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Original Research Article

An Observational Study on the Outcomes of Minimally Invasive Nephrectomy for Inflammatory Renal Disease

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Abstract

Aim: The aim of the present study to determine the minimally invasive nephrectomy for inflammatory renal disease.

Methods: This was a prospective observational study conducted in the Department of Urology, Indira Gandhi Institute of Medical Sciences, Patna, Bihar, India, for 1 year. 100 patients who underwent a LN for IRD were included in this study. Interstitial nephritis, chronic pyelonephritis, renal tuberculosis and xanthogranulomatous pyelonephritis. The demographics, pre- operative diagnosis based on images (computed tomography [CT], magnetic resonance imaging [MRI], ultrasound and/or renal scintigraphy), and intraoperative variables such as operative time, blood loss, need for open conversion, length of hospital stay, intra and postoperative complications following the Clavien-Dindo classification were analyzed.

Results: Left side nephrectomy was performed in 67% of the cases. A positive history of urolithiasis was present in 52% of the cases, followed by urinary tract infections (UTI) (42%), high blood pressure (HBP) (30%) and Type II diabetes mellitus (DM II) (9%). We identified 5 cases of nephron-intestinal fistulas (pyeloduodenal and pyelocolonic) at the moment of surgical dissection, 5 cases (5%) as misdiagnosed neoplasia, 9(9%) cases of pyonephrosis and 5 case (5%) of emphysematous pyelonephritis. Most of the cases had severe pyonephrosis (60%). According to pathology results, there were 10 cases (10%) of xanthogranulomatous pyelonephritis (XGP), 86 cases (86%) of chronic nephritis, 2 case of renal abscess and 2 case of renal tuberculosis. The mean operative time for patients who did not required conversion to open surgery was 203±88 min, for the conversion ones was 388±174min and for all the 100 patients was 218±111min, ranging between 85min and 647 min. The mean estimated blood loss for patients who did not required conversion to open surgery was 213±221mL, for the conversion ones was 1477±748mL and for all the patients was 258±423mL, with a range of 55-3275 mL. The mean length of hospital stay after surgery was 2.9± 2.2 days, being longer for the converted ones compared to the no converted ones (5.6± 2.2 days vs. 3.2 ±2.2 days), ranged between 1 and 14 days.

Conclusion: Laparoscopic nephrectomy for IRD isa reproducible technique with low risks and complication rates despite the surgical challenge it represents.

Keywords: Nephrectomy, Complications, Inflammatory Renal Disease.

Introduction

Laparoscopic nephrectomy is fast becoming the gold standard procedure in both benign and malignant renal conditions requiring surgical removal since it was first introduced by Clayman *et al*. in 1991.[1] With the increasing experience of laparoscopic techniques, the indications of laparoscopic nephrectomy (LN) have been gradually extended to inflammatory renal disease (IRD), such as xanthogranulomatous pyelonephritis (XGPN), tuberculosis, hydronephrosis, pyelonephritis, and pyonephrosis. These certain conditions are often associated with marked chronic inflammation, dense adhesion, and anatomical disorganization, leading to higher complication rates and conversion rates in laparoscopic procedures[2]. Also as a minimally invasive approach, hand assisted laparoscopic nephrectomy (HALN) was first introduced in 1997 as a transition from open surgery to standard laparoscopic surgery.[3] Hand assisted laparoscopic surgery might offer more convenience and possibilities in those challenging situations, as it can provide surgeons with the assistance of tactile feedback, effective dissection, and facilitated control of the renal hilar vessels.[4] Compared with standard laparoscopy, HALN has been reported to be associated with shorter operative time and higher safety, and has been considered an alternative for IRD.[5] However, laparoscopic surgeons argued against HALN because it might lead to longer incision, more blood loss, delayed postoperative patient recovery, or higher perioperative complication.

