



Laparoscopic Retro-peritoneal Surgery in the Management of Upper Ureteric and Renal Pelvic Stones: An Evaluation from a Teaching Institute from North India

**Mushtaq Chalkoo^{1*}, Zahid Mohd Rather¹, Awhad Mueed Yousuf²,
Syed Shakeeb Arsalan², Zubair Gul Lone² and Aabid Rasool Bhat²**

¹Department of Surgery, Government Medical College, Srinagar, J&K, India.

²Government Medical College, Srinagar, J&K, India.

Authors' contributions

This work was carried out in collaboration between all authors. Author MC operated all the cases, designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author ZMR managed the analyses of the study. Rest of the authors managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2018/40665

Editor(s):

(1) Dean Markic, Assistant Professor, Department of Urology, University Hospital Rijeka, Croatia.

Reviewers:

(1) Manickam Ramalingam, PSG Institute of Medical Sciences, India.

(2) Nicola Basso, University of Rome-Sapienza, Italy.

(3) Rachna Wadhwa, Dr. Baba Saheb Ambedkar Hospital, India.

(4) Einar Ambjörnsson, Lund University, Sweden.

(5) Justin Mboloko Esimo, University of Kinshasa, Congo.

Complete Peer review History: <http://www.sciencedomain.org/review-history/24424>

Original Research Article

Received 21st February 2018

Accepted 27th April 2018

Published 3rd May 2018

ABSTRACT

Background: The purpose of the study of laparoscopic retro-peritoneal surgery in the management of upper ureteric and renal pelvic stones was to evaluate the safety and efficacy of this recommended technique and to investigate that minimal invasive surgery is an alternative method in the current era of endoscopic procedures.

Aims and Objectives: The current study was aimed to share our experience with laparoscopic retro-peritoneal approach for the management of upper ureteric and renal pelvic stones in the face

*Corresponding author: E-mail: mushtaq_chalkoo@rediffmail.com;

of non availability of Extra-corporeal shock wave lithotripsy (ESWL) Percutaneous nephrolithotomy (PCNL) and Uretrorenoscopy. The observed data was evaluated vis-a-vis the patient profile with respect to age, sex and presenting side, complications, operative time, time to resumption of oral intake, postoperative hospital stay, convalescence, wound infection and Conversion to open technique.

Materials and Methods: The study was under taken in our teaching institute in the Post Graduate Department of General and Minimal Access Surgery in a Medical College setting. The study was completed in a span of 5 years from Feb. 2012 to Feb. 2017. A total of 120 patients were enrolled in the study, admitted directly from our outpatient department. The evaluation and assessment of all these patients was done on the Out patient basis with reference to their indication and suitability for laparoscopic retro-peritoneal modality of treatment.

Results: The study revealed the promising results with reference to the observations made. An analysis of the data collected over the period of 5 years of these patients showed that the majority of our patients were males i.e 85(70.8%) and rest 35(29.16%) patients were females. Interestingly patients in the age range of 3rd to 4th decade reported with stone disease. The study sample was divided into two groups. Group A comprised of the patients who underwent Laparoscopic pyelolithotomy (N=72) and Group B underwent Laparoscopic ureterolithotomy (N=48). Around 69 (57.5%) cases presented with right sided involvement and 51 (42.5%) left side involvement. The operative time calculated on an average was 80.6 minutes (range 60-120 minutes) for pyelolithotomy and 70 minutes (range 50-90 minutes) for ureterolithotomy. The post operative stay on an average was 2.1 days (range 2-7 days) in the ureterolithotomy group and 2.4 days (range 3-11 days) in the pyelolithotomy group. The conversion rate in our study due to one or other problem was more for ureterolithotomy group (4 case=8.3 %) than for pyelolithotomy group (5 case=6.9%).

Conclusion: We recommend that laparoscopic retro-peritoneal technique is an excellent tool in the hands of an expert laparoscopic surgeon especially for stones that are not amenable to endoscopic procedures and shock wave therapy. It may also score an edge over the circumstances where either the endoscopic facilities are not available or the patient is not fit for them.

Keywords: Laparoscopy; retro-peritoneum; ureter; kidney; stones.

