Original Article

Retroperitoneoscopic nephrectomy for benign nonfunctioning kidneys: Training and outcome

Yusuf Saifee, Ramya Nagarajan, Syed Javed Qadri, Amlan Sarmah, Suresh Kumar, Bipin Chandra Pal, Pranjal Modi

Department of Urology and Renal Transplantation, Smt. Gulabben Rasiklal Doshi and Smt. Kamlaben Mafatlal Mehta Institute of Kidney Diseases and Research Centre and Dr. H. L. Trivedi Institute of Transplantation Sciences, Civil Hospital Campus, Ahmedabad, Gujarat, India

ABSTRACT

Introduction: Between the two techniques of laparoscopic nephrectomy, retroperitoneoscopy has certain distinct advantages over transperitoneal access but may be a more difficult technique to learn. We present our experience of training novices in retroperitoneoscopic nephrectomy with a good outcome, making it a standard of care for nephrectomy at our institute.
Methods: The aim of this study was to report the initial experience, learning curve, and outcome of retroperitoneoscopic nephrectomy by novices under a mentored approach. The series included four novice urologists. The data from the initial forty retroperitoneoscopic nephrectomies performed by each of them were reviewed.
To assess the learning curve for retroperitoneoscopic nephrectomy, we studied changes in key operative parameters (operative time, blood loss, complications, nonprogression by novices, conversion rate) as a function of the case number.
Results: Retroperitoneoscopic nephrectomies were successfully completed by novices in 88.1% (141/160) of the patients. Nine cases (5.6%) required the mentor's help because of nonprogression, and ten cases (6%) required conversion to open nephrectomy. The median operative time of all surgeons decreased with increased surgical experience. There was some intersurgeon variation in the learning curve ranging from 10 to 30 cases, but all surgeons showed a significant reduction in operative time across consecutive sets of ten cases. Seven cases required mentor help in the initial series (7/80) and only two in later half of cases (2/80). All minor complications were also significantly less in the later series.
Conclusions: The present series represents the effectiveness of training in retroperitoneoscopic nephrectomy of novices by a responsible team and with the standard protocol and surgical steps. Through effective mentoring, the steep learning curve associated with retroperitoneoscopic nephrectomy has been overcome, making it standard of care for nephrectomy at our institute.

Key words: Benign nonfunctioning kidney, learning curve, retroperitoneoscopic nephrectomy

For correspondence: Dr. Yusuf Saifee,
Department of Urology and Renal Transplantation, Room No. 106, Smt. Gulabben Rasiklal Doshi and Smt. Kamlaben Mafatlal Mehta Institute of Kidney Diseases and Research Centre and Dr. H. L. Trivedi Institute of Transplantation Sciences, Civil Hospital Campus, Asarwa, Ahmedabad - 380 016, Gujarat, India.
E-mail: yusuf.saifee@gmail.com

Access this article online

Quick Response Code:

Website: www.indianjurol.com

DOI: 10.4103/0970-1591.189724

INTRODUCTION

The first laparoscopic nephrectomy was performed by Clayman in 1990 through the transperitoneal route.[1] Retroperitoneoscopic nephrectomy, although first reported in 1969, did not become popular until Gaur's demonstration of

How to cite this article: Saifee Y, Nagarajan R, Qadri SJ, Sarmah A, Kumar S, Pal BC, *et al*. Retroperitoneoscopic nephrectomy for benign nonfunctioning kidneys: Training and outcome. Indian J Urol 2016;32:301-5.

the elegant technique of atraumatic balloon dissection of the retroperitoneum.[2,3] With all the advantages of maintaining an extraperitoneal surgical field, and with prompt access to the great vessels and renal vasculature, retroperitoneoscopic nephrectomy provides excellent outcomes with minimal morbidity.[4-6] We present our experience of training novice urologists in retroperitoneoscopic nephrectomy.

