Retroperitoneoscopic nephrectomy: Technique, safety and results

Sanjay P Dhangar[1*], Avais A Syed[2], Manisha Shengal[3]

[1]Consultant Urologist and Assistant Professor, [2]Consultant Urologist, [3]Resident Medical Officer, Dept. of Surgery, SMBT IMSRC, Dhamangaon, Ghoti, Igatpuri, Nashik, Maharashtra, India

***Corresponding Author: Sanjay P Dhangar**
Email: sanjayamrapali18@gmail.com

Abstract

Introduction: Minimal invasive surgery has become the mainstay of surgery in all the fields of medicine. Inclusion of laproscopy/retroperitoneoscopy in the urology increases its armamentarium and maintain the minimal invasive nature inherited with it. Retroperitoneoscopic surgery has many advantages. The best part of this approach is the quick approach to the hilar area and early control of the renal vessels. We here stepwise describe the steps of retroperitoneoscopic nephrectomy and elaborate various advantages and disadvantages and share our experience of retroperitoneoscopic simple nephrectomy.

Materials and Methods: This retrospective study was done in SMBT IMS & RC, Nashik, Maharashtra, India from August 2016 to July 2020. A total of 53 patients underwent nephrectomy for various reasons were included except the cases of malignancy. This was a retrospective Cross-sectional study. Data were collected from hospital record in a structured questioner. Following collection of data, it was analysed by computer software Statistical Package for the Social Sciences (SPSS version 19).

Results: The mean age of the patients was 45.5 years. Male is to female ratio was 3:1. Thirty-five patients underwent left sided nephrectomy and eighteen underwent right sided nephrectomy. The most common cause for non-functioning kidney was renal calculi followed by pelvi-ureteric junction obstruction. The mean operative time was 162.3 minutes with mean blood loss of 180.6ml. There were 5 conversion to open surgery in our study. These cases had severe adhesions and inability to identify the vascular structures safely. Minor Clavien grade I and II were observed in 16.9% cases.

Conclusion: Retroperitoneoscopic nephrectomy is technically challenging procedure as compared to the transperitoneal approach for patients with non-functioning kidneys caused by benign conditions. But it is a safe, effective and reproducible surgical technique for nephrectomy in benign renal diseases.

Keywords: Retroperitoneoscopy, Retroperitoneal nephrectomy, Nephrectomy for benign disease.

Introduction

Minimal invasive surgery has become the mainstay of surgery in all the fields of medicine. Last decade has witnessed its increasing use, not just endoscopic or laproscopic but robotic surgery is now the initial approach in many developed countries. Currently it is used well in advanced oncologic and reconstructive surgery. It has now become an established part of the armamentarium of the surgeon. Urologic surgeries involved mostly endoscopic surgeries. Inclusion of laproscopy/retroperitoneoscopy in the urology further increases its armamentarium and maintain the minimal invasive nature inherited with it. The urologic surgeons are well versed with the retroperitoneum. Applying the same anatomy for the minimal invasive surgery becomes easier for them. In 1969, Bartel first described retroperitoneoscopy.[1] But due to limited working space, abundant fat and lack of clear-cut anatomic landmarks it was not given much consideration and was found to be technically difficult. There are advantages too of this approach. There is no entry into the peritoneal cavity, there is early return of bowel activity, contamination of the peritoneal cavity is avoided if there is spill of urine and there is always one-opening surgery option.[2] Moreover, prior abdominal surgery, adhesions, and obesity cause fewer problems in the retroperitoneoscopic approach. The best part of this approach is the quick approach to the hilar area and early control of the renal vessels. We here stepwise describe the steps of retroperitoneoscopic nephrectomy and elaborate various advantages and disadvantages and share our experience of retroperitoneoscopic simple nephrectomy.

Materials and Methods

This retrospective study was done in SMBT IMS & RC, Nashik, Maharashtra, India from August 2016 to July 2020. A total of 53 patients underwent nephrectomy for various reasons were included except the cases of malignancy. This was a retrospective Cross-sectional study. Data were collected from hospital record in a structured questioner. Following collection of data, it was analysed by computer software Statistical Package for the Social Sciences (SPSS version 19).

Surgical technique

The procedure was performed under general anaesthesia. End tidal CO_2 ($EtCO_2$) monitoring was done in all cases. Prophylactic antibiotics were started one hour prior to induction and were continued as per the indication of the surgery. Minimum three doses were given in clean contaminated cases and continued upto fourteen days in infected cases. All patients were catheterised prior to starting the procedure. Standard lateral kidney position was given as in open nephrectomy cases (classic lumbotomy position). The only difference here was instead of breaking the table, we flexed the table to get more space. The surgeon and the camera person stood on the side of the nephrectomy to be done whilst the scrub nurse was on the opposite side. We used the open (Hasson) technique for obtaining initial access.[3] A