1. INTRODUCTION

Laparoscopic surgery has revolutionized the surgical treatment of many disorders like gall stone diseases, colorectal surgery and hernias. It has also invaded the domain of urology with excellent results. Urolithiasis is a very common surgical entity and its management is rapidly changing with the evolution of new gadgets and new techniques [1]. The formation of renal calculi in the upper urinary tract is a common surgical problem and is prevalent globally. The life time incidence of urolithiasis is up to 15 % in males and 8% in females with a yearly incidence of around 131 per 100,000. The life time recurrence rate in patients with known urolithiasis approaches 50%. Even today most of these patients are still handled by surgeons [2]. The management of urinary stones has evolved primarily from open surgical approach to many various minimally invasive options. Endoscopic procedures like ureteroscopy, percutaneous stone removal and retrograde intra-renal surgery supplanted with shock wave lithotripsy have taken a lead in the management of urolithiasis as

the procedures of first choice [3]. Open surgery is becoming obsolete day by day, however, it is important to mention there are still indications, where open surgery may prove promising results, where ESWL or Endo-urologic methods fail or in situations where simultaneous reconstructive treatment of other urinary tract pathologies is required. Laparoscopic surgery has emerged as an alternative tool to handle the kidney stone disease. The patients who are otherwise candidates for open surgery constitute the target population that may benefit from laparoscopic surgery in reducing morbidity and hastening recovery. Laparoscopic ureterolithotomy is gaining popularity for the management of upper ureteric stones especially if the stone is big or may require many endoscopic procedures and ESWL sessions. With the increase in the size of stone, the chance of clearance decreases and the need for multiple session increases. ESWL is found to be suitable for managing ureteric stones of <1 cm. Laparoscopic ureterolithotomy is good for stones which cannot be accessed ureteroscopically or cannot be fragmented [4,5,6] Laparoscopic pyelolithotomy is an excellent

alternative for the stones that are > 3 cm in size but unfortunately there are no defined guide lines as the indications are concerned. The decision to perform laparoscopic pyelolithotomy is based on the experience of the laparoscopic surgeon. A dilated extra renal pelvis with a big stone is suitable for laparoscopic approach.

2. MATERIALS AND METHODS

The study titled “Laparoscopic Retro-peritoneal Surgery in the management of upper ureteric and renal pelvic stones: An evaluation from a teaching institute from North India” Was undertaken in the Post Graduate Department of General Surgery and Minimal Access Surgery from a teaching institute from north India. The study was completed in 5 years time period from Feb 2012 to Feb. 2017. A total of 120 patients were enrolled in the study. It was prospective observational study. *The approval from ethical committee was obtained, signed and informed consent was obtained from all the patients. Patients presenting with symptomatic renal pelvic stones and upper ureteric stones were included in the study. The diagnosis was established by ultra sound, KUB, IVU and CT Urography in some patients (Figs. 1 and 2). Patients with multiple stones, bilateral stones, calyceal stones and patients having purely intra renal pelvis on IVU, having previous retro-peritoneal surgery and those unfit for

general anesthesia were excluded from the study.

The study sample was divided in to two groups. Group A underwent laparoscopic pyelolithotomy (LP group A) and group B underwent Laparoscopic ureterolithotomy(LU group B). The study sample of patients was evaluated by detailed history, thorough general physical examination, and focused systemic examination and by metabolic profile. Informed consent was taken from all patients after explaining various available modalities of treatment with their potential benefits and possible risks. The patients were kept fasting over night and morning KUB was advised in all patients before surgery. All patients received a prophylactic dose of injection of ceftriaxone 1 gm 1 hour before surgery.

3. OPERATIVE TECHNIQUE

The patient having pelvic renal calculus or the upper ureteric stone were managed by the standard technique of 3 ports. After positioning; the first port was made distal and anterior to the 12th rib in mid axillary line by designing 1.5 cm incision. The balloon dissection was used in some patients and in others, finger dissection to develop the space. The other 2 ports 5 mm and 5/10 mm were made either finger guided or video guided. The Hassan's cannula was fixed in the camera port and secured with 2 -0 vicryl sutures to avoid gas leak. Two 5 mm ports were created anterior and lateral to this 10 mm optical port.



