

# Comparison of the right and left laparoscopic live donor nephrectomies: a clinical case load

N. GURES, E. GURLULER, I. BERBER, A. H. KARAYAGIZ, O. KEMIK,  
A. SUMER, U. CAKIR, A. GURKAN

Acibadem University, International Hospital Organ Transplant Center, Istanbul, Turkey

*Nazim Gures and Ercument Gurluler* Authors contributed equally to this study

**Abstract. – BACKGROUND:** The aim of the present study was to retrospectively compare the results of right- and left-laparoscopic donor nephrectomy (LDN) performed in our Center.

**PATIENTS AND METHODS:** Two hundred and eight patients who were operated on between October 2010 and October 2011 were included. Of the patients, 65 underwent right-LDN and 143 underwent left-LDN. The groups were compared in terms of duration of surgery, warm ischemia time, postoperative complications, length of hospital stay, and donor outcomes.

**RESULTS:** The mean duration of surgery was  $144 \pm 19.7$  min and  $147.8 \pm 20.2$  min in the right- and left-LDN groups, respectively. The mean warm ischemia times were  $139.1 \pm 54.1$  s and  $141.5 \pm 37.9$  in the right- and left-LDN groups, respectively. The mean length of hospital stay was  $2.4 \pm 1.0$  days for both groups. No major complications were observed in the groups. There was no significant difference between the groups in terms of donor outcomes.

**CONCLUSIONS:** The right-LDN is approached cautiously because of short length of vein and the risk for thrombosis. The results of the present study demonstrated that the right-LDN is as safe and effective as the left-LDN.

*Key Words:*

Donor nephrectomy, Laparoscopy.

## Introduction

In patients with end-stage renal disease, the treatment of choice is kidney transplantation, since a successful transplantation provides a better quality and duration of life as compared with long-term dialysis<sup>1</sup>. In 1995, Ratner et al<sup>2</sup> established laparoscopic live donor nephrectomy (LLDN) as a less invasive alternative to kidney procurement and expected decreases in the disincentives to live renal donation. The procedure has been repeatedly evaluated, and it

has recently been recognized as a practicable alternative to traditional open donor nephrectomy (ODN)<sup>3</sup>. Laparoscopic techniques are associated with several advantages, such as reducing length of hospitalization, improving pain scores, and producing a better cosmetic outcome<sup>4</sup>. The majority of transplant surgeons are unwilling to perform right-sided laparoscopic donor nephrectomy due to concerns about short vessels and renal vein thrombosis<sup>5</sup>. Additionally, most right donor nephrectomies are performed in open surgery due to a lack of experience or technical difficulties in performing laparoscopic procedures; thus, there have been fewer reports on right laparoscopic donor nephrectomy. The aim of the present study was to assess and compare the right-LDN and left-LDN performed in our center.

## Patients and Methods

Two hundred and eight patients (113 females and 95 males) that underwent surgical procedure between October 2010 and October 2011 were included in the study. In this time period, all the donor nephrectomies of both sides were performed only by laparoscopically and no open procedure was planned. The patients were preoperatively evaluated in terms of medical, psychosocial and surgical aspects. Both of the kidneys and other intra-abdominal organs were examined by abdominal ultrasonography. Computed tomography angiography was used to examine renal vascular anatomy. Renal function and glomerular filtration rate were measured using renal nuclear perfusion scan. The kidney with better function was left in the donor; however, left nephrectomy was preferred in case of a renal function difference not exceeding 5%. In the presence of multiple arteries, the side of the sin-

gle artery was preferred; left nephrectomy was performed if both kidneys had double arteries and if renal function difference was not more than 5%. An approval was obtained for the study from our Institute's Ethics Committee.

### ***Surgical Technique***

Following anesthesia induction and placement of Foley catheter, the patient was placed in the 45-degree flank-up position and fixed to the operating table with adhesive bands. Thereafter, a trocar (Ethicon Endo-Surgery, Cincinnati, OH, USA) was placed 4 cm below the umbilicus and at the lateral aspect of the rectus muscle using open technique, insufflation was then performed and a pneumoperitoneum of 12 mmHg was induced. Under direct vision, a 10 mm camera port was placed 2 cm lateral to the umbilicus, a 5 mm working port was placed 2 cm below the 12<sup>th</sup> rib in the midclavicular line, and a working port, which was used to suspend the ureter, was placed 4 cm below the 12<sup>th</sup> rib in the anterior axillary line. A 10 mm port was preferred for the retraction of the liver on the right side. Following the port placement, Todd's fascia was opened, and the colon was mobilized to the medial aspect and moved away from the kidney. The ureter was identified and suspended. Gerota's fascia was opened, and the upper pole of the kidney was separated from the adrenal gland via dissection. Gonadal, adrenal and lumbar venous branches were exposed at the point where they join the renal vein, and then cut by sealing with LigaSure (Valley Lab, Boulder, CO, USA). Renal vein and renal artery (both renal arteries in the presence of double artery) were cautiously dissected and exposed to gain the possible maximal length. After releasing its lateral ligaments and when only renal vascular structures remained, the peritoneum was exposed by cutting the layers by approximately a 6 cm inguinal incision, and it remained intact. Ureter was cut by clamping at the pelvic entry. Renal vein and artery (arteries) were cut together using a 30 mm vascular stapler (Multi-fire Endo TA 30 Stapler, Covidien, Mansfield, MA, USA) by obtaining maximum length following kidney retraction; the peritoneum was released and the kidney was removed out through the inguinal incision. After closing the peritoneal opening, the abdomen was re-insufflated; the surgical lodge was controlled in terms of bleeding and damage. A drain was inserted into the surgical lodge, and the incisions were closed in anatomical layers.

