**Original Article:**

**Retroperitoneal Laparoscopic Pyelolithotomy for Unilateral Large Sized Staghorn Renal Calculi**

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**Citation**

Submitted: Jan 18, 2021; Accepted: Jun 11, 2021; Published: Jun 30, 2021

**Abstract: Background:** The introduction of endourological procedures such as percutaneous nephrolithotomy and extracorporeal shock wave lithotripsy has led to a revolution in the management of nephrolithiasis. But in large sized staghorn calculi with branching, laparoscopic pyelolithotomy has a role and in recent years, retroperitoneal laparoscopic pyelolithotomy (RPPL) approach has been reported as a feasible alternative in various series. **Aims and Objectives:** To study the safety and efficacy of retroperitoneal laparoscopic pyelolithotomy (RPPL) in management of renal calculi bigger than 4 cm. **Methods:** This prospective study was conducted from January 2017 to June 2020 at the Department of Surgery, SKIMS Medical College, Bemina, Srinagar, Kashmir, India. The study included a total of 20 cases with the diagnosis of solitary renal pelvic calculi sized 4 cm and above. **Results:** There were 16 males and 4 females. The mean operative time was 107 min (range 86min-124 min) and the approximate mean blood loss was above 98.2 ml (range 74 ml – 144ml). Stone clearance was achieved in 18 cases and 2 cases were converted to the open procedure due to technical difficulties. **Conclusion:** Retroperitoneal laparoscopic pyelolithotomy (RPPL) is a safe, simple and feasible option that can be recommended for management of large sized staghorn renal calculi, if proper logistics and skilled personnel are available. **Key Words:** Retroperitoneal laparoscopic pyelolithotomy, Renal calculi, Nephrolithiasis, Percutaneous nephrolithotripsy, Extra corporeal shock wave lithotripsy.

**Introduction:**
In last three decades, significant advances in urologic surgery have established various minimally invasive surgical options for management of nephrolithiasis, based on the stone location and distribution [1-2] which include extracorporeal shockwave lithotripsy (ESWL), retrograde intrarenal surgery (RIRS), percutaneous nephrolithotomy (PCNL), Robotic pyelolithotomy (RP) Robotic anatrophic nephrolithotomy (RAN) and laparoscopic pyelolithotomy (LP).

The clearance rate of renal calculi relies on factors including the stone bulk, location, composition and collecting system anatomy and the complexity of stone distribution can sometimes be a hindrance for clearing stones in one session with the established techniques [3-4]. Several sessions may be required in such cases or else a combination of different methods may be required to completely clear the stones thereby incurring more expenditure and potentially more complications [5]. LP has been suggested as a viable approach for large renal stones with an excellent stone-free rate, and added advantage of being a single session management modality [6].

During the last two decades, the development of two approaches (transperitoneal/ retroperitoneal) has paralleled however, the retroperitoneal pyelolithotomy (RPPL) witnessed a steeper learning curve because of the constraint of the working space. This study presents the experience of management of large staghorn calculi with RPPL by a general surgical facility.

**Material and methods**
The study was conducted at the Department of Surgery, SKIMS Medical College, Bemina, Srinagar, Kashmir, India January 2017 to June 2020. The study included 20 cases of solitary staghorn renal calculi, with a male to female ratio 4:1 (male 16; female 1). The goals of the study and data usage were explained to the participants as per the ethical guidelines of Helsinki and proper informed consent was secured. The study was approved by the departmental academic and research committee. The exclusion criteria included the patients with recurrent stones, bleeding diathesis, pregnancy, and congenital anomalies that precluded retroperitoneoscopy. The collected data was analysed with Microsoft Excel -2016.

**Technique**
Surgery was conducted under general anaesthesia in all the cases. Under all aseptic precautions, the patients were placed in the standard kidney position. The first port was inserted just below the tip of the 12th rib through a 15-mm incision. The muscles and the dorsolumbar fascia were incised, the retroperitoneal space entered and dissection was carried out posterior to the kidney (Figure 1 C). Gerota’s fascia was breached and a balloon was inserted and inflated with air (approximately 500 mL) inside it. The balloon was kept inflated for 3 to 5 minutes to achieve hemostasis. A second 10-mm port was placed in the line of the first port above the iliac crest and a third 5-mm port was placed...
Staghorn renal calculi are a specific type of morphology that is branching into several or all of the calyces as shown in Figure 1 A. This approach provides full vision to the urinary tract, is easy to manage and prevents the leakage of urine into the peritoneum. The main problem however, in retroperitoneal approach is lesser working area, particularly at the stage of closure of pyelotomy incision. The pyelotomy is carried out through the second port after having performed CO2 insufflation until reaching 12 mm Hg tension. The pelvis was dissected and a pyelotomy incision made with a hook dissector by using monopolar cautery (Figure 1 D) and calculus extracted (Figure 1 E). DJ stent was inserted through the pyelotomy and negotiated through the ureter (Figure 1 F). The pyelotomy incision was closed back with by absorbable 4.0 - polyglactin 910 sutures (Figure 1 G). The pelvic stone was removed by the 12 mm port incision site (after stretching or else enlarging, if required (Figure 1 H). Ureteric stent was confirmed on X-Ray KUB on first postoperative day (Figure 1 I) and was extracted in outpatient clinic after 4-6 weeks.