Fig. 1. KUB and IVP of patient showing stone In pelvis of right kidney

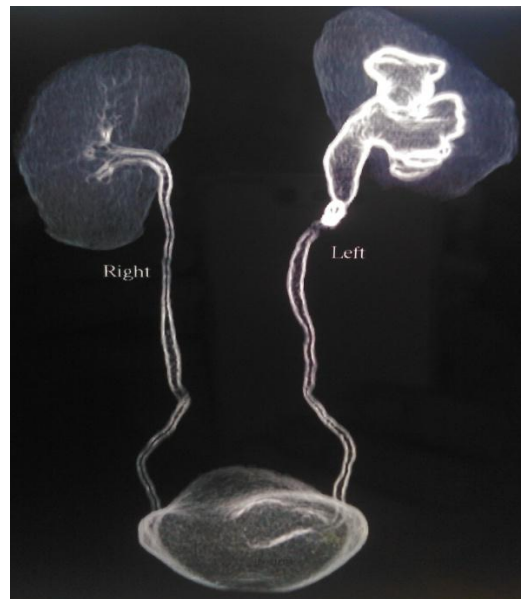


Fig. 2. CT-urography of patient showing stone in Left upper ureter

However the 5 mm port made 5 cm above and anterior to the anterior ileac spine was changed to 10 mm port in most of patients of laparoscopic pyelolithotomy as gauze insertion and a big stone removal becomes feasible through 10 mm port. In patients undergoing laparoscopic pyelolithotomy the kidney was identified first by splitting the perinephric fat and to localize the renal pelvis. The pelvic fat was cleared by either harmonics or mono polar cautery to expose the pelvis. In some patients we required an accessory port of 5 mm which was designed at 5 cm above and anterior to the optical port. This port was helpful to hold the kidney up and facilitate the removal of stone by other 2 working ports. The pyelotomy was made either by using harmonic ace, mono-polar hook or by Endo knife. The stone was identified and negotiated out of the pelvis by 2 working ports. The flushing was done either by using the feeding tube within the kidney or by the suction tip. A double J pig tail stent was used in all patients undergoing pyelolithotomy and ureterolithotomy. The upper end of stent was put in to the renal calyceal system. The pyelotomy wound was closed by vicryl. A 28 drain was put in all patients. The Psoas muscle was identified and the ureter located along its medial boarder. The ureterotomy was made. The flushing was done. The DJ stent was put by same technique as described for the pyelolithotomy. The ureterotomy was closed by vicryl. The stones were removed through the 10 mm working port using stone scoop forceps (Figs. 3 to 9). On the

1st postoperative period a plain X-Ray KUB was performed to check the status of stent and any residual stone bit left over. The catheter was removed early in ureterolithotomy group and little late in the pyelolithotomy group. The catheter was always removed first followed by drain. The patients were discharged usually between 3 to 7 days postoperatively. The patients were advised to come for follow up and removal of DJ stent was done usually after 6 weeks.

4. RESULTS

The prospective analytic observational study of, "Laparoscopic Retro-Peritoneal Surgery in the management of upper ureteric and renal pelvic stones: An evaluation from a teaching institute from North India" was carried out in the post graduate department of General and minimal access surgery Government medical College from Feb 2012 to Feb 2017. A total number of 120 patients were evaluated with reference to aims and objectives mentioned by analyzing the collected data from them. Two groups were designed; Group A was the group of patients who underwent laparoscopic pyelolithotomy(72 cases) and Group B underwent Laparoscopic ureterolithotomy (48 cases). The age of patients ranged from 20–70 years with mean age 36 years. Majority of patients were in the age range of 30 -40 years. The study reflected that males were mostly affected; 70.8% and females 29.16% (Table 1).