### ***Recipients***

Kidney was implanted into the iliac fossa via extraperitoneal approach. Prednisone, a calcineurin inhibitor, and mycophenolate mofetil were used as standard immunosuppression.

### ***Postoperative Care***

The patients received patient-controlled analgesia and parenteral analgesics in the early postoperative period. Liquid foods were given in the morning on the first postoperative day, and oral medication was initiated; parenteral analgesics were also administered when needed. The patients, who were routinely asked to wear anti-embolus stockings before the surgery, were encouraged for early mobilization in the postoperative period. They were given postoperative respiratory exercises. The urinary catheter and the space lodge were removed on the first postoperative day. Most of the patients were discharged on the 2<sup>nd</sup> postoperative day. All donors were called for control visits on the postoperative 10<sup>th</sup> day and 6<sup>th</sup> month.

### ***Data Collection***

Data regarding age, gender, body mass index (BMI), duration of surgery, length of hospital stay, switching to open surgery, preoperative and postoperative creatinine values, and postoperative complications were determined for the donors. Data regarding age, gender, warm and cold ischemia times were determined for the recipients. Creatinine values were assessed both at the time of discharge and on the postoperative 3<sup>rd</sup> and 6<sup>th</sup> months. Postoperative complications in the recipients (acute rejection, delayed graft function) and long-term morbidity (renal artery stenosis, graft loss) and mortality were identified.

### ***Statistical Analysis***

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS, Inc., Chicago, IL, USA) version 15.0 for Windows. Categorical variables were presented in frequency tables, whereas numerical variables were presented as descriptive statistics (mean, standard deviation, median, minimum, and maximum). Crosstab statistics are presented for intergroup comparisons of categorical variables; chi-square test was used when conditions of the chi-square test was met, if not, Fisher's Exact Test was used. Monte Carlo Simulation was used for multiple comparisons. In the comparison of nu-

merical variables, the Mann-Whitney U test was used for independent groups of non-normally distributed data, whereas t-test was used for independent groups of normally distributed data. Repeated measures were used to evaluate the patients that were followed. A regression analysis with a forward-stepwise method was used to identify risk factors. A *p* value < 0.05 was considered statistically significant.

### Results

Data of the donors are presented in Table I. Of the patients, 65 underwent right nephrectomy and 143 underwent left nephrectomy. All nephrectomies were completed laparoscopically and none of the operations were converted to the open procedure. The mean age was 50.0±14.1 years (range, 25-84 years), and the mean BMI of the patients was 27.8±5.0 kg/m<sup>2</sup> (range, 21.2-33.6 kg/m<sup>2</sup>). The mean BMIs were 27.8±5.0 kg/m<sup>2</sup> (range, 21-34 kg/m<sup>2</sup>) in the right-LDN group and 27.8±5.1 kg/m<sup>2</sup> (range, 23-35 kg/m<sup>2</sup>) in the left-LDN group. Length of hospital stay ranged from one to three days in both right- and left-LDN groups. No significant difference was identified between the groups in terms of skin-to-skin duration. There was no difference between the groups also in terms of postoperative complications. Trocar site hernia was observed in two patients that underwent left-LDN. Incision site infection was observed in one patient that underwent left-LDN and in two patients that underwent right-LDN. No other postoperative complications were observed in any of the donors. The patients in both groups were discharged within one to three days.

Demographic and intraoperative parameters of the recipients are presented in Table II. Warm ischemia times were 139.1±54.1 s (range, 122-224 s) and 141.5±37.9 s (range, 118-232 s) in the right- and left-LDN groups, respectively; the difference was not statistically significant. There were no significant differences between the groups regarding creatinine values measured at the time of discharge and in the postoperative 3<sup>rd</sup> and 6<sup>th</sup> months.