The complications occurred in 3 out of 20 (15%) cases. 2 cases required conversion to open pyelolithotomy due to technical difficulties arising out of perirenal adhesions leading to non-progression of surgery for more than 30 minutes, thereby giving the success rate of 90%. In 1 patient (5%), there was an urinario tract infection in the postoperative phase which was managed conservatively. 18 out of 20 (90%) were satisfied with the overall procedure and the outcome. None of the patients required any blood transfusion. Ultrasonography was reviewed at 6 months follow-up in each case and no aggravating hydronephrosis or calculus was found.

Discussion
Nephrolithiasis is an important healthcare problem affecting adults and children [7]. Technical advances have improved the management strategies in recent decades. PCNL and ESWL have got established as first choice treatment options [8-9]. Staghorn renal calculi is a specific type of morphology that occupies a large portion of the collecting system filling the renal pelvis and branching into several or all of the calyces [10]. Staghorn renal calculi remain a challenge in urological practice and the goal of treatment is to inhibit recurrence, control infection-associated complications and protect patients' renal function. Laparoscopic retroperitoneal Pyelolithotomy (RLP) has emerged in recent years as an effective alternative for management of these calculi in adults as well as paediatric age group [11-14]. This approach provides full vision to the urinary tract, is easy to manage and prevents the leakage of urine into the peritoneum. The main problem however, in retroperitoneal approach is lesser working area, particularly at the stage of closure of pyelotomy incision. These disadvantages may be overcome by the surgeon’s refined skills and experience [15].

The results of our study corroborate with the results of similar studies in the literature. Shi et al in 2019 [16] managed 28 patients of unilateral staghorn renal stones with concurrent urinary tract infections by retroperitoneal laparoscopic pyelolithotomy without any conversion to open surgery but their mean calculus size was 3.3±0.79 cm as compared to the calculi size of 5.63 ±0.92 in our study. The mean operation time of 114.4±12.09 min was similar to 107±10.93 min achieved in this study though the post-operative hospital stay of 5.8±1.42 days was longer than the stay of 4.2 ±0.69 in this study. There was no requirement for blood transfusion in either of the study.

In literature technical aspects and potential complications have been mentioned in various series. The reported complications include inadvertent opening of the peritoneum, haemorrhage, prolonged urinary leakage, subcutaneous emphysema and...
superficial port site infections [15-17]. In our study we did not encounter any difficulty with the port site position, surgical emphysema nor any peritoneal tear though as mentioned above, two cases had to be opened due to technical difficulties in exposing pelvis of the kidney and one of the patients developed urinary tract infection. Retroperitoneal haemorrhage can be of either generalized ooze from the dissected peritoneum and parietes or from a specific operative site like the renal pelvis [18]. Keeping the balloon inflated for 3 to 5 minutes to achieve perfect homeostasis can easily control the first type of bleed as was applied in our study. The bleed from a specific operative site, can be minimized by precise knowledge of retroperitoneal anatomy and meticulous surgical technique [18]. In retroperitoneal approach, excess fat is a potential disadvantage due to its occupation of a major portion of otherwise confined retroperitoneal space, making dissection and retraction cumbersome though a moderate amount of fat may allow relatively easier dissection. The procedure requires the meticulous closure of the renal pelvotomy to decrease the morbidity related to prolonged drainage, hence, it is recommended that only the surgeons, who are well versed with laparoscopic knotting techniques, should perform this procedure [18]. Chander et al. [19] in another study evaluated the role of Double J ureteral stenting in retroperitoneal laparoscopic pyelolithotomy and found that D-J stenting and type of renal pelvis influenced the results, i.e., duration of drainage, analgesic requirement, and duration of stay, in patients undergoing RPPL. However, there was no significant difference in operative time, intraoperative blood loss, and postoperative complications. D-J stent group had significant increase in the rate of urinary tract infection postoperatively. RPPL has been compared with other established modes of management of renal calculi. Chander et al. [20] evaluated the role of RPPL and its comparison with extra corporeal shock wave lithotripsy in the management of renal calculi and found that the RPPL group showed better stone clearance, fewer hospital visits, low analgesic requirement, fewer number of man days lost, and early resumption of normal activities, as compared to the ESWL group. Goel and Hemal [21] evaluated the role of RPPL in comparison with PCNL for the management of renal pelvic calculus bigger than 3 cm and found PCNL to be better though they recommended that RPPL should be offered to those who need adjunctive procedure such as pyeloplasty or puncture during PCNL under vision. Xiao et al. [22] compared the perioperative and long-term outcomes of RPPL and PCNL for the treatment of staghorn calculi and concluded that PCNL remains the first-line treatment for most cases of staghorn calculi. Nevertheless, in some selected cases with the extrarenal and dilated pelvis, RPPL can be considered as an alternative management of staghorn calculus, which was associated with a high single-session stone-free rate, low rates of complications, and better functional preservation of the affected kidney. Al-Hunayan et al. [23] in a similar type of study concluded that RPPL is a suitable surgical technique for patients with large renal pelvic stones but with good selection of cases. The limitation of the present study is the small sample size and lack of comparison with a standard procedure as a reference (PCNL). However, when the results are analysed in the light of the recent literature, we believe that the results provide useful information on the role of RPPL.

Conclusion

Retroperitoneal laparoscopic pyelolithotomy is a safe, simple, and effective minimally invasive procedure with a potential to get established as a procedure of choice in a subset of nephrolithiasis with large, staghorn calculi.

Acknowledgements

The authors would like to thank all the participants for their contribution to the study. This research project did not receive any sort of grant from any funding agency in the public, commercial or not-for-profit sector nor is there any conflict of interests. Prof Ajaz A Rather have contributed to the data collection/data analysis and Dr Sajad Ahmad Salati has contributed by drafting of this article.

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