Material and methods

This was a prospective observational study conducted in the Department of Urology, Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India for 1 year. after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

100 patients whounderwent a Laparoscopic Nephrectomy for Inflammatory renal disease were included in this study. This included patients who had Interstitial nephritis, chronic pyelonephritis, renal tuberculosis and xanthogranulomatous pyelonephritis on their HPE report. The demographics, pre- operative diagnosis based on images (computed tomography[CT], magnetic resonance imaging[MRI], ultrasound and/or renal scintigraphy), and intraoperative variables such as operative time, blood loss, need for open conversion, length of hospital stay, intra and postoperative complications following the Clavien-Dindo classification were analyzed.

After data collection, we calculated the mean and standard deviation of the operative time, blood loss and length of hospital stay for all 100 patients, including both, those who required conversion and those who did not. Then, we did the same statistical analysis excluding patients with conversion to open surgery. Following this, we obtained the percentage of patients with mild and severe peri-surgical complications. We applied the Clavien-Dindo's classification to the post-surgical complications.

Surgical technique

LN was considered an option for all inflammatory renal units, preferring transperitoneal approach for all cases. Patient positioning and prepping follow the usual laparoscopic approach in a semi lateral decubitus position. No significant

bed breaking is usually required. Patient is well secured and padded to the surgical table, as tilting might be necessary during the procedure. For trocar placement, we use three trocars of 10 mm for adult patients and for pediatric patients 3 mm or 5 mm depending on patient's weight. For the placement of the first trocar, we always perform a Hasson's open technique at the base of the belly-button. Subsequent trocars are placed at the subcostal region at Palmer's point and the other trocar above the iliacspine at the anterior axillar line. If the case can be completed with those three ports, we try to avoid the needof a fourth one. The fourth port is usually needed to retractthe liver. For this purpose, we used a trocar of 5 mm.

Results

We included 100 patients with any IRD in the histopathology report who underwent modified-laparoscopic nephrectomy technique. The demographic data show in table 1. Left side nephrectomy was performed in 67% of the cases. A positive history of urolithiasis was present in 52% of the cases, followed by urinary tract infections (UTI) (42%), high blood pressure (HBP) (30%) and Type II diabetes mellitus (DM II) (9%). We identified 16 patients with anatomic abnormalities of urinary tract.

All patients had presurgical diagnoses according to renal and urinary tract image that suggested a probable cause of renal dysfunction or severe damaged kidney. We identified 3 cases of nephron-intestinal fistulas (preduodenal and pyelocolonic) at the moment of surgical dissection, 5 cases (5%) as misdiagnosed neoplasia, 9(9%) cases of pyonephrosis and 5 case (5%) of emphysematous pyelonephritis. Most of the cases had severe pyonephrosis (60%). According to pathology results, there were 10 cases (10%) of xanthogranulomatous pyelonephritis (XGP), 86 cases (86%) of chronic nephritis, 2 case of renal abscess and 2 case of renal tuberculosis.

11 patients (11%) developed severe intraoperative complications that risked patients' life. There were 5 cases of vascular injury, 2 in the inferior vena cava and the other in the superior segmental branch of renal artery. There was also 3 diaphragmatic injury and 3 colon perforations. Additionally, to the 2 conversion cases previousmentioned, there was a third case consisting in a pyelocolonic fistula that required right hemicolectomy. The total conversion rate to open surgery was 7%. From the seven cases of conversion, 3 were right sided and 4 had HBP. For post-operative complications, there were 11 (11%) cases classified as severe and 7 as mild complications(7%). 2 patients received full anticoagulation after the procedure for acute myocardial infarction (AMI) and pulmonary thromboembolism (PTE) respectively. 2 patient required reintervention for evisceration 5 days after firstsurgery with no other complications. Other developed postoperative pleural effusion not related to diaphragmatic lesion relieved with Ultrasound guided aspiration and chest physiotherapy. Mild complications consisted in 3 cases of surgical site infection (SSI) that were treated with antibiotics, 2 dehisced the skin incision and 2 presented ileum that resolved with medicaltreatment (the same one that presented the AMI). table 2.