METHODS

The aim of this study was to report the initial experience, learning curve and outcome of retroperitoneoscopic nephrectomy by novices under a mentored approach. The series included four novice urologists (two chief residents and two recently qualified consultants). All surgeons including junior consultants had insignificant prior laparoscopic experience. They had only assisted in some transperitoneal laparoscopic nephrectomy (<10 cases) during their residency and had never assisted/performed retroperitoneoscopic nephrectomy. The data from the forty retroperitoneoscopic nephrectomies performed by each of them (total 160 cases) between May 2013 and August 2015 were reviewed after permission from all surgeons. To assess the learning curve for retroperitoneoscopic nephrectomy, we studied changes in key operative parameters (operative time, blood loss, complications, nonprogression by novices, conversion rate) as a function of the case number.

All patients who underwent nephrectomy for nonfunctioning and very poorly functioning (creatinine clearance <10 mL/min) kidney secondary to various benign diseases were included in the study. Patients with pyonephrosis (thick pus through percutaneous nephrostomy [PCN] drainage), genitourinary tuberculosis, xanthogranulomatous pyelonephritis (on imaging), autosomal dominant polycystic kidney disease, history of open renal surgery were excluded from the study. All these conditions lead to significant scarring and leads to increased operative difficulty, therefore these were not operated by novices. High-risk patients due to poor cardiopulmonary reserve were also not included. These patients were operated either by experienced surgeons or by open nephrectomy as indicated.

All collected data entered into the SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp S version nd analysis was performed. Independent *t*-test has been used to calculate statistically significant value, i.e. *P* value.

Training approach

During the implementation of retroperitoneoscopic nephrectomy at our institution, we adopted an approach that we hoped would allow us to minimize the morbidity associated with the learning curve. For all novice surgeons, we use a standardized protocol that includes an initial phase of observation and assistance to the mentor for 9–12 months in retroperitoneoscopic donor and simple nephrectomy (20–30 cases), followed by operating independently under the supervision of a mentor. In this phase, the novice surgeon was made familiar with the basics of retroperitoneoscopy through theoretical as well as practical knowledge of the procedure. This incorporated everything from patient positioning to wound closure, with continual interactive teaching by the mentor. Teaching included patient positioning, selection of instrumentation, appropriate surgeon and camera assistant positioning, the steps to achieve retroperitoneal access, techniques to obtain optimal clear vision, instrument manipulation, and advice on how to achieve dexterity throughout the surgery.

Standard steps of surgery were followed which includes three port insertion after retroperitoneal dissection, ureter identification, hilar dissection, and kidney mobilization. We believe that familiarity with technique and standard steps enhance efficiency during retroperitoneoscopic surgery and has the potential to shorten the duration of the learning curve.

After this training, the surgeons operated independently. Mentors were available for supervision during technical difficulty. Operating surgeon was assisted by fellow resident, junior consultant or an experienced nursing staff.

Retroperitoneoscopic nephrectomy was performed by the standard technique. The patient was placed in the lateral flank position. The primary port was placed using a 1.5 cm incision below the 12th rib at mid axillary line, deepened down to the thoracolumbar fascia. A retroperitoneal space was created using an indigenous balloon (tying the finger of a glove over a K-90 catheter) and inflating it with saline up to 500–700 mL. Two secondary ports were inserted under laparoscopic vision. Second port (10 mm) at renal angle, at least 3 finger breadths distant from first port and third port (5 mm) 3 finger breadths anterior to first port, forming a straight line with the other ports. After port insertion, standard surgical steps in sequence followed, ureter identification→hilar vessel dissection and division→kidney mobilization.

We evaluated and compared key operative parameters such as operative time, complications and conversions for each novice surgeon and the number of cases taken to reach proficiency.

RESULTS

This series had total 160 patients, 40 cases by each surgeon. Patient characteristics and preoperative details are described in Table 1. The most common cause for nonfunctioning kidney was stone disease followed by pelviureteric junction obstruction. Other causes were ureteral strictures, vesicoureteral reflux, obstructed megaureter, renal dysplasia, renovascular hypertension, etc. Some of the patients had a PCN placed 4–6 weeks before nephrectomy for infected hydronephrosis or to assess the salvageability of the kidney. Since the creatinine clearance

did not improve (<10 mL/min), these patients underwent retroperitoneoscopic nephrectomy.