When the postoperative complications in the recipients were evaluated (Table III), acute rejection was identified in 11 patients that underwent right-LDN and in 21 patients that underwent left-LDN. Delayed graft function (DGF) was observed in four patients in the left-LDN group and in one patient in the right-LDN group. A patient in the left-LDN group developed renal artery stenosis, and the stenosis was treated with a stent via interventional radiology. Lymphocele formation was observed in three patients that underwent left-LDN. One patient from each group developed ureter stenosis, and these two patients underwent ureteroneocystostomy revision. No venous thrombosis was observed in two group of patients. No significant difference was noted between the groups in terms of postoperative complications in the recipients.

### Discussion

Renal transplantation is an effective treatment for the end-stage renal disease. Compared with dialysis treatment, renal transplantation provides longer survival and offers better quality of life<sup>6</sup>. Live donor organ transplantation results in better outcomes, particularly lower rates of acute tubu-

**Table I.** Characteristics of the donor group.

	Total (N = 208)	Right kidney (N = 65)	Left kidney (N = 143)	<i>p</i>
Gender				
Female	113 (54.5)	40 (61.5)	73 (51.0)	
Male	95 (45.5)	25 (38.5)	70 (49.0)	
Age, years	50.0 ± 14.1	48.7 ± 14.0	50.7 ± 14.2	0.371
BMI, kg/m <sup>2</sup>	27.8 ± 5.0	28.0 ± 4.7	27.8 ± 5.1	0.667
Length of hospital stay, days	2.4 ± 1.0	2.4 ± 1.0	2.4 ± 1.0	0.469
Surgery duration, min	146 ± 19.6	144 ± 19.7	147.8 ± 20.2	0.413
Creatinine, mg/dL				
Preoperative	1.2 ± 5.0	1.7 ± 8.0	1.0 ± 2.9	0.422
At discharge	1.1 ± 0.2	1.1 ± 0.2	1.1 ± 0.3	0.238

Data are presented as n (%) or mean±standard deviation, where appropriate. BMI, Body mass index.

**Table II.** Characteristics of the recipient group.

	Total (N = 208)	Right kidney (N = 65)	Left kidney (N = 143)	p
Gender				
Female	73 (35.4)	13 (20.0)	61 (42.7)	
Male	135 (64.6)	52 (80.0)	82 (57.3)	
Age, years	41.9 ± 13.8	41.8 ± 13.5	42.0 ± 14.1	0.929
BMI, kg/m <sup>2</sup>	24.5 ± 4.9	24.7 ± 4.9	24.4 ± 4.9	0.689
Number of arteries				
1	165 (80.2)	54 (83.1)	112 (78.9)	
2	38 (18.4)	10 (15.4)	28 (19.7)	
3	2 (1.0)	0 (0.0)	2 (1.4)	
4	4	1 (0.5)	1 (1.5)	0 (0.0)
Number of veins				
1	199 (96.2)	60 (92.3)	140 (97.9)	
2	7 (3.4)	4 (6.2)	3 (2.1)	
3	1 (0.5)	1 (1.5)	0 (0.0)	
Warm ischemia, s	140.8 ± 43.4	139.1 ± 54.1	141.5 ± 37.9	0.291
Creatinine, mg/dL				
At discharge	1.5 ± 0.9	1.6 ± 1.0	1.5 ± 0.8	0.743
3 <sup>rd</sup> month creatinine	1.4 ± 0.6	1.5 ± 0.7	1.4 ± 0.6	0.146
6 <sup>th</sup> month creatinine	1.4 ± 0.7	1.3 ± 0.5	1.4 ± 0.7	0.621

Data are presented as n (%) or mean ± standard deviation, where appropriate. BMI, Body mass index.

lar necrosis and longer graft survival, than cadaver organ transplantation<sup>7</sup>. Consequently, need for re-dialysis or a new transplant occurs later; thus, economic burden is reduced<sup>8</sup>.

The first successful live donor nephrectomy was performed in 1954 at Boston Peter Bent Brigham Hospital<sup>9</sup>. From that time, ODN has been performed as the unique choice until the first LDN was performed in 1995<sup>2</sup>. Recently, LDN is being performed in many transplantation centers as the gold standard method because it reduces donor morbidity rates and provides shorter healing period<sup>10-12</sup>. A review comparing open and laparoscopic methods<sup>13</sup> evaluated vari-

ous retrospective and prospective studies and demonstrated that there was no significant difference between ODN and LDN in terms of postoperative graft function and graft survival. Nevertheless, LDN causes significantly lesser postoperative pain and shorter hospital stay. Wolf et al<sup>14</sup> and Slakey et al<sup>15</sup> introduced hand-assisted laparoscopic donor nephrectomy (HALDN). Some centers perform HALDN suggesting that the technique is faster and associated with lower rates of intraoperative complications<sup>9,16,17</sup>. We are in the opinion that, this technique, in which the surgeon's hands restrict the surgeon's field of view in the intra-abdominal area and which leads

