

Living Donor Nephrectomy at the National Kidney and Transplant Institute: Surgical Techniques, Perioperative Complications and Outcomes

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Abstract

Objectives: To report the cumulative experience of the National Kidney and Transplant Institute in terms of the surgical technique, perioperative complications and outcomes of living-donor nephrectomy.

Methods: A retrospective review on all living donor nephrectomy done at our Institution from year 2008 to 2012. Surgical complications of laparoscopic and open donor nephrectomy were compared.

Results: In this study, majority of the living kidney donors were male and single. There were 654 open donor nephrectomy and 307 laparoscopic nephrectomy. Open donor nephrectomy was performed faster with less hospital stay than laparoscopic donor nephrectomy. The mean increase in serum creatinine from baseline to 1 week post-donation was 43%. No perioperative mortalities were noted over the 5 year period. The most common minor complication was fever followed by cough. When separated by technique, the overall complication rate in open donor nephrectomy was higher than laparoscopic donor nephrectomy. Minor complications such as pneumothorax, urinary tract infection and ileus were exclusively seen in open technique while peritonitis and wound infection were exclusively seen in laparoscopic technique.

Conclusion and Recommendation: Living kidney donor nephrectomy in our Institute from 2008-2012 has been very favorable. No mortality noted with comparable rate of complications. Laparoscopic nephrectomy is the recommended surgical technique due to the higher complications noted in open donor nephrectomy.

Keywords: Living Donor Operation; Living Kidney Donation; Laparoscopic Nephrectomy; Living Donor; Open Nephrectomy

Introduction

Living kidney donation is an altruistic act which is the best option for patients with End Stage Renal Disease (ESRD). Thus far, the procedure is considered to be safe and the long-term outcome is good [1]. For the past decade, surgical techniques for donor nephrectomy have evolved from open donor nephrectomy to minimally invasive laparoscopic procedure in order to improve surgical outcome, quality of life and minimize cost. Open donor nephrectomy is an open surgery performed through a flank incision. Approximately the length of incision is about 12-15 centimeters (cm). In comparison with laparoscopic nephrectomy, it has 4 incisions: 3 port incision and 1 extraction incision. The length of each port incision is about 0.5 cm and extraction incision is about 4 cm. The open nephrectomy utilizes general and epidural anesthesia while laparoscopic nephrectomy utilizes general anesthesia only.

In a study in Japan, the perioperative complication was 3% with no mortality among 700 laparoscopic nephrectomies [2]. Another study showed that their extensive experience with living donor nephrectomy has been very favorable with low risk of major and minor complications. There were no perioperative mortalities or deep venous thrombosis. Minor complications, including hernia, fever and Clostridium difficile diarrhea were very rare, the most common being testicular pain. The overall major complication rate was 1.4%, and minor complication rate was 6.7% [1]. Baron, et al. in Loma Linda University, California concluded that hand laparoscopic donor nephrectomies in 200 cases had very low morbidity and no mortality because of the improved safety and decreased invasiveness from laparoscopic

approach. The donor complication rate was 5.5% for major complications and 2% for minor complications [3].

In the study in Germany, they concluded that living donor nephrectomy appears to be a safe intervention in specialized centers where it entails a low morbidity for the donor. The overall major complications rate was 3.8% and minor complication rate was 21.9% [4]. Even in high risk donors, long term complications were not observed.

In addition, laparoscopic technique was associated with less pain compared with open surgery; however there are equivalent numbers of complications and occurrences of perioperative events that require further intervention [5]. Kidneys obtained using laparoscopic procedure were exposed to longer warm ischemia periods than open donor nephrectomy acquired grafts, although this has not been reported as being associated with short term consequences.

Our hospital, the National Kidney and Transplant Institute, has the highest number of donor nephrectomy procedure in the Philippines with an average of 200 per year [6]. In this study, we will review the surgical techniques, issues surrounding the technique and the complications of live kidney donor nephrectomy.

Objectives

General Objective

To review the perioperative complications and outcome as well as the surgical techniques of living donor nephrectomy in our Institution between January 2008 to December 2012

Specific Objectives

To describe the following among the living donor nephrectomies done from January 2008 to December 2012

1. Demographic profile of living kidney donors
2. Surgical techniques done including length of operation, pain medications required after the operation, site of the operation
3. Intra- and post-operative complications and outcome following donor nephrectomy

Methodology

Study Design

Retrospective Cohort Study

Materials and Methods

All living kidney donor nephrectomies from January 1, 2008 to December 31, 2012 were included in the study. Data were reviewed and retrieved from Medical Records Section and Philippine Renal Disease Registry (PRDR) which included the following: demographic profile, donor nephrectomy techniques, renal function measurement, peri-operative complications. Donors' statuses were reviewed from the time of admission up to discharge.