Fig. 3. Pelvis with stone identification

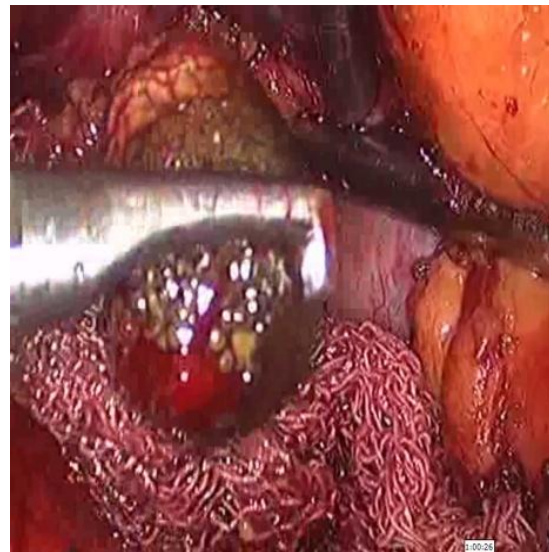


Fig. 4. Stone retrieved from pelvis

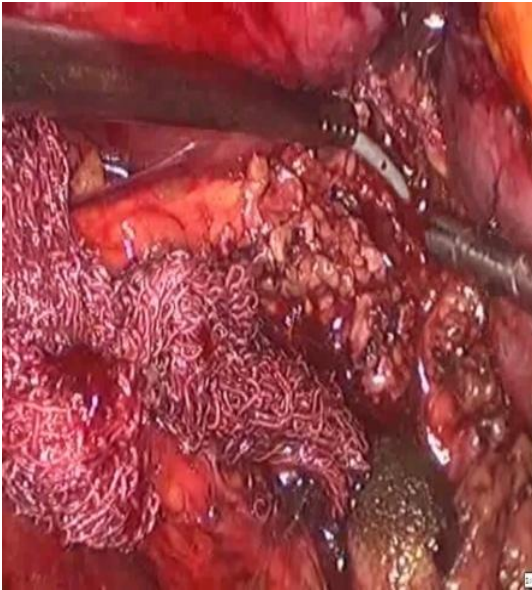


Fig. 5. Placing DJ stent

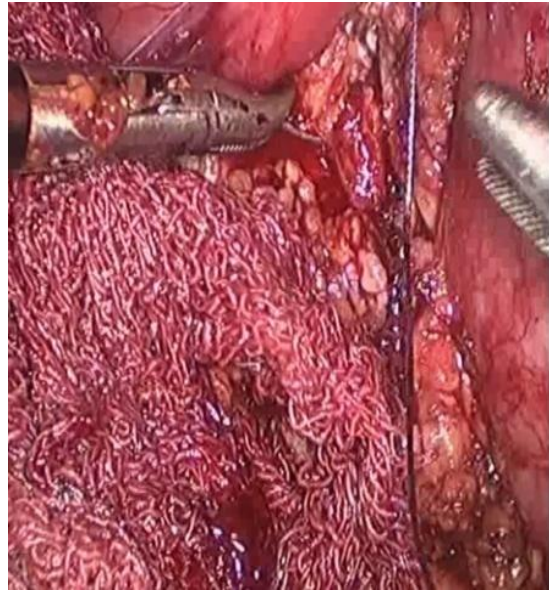


Fig. 6. Closure of pyelolithotomy

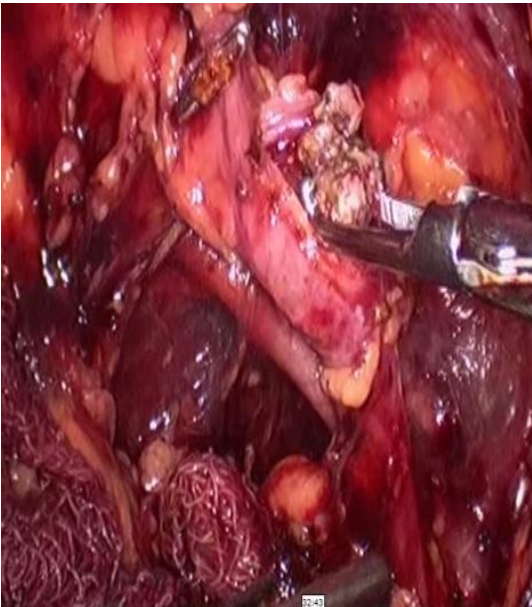


Fig. 7. Retrieving of stone from ureter

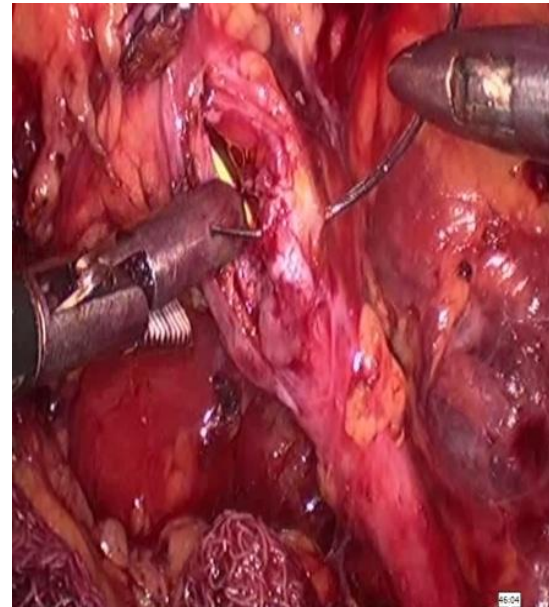


Fig. 8. Closure of uretrotoomy

Majority of patients showed right side involvement with the observation that 55.55% of pyelolithotomy were performed on right side in Group A patients while as ureterolithotomy to the tune of 60.4% belonged to the right side in group B patients (Table 2).

Fortunately there were not much complications encountered in either group. The complications

faced were inability to create space, bleeding, conversion to open, stone migration, urinary leakage, wound infection, sepsis and stent migration. The various complications and their percentage are depicted in Table 3.

However the analysis of study sample also revealed various observations mentioned in Table 4.



Fig. 9. Laparoscopic retroperitoneal port position

Table 1. Demographic profile

Age in Years	Pyelolithotomy (Group A) N=72		Ureterolithotomy (Group B) N=48		Study sample N=120 M=85 (70.8%) F=35 (29.16%)
	Male(M) N=50	Female(F) N=22	Male(M) N=35	Female(F) N=13	
≤20	3	0	2	0	5(4.16%)
21-30	9	4	9	3	25(20.8%)
31-40	21	9	13	5	48(40%)
41-50	8	4	5	2	19(15.8%)
51-60	6	3	5	3	17(14.16%)
>60	3	2	1	0	6(5%)

Table 2. Pre-operative data

Stone location	Pyelolithotomy (Group A) N=72	Ureterolithotomy(Group B) N=48	Study sample N=120
Right	40 (55.55%)	29 (60.4%)	69(57.5%)
Left	32 (44.44%)	19 (39.58%)	51 (42.5%)

Table 3. Peri and postoperative complications of the study sample

Complications	Reteroperitoneal procedures		Study sample N=120
	Pyelolithotomy (Group A) N=72	Ureterolithotomy (Group B) N=48	
