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## Original Article

### **Laparoscopic Nephrectomy : Technique and Outcome**

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#### **Abstract**

**Objective:** To review case series of retroperitoneal laparoscopic nephrectomies.

**Methods:** Between May 2003 and May 2006, 60 laparoscopic nephrectomies were performed by a single surgeon. Laparoscopic route for nephrectomy was retroperitoneal in 50 cases and transperitoneal in 10 cases.

**Results:** The patients included 37 males and 23 females. The mean age was  $18.5 \pm 16.6$  years and ranged from 2 years to 60 years. Right sided nephrectomy was performed in 31 cases while left kidney was removed in 29 cases. The indications for nephrectomy were stones (n=29), dysplasia (n=11), chronic pyelonephritis (n=8), pelvi ureteric junction obstruction (n=4), tuberculosis (n=3), vesicoureteric reflux (n=3) and ureterocele (n=2). Mean operating time for laparoscopic nephrectomy alone was  $140 \pm 51.1$  min (range 25-300 minutes). In our series, 19 additional surgical procedures were performed under the same general anaesthesia. The mean hospital stay for all patients was  $3.1 \pm 2.39$  days; however the mean hospital stay for those patients who underwent laparoscopic nephrectomy without any additional procedure is  $2.2 \pm 0.92$  days (1.5 - 4 days). The mean size of kidney removed was  $7.4 \pm 3.13$  cm (4.6-15.9 cm). Complications were seen in 2 patients (3%); one developed wound infection and the other was found to have a haematoma for which the wound was re-explored. Conversion to open nephrectomy was required in 7 patients (11.6%) due to bleeding from renal pedicle (n=4), poor vision secondary to pus spillage from pyonephrotic kidney (n= 2) and failure to progress due to indwelling percutaneous nephrostomy. There was no mortality and none of the patients had prolonged ileus. Blood transfusion was not required in any case. There was no bowel injury or port site herniation.

**Conclusion:** Laparoscopic nephrectomy is a feasible and safe technique. The length of hospital stay and convalescence is short and hence rapid return to normal activity is expected (JPMA 57:355:2007).

## Introduction

Nephrectomy is one of the most common ablative surgeries performed by urologists. Apart from the psychological trauma of losing a kidney, the patient usually undergoes significant discomfort and disfigurement due to the extensive surgical incision. The traditional approaches require a large muscle cutting skin incision in order to reach the organ. Until the last decade there was no option but to undergo this mutilation in order to achieve the end result.

Retroperitoneoscopy was initially described by Bartel<sup>1</sup> in 1969 but was considered to be technically cumbersome because of limited working space, lack of clear cut anatomic landmarks, and abundant fat in the retroperitoneum. Wickham<sup>2</sup> reported the initial retroperitoneoscopic ureterolithotomy in 1979. In 1982 Bay-Nielson and Schultz<sup>3</sup> performed endoscopy of the retroperitoneum to remove upper ureteral calculi. The first attempts at retroperitoneal endoscopic nephrectomy were made by Coptcoat<sup>4</sup>, Wickham and Miller<sup>5</sup>, Weinberg and Smith<sup>6</sup> in the early 1980s, and were based on the technique of percutaneous renal stone surgery. The real breakthrough was a transperitoneal laparoscopic nephrectomy performed by Clayman et al in 1991.<sup>7</sup>

In the last decade minimally invasive surgery has become the frontier of surgical development. From its initial diagnostic use in gynaecology to the current advanced oncological and reconstructive surgery, laparoscopy has become firmly established in the armamentarium of surgeons in every field. The advantages of lower post-operative pain, minimal scars, rapid recovery and early return to work have offset the marginal increase in instrumentation costs and longer training period for the surgeon. With the introduction of re-usable gadgetry and cost consciousness this can be minimized.

We have reviewed a case series of laparoscopic nephrectomies; and discussed the surgical technique.

## Patients and Methods

Between May 2003 and May 2006, 60 laparoscopic nephrectomies were performed by a single surgeon.

**Surgical Technique:** Since majority of the cases in this series are done via the retroperitoneal route and it is our preferred route, hence surgical details of this procedure are described. The procedure is performed under general anaesthesia with end tidal CO<sub>2</sub> monitoring. Intravenous antibiotics are routinely administered. After bladder catheterization the patient is placed in the standard lateral kidney position. The authors always use the open (Hasson)<sup>8</sup> technique for obtaining initial access. A 10-12 mm incision is made in the lumbar (Petit's) triangle below the 12th rib at