Definition of Terms

- Living Related Donor (LRD) is a person who donates an organ to a blood relative. The donor may be the parent, sibling, child, first cousin, uncle or aunt.
- Living Non-Related Donor (LNRD) is a person who donates an organ to a non- blood relative recipient
- Laparoscopic nephrectomy is a surgery that uses a thin, lighted tube put through a cut (incision) in the belly. It results in small incision and gives latitude in the location of trocar placement. It also affords an optimal working space and facilitates orientation by providing readily available landmarks.
- Open nephrectomy is an open surgery performed through a flank incision with or without rib resection or by an intraperitoneal or extraperitoneal incision.
- Surgical complications are classified according to Clavien-Dindo Grading System [7]. It is classified as follows:

Clavien-Dindo Grading System	
Grade	Definition
Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions. Allowed therapeutic regimens are: drugs as anti-emetics, antipyretics, analgesics, diuretics and electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside.
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included.
Grade III	Requiring surgical, endoscopic or radiological intervention
Grade III-a	Intervention not under general anesthesia
Grade III-b	Intervention under general anesthesia
Grade IV	Life-threatening complication (including CNS complications: brain haemorrhage, ischaemic stroke, subarachnoid bleeding, but excluding transient ischaemic attacks) requiring IC/ICU management.
Grade IV-a	Single organ dysfunction (including dialysis)
Grade IV-b	Multi-organ dysfunction
Grade V	Death of a patient
Suffix 'd':	If the patient suffers from a complication at the time of discharge, the suffix "d" (for 'disability') is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication.

In this study complication under Clavien Classification I – II will be under minor complication and those with Clavien Classification III – V will be under major complication

Statistical Analysis

The population were described using estimates of central tendency (means, median), and spread (Standard Deviation [SD]) for continuous variables and frequency and percentages for categorical variables. Percentages of major and minor complications were used.

Ethical Consideration

Confidentiality of the subjects was maintained. Anonymity was ensured and each patient was assigned a case number.

Results

Among the 1,437 kidney transplantation done at NKTl from January 1, 2008 to December 31, 2012, 1,185 were from living kidney donation. Out of 1,185 living kidney donors, around 961 were included and 224 were excluded due to lost chart and incomplete data.

Majority (99.2%) of the donors were Filipino, male, single, with mean age of 31 years old. The mean weight was 61 kg and mean height of 162 cm. Majority (67.2%) were living related donors and under private service.

Surgical Technique and Findings

Among the 961 live donor nephrectomies performed, 654 (68.1%) were open donor nephrectomy and 307 (31.9%) were laparoscopic nephrectomy. The surgical technique breakdown by year is shown in (Figure 1).

The mean time length of operation for open donor nephrectomy was 3.63 hours while laparoscopic nephrectomy was 3.77 hours in which the difference was statistically significant (p value = 0.001) (Table I).

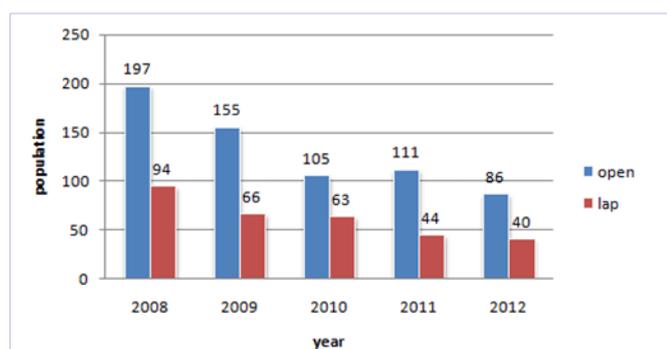


Figure 1: Surgical Technique by Year

	Laparoscopic Nephrectomy	Open Nephrectomy
Mean (hours) \pm SD	3.77 \pm 0.58	3.63 \pm 0.56
Range	2 - 6	2 - 8
p value	0.001	

The most common kidney donated was the left side, 64.6% vs 35.4% right side. Most of the kidneys had single arterial and venous vessels.