The mean operative time for patients who did not required conversion to open surgery was 203±88 min, for the conversion ones was 388±174min and for all the 100 patients was 218±111min, ranging between 85min and 647 min. The mean estimated blood loss for patients who did not required conversion to open surgery was 213±221mL, for the conversion ones was 1477±748mL and for all the patients was 258±423mL, with a range of 55-3275 mL. The mean length of hospital stay after surgery was 2.9± 2.2 days, being longer for the converted ones compared to the no converted ones (5.6± 2.2 days *vs.*3.2 ±2.2 days), ranged between 1 and 14 days.

Table 1: Demographic profile of the patients

Demographic profile	Number	%
Age (range)	5-72	
Sex		
women	68	68
Men	32	32
Side, *n* (%)		
Right	37	37
Left	67	67
Personal history Urolithiasis	52	52
UTI	42	42
HBP	30	30
VUR	10	10
DM II	9	9
Ureteral stricture	19	19
Primary obstructive mega ureter	3	3
Duplex collecting system	3	3
Neurogenic bladder	2	2

DM II, type II diabetes mellitus; HBP, high blood pressure; UTI, urinary tract infection; VUR, vesicoureteral reflux.

Table 2 : Post-operative complications classified by Clavien-Dindo's grading system

Post-surgical complications	**Clavien-Dindo score**	***N*=100**
Pleural effusion	II Ia	2
Dehiscence	I	2
SSI	II	3
Ileum	II	1
AMI	IVa	2
PTE	IVa	1
Evisceration	IIIb	1

AMI, acute myocardial infarction; PTE, pulmonary thrombo embolism; SSI, surgical site infection

Table 3 : Operative data on inflammatory renal conditions

Parameter	**No conversion to open**	**Conversion to open**	**Total, *n*=100**
Operative time, mean SD, min	203±88	388±174	218±111
Estimated blood loss, mean SD, mL	213±221	1477±748	258±423
Days hospitalized, mean SD, day	2.9±2.2	5.6±2.2	3.2±2.2

Discussion

The inflammatory renal conditions develop an inflammationprocess compromising the renal parenchyma and adjacent renal structures.[6] IRD is usually secondary to renal infections promoted by obstruction of the urinary tract,specially by stones.[6] In the Indian scenario, complicated urolithiasis has become a very frequent disease due to the delay of surgical intervention which leads to the development, in most cases, of chronic non-functional inflammatory kidneys.[7] Because of this, it is important to reduce the morbidity and mortality of these patients by selecting the best surgical approach.

The demographic data reported in the present article highlight the predominance of these diseases in women (70%), described also in other publications.[8,9] The most common comorbidities were urolithiasis and UTI, as reported in the literature.[8,9] The pyeloduodenal fistula was related to XGP, previously reported by one of the authors due to its low rate presentation.[11] Other studies, similar to the present one, reported that hydronephrosis, kidney enlargement, poor excretion of contrast medium and air in the urinary tract were some of the common findings in urologic imaging.[8] Misdiagnosed neoplasia is also seen, especially in XGP, which is considered the "Great imitator".[9,12,14]

The nephrectomy is the first line of treatment for a chronic non-functioning inflammatory kidney disease, especially when patients present severe lumbar pain, recurrent urinary tract infections or renovascular hypertension.[15,16] The minimally invasive nephrectomy is the modality of choice for benign renal diseases; however, inflammatory conditions have been considered a relative contraindication for this surgical approach.[15,16] Most surgeons prefer to perform open surgery for IRD due to the technical challenging dissection of these kidneys. Most recently, surgeons have accumulated a vast experience in laparoscopy, supporting the possibility of performing LN for IRD.[6,17] However, complications and conversion rates arenot uncommon.[15,18,20]

