

# Retroperitoneal Pyelolithotomy for Management of Renal Calculi

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## ABSTRACT

**Objective:** We evaluated the role of retroperitoneoscopic pyelolithotomy in the management of renal calculi.

**Methods:** Fifty-six cases (male, 27; female, 29) of solitary or multiple renal calculi were evaluated in the study. There were 46 patients with a single calculus, 4 patients with a staghorn calculus, and 6 with a caliceal calculus. Retroperitoneoscopic pyelolithotomy was carried out after creating a retroperitoneal space with the balloon dissection method. Pneumoretroperitoneum was maintained by carbon dioxide insufflation.

**Results:** Stone clearance was achieved in all cases barring 2 cases of caliceal calculi that were converted to the open procedure. The postoperative hospital stay averaged 4 days. Patients were ambulatory within 24 hours and back to work within 7 days on average. Complications encountered were peritoneal rent, subcutaneous emphysema, and superficial wound infection. The postoperative analgesic requirement averaged 100 mg of diclofenac (2 tablets).

**Conclusions:** Retroperitoneoscopic pyelolithotomy is a safe, simple, and effective minimally invasive procedure and is a feasible option that can be recommended for management of renal calculi.

**Key Words:** Laparoscopy, Retroperitoneal pyelolithotomy, Renal calculi.

## INTRODUCTION

The last 2 decades have witnessed the development of minimally invasive treatment for urinary stones. With the advent of extracorporeal shock wave lithotripsy (ESWL), ureterorenoscopy (URS), and percutaneous nephrolithotomy (PCNL), the role of open surgery has shrunk considerably. The role of laparoscopy is established for the removal of nonfunctioning kidneys and small-sized renal tumors.<sup>1-5</sup> However, retroperitoneoscopic pyelolithotomy (RP) in the management of renal stones is yet to be evaluated, because very few centers throughout the world are performing this procedure. This study is an endeavor in this direction to evaluate the role of RP in the management of renal calculi.

## METHODS

The study was conducted at the Department of Surgery, Maulana Azad Medical College and associated Lok Nayak Hospital, New Delhi, India from January 2001 to February 2002. The study included 56 cases of solitary or multiple renal calculi, with a male to female ratio 1:1.07 (male, 27; female, 29). There were 46 patients with a single stone in the renal pelvis, 4 patients with staghorn calculi, and 6 patients with caliceal calculi. The average size of stones was 2.75 cm (range, 1.5 to 4 cm). Two patients had a bifid renal pelvis, and another had renal vessels and the pelvis lying in the same plane. The mean age of the patients was 33.74 years (range, 18 to 60 years). Patients with recurrent and residual stones, bleeding diathesis, pregnancy, and congenital anomalies that precluded retroperitoneoscopy were excluded from our study.

## Technique

Preoperatively, a double "J" ureteral stent was inserted in all patients under local anesthesia. Surgery was performed with all patients under general anesthesia. The patients were placed in the standard kidney position. The first port was inserted through a 15-mm incision made just below the tip of the 12th rib. The muscles were divided under vision, and the dorsolumbar fascia was incised and the retroperitoneal space entered. Blunt finger dissection was carried out posterior to the kidney. Wherever possible,

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Gerota's fascia was either incised under vision or breached with the fingertip. The balloon was inserted and inflated with air (approximately 500 mL) inside Gerota's fascia. The balloon was kept inflated for 3 to 5 minutes to achieve homeostasis. In cases where it was not possible to gain entry inside Gerota's fascia, the balloon was inflated posterior to the kidney; a 0° telescope was introduced through this port; and the peritoneum was further stripped off the transversalis fascia with counterpressure from the opposite side.

A second 10-mm port was placed in the line of the first port above the iliac crest. A third 5-mm port was placed anteriorly mid way between the first 2 ports in such a manner that the 3 ports formed an equilateral triangle. Secondary ports were inserted with finger guidance. A laparoscope was introduced through the first port after suitably tightening the incision around it. A 5-mm triflange retractor introduced through the third port was used to retract the kidney anteriorly. Dissection was carried out through the second port. We prefer to approach the pelvis directly; however, in cases where the pelvis is either not easily accessible or an aberrant vessel is present, the upper end of the ureter is exposed and traced upwards to the pelvis. The pelvis was dissected and a pyelotomy incision made with a hook dissector by using monopolar cautery. Gilvernet's plane was dissected wherever necessary to carry out the extended pyelolithotomy. A longitudinal pyelotomy incision was made in patients with a single calculus in the renal pelvis; however, in cases of extended pyelolithotomy, a curvilinear pyelotomy incision was made with extension of the incision into the appropriate calyx. After extraction of the calculus, the pyelotomy incision was closed meticulously with 3-0 Vicryl. The operated area was drained with a draining tube and the wound closed. The drain was removed when drainage was less than 25 mL/day. The double "J" ureteral stent was removed on an outpatient basis. Postoperatively, the kidneys, ureter, and bladder were x-rayed in all cases to confirm stone clearance.