Operative parameters and complication are shown in Table 2. Retroperitoneoscopic nephrectomy was successfully completed by novices in 88.1% (141/160) of the patients. Nine cases (5.6%) required mentor help because of non progression and ten cases (6%) required conversion to open nephrectomy.

The reasons for conversion were mainly elective, secondary to adhesions (in nine cases), only one emergency due to inferior vena cava (IVC) tear (one case). Two cases had severe adhesions and inability to identify the vascular structures safely. These were converted early in the surgery by the standard 11th rib excision approach. The remaining seven patients required open conversion late in the surgery. Here, hilar dissection was done, and the renal vessels were secured, but safe kidney removal was difficult due to adhesion to vital structures: Duodenum, IVC, etc. Hence, kidney removal was done by joining 2 or sometimes all 3 ports. These incisions were small and subcostal.

There was only one major complication (Clavien grade IIIB) recorded. There was an IVC injury during hilar dissection of right side nephrectomy which required conversion to open surgery for repair of the IVC rent. The most common minor complications (Clavien grade I) were peritoneal rent in 27 patients (16.8%), which was managed by inserting a veress needle into the peritoneum to reduce the intraperitoneal pressure. Puncture and spillage of renal contents occurred in 11 (6.8%) patients. All these had hydronephrotic kidneys with thinned out parenchyma. The retroperitoneoscopic approach has an advantage in such patients and prevents contamination of the peritoneal cavity. Subcutaneous emphysema developed in 15 patients (9.3%), but in none of the patients was it significant enough to cause hypercarbia or necessitate conversion. Only one case with IVC injury required blood transfusion; the rest had minimal blood loss was very low (20–60 ml) and therefore did not require transfusion.

For self-evaluation, we compared the initial twenty cases of all surgeons with their next twenty cases. All surgeons had a significant reduction in operative time by as much as 60 min. It was found to be statistically significant. Furthermore, comparing ten consecutive cases of each surgeon, there was some intersurgeon variation in the learning curve. It was found that for half of surgeons (surgeon A and D), median operative time reduced significantly by 40 min approximately (from 200 to 160 min) after first twenty cases, while operative time of one surgeon (surgeon B) stabilized rapidly after first ten case, another surgeon (surgeon C) took thirty cases. However importantly, all surgeons showed a progressive reduction in the median operative time across consecutive sets of ten cases [Graph 1]. Furthermore, some variability in operative time persisted and a few cases of all surgeons, even in the last sets of patients, had very long operative time. This may be because no two nephrectomies were ever the same and operative time was influenced by operative complexity because of inflammatory adhesion and bulk of perinephric fat.

Table 1: The demographic and diagnosis of cases

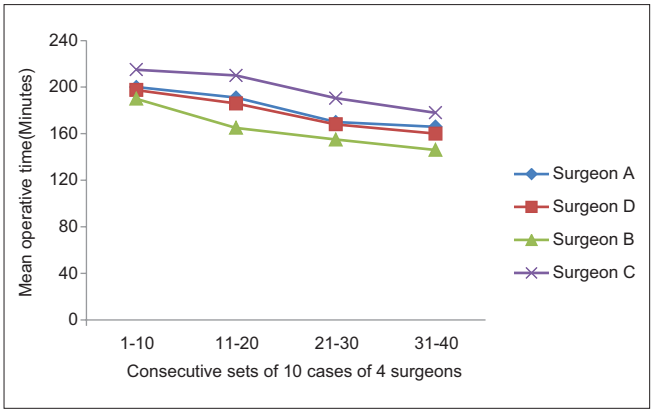
Surgeon	A	B	C	D
Number of cases	40	40	40	40
Ureteropelvic junction obstruction	7	11	6	10
Stone disease	24	21	27	22
Others	9	8	7	8
Previous percutaneous nephrostomy	7	8	8	10
Male/female	24/16	22/18	25/15	17/23
Age	21-58	17-65	25-55	20-61
Right side/left	23/17	28/12	18/22	21/19

DISCUSSION

Urologists have historically favored a retroperitoneal approach for open simple nephrectomy. On the contrary,