**Table III.** Antiplatelet agents and CHADS<sub>2</sub> score at baseline visit.

	Total (N = 208)	Right kidney (N = 65)	Left kidney (N = 143)	p
Acute rejection	32 (15.3)	11 (16.9)	21 (14.7)	0.678
Recipient loss	6 (2.9)	3 (4.6)	3 (2.1)	0.379
Kidney loss	5 (2.4)	1 (1.5)	4 (2.8)	1.000
Lymphocele	3 (1.4)	0 (0.0)	3 (2.1)	0.554
Ureter stenosis	2 (1.0)	1 (1.5)	1 (0.7)	0.530
Renal artery stenosis	1 (0.5)	0 (0.0)	1 (0.7)	1.000
Incision site infection	3 (1.4)	1 (1.5)	2 (1.4)	1.000
Delayed Graft Function	5 (3.1)	1 (2.0)	4 (3.7)	1.000
Venous thrombosis	—	—	—	—

Data are presented as n (%).

to higher postoperative complication rates, may be helpful in shortening the laparoscopic learning process; however, with the increase in laparoscopic experience, pure laparoscopic technique is fast and reliable, and is preferred by us. Decreases in the rates of DGF and in duration of surgery have been reported to occur in LDN after a mean of 30 cases<sup>18</sup>.

Leaving the kidney with better function in the donor is the accepted opinion. Many centers prefer left kidney nephrectomy unless there is a function difference higher than 5% or complex or multiple renal vascularity. The left renal vein's being longer facilitates the implantation of the kidney<sup>19</sup>. The use of vascular stapling device provides shorter lengths of artery and vein than that intended; this much more limits the choice of the right kidney. In the literature, the rates of right-LDN have been reported to range from 1% to 56%<sup>20</sup>. In our center, the number of right-LDNs was 65 accounting for 31% in total.

In the present study, no significant differences were found between the patients that underwent right- or left-LDN in terms of donor and recipient parameters. Limited number of studies in the literature comparing pure laparoscopic technique has demonstrated that right- and left-LDN result in similar outcomes. In their series of 303 patients, Bagul et al<sup>21</sup> performed 59 right-LDN, and found no significant difference between right- and left-LDN in terms of warm ischemia time, graft function, and donor-recipient complications. Additionally, DGF and vascular thrombosis were not observed in any of their patients in either group. In their study, Baschir et al<sup>20</sup> observed no acute rejection in the patients undergoing right-LDN, whereas they noted acute rejection in two patients undergoing left-LDN. While three of 74 left-LDNs were converted to open surgery, only one of 20 right-LDNs were converted to open surgery<sup>20</sup>. In a study, no significant difference was found between complex LDN group, which contained all right- and left-sided kidneys with multiple renal arteries, and the simple LDN group, which contained left live donor kidney with single renal artery, in terms of postoperative complications and graft function; the study defined the right-LDN as a safe method<sup>22</sup>. In a 73-case LDN series (48 left and 25 right) performed between 1998 and 2006<sup>19</sup>, the rate of surgical complications in recipients was reported to be 10% for left-LDN and 8% for right-LDN.

In the present study, no significant difference was found between the left- and right-LDN in

terms of skin-to-skin duration, which was about 145 min for both the left- and right-LDN group. Diner et al<sup>23</sup> reported the mean operative duration to be 228 min for right-LDN and 220 min for left-LDN, whereas Dols et al<sup>5</sup> reported the mean duration of surgery to be 202 min for right LDN and 247 min for left-LDN. It is evident that duration of surgery is shortened with increasing experience. Shorter duration associated with right donor nephrectomy appeared to be due to easy dissection and easy mobilization of colon in the right side. Dissection of the splenorenal ligaments sometimes causes difficulties. In our series, complications in the donors were quite less in both right- and left-LDN groups despite short durations of surgery, and none of the donors developed major complication requiring major transfusion or re-operation.

Minimal invasive techniques are gradually becoming more advanced. Results have been reported in the studies using the techniques such as single-site laparoscopic surgery, retroperitoneal LDN, robot-assisted surgery, and vaginal graft extraction, which aim at decreasing postoperative pain and complications in the donor<sup>24-26</sup>. In our center, single-site donor nephrectomy and vaginal-assisted donor nephrectomy are being performed. Initial outcomes have been appeared to be positive; however, studies on this subject with larger series are needed. LDN, which is being used in many centers as the gold standard, is still a reliable method.

## Conclusions

The right-LDN is a method performed as safely as the left-LDN; thus, we are in the opinion that laparoscopy should be preferred for donor nephrectomy regardless of the side.

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## Disclosure of Interest

Authors declare no conflict of interest or financial disclosure for this manuscript.

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