Since Robson's technical description of early vascular control and subsequent dissection of the rest of the kidney,surgeons have continued to perform nephrectomies with this principle.[21]In our series we modified this approach and left the hilum for last. Dissection was completed by mobilizing the kidney, usually around Gerota's fascia. Authors who have performed a similar approach have reported a 28% conversion rate due to intraoperative vascular or intestinal injuries.[6]

In 1998 Doehn et al.[22] reported that there were no significant differences in operative times and complication rates between laparoscopic and open nephroureterectomy in patients with benign renal disease (including IRDs). Additional to this, minimally invasive approach has lower needs of postoperative analgesics, shorter hospital stays, shorter times to achieve full ambulation and faster returnsto daily activities.[22] Tobias-Machado and associates[23] ,also reported 20 successful minimally invasive procedures, including transperitoneal and retroperitoneal approach, asa feasible option for IRDs. In this way, these publications allowed urologists to consider the LN a suitable option for IRD, however it needed more research.

Of the 100 patients in our cohort, we documented only 11 (11%) surgical severe complications and 1(11%) severe post-surgical complication classified by Clavien-Dindo grading system. If we compare these results to Duarte et al.[6], we had similar surgical and post-surgical complications. These results allowed us to confirm that the LN can have minimal complications despite the abundant adhesion and fibrosis process.

Liang et al[17]. analyzed the experience in LN with a method of outside Gerota's fascia dissection and en-block ligation and division of the renal pedicle similar to our re- ported cases. They reported 11% of conversions to hand- assisted laparoscopy and only one conversion to open nephrectomy. Mean operative time was 99.6 29.2 min, blood loss was 75.2 83.5 mL and average hospital stay was4:8 1:4 days[17] Comparing these results to our study, we had longer operative time and more bleeding, considering the conversion and non-conversion groups. Nonetheless, wehad lower conversion rates (7%) and our length of hospital stay was shorter compared to theirs (3.2±2.2days). We used a similar laparoscopic technique by beginning with renal release at the lower pole completing the dissection outside

Gerota's fascia dissection, then lifting the upper pole preserving the adrenal gland and finally resecting therenal pedicle en-block or dividing them and occluding the vascular structures with Hem-O-Lok vascular clips. These studies are the most recent research about this topic, concluding both that laparoscopic nephrectomy has minimal morbidity and mortality in patients with IRD.

XGP is a chronic inflammatory process in most cases due to renal parenchyma infection secondary to tract urinary obstruction[24]. In 2007, Vanderbrink and associates[25] reported LN had longer operative times but shorter post- operative hospital stay compared to open surgery, without any differences in blood loss, transfusion rates or analgesics. Lima et al[26]found that the time to control renal vessels (32±18 min), renal length greater than 12 cm and right-sided nephrectomy were some predictive factors associated with a higher conversion rate in laparoscopic approach. In our cohort, there were 6 cases of XGP, with only 1 conversion, 1 severe intraoperative complication (diaphragmatic perforation) and no postoperative complications. Since this study was retrospective, it was difficult for us to have lengths of all the kidneys, however we could see that there was more conversion to open surgery for right-sided patients, and for patients who had HBP.

The non-functioning tuberculous kidney was also considered a relative contraindication for LN, not only for its technical difficult dissection, but also because of the high risk of spillage of caseous material into the peritoneal cavity with subsequent dissemination of the disease[27] Nevertheless, in a more recent publication Kim et al[20] described the experience in 12 patients with renal tuberculosis managed with LN, who presented minor complicationsand only one conversion. In this study we reported a single case of tuberculous pyelonephritic nonfunctioning kidney, with excellent outcomes, no conversion required, no leaking of caseous material and no postoperative complications.

Conclusion

Laparoscopic nephrectomy for IRD is a reproducible technique with acceptable risks and complication rates despite the surgical challenge it represents, especially in expert hands. Our experience supports that releasing the kidney first and leaving the hilum for the end is a safe approach when vascular structures are embedded into a single block of inflammatory and scar tissue. There were minimal surgical and post-surgical complications, few conversions to open nephrectomy, blood loss, operative time and days hospitalized.

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