Table 2: Operative parameters and complications

Surgeon	Cases	Operative parameters				Complications						
		Operating time (min)	Blood loss (mL)	Conversn	Nonprogression by novices	Trocar injury	Major vessel injury	Bowel injury	Peritoneal rent	Subcutaneous emphysema	Spillage	Retroperitoneoscopic collect
A	1-20	194.5 (175-260)	50	2	2	0	0	0	5	3	2	1
	21-40	167.5 (150-250)	20	0	1	0	0	0	2	0	1	0
B	1-20	185 (140-240)	40	1	1	0	0	0	3	2	2	0
	21-40	150 (120-230)	30	2	0	0	0	0	1	0	0	0
C	1-20	210 (186-270)	60	2	3	0	0	0	7	5	3	0
	21-40	181 (155-260)	50	1	1	0	0	0	4	2	1	0
D	1-20	188.5 (170-255)	40	1	1	0	0	0	4	3	2	0
	21-40	163 (145-250)	150	1	0	0	1	0	1	1	0	0
Total (%)				10	9				27 (16.8)	16 (9.3)	11 (6.8)	1



Graph 1: Operative time progression of each surgeon

for laparoscopic simple nephrectomy, the transperitoneal approach still dominates worldwide. The retroperitoneal approach has several advantages over the transperitoneal approach, including ease of direct access to the kidney through the creation of the retroperitoneal space with a decreased risk of injury to intra-abdominal organs such as the bowel, liver, and spleen. Other advantages of the retroperitoneal approach are that previous abdominal surgery is not a contraindication, and the risk of postoperative adhesive intestinal obstruction is avoided.[4-7] The smaller working space, relative lack of anatomic landmarks, trocar spacing and difficulty in orientation for beginners are some of the disadvantages of the retroperitoneal approach.

Modi *et al*. in the initial phase of learning had reported a higher conversion rate, longer operative time, and more complications.[5,8,9] During the last 10 years, the technique has become safe, simplified, reproducible, and effective. Modi *et al*. have also reported retroperitoneoscopic nephrectomy for various technically challenging scenarios such as pyonephrotic kidneys (with a success rate of 86%), nephrocolonic fistula due to the tuberculous nonfunctioning kidney, pretransplant nephrectomy, pyonephrotic nonfunctioning moiety of horseshoe kidney, and crossed fused ectopic kidney.[10-14]

This study evaluates the learning curve of residents/novices when trained by experienced mentors. Here, the novice surgeon had the benefit of using techniques already refined by their mentors. Furthermore, the initial orientation phase facilitates mentors, in making the trainee well versed with all standardized surgical steps, along with simultaneous discussion, thus clearing the doubts related to anatomical details. This is not feasible by just reading the books or reviewing of video tapes.

In this study, the median operative time of all surgeons reduced with increased surgical experience. Major complication occurred in only one case (IVC injury). Minor complications were not significant enough to either hamper the successful completion of the procedure or alter the outcome. Thus, there was some learning curve effect observed only in operative time with longer operative time in initial cases of all surgeons. However, the overall operative complications were minimal, showing that this learning curve had no deleterious effects on patient care.

Box 1: Tips for retroperitoneoscopic nephrectomy

1. Observe and assist in at least 10 cases in a high volume centre
2. In the initial l learning phase, avoid cases with with frank pyonephrosis (thick pus through PCN drainage), genitourinary tuberculosis, xanthogranulomatous pyelonephritis (on imaging)
3. Creation of retroperitoneal space: Routinely a peanut swab is used to sweep the Gerota's fascia, before inserting Gaur's balloon for inflation. Patients with percutaneous nephrostomy, requires removal of PCN tube, digitally break the fibrous tract and then insert Gaur's balloon to achieve a larger retroperitoneal space
4. Port insertion - The incision for placing the primary port was made directly up to the thoracolumbar fascia, and minimal dissection of the subcutaneous tissue and muscle planes was performed, thus avoiding the opening of potential planes for extravasation of CO_2. Leakage from a loose first port can lead to surgical emphysema and gas loss. If this occurs, inserting a piece of plain gauze beside the port and tying the stay sutures tight, prevents leak
5. Port fixation - After port insertion, all ports withdrawn until the fascial edges. This ensures that the inner end of the port is at the edge of the operative field and maximises the visual field. The port is then fixed by securely tying the fixing sutures around it to avoid displacement of ports during instrument handling
6. Maintaining orientation during surgery. The major landmark in retroperitoneal laparoscopy is the psoas muscle. This should be kept in a horizontal view at all times to facilitate hilar vessel orientation
7. Peritoneal rent during surgery is managed by inserting veress needle into the peritoneum to reduce the intraperitoneal pressure
8. Standard surgical steps in sequence are ureter identification→hilar dissection→kidney mobilization
9. In case of right sided nephrectomy, if dense adhesion are present, it precludes short renal vein control. In this situation, after renal artery control, the kidney is mobilized and then the renal vein is clipped and cut
10. In cases of significant adhesion to vital structures - duodenum, inferior vena cava etc., precluding kidney mobilization, open conversion can be done. Here, hilar dissection and renal vessels is often possible and kidney removal can be done by joining the two or sometimes all three ports, so that the incision remains small subcostal