the lateral border of paraspinalis muscles. The muscle fibres are gently separated and entry is gained into the retroperitoneum by gently piercing the thoracolumbar fascia with the tip of an artery forceps. A home made balloon dilator is constructed as described by Gaur.<sup>9</sup> This consists of a glove finger stall tied by silk over the end of a suction catheter. The balloon dilator is then inserted into the opening. Distension of the balloon with air rapidly and atraumatically displaces the adjacent fat and peritoneum, there by creating an adequate working space for laparoscopic surgery within that area. A 10 mm port is then placed in this opening for the laparoscope. All work is visualized via a monitor at the head of the table using a high quality charge-couple device (CCD) camera connected to the laparoscope. The 2nd and 3rd ports are inserted under direct vision as shown in Figure 1. An automatic insufflator is used to maintain the CO<sub>2</sub> pressure at 15 mm Hg. The Psoas muscle acts as a landmark and should be sought. In the retroperitoneal approach, the posterior aspect of the kidney is reached first and the pulsating renal artery is identified at the hilum. The renal hilum is dissected, renal vein and renal artery cleaned of fat and clipped using Liga Clips 400 series™ (Ethicon). Endo GIA if available can also be used. Three clips are applied on the proximal part of the vessel and 2 on the distal end.<sup>10</sup> The vessels are divided and then further dissection of the kidney is performed separating it from the surrounding fat. The ureter is clipped and divided and once the kidney is fully mobilized it is removed from the body by incising one of the port sites and increasing it to 2.5-3 cm. A drain is always left in the retroperitoneum and CO<sub>2</sub> evacuated before the end of the procedure.

If the kidney is hydronephrotic, it is aspirated to get a wider working space and to facilitate grasping of kidney tissue. Laparoscopically guided percutaneous needle aspiration is performed. This minimizes the spillage in the retroperitoneal space obviating the frequent use of suction, loss of pneumoperitoneum and subsequent delays.

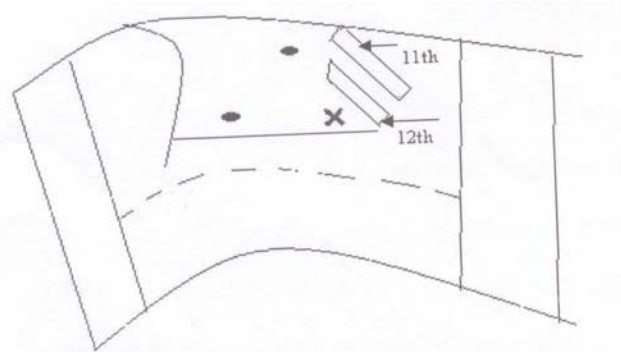


Figure 1. Left kidney position hyper extension produced. Dashed line represents vertebral spinous processes. Solid line denote edge of para spinalous muscles. 11th and 12th rib marked. X marks primary port site and balloon insertion site. Solid circles represent secondary port sites patient is strapped to keep in kidney position.

Specimen removal is by increasing the opening of a port to allow delivery of the specimen. Endo catch bag is not used due to cost of the device.

Foleys catheter is removed within 24 hours and oral feeding started after 12 to 18 hours after confirming return of bowel sounds. Patient is fully mobilized within 24 hours after which the drain is removed.

## Results

In our series of 60 patients, 50 laparoscopic nephrectomies were done via the retroperitoneal route while 10 nephrectomies were performed via the transabdominal route. The mean age of patients was  $18.5 \pm 16.6$  years (2-60 years). There were 37 males and 23 females. Right sided nephrectomy was performed in 31 cases while left kidney was removed in 29 cases. The indications for nephrectomy are given in Table 1.

Mean operating time for laparoscopic nephrectomy alone was  $140 \pm 51.1$  min (range 25-300 minutes). Nineteen additional surgical procedures were performed in 21 patients under the same general anaesthesia and are detailed in Table 2 (some patients had more than one additional procedure).

The mean size of kidney removed was  $7.4 \pm 3.13$  cm

**Table 1. Indications for Nephrectomy.**

Indication for Nephrectomy	Number	Percentage
Stones	29	48%
Dysplasia	11	18.3%
Chronic pyelonephritis	8	13%
Pelviureteric junction obstruction	4	6.6%
Tuberculosis	3	5%
Vesicoureteric reflux	3	5%
Ureterocele	2	3.3%
Total	60	

**Table 2. Additional Procedures.**

Additional Procedures	Number
Ureteric Reimplant (contra lateral)	3
Augmentation Ureterocystoplasty (ipsi lateral ureter)	2
Mitrofanoff appendicovesicostomy	2
Ureterorenoscopy (contra lateral) and stone removal	3
Bladder stone removal	2
Ureteric stent insertion (contra lateral)	2
Percutaneous Nephrolithotomy (contra lateral)	1
Bladder neck incision	1
Closure vesicostomy	1
Ureterocele incision	1
Cystoscopy	1
Total	19

(4.6-15.9 cm). Histopathological examination of 4 kidneys revealed Xanthogranulomatous Pyelonephritis (XGP).

The mean hospital stay for all the patients was  $3.1 \pm 2.3$  days however the mean hospital stay for those patients who underwent laparoscopic nephrectomy without any additional procedure was  $2.2 \pm 0.92$  days (range 1.5 - 4 days).