## RESULTS

The average operating time was 81 minutes. In the first half of the patients, it was 94 minutes, and in the second half, it dropped to 69 minutes. Of the 56 patients who underwent RP, 47 had extrarenal pelvis while 7 patients had intrarenal pelvis, and 2 patients had total intrarenal pelvis. Blood loss varied from 15 mL to 60 mL with the average being 27 mL. No blood transfusion was required in any of the patients. The drainage ranged from 1200

mL/day to 50 mL/day. Average drainage was 164 mL/day in the first 48 hours. The drain removal ranged from 48 hours to 7 days. The drain was removed in the first 48 hours in 34 (61%) patients. The drain was removed whenever the drainage was less than 25 mL/day.

Overall, stone clearance occurred in 54 of the 56 patients (96.4%). It was 100% in cases of pelvic renal calculi, and 2 of 6 failures occurred in caliceal calculi. The postoperative analgesic requirement was less, and on average, the patients required 2 tablets of diclofenac sodium ( $100 \pm 75$  mg of diclofenac). The average duration of hospital stay was 4.3 days. Time taken to resume normal activities was  $1 \pm 0.3$  days, and the number of person-days lost was  $7.4 \pm 3.1$  days. Two patients had peritoneal rents while performing retroperitoneal balloon dissection. Three patients had balloon rupture while the retroperitoneal space was being created. There were no vascular, visceral, or neural complications during the course of the study. Two conversions to open pyelolithotomy were necessary due to nonprogression of surgery for more than 45 minutes; both were cases of caliceal calculi. Three patients developed subcutaneous emphysema, and 2 patients developed superficial wound infection of the port sites.

## DISCUSSION

The development of retroperitoneoscopic surgery including RP has been slow compared with that of transperitoneal laparoscopic surgery due to the inability to establish adequate pneumoretroperitoneum with direct introduction of a needle into the retroperitoneum. However, the advent of the balloon dissection technique by Gaur<sup>6</sup> in 1992 has opened new horizons in the field of retroperitoneoscopic surgery. Gaur et al<sup>7</sup> reported a small series of 8 cases of retroperitoneoscopic pyelolithotomy in 1994 with a success rate of 62%. Subsequently, Micali et al<sup>8</sup> in 1997 reported a series of 11 cases and Hemal et al<sup>9</sup> in 2001 reported a series of 7 cases with success rates of 90% and 71%, respectively. Of the 3 studies available for comparison, 2 adopted the retroperitoneal approach, and the third was done through the transperitoneal route<sup>7-9</sup> (**Table 1**). These studies had a small number of patients ranging from 7 to 11 with success rates varying from 62% to 90%. However, in the present study, the success rate is 96.4%, and the higher success rate could be because of the greater experience gained over time. In our study, success was 100% in pelvic calculi, and 2 failures occurred in caliceal calculi. Based on our experience so far, the procedure does not seem suitable for caliceal calculi unless the pelvicaliceal system is dilated. Moreover, at present,

**Table 1.**  
Comparative Study of Published Series on Retroperitoneoscopic Pyelolithotomy

Series	Approach	No. of Patients	Age Range (Years)	M/F	Success	Operating Time (Minutes)	Blood Loss (mL)
Gaur et al <sup>7</sup>	Retroperitoneal	8	22–65	6:2	5 (62%)	120	15
Micali et al <sup>8</sup>	Transperitoneal	11	22–75	—	10 (90%)	249	132.9
Hemal et al <sup>9</sup>	Retroperitoneal	7	21–55*	5:2	5 (71%)	108.2	127.2

\*Mean=37.5

suitable instruments are also not available for extraction of caliceal calculi. Though we did not use any flexible endoscopes in this study, we believe that use of flexible endoscopes through the operating ports will help in localization and extraction of caliceal calculi. Average operating time in other series ranged from 108 minutes to 249 minutes, which is substantially higher than that in our series (81 minutes). Blood loss in our study was 27 mL, which is comparable to that of other series, where it ranged from 15 mL to 132.9 mL. The time taken to resume normal activities was  $1 \pm 0.3$  days, which was very encouraging, and the number of person-days lost was only  $7.4 \pm 3.1$  days.