Inability to create retro-peritoneal space	4(5.5%)	3(6.25%)	7 (5.83%)
Bleeding	3 (4.16%)	3(6.25%)	6 (5%)
Injury to peritoneum	2(2.77%)	1(2.08%)	3(2.7%)
Transfusion	0(0%)	0(0%)	0(0%)
Major Vessel Injury	0(0%)	0(0%)	0(0%)
Conversion to open	5 (6.9%)	4(8.3%)	9 (7.5%)
Stone migration	0(0 %)	1(2%)	1(0.8%)
Urinary leakage	4(5.5%)	1(2.08%)	5(4.16%)
Port Infection	5(6.9%)	2(4.16%)	7(5.8%)
Sepsis	5(6.9%)	1(2.08%)	6(5%)
Stent migration	1(1.38%)	0 (0%)	1(0.8%)

Table 4. Analysis of other variables of the study sample

Variable	Retroperitoneal procedures	
	Pyelolithotomy (Group A) N=72	Ureterolithotomy (Group B) N=48
Operative Time, Min	80.6(60-120)	70(50-90)
Mean Blood Loss, ml	70.4 (25-100)	82.5 (30-120)
Resumption to Orals intake, Days	1.4 (1-3)	1.2(1-2)
Removal of Foleys Catheter, Days	2.1(2-10)	1.2(1-6)
Removal of Drain, Days	2.2(3-11)	1.6(1-7)
Hospital Stay, Days	2.4(3-11)	2.1(2-7)
Stone Clearance	70(97.2%)	47(97.9%)

The operative time was higher in Group A patients undergoing Pyelolithotomy showing a mean value of 80.6 mints while as in Group B the mean time of surgery was 70 minutes. Interesting to note was that the blood loss in the Group A 70.4 ml and 65 ml in Group B. Pyelolithotomy group tolerated oral intake little later than the Ureterolithotomy group which ranged from 1.4 and 1.2 days an average mean respectively. The catheter was removed first in both groups followed by removal of drain. In Group A the catheter was removed on an average mean of 2.1 days and in Group B 1.2 days. While as drain was removed 2.2 days in group A and 1.6 days in Group B. The hospital stay was 2.4 and 2.1 days in Group A and Group B respectively. To check for the residual stones and the stone clearance was not aim of the study however the X-Ray KUB done on the 1st postoperative day showed that 117 patients (97.5%) were stone free.

