 12.5% (5/40) in PCNL group in concordance with previous studies^{[17]:[18]}. Based on previous studies, post operative fever is the most common medical complication (23-25%) after PCNL due to various reasons like fragmentation of stone, injury to kidney, but documented infection was less^{[18]:[19]}. Although the mean analgesic requirement measured in terms of morphine equivalents was statistically low in PCNL group (24.81mg), the results were almost similar to RP group (28.43mg). The possible reason was the need of four ports in RP compared to single puncture in PCNL which caused less pain comparatively. Mean day of oral intake were almost similar in both groups. As both the procedure was performed in retroperitoneal space, post operative ileus delaying oral intake was not seen. Mean day of ambulation was statistically less in PCNL group compared to RP group (1.55 days versus 2.13 days).

Lesser pain of single puncture and suture less procedure in PCNL may be the possible reasons for the early ambulation. Although not statistically significant, none required ancillary procedure like ESWL in RP group after surgery as stone was removed intact. All patients were stone free on follow up in RP group compared to 95% (38/40) success rate in PCNL group. Disintegration of stone by lithotripter was the reason for lesser stone free rate as clearance of fragments completely may at sometimes difficult due to restricted field of vision in conventional PCNL. Success rate was higher in RP group as compared to PCNL group as the stone was removed intact and increasing learning curve based on another study by Adel Al-Hunayan *et al*^[11]. In our experience, each step in retroperitoneoscopic pyelolithotomy is getting evolved with increasing learning curve. With no injury to kidney, no intraperitoneal toileting, no muscle cutting incision, retroperitoneoscopic pyelolithotomy will significantly reduce to post operative morbidity compared to open surgery, transperitoneal laparoscopy or PCNL. Even though the need of four small incisions for ports in contrast to PCNL, it may be compromised considering the morbidity of conventional PCNL. However, proper selection of cases with extra renal pelvis is considered as determining factor for the success of the procedure. Based on previous study by Adel Al-Hunayan *et al*, RP can be considered as successful alternative in properly selected cases like single large renal pelvic stone with extra renal pelvis and without prior history of pyelonephritis or surgery^[17]. Similar study by Sinha R *et al* also supported the benefits of RP in selected uncomplicated renal pelvic stones^[15].

CONCLUSION

In high volume centers where retroperitoneoscopic approach for urological conditions are routinely practiced, Retroperitoneoscopic pyelolithotomy can be considered as safe, effective and suitable alternative for conventional PCNL in patients with solitary large renal pelvic calculus with extra renal pelvis. Retroperitoneoscopic pyelolithotomy reduces the post operatively morbidity significantly

compared to conventional PCNL. However multicenter prospective randomized trials need to be conducted to further strengthen the evidence.

Source of Support: Nil

Conflict of Interest: None declared.

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