In the present era, ESWL is the preferred method of treating kidney stones smaller than 3 cm. Although the procedure is noninvasive, shock waves often induce acute and occasionally chronic lesion to kidneys and other organs, and sequelae may include hypertension and loss of renal function. In a study by Eterovic et al,<sup>10</sup> it was shown that while open pyelolithotomy from day one continuously improves renal function, ESWL first decreases it and then over a period of months at best brings it back to the pretreatment level. These reports suggest that retroperitoneal laparoscopic pyelolithotomy, having procedural similarity to open pyelolithotomy, is not only nephron-sparing but also nephron-reviving and, consequently, could eventually become accepted as the procedure of choice in select patients with renal calculus disease.

Renal stones larger than 3 cm often require multiple ESWL or PCNL sessions, or both, with adjuvant endoscopic procedures and exposure to ionizing radiation in PCNL. Even after this, some patients may not be completely stone free. RP can make these patients completely stone free in a single sitting with the added advantage of not being invasive to kidneys. However, this difference between RP and other procedures is more pronounced when either the stone is large or multiple calculi are present. Retroperitoneoscopic pyelolithotomy can also be used in staghorn

calculi, and the patient becomes stone free in a single sitting as compared with percutaneous nephrolithotomy, which requires multiple sittings, exposing the patient to ionizing radiation.<sup>11</sup> Another advantage is that many auxiliary procedures like pyeloplasty and ureteric surgeries can be carried out in the same sitting.<sup>12</sup>

For patients with ectopic kidney, the results of ESWL are only moderately successful and PCNL is difficult; RP is a viable alternative in such situations. Various authors<sup>13,14</sup> have reported the laparoscopic approach for renal stones in patients with ectopically located kidney because the results of other minimally invasive techniques are only moderately successful. A history of previous open surgery on the kidneys is a relative contraindication, though we did not include any patient with previous surgery in our study.

A large number of patients with renal calculus disease in the developing countries are still being treated by an open operative procedure, as either the modern minimally invasive modalities are not available or they are beyond their access due to economical reasons. RP can be considered an economically viable minimally invasive technique for these patients in developing countries like India.

RP has a steep learning curve because of the relative absence of landmarks and the paucity of space, which makes this surgery difficult for beginners. The only constant landmark is the psoas muscle, but for surgeons experienced in open renal surgery, the learning curve is definitively shorter. Despite the learning curve, no significant complications occurred in this study. There is always a paucity of space in retroperitoneoscopic surgery, and Gaur et al<sup>7</sup> reported the “striking of handle” and “cross sword effect” due to it. However, in our study, we did not encounter such a problem due to judicious and strategic placement of ports. We feel the placement of ports in a triangular manner obviates this problem. Contrary to this, Gaur et al placed all the ports in a single line, which could

have resulted in the aforementioned problem. In this study, Gilvernet's plane was dissected in 10 cases. It is easier to dissect Gilvernet's plane in RP compared to in open surgery because the laparoscope offers a direct view of the renal sinus with excellent anatomical display of all the structures, which is often not possible with the naked eye.

In this series, the only significant complications were peritoneal rent, subcutaneous emphysema, and superficial wound infection. But the peritoneal rent did not create much difficulty in dissection and the progression of surgery. All 3 patients who had peritoneal rent were thin and emaciated. Therefore, the peritoneum was adherent firmly to the psoas sheath; and in the absence of a fat cushion, the peritoneum and the psoas sheath were not easily separable, thereby leading to peritoneal rent due to forced separation. In emaciated and small-sized patients, the balloon should not be inflated to full size, which often leads to peritoneal rent. It was observed that inflation of the balloon to 400 mL prevented peritoneal rent in such cases. Excess fat is a disadvantage in RP, as it occupies a major portion of otherwise confined space, leaving little room for dissection and retraction. Also, it leads to bleeding during dissection, but a moderate amount of fat was found suitable as peritoneum could be separated easily and dissection was relatively easier. It is advantageous to insert the balloon inside Gerota's fascia and posterior to the kidney, so that only the posterior half of Gerota's fascia and perinephric fat are stripped off. The anterior half of fascia is kept adherent to the kidney, which helps in keeping the kidney in a relatively fixed position. Following creation of pneumoretroperitoneum, kidney 'hangs up' with the posterior half exposed, thereby requiring a minimal retraction.

Subcutaneous emphysema could be another major problem in RP. In our study, this complication was kept to a minimum with the use of the Tristar port (Ethicon Endo-Surgery, Inc., Cincinnati, OH), which has a conical sleeve with a flange around the port that tightly fits into the primary incision and thereby prevents leakage of carbon dioxide gas into parietes. Bleeding in the retroperitoneum can be of either generalized ooze from the dissected peritoneum and parietis or from a specific operative site like the renal pelvis. Keeping the balloon inflated for 3 to 5 minutes to achieve perfect homeostasis can easily control the first type of bleed. The second type of bleed, that is the bleed from a specific operative site, can be minimized by precise knowledge of retroperitoneal anatomy and meticulous dissection.