5. DISCUSSION

The kidney stone disease makes a majority of our day to day admissions for surgical management. The recommended techniques and their guidelines have been already formulated. The endoscopic procedures take a lead in the management of urinary tract calculi. However over the last few decades no surgical technique has generated as much of excitement and enthusiasm among the surgeons as has interventional laparoscopy. The Gaur's technique made the creation of space easy. The retroperitoneal laparoscopic surgery for renal and ureteric stones was only possible when the idea of retro-peritoneal peri-visceral space creation was conceptualized by the pioneers of this technique. Trans-peritoneal laparoscopic approach for renal pelvic and upper ureteric stones has not gained much popularity as it has its own associated problems. Laparoscopic trans-peritoneal approach for renal calculi disease, though difficult yet is an excellent

alternative technique in situations where endoscopic facilities are not available or skilled personnel for Endo-urological procedures are lacking [7]. Laparoscopic retroperitoneal management of renal calculi disease and upper ureteric stones are the procedures of choice in a selected group of patients where the stone cannot be accessed ureteroscopically or where stones cannot be fragmented. Laparoscopic pyelolithotomy and ureterolithotomy are also considered economically viable, minimally invasive techniques for this subset of patients especially in developing like ours. However it demands a steep learning curve and should be performed by a skilled surgeon.

Currently, most of the renal pelvic calculi are treated with Extra-corporeal shock wave lithotripsy and Percutaneous nephrolithotomy in developed countries [8]. Since the use of E.S.W.L and ureteroscopy for the management of ureteric calculi, the routine use of open surgical approach has almost become obsolete in developed countries. The practice of open surgical technique is still in vogue in many third world countries even in India. It is agreed that large ureteric calculi pose significant difficulty for Endo-urological techniques usually requiring several endoscopic procedures as well as many ESWL sessions. ESWL is suitable for managing ureteric stones of less than 1 cm in size. With the increase in stone size the chances of stone clearance decreases and the need for multiple sessions increases which together tells upon the patient compliances and adds cost to the treatment [9].

The study with 120 patients presenting with renal pelvic and upper ureteric stones and performed laparoscopic retroperitoneal pyelolithotomy and ureterolithotomy on all of them depending on the location of the stone accordingly. There was the significant learning curve in our performance and took us more than 10 cases initially to grasp the

technique. The analysis of our series showed that males were predominantly involved in the renal calculi disease and majority of them reported in the third and fourth decade [10] [Table 1]. The data was also evaluated and found that the presentation of stone and the location was predominantly on the right side 57.5% and 42.5% on the left side [11]. Table 2. In the first few cases we had difficulty in creating the retroperitoneal space which led to the conversion to open technique. With the progress gradually during learning curve this problem was solved subsequently. The reasons for our conversion to open were mostly due to tear in the peritoneum resulting in the collapse of space and occasionally for bleeding and migration of stone. Study didn't encounter any major vessel injury thereby no transfusions were required in any patient. The conversion rate in our study was 6.9% and 8.3% in laparoscopic pyelolithotomy and laparoscopic ureterolithotomy respectively. Various series in the literature reflect a conversion rate of less than 10% [12,13]. In one (0.8%) of our patients undergoing laparoscopic ureterolithotomy, we encountered the migration of stone up in to the dilated pelvic calyceal system and this patient was converted to open managed thereof. Subsequently it was learned that in upper ureteric stones one should always hold the proximal dilated ureter above the stone with a soft non traumatic grasper before making ureterotomy. The study conducted by Selcuk Sahin et al. [14] reported higher stone migration rate (11%) as compared to our study. We routinely stented all patients undergoing pyelolithotomy and ureterolithotomy and sutured pyelotomy and ureterotomy with vicryl 4-0 in all patients. This helped us to reduce the prolonged urinary leakage in the post operative period which otherwise increases the morbidity and the hospital stay; though it will increase operative time. However it is agreed that patients undergoing pyelolithotomy may still develop prolonged urinary leakage as it was noticed in 5 (4.16%) patients. This was probably in patients where it was difficult to close the pelvis and ureter water tight. Though port infection is mentioned in many series but our study didn't encounter much of this complication, possibly all the patients were stented and closure was routinely done with a good antibiotic usage in a pre and post operative period. It was found in 7 cases (5.8%). These patients were managed by culture sensitivity specific antibiotics and daily dressing. Sepsis is part of any surgical procedure and was encountered in 6 cases (5%), possibly due to urinary tract infection or prolonged surgery in