Complications were seen in 2 patients (3%). One patient had a wound infection secondary to spillage of pus in the retroperitoneal cavity while one child required re-exploration of wound due to a haematoma from the cut ureteric end. He was diagnosed to have Idiopathic Thrombocytopenic Purpura (ITP). Conversion to open nephrectomy was performed in 7 patients (11.6%), 4 patients (6%) had bleeding from renal pedicle necessitating open conversion, 2 patients (3%) had open conversion due to excessive pus in the kidney which had spilled in the retroperitoneum resulting in poor visualization. In one patient there was failure to progress. She had a longstanding indwelling percutaneous nephrostomy and it was impossible to dissect around it. There was no mortality and none of the patients had prolonged ileus. Blood transfusion was not required in any case. There was no bowel injury or port site herniation.

## Discussion

Laparoscopy has raised great interest in the past few years in the field of urology. It has evolved from a simple diagnostic manoeuvre to complex operative procedures. In general, from an anatomic point of view, retroperitoneoscopy seems to be more suitable than the transperitoneal laparoscopic approach to reach the upper urinary tract. It also is less invasive and complies with the criteria for open renal surgery. The first attempts at retroperitoneal endoscopic nephrectomy were made by Wickham and Miller<sup>5</sup> in early 1980s and was based on the technique of percutaneous renal stone surgery. The real breakthrough was a transperitoneal laparoscopic nephrectomy performed by Clayman et al in 1991.<sup>7</sup> Endoscopic access to upper and lower retroperitoneum did not find wide acceptance initially. The main reason was the suboptimal view due to inability to establish pneumoperitoneum. On the other hand establishment of a pneumoperitoneum using CO<sub>2</sub> insufflation alone proved to be a problem. The balloon dissection technique described by Gaur<sup>9</sup> allowed the safe and reproducible creation of a retroperitoneal operating field. Using single digit dissection Rassweiler<sup>11</sup> has shown it to be sufficient for adequate exposure of the retroperitoneal space and reduces the operating time by 10-15 minutes.

The basic surgical technique of laparoscopic

nephrectomy has been described in detail by Clayman<sup>7</sup> and Gill.<sup>12</sup> The technique described here has some modifications as compared to the original descriptions. A pre-operative angiogram or renal artery embolization was not performed as it adds to cost and morbidity and makes little difference to outcome. A ureteric catheter was not used, so preliminary cystoscopy can be avoided unless otherwise indicated.

Some technical points should be detailed for the avoidance of complications: strict attention to basic surgical principles, placement of trocars under direct vision, meticulous attention to avoid even minor haemorrhage as blood in the field obscures vision dramatically, approaching the renal hilum before perirenal or ureteric dissection if at all possible, later dissection of anterior-medial aspect of kidney to avoid the kidney from falling on the posterior-lateral pedicle area, adequate exposure and retraction, early conversion to open surgery if failure to progress and a regular team of surgeons and nurses to reduce unnecessary delays and frustration.

The relatively long operative duration reported by some investigators<sup>13</sup> for laparoscopic nephrectomy and nephroureterectomy has been used by critics to argue against the widespread adoption of this technique. The present mean duration of 140 minutes compares favourably with 153 minutes<sup>14</sup> and 154 minutes<sup>15</sup> reported in other series and in a contemporary open surgical series.<sup>16</sup> Moreover the present series has a significant number of concurrent surgical procedures performed ranging from reconstruction to simple cystoscopy. By maintaining the operative duration in line with that for open surgery, we support reports rating laparoscopic nephrectomy over all as less expensive than open nephrectomy.<sup>17</sup>

The complication and conversion rates in the current study are broadly similar to those published previously. Gill et al<sup>18</sup> reported a 16% rate of complication and 6% rate of conversion to open surgery in a multi institutional study. Complications in that series tended to occur in the first 20 cases and were more common in patients undergoing laparoscopic radical nephrectomy. Fahlenkamp<sup>19</sup> reported an 8.3% complication rate and 10.3% rate of conversion to open surgery in a German multi institutional experience of 2407 procedures. Keely [14] in a series of 100 laparoscopic nephrectomies identified risk factors for complications and reported 18% complications and 5% conversion to open surgery. They found that XGP, pyonephrosis and previous surgery proved to be significant risk factors for complications and conversion to open surgery. Recent studies<sup>20,21</sup> have reported complication rates of 8.7% and 7.3% including injuries to spleen, inferior vena cava and aorta, while conversion rates were 6.7% and 8.2%

respectively.

Given the greater difficulty involved in performing laparoscopic nephrectomy compared with diagnostic laparoscopy, a longer period of training and experience should be expected. Peters<sup>22</sup> in a survey of the laparoscopic experience of paediatric colleagues, reported that complication rates diminished significantly only after 100 cases.

## Conclusion

For a selected group of patients, laparoscopic nephrectomy is a feasible and safe technique. The length of hospital stay and convalescence is short and return to normal activity is rapid. Moreover, laparoscopic nephrectomy can easily and safely be performed with concurrent surgical procedures of varying complexity without added morbidity and with comparable results.

## Acknowledgement

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