10 mm incision was made in the lumbar (Petit's) triangle below the 12th rib at the lateral border of paraspinal muscles. The muscle fibres were separated carefully. The entry was gained into the retroperitoneum by gently piercing the thoracolumbar fascia with the tip of an artery forceps. A balloon dilator was constructed as described by Gaur.[4] This consists of a glove finger stall tied by silk over the end of a suction catheter/Nelaton's catheter or a large bore feeding tube. The balloon dilator was then inserted into the opening. Distension of the balloon with saline displaced the adjacent fat and peritoneum. This creates an adequate working space for retroperitoneoscopic surgery within that area rapidly and atraumatically. A 10mm port was then placed in this opening and it used as the camera port. All work was visualised via a monitor at the head of the table using a high-quality camera connected to the laparoscope. The 2nd and 3rd ports were inserted under direct vision as shown in Fig. 1. One 10/5mm port 2 cm above the iliac crest and another 5 mm port in anterior axillary line. An automatic insufflator was used to maintain the standard CO_2 pressure at 14mm Hg. The psoas muscle acts as a landmark and was seen immediately on entry with the laparoscope. The muscle was dissected and the ureter and the gonadal vein were identified on the left side and the inferior vena cava on the right side. On the left side, the renal vein was identified following the gonadal vein and the artery was found just above the renal vein. On the right side, the renal vein was dissected by following the vena cava and the renal artery was dissected over the renal vein. The posterior aspect of the kidney was reached first and the hilum was identified and confirmed after seeing the pulsating renal artery. The renal hilum was dissected, the renal vein and renal artery isolated and dissected of the fat and clipped using Ligasure/Hem-o-lock clips. Two clips were applied on the proximal part of the vessel and one on the distal end. The vessels were divided with endoscissors and then further dissection of the kidney was performed. The dissection was started inside the Gerota's fascia at the renal upper pole preserving the adrenal gland in most of the cases. The lower pole was then dissected. The kidney was separated from the surrounding fat and soft tissue. The ureter was clipped and divided as low as possible. After the kidney was fully mobilised, it was removed from the body by incising one of the port sites and increasing it to 2.5–3 cm. A drain was left in the retroperitoneum. CO_2 was evacuated before ending the procedure. We used a handmade bag from the urobag plastic cover. We can also use an Endo catch bag, if available. The duration of the procedure was recorded. The Foley's catheter was removed on first post-operative day. Feeding was started after returning of bowel sounds next day. The patient was fully mobilised within 24 hours after which the drain was removed.

Table 1: Patient demographics

Mean age (years)	**45.5**	**Range (30-72)**
Male:Female	3:1	Actual numbers (40:13)
BMI	24.2	Range (18.5-32.6)
Comorbidity	Diabetes Meliitus	6
	Hypertension	2
	Obesity	6
Laterality	Right	18
	Left	35

Table 2: Causes of non-functioning kidney

No.	**Cause**	**Number**	**Percent**
1.	Renal calculi	27	50.9
2.	Pelvi-ureteric junction obstruction	13	24.5
3.	Ureteric calculi	5	9.4
4.	Reflux nephropathy due to bladder outlet obstruction	3	5.6
5.	Renal tuberculosis	2	3.7
6.	Ectopic ureter	2	3.7
7.	Duplex system	1	1.8

Table 3: Surgical results

Operative time (minutes)	**Mean – 162.3**	**Range – 120 to 220**
Blood loss (ml)	180.6	100-300
Conversion to open	Number = 5	9.4%
Clavien grade of complication	Grade I – 6	11.3%
	Peritoneal rent - 2	3.7%
	Spillage of renal contents – 2	3.7%
	Emphysema – 2	3.7%
	Grade II – 3	5.6%
Hospital stay (days)	Mean – 2.4	Range = 2 to 5

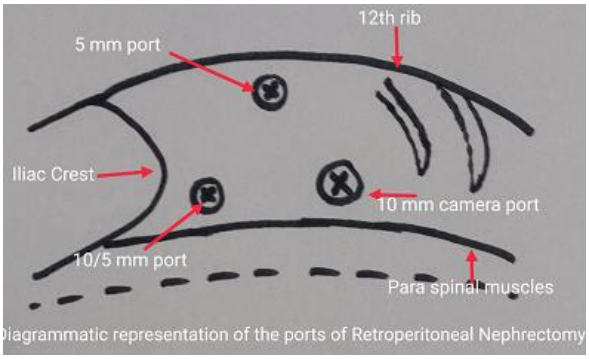

Fig. 1: Ports of RPscopic Nephrectomy.

Results

This study had total 53 patients. Patient characteristics and preoperative details are described in Table 1. The mean age of the patients was 45.5 years. Male is to female ratio was 3:1. Thirty-five patients underwent left sided nephrectomy and eighteen underwent right sided nephrectomy. The most common cause for non-functioning kidney was renal calculi followed by pelvi-ureteric junction obstruction. Other causes were ureteric calculi, genito-urinary tuberculosis, ectopic ureter, reflux nephropathy due to bladder outlet obstruction and duplex system (Table 2).

Surgical results are shown in the Table 3. The mean operative time was 162.3 minutes with mean blood loss of 180.6ml. There were 5 conversion to open surgery in our study. These cases had severe adhesions and inability to identify the vascular structures safely. We used 12th rib cutting approach for open surgery.