PCN=Percutaneous nephrostomy

With our large experience in performing retroperitoneoscopic nephrectomies over a decade, we would like to like to propose certain tips in the initial part of the learning curve that is given in Box 1.

CONCLUSIONS

The present series represents the effectiveness of training of novices in retroperitoneoscopic nephrectomy by a responsible team with the standard protocol and surgical steps. Through effective mentoring, the steep learning curve associated with retroperitoneoscopic nephrectomy has been overcome, making it the standard of care for nephrectomy at our institute.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Clayman RV, Kavoussi LR, Soper NJ, Dierks SM, Meretyk S, Darcy MD, *et al*. Laparoscopic nephrectomy: Initial case report. J Urol 1991;146:278-82.
2. Bartel M. Retroperitoneoscopy. An endoscopic method for inspection and bioptic examination of the retroperitoneal space. Zentralbl Chir 1969;94:377-83.
3. Gaur DD. Laparoscopic operative retroperitoneoscopy: Use of a new device. J Urol 1992;148:1137-9.
4. Gaur DD, Agarwal DK, Purohit KC. Retroperitoneal laparoscopic nephrectomy: Initial case report. J Urol 1993;149:103-5.
5. Gill IS, Clayman RV, Albala DM, Aso Y, Chiu AW, Das S, *et al*. Retroperitoneal and pelvic extraperitoneal laparoscopy: An international perspective. Urology. 1998;52:566-71.
6. Gupta NP, Hemal AK, Mishra S, Dogra PN, Kumar R. Outcome of retroperitoneoscopic nephrectomy for benign nonfunctioning kidney: A single-center experience. J Endourol 2008;22:693-8.
7. Quintela RS, Cotta LR, Neves MF, Abelha DL Jr., Tavora JE. Retroperitoneoscopic nephrectomy in benign pathology. Int Braz J Urol 2006;32:521-8.
8. Modi PR, Kadam GV, Dodia S, Jain R, Patel R, Devra A. Laparoscopic retroperitoneal nephrectomy: Overcoming the learning curves. Indian J Urol 2005;21:102-5.
9. Rassweiler JJ, Seemann O, Frede T, Henkel TO, Alken P. Retroperitoneoscopy: Experience with 200 cases. J Urol 1998;160:1265-9.
10. Modi P, Kadam G, Goel R. Retroperitoneoscopic nephrectomy for pyonephrotic kidneys. J Endourol 2007;21:75-7.
11. Modi P, Patel S, Dodia S, Goel R. Case report: Retroperitoneoscopic nephrectomy in pyonephrotic nonfunctioning moiety of horseshoe kidney. J Endourol 2006;20:330-1.
12. Goel R, Modi P, Dodia S. Retroperitoneoscopic pre-transplant native kidney nephrectomy. Int J Urol 2006;13:337-9.
13. Modi PR, Rizvi SJ. Retroperitoneoscopic nephrectomy for nephrocolonic fistula due to tuberculous nonfunctioning kidney. J Laparoendosc Adv Surg Tech A 2008;18:841-3.
14. Modi P, Rizvi SJ, Gupta R, Patel S. Retroperitoneoscopic nephrectomy for crossed-fused ectopic kidney. Indian J Urol 2009;25:401-3.