these cases which might also be due to port infection. The technique of stenting was practiced meticulously in all patients however in one patient (0.8%) the stent had curled in the lower ureter. It didn't pose any post operative problem but needed Ureteroscope after balloon dilatation of the lower ureter in the third post operative week by the urologist [Table 3].

The evaluation of the mean operative time for either procedures in Group A (LP) was 80.6 minutes (range 60-120 mins) and in Group B (LU) it was 70 minutes (range 50-90 mins). The operative time decreased with experience. It is less in comparison to the study done by Gaur et al. showing a mean operative time of 120 mins. Micalli et al. [15] reported an operative time ranging from 153-395 mins (mean operative time 249 mins). Hemal et al. [16] reported time ranging from 55-240 mins (mean operative time 108.2 mins). It is important to mention that one has to be skilled in the technique of port making, establishing a space, localizing the pelvis and ureter, stent insertion and intra corporeal suturing. In our series all patients were done by single surgeon skilled in the advanced laparoscopic procedures. The blood loss is a part of all surgical procedures but fortunately, there was a negligible blood loss amounting to mean of 70.4 ml (range 25-100 ml) in laparoscopic pyelolithotomy and 82.5 ml (range 30-120 ml) in laparoscopic ureterolithotomy. D.K. Nigam et al. reported mean blood loss of 63.8 in pyelolithotomy and 72.5 in ureterolithotomy. While as study conducted by Gaur et al. has a mean blood loss of 25 ml (range 5-100 ml). Mean start of oral feeds in our study was 1.4 days in LP and 1.2 days in LU after surgery. However it was a standard practice to promote oral sips in majority of patients of our series in 1st post operative day. The Foleys catheter was removed first and drained was removed next. After removal of catheter the patients drain output was observed for more than 12 hours. If it would not increase to more than 50 ml the drain was removed. Average duration of removal of Foleys catheter 2.1 days in LP and 1.2 days in LU while as mean duration of removal of the drain was 2.2 and 1.2 days in LP and LU respectively. It is important to mention that the patients who had prolonged urinary leakage were discharged from the hospital with an advice to report back after the drain output would substantially would decreased. Urinary loss of 2-20% is reported in the literature [17,18]. Mean hospital stay of our study was 2.4(3-11) and 2.1(2-7) days in LP and LU group respectively. The study also noticed a

short hospital stay in possibly because of using stents and closing pyelotomy and ureterotomy in all patients. Satisfaction was observed with the stone clearance though it was not an aim of the study, as we didn't have a prolonged follow-up of these patients. All patients had to undergo an X-Ray KUB in the first post operative period to access the status of the stent and any residual stone left over. It was noticed from the data that we achieved stone clearance to the tune of 97.2% in LP and 97.9% in LU [Table 4]. Chandreret al. [19] reported that the RPPL group showed better stone clearance, fewer hospital visits, low analgesic requirement, fewer number of mandays lost, and early resumption of normal activities, as compared to the SWL group.