It is necessary to place the double "J" ureteral stent pre-operatively as it is very difficult to insert the stent from the ports intraoperatively due to the paucity of space and continuous leakage of gas. When this occurs, the procedure becomes very cumbersome. Also, the double "J" ureteral stent acts as a guide and helps the surgeon to localize the stone. To decrease the morbidity related to prolonged drainage, meticulous closure of the renal pelvis should be carried out. Therefore, it is recommended that surgeons, who are well versed with intracorporeal knotting techniques, should perform this procedure.

The mean total analgesic requirement for RP is  $100 \pm 75$  mg of diclofenac, which is equivalent to 2 tablets of diclofenac. However, in a parallel study conducted by us, the difference was significant when compared with that of ESWL, where the mean total requirement of diclofenac was  $1000 \pm 600$  mg. This difference is highly significant and can be explained by the fact that passage of stone fragments causes ureteric colic requiring round-the-clock analgesic cover for several days after ESWL. The number of hospital visits in patients undergoing RP was  $2.7 \pm 0.5$ . This is significant, as the patients managed with ESWL required multiple visits to the hospital ( $4.5 \pm 2.8$ )

## CONCLUSION

RP is a safe, simple, and effective minimally invasive procedure and is an exciting option for management of renal calculi. It has potential to replace PCNL/ESWL as a procedure of choice in a subset of patients with staghorn, large, and multiple calculi. Although at present, it seems relatively unsuitable for caliceal calculi, with more experience and the availability of better hand instruments, even caliceal calculi may become equally amenable to this procedure.

## References:

1. Doublet JD, Barreto HS, Degremont AC, Gattegno B, Thibault P. Retroperitoneal nephrectomy: comparison of laparoscopy with open surgery. *World J Surg.* 1996;20:713–716.
2. Rassweiler JJ, Henkel TO, Stock C, et al. Retroperitoneal laparoscopic nephrectomy and other procedures in the upper retroperitoneum using a balloon dissection technique. *Eur Urol.* 1998;33(5):489–496.
3. Uno Y, Katoh N, Kinukawa T, Matsura O, Ohshima S. Laparoscopic nephrectomy via the retroperitoneal approach. *J Urol.* 1996;156:1101–1104.
4. Clayman RV, Kavoussi LR, McDougall EM, et al. Laparo-

- scopic nephrectomy: a review of 16 cases. *Surg Laparosc Endosc.* 1992;2(1):29–34.
5. Gill IS, Schweizer D, Hobart GM, Surg GT, Klein EA, Norvick AC. Retroperitoneal laparoscopic radical nephrectomy: the Cleveland experience. *J Urol.* 2000;163:1685–1670.
  6. Gaur DD. Laparoscopic operative retroperitoneoscopy: use of new device. *J Urol.* 1992;148:1137–1139.
  7. Gaur DD, Agarwal DK, Purohit KC, Darshne AS. Retroperitoneal laparoscopic pyelolithotomy. *J Urol.* 1994;151(4):927–929.
  8. Micali S, Moore RG, Averch TD, et al. The role of laparoscopy in the management of renal and ureteric calculi. *J Urol.* 1997;157:463–466.
  9. Hemal AK, Goel A, Kumar M, Gupta NP. Evaluation of laparoscopic retroperitoneal surgery in urinary stone disease. *J Endourol.* 2001;15(7):701–705.
  10. Eterovic D, Juretic-Kuscic L, Capkun V, Dujie Z. Pyelolithotomy improves while extracorporeal lithotripsy impairs kidney function. *J Urol.* 1999;161:39–44.
  11. Gaur DD, Trivedi S, Prabhudesai MR, Gopichand M. Retroperitoneal laparoscopic pyelolithotomy for staghorn calculus. *J Laparoendosc Adv Surg Tech A.* 2002;12(4):299–303.
  12. Ramakumar S, Lancini V, Chan DY, Parsons JK, Kavoussi LR, Jarrett TW. Laparoscopic pyeloplasty with concomitant pyelolithotomy. *J Urol.* 2002;167(3):1378–1380.
  13. Harmon WJ, Kleer E, Segura JW. Laparoscopic pyelolithotomy for calculus removal in a pelvic kidney. *J Urol.* 1996;155:2019–2020.
  14. Valdivia-Uria JG, Abrill Baquero G, Monzon Alegesque F, et al. Laparoscopic management of complex lithiasis in horse shoe kidneys [in Spanish]. *Actas Urol Esp.* 1994;18(suppl):346–350.