There were only minor complications (Clavien grade I and II) recorded. The most common minor complications (Clavien grade I) were peritoneal rent in 2 patients (3.7%), which was managed by inserting a veress needle into the peritoneum to reduce the intraperitoneal pressure. Puncture and spillage of renal contents occurred in 2 (3.7%) 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 2 patients (3.7%), but in none of the patients was it significant enough to cause hypercarbia or necessitate conversion. There was minimal blood loss (mean 180.6 ml) so, no patient required transfusion. Three patients had post-operative fever, which was managed conservatively with symptomatic treatment and upgrading the antibiotics.

Discussion

The transperitoneal approach for simple nephrectomy is favoured worldwide. Since the old times, the urologists have favoured the retroperitoneal approach for simple open nephrectomy. Because of this reason, many urologists still prefer the retroperitoneal approach for simple nephrectomy over the transperitoneal approach. Even if we think from an anatomic point of view, retroperitoneoscopy is more suitable than the transperitoneal laparoscopic approach to reach the upper urinary tract. Wickham and Miller 6 in 1983 performed one of the first retroperitoneal endoscopic nephrectomy.[5]

The advantages of retroperitoneoscopy are many like the preservation of the peritoneal cavity so, minor spillage of renal contents doesn't matter. The direct access to the renal pedicle posteriorly makes possible a straight dissection and the control of the vessels in the first step of the surgery. This approach can be done without any difficulties even in hard cases.[6,7] We can even remove the ureteric calculi upto the mid ureter, even below the iliac artery cross-over. Prior abdominal surgery, adhesions, and obesity cause fewer problems in the retroperitoneoscopic approach. Finally, there is always one-opening surgery option through the same retroperitoneum.

The disadvantage of retroperitoneoscopy is the reduced working space that requires a good surgical team to avoid instrument collision. Creating good pneumo-retroperitoneum with the help of Gaur's balloon helps in getting enough room to reach the whole kidney.

The contraindication of retroperitoneoscopy is the presence of previous retroperitoneal surgery like open pyelolithotomy. Relative contraindication includes patients with chronic inflammatory pathologies such as renal tuberculosis or xantogranulomatous pyelonephritis. In these cases, the possibility of conversion to open surgery is higher because of the dense adhesions. We had conversion to open surgery in 5 cases (9.4%) in our series. Hemal AK et al, Zhang X et al and Merrot T et al had the same problem in their studies.[6-8] Rodrigo S. Quintela et al also had to convert to open surgery in 3 cases in his study.[9] Rassweiler J J et al also had similar conversion rate.[10] Narmada P Gupta et al had to convert to open surgery in 25 cases in their study.[11]

The mean operative time in our surgery was 162.3 minutes. This was due to the initial learning curve. Yusuf Saifee et al in their study showed that the median operative time of all surgeons reduced with the increased surgical experience.[12] Rodrigo S. Quintela et al had mean operative time of 160 minutes in their study.[9] Narmada P Gupta et al had mean operative time of 85 minutes in their study.[11]

The mean blood loss in our study was 180.6 ml. Rodrigo S. Quintela et al had mean blood loss of 200 ml in their study.[9] Yusuf Saifee et al in their study had less blood loss as compared to our study.[12] Narmada P Gupta had mean blood loss of 110 ml in their study.[11]

We had only 16.9% minor Clavien grade I and II complication in our study. Yusuf Saifee et al in their study had 6.2 to 16.8 % minor complications.[12] Rodrigo S. Quintela et al minor complications in 13% of the cases in their study.[9]

Mean hospital stay in our study was 2.4 days. Shahid Aquil et al discharged their patient on third post-operative day.[13] Hamdan H. Al-hazmi et al had mean hospital stay of 2.5 days in their patients.[14] Rodrigo S. Quintela et al discharged most of their patients in two days.[9] Narmada P Gupta et al had mean stay of 3 days in their study.[11]

In our study, renal calculi were the most common reason for the non-functioning of the kidney (Table 2). Rodrigo S. Quintela et al also had the calculi as the most common cause

for the removal of the kidney.[9] Yusuf Saifee et al also had the stone disease as main reason for nephrectomy in their study.[12]

As compared to transperitoneal approach, retroperitoneal approach is associated with lower morbidity. The reason being the non-violation of the peritoneal cavity. This means that there is no manipulation of intraperitoneal organs and the blood, urine or pus, if leaked, don't come in the contact of peritoneum, so no paralytic ileus or any chances of intra-operative organ injury. Another good thing is non-contact of the CO2 with the diaphragm, which means that there would not be any diaphragmatic irritation post-operatively. All these benefits convert into lesser morbidity and early recovery.

Conclusion

Retroperitoneoscopic nephrectomy is technically challenging procedure as compared to the transperitoneal approach for patients with non-functioning kidneys caused by benign conditions. But it is a safe, effective and reproducible surgical technique for nephrectomy in benign renal diseases.

Source of Funding

None.

Conflict of Interest

None.

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