The mean estimated blood loss was 127.28 \pm 81.514 ml (range, 30 - 1,000). More blood loss was seen in open nephrectomy than laparoscopic nephrectomy but the difference was not statistically significant (p value = 0.13) (Table 2).

Table II: Estimated Blood Loss

	Laparoscopic Nephrectomy	Open Nephrectomy
Mean (ml) \pm SD	120.11 \pm 77.371	127.28 \pm 81.514
Range	30 - 1000	30 - 1000
p value	0.13	

Medical Profile

The mean Systolic Blood Pressure (SBP) was 112 \pm 9.1 (range, 90-150) and 111 \pm 9.03 (range, 90-140) mm Hg on admission and on discharge respectively. The Mean Diastolic BP (DBP) was 74.88 mm Hg (range, 60-100) upon admission and 74.1 mm Hg (range, 60-100) on discharge.

The mean serum creatinine level of donors under laparoscopic nephrectomy was 0.90 \pm 0.228 mg/dl (range, 0.4-1.6) and 1.25 \pm 0.264 mg/dl (range, 0.6-1.9) on admission and on discharge respectively. For the open nephrectomy, the mean creatinine on admission was 0.85 \pm 0.206 mg/dl (range, 0.4-1.7) and on discharges 1.2 \pm 0.28 mg/dl (range, 0.5-2.1). The mean increase in serum creatinine from baseline within 1 week post-donation was 43%.

The mean hemoglobin level was 14.27 \pm 1.374 gm/dl (range, 10-18) on admission and 12.66 \pm 1.485 gm/dl (range, 7.4-17) on discharge. Around 98.1% had decreased hemoglobin level upon their discharge; however, the mean decrease in hemoglobin level from baseline within 1 week post donation was only 11%. There was a significant difference in the decline of baseline hemoglobin level between the 2 surgical techniques (p value = 0.002).

The mean duration of pain medications given was 4 days (1-14) for both groups in which the most common pain reliever given were combination of morphine, paracetamol and tramadol (57.3%) followed by nalbuphine, paracetamol and tramadol (16.4%).

The mean duration of antibiotic treatment was 5 days (range, 1-10); Majority of donors under laparoscopic nephrectomy took antibiotics for only a day (69.4%), while those under open technique took for seven days (88.2%). The most common antibiotics used were cefuroxime (59%), sultamicillin (21.2%) and co-amoxiclav (12.6%).

The mean length of hospital stay was 4.19 ± 1.33 days (range, 2-14 days) for laparoscopic nephrectomy and 4.17 ± 1.25 days (range, 2-14 days) for open nephrectomy. There was

no sufficient evidence to prove the statistical difference in the mean length of hospital stay between open and laparoscopic nephrectomy (p -value = 0.78).

Table III: Frequency and Percentage of Complication

Complications	Overall	Surgical Technique	
		Laparoscopic Nephrectomy	Open Nephrectomy
None	774 (80.54%)	239 (24.87%)	532 (55.36%)
Overall complications	189 (19.6%)	68 (7%)	121 (12.39%)
Grade I	178 (18.52%)	63 (6.56%)	115 (11.97%)
Fever	143 (14.88%)	49 (5.10%)	94 (9.78%)
Cough	18 (1.87%)	9 (0.94%)	9 (0.94%)
Scrotal edema	2 (0.20%)	1 (0.10%)	1 (0.10%)
Pneumonia	5 (0.52%)	1 (0.10%)	4 (0.42%)
Pneumothorax	4 (0.42%)	0	4 (0.42%)
Urinary tract infection	2 (0.21%)	0	2 (0.21%)
OR site infection	2 (0.21%)	2 (0.21%)	0
Ileus	1 (0.10%)	0	1 (0.10%)
Peritonitis	1 (0.10%)	1 (0.10%)	0
Grade II	8 (0.83%)	4 (0.42%)	4 (0.42%)
Blood transfusion	8 (0.83%)	4 (0.42%)	4 (0.42%)
Grade III	3 (0.31%)	1 (0.10%)	2 (0.20%)
Hematoma	2 (0.20%)	1 (0.10%)	1 (0.10%)
Distal gut obstruction	1 (0.10%)	0	1 (0.10%)

Minor complication was 19.4% and major complication was 0.3%. Of the 3 major complications, 2 were done under open donor nephrectomy, and 1 under laparoscopic nephrectomy. The 3 major complications noted were; two hematoma which required reoperation for exploration of bleeders and evacuation of hematoma and one had distal gut obstruction, in which exploratory laparotomy was done with cholecystectomy and appendectomy. All major complications required blood transfusion.