6. CONCLUSION

We conclude from our study that Endoscopic management takes a lead in the management of urinary calculi disease. Laparoscopic management of urolithiasis is an excellent alternative in a setup where the facilities vis-a-vis the gadgets and skilled persons for endourological procedures are lacking. Laparoscopic management of stone disease is also a suitable alternative wherever the stones don't suit to an endoscopic procedures or shock wave therapy. It is also a cost effective technique especially in patients who need repeated endoscopic procedures to handle the stone load especially in developing countries like ours. Laparoscopy also avoids exposure to repeated radiation and removes the stone as a whole in a single sitting with the best stone clearance. Laparoscopy retains all benefits of minimal access techniques. However, Laparoscopic ureterolithotomy and pyelolithotomy need a long learning curve and should be performed by a skilled surgeon.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. James S, Darren JK, Ohad S, Christopher L. Urolithiasis- Ten things every general practitioner should know. *Urology*. 2017; 46:648-652.
2. Qingfeng H, Weihong D, Yuancheng G, Yafaat H, Ke X, et al. Retroperitoneal laparoscopic ureterolithotomy for proximal ureteral calculi in selected patients. *Scientific World Journal*. 2014; 687876:1-8.
3. Michael SB, James EL. The role of open and laparoscopic stone surgery in the modern era of endourology. *Nat Rev Urol*. 2015; 12:392-400.
4. Feyaerts A, Rietbergen J, Navarra S, Vallancien G, Guillonneau B. Laparoscopic ureterolithotomy for ureteral calculi. *Eur Urol*. 2001; 40:609-13.
5. Gaur DD, Trivedi S, Prabhudesai MR, Madhusudhana HR, Gopichand M. Laparoscopic ureterolithotomy: Technical considerations and long-term follow-up. *BJU Int*. 2002; 89:339-43.
6. Wolf Jr JS. Treatment selection and outcomes: ureteral calculi. *Urol Clin North Am* 2007; 34:421-30.
7. Patloo AM, Sarmast AH, Khan MA, Khan MA, Zaz M, Khan MA, et al. Laparoscopic retroperitoneal pyelolithotomy and open pyelolithotomy: A comparative study. *Turkish Journal of Urology*. 2012; 38:195-200.
8. Wignall GR, Canales BK, Denstedt JD, Monga M. Minimally invasive approaches to upper urinary tract urolithiasis. *Urol Clin North Am*. 2008; 35:441-454. DOI: 10.1016/j.ucl.2008.05.004
9. Park H, Park M, Park T. Two experience with ureteral stones. Extracorporeal shockwave lithotripsy Vs Ureteroscopy manipulation. *J endourol*. 1998; 12:501-4.
10. Nigam DK, Rajesh. Laparoscopic stone surgery for renal and ureteric stones: An evaluation. *International Surgery Journal*. 2016; 3(2):821-824.
11. Selcuk Sahin, Bekir Aras, Mithat Eksi, et al. Laparoscopic ureterolithotomy. *Journal of the Society of Laparoendoscopic Surgeons*. 2016; 20(1):2016.00004.
12. Harewood LM, Webb DR, Pope AJ. Laparoscopic ureterolithotomy: The results of an initial series, and an evaluation of its role in the management of ureteric calculi. *Br J Urol*. 1994; 74:170-6.
13. Keeley FX, Gialas I, Pillai M, Chrisofos M, Tolley DA. Laparoscopic ureterolithotomy:

- The Edinburgh experience. *BJU Int.* 1999;84:765-9.
14. Mohamed Gad El-Moula, Adel Abdallah, Fathy El-Anany, Yaser Abdelsalam, Ahmad Abolyosr, Daaa Abdelhameed, et al. Laparoscopic ureterolithotomy: our experience with 74 cases. *Int J Urol.* 2008;15:593-7.
 15. Micalli S, Moore RG, Averch TD. The role of laparoscopy in the management of renal and ureteric calculi. *J. Urol.* 1997;157:463-6.
 16. Hemal AK, Wadhwa SN, Kumar M, Gupta NP. Transperitoneal and retroperitoneal nephrectomy for giant hydronephrosis. *J. Urol.* 1999;162:35-9.
 17. Flasko T, Holman E, Kovacs G, Tallai B, Toth C, Salah MA. Laparoscopic ureterolithotomy: The method of choice in selected cases. *J Laparoendosc Adv Surg Tech A.* 2005;15:149-52.
 18. El-Feel A, Abouel-Fettouh H, Abdel-Hakim AM. Laparoscopic transperitoneal ureterolithotomy. *J Endourol.* 2007;21:50-4.
 19. Chander J, Gupta N, Lal P, Lal P, Ramteke VK. Retroperitoneal laparoscopic pyelolithotomy versus extra corporeal shock-wave lithotripsy for management of renal stones. *Journal of Minimal Access Surgery.* 2010;6(4):106-10.

© 2018 Chalkoo et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<http://www.sciencedomain.org/review-history/24424>