No mortality noted.

Complication and Outcome

Among the 961 donors, 81% had no complications. Around 19.6% had complications in which the most common was fever (14.9%) followed by cough (1.9%) as shown in (Table III).

Discussion

On February 23, 1983, the first living related kidney transplant was performed at the Lung Center of the Philippines. Then on August 5, 1983 the first living related donor transplantation was performed at National Kidney Foundation of the Philippines (NKFP), currently known as National Kidney and Transplant Institute (NKTi). Since then there was an increase in the number of kidney transplantation with majority from living

kidney donation [6]. Open nephrectomy was the first method used but on February 24, 2004, the first live operative demonstration of hand-assisted laparoscopic donor nephrectomy was done [8]. Since then laparoscopic procedure tends to replace open nephrectomy in this Institute.

In this study, majority of the living kidney donors were male which is similar to other Asian countries such as Iran, Korea, Pakistan and Saudi Arabia [9-12]. However, in other countries such as USA, Singapore, Germany and Amsterdam, majority were female donors [13-16].

Majority of living donors in our study were single. This pattern is similar to what has been observed in Saudi Arabia [17]. However, in other countries such as United Kingdom and Iran majority of their living donors were married [18,19].

Regarding surgical technique used, more laparoscopic nephrectomies were done in transplant centers in western countries such as University of Miami [1]. This is in comparison to our institute in which more open donor nephrectomy were done. The difference might be secondary to financial aspect, since laparoscopic donor nephrectomy is inherently more expensive than open donor nephrectomy. This high cost might be the major cause of reluctance of our patients regarding laparoscopic donor nephrectomy.

Open donor nephrectomy is performed more quickly than laparoscopic donor nephrectomy which is similar to our study [1,20]. Laparoscopic donor nephrectomy is technically more challenging to do and is associated with a steeper learning curve [20]. Majority of donor nephrectomies were left sided. This preferred laterality of left kidney donation is because of the resulting longer renal vein [21].

Kidney donors who underwent laparoscopic nephrectomy had lesser hospital stay than open nephrectomy [1]. Conversely, the mean length of hospital stay was not different between the 2 surgical techniques in this study. The reasons noted were: 1) majority of donors who underwent laparoscopic technique were advised to go home 3 days post-surgery, however some refused to be discharged and preferred to wait for the recipient to be discharge; 2) monetary reason.

The mean increase in serum creatinine from baseline to 1 week post-donation was 43% in this study which is similar to the finding in another study which is around 49% [22]. This might be due to compensatory hypertrophy and hyperfiltration in the remaining kidney. Although 50% of the renal mass has been removed in this setting, the Glomerular Filtration Rate (GFR) usually falls by only 20-30%. Thus, the nephron in the remaining kidney must have increased their individual filtration rates by approximately 50% [23]. Nevertheless, the increase in post-donation creatinine level usually decreases then stabilizes and did not deteriorate in succeeding years [4,24].

The overall major complication was 1.4% and minor complication was 6.7% among the living donor nephrectomy program in Miami Transplant Institute [1]. Another study done at Loma Linda University, California concluded that hand laparoscopic donor nephrectomies in 200 cases had very low morbidity and no mortality because of the improved safety and decreased invasiveness from laparoscopic approach. Their donor complication rate was 5.5% for major complications and 2% for minor complications [3]. In comparison to our study, no perioperative mortalities were noted over the 5 year period. Compared to other countries, we had less major complications (0.3%) but higher minor complications (19%). The differences were due to varied classification used to stratify complications.

The most common minor complication in this study was fever followed by cough. In comparison to other study in which their most common complication was testicular pain followed by urinary tract infection and fever [1].

When separated by technique, the overall complication rate in open donor nephrectomy was higher than laparoscopic donor nephrectomy in this study which is similar to other studies [25]. Minor complications such as pneumothorax, urinary tract infection and ileus were exclusively seen in open technique while peritonitis and wound infection were exclusively seen in laparoscopic technique.

Conclusion And Recommendation

Living kidney donor nephrectomy in our Institute from 2008-2012 has been very favorable. No mortality noted with

comparable rate of complications.

Laparoscopic nephrectomy is the recommended surgical technique due to the higher complications noted in open donor nephrectomy.

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