Is Laparoscopic Technique Suitable for Initial Experience in Live Donor Nephrectomy? Results of The First 51 Cases

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INTRODUCTION

Renal transplantation (RT) is considered the best treatment option in last stage kidney failure and promises better survival rates than dialysis [1]. This better survival is due to improvements in surgical technique, increased quality in postoperative care and the introduction of individualized immunosuppressive treatment protocols and had improved transplant results [2]. Live donor nephrectomy (LDN), wherefore it is a surgical technique related to the main vascular structures, has the possibility of postoperative complications, and is a considerable surgical procedure because the people to whom the procedure is applied are healthy individuals.

The minimally invasive technique has come to the fore in RT as in all other surgeries, and since the first laparoscopic nephrectomy (LN) surgery had performed in 1995, they have been started to be recommended as the standard method today [3-6]. The rates of laparoscopic live donor nephrectomy increased from 28% to 43% between 1993-2002, and the increasing rate was 11% only between 2000-2001 [7]. In the current literature the LN is the gold standart method for live donors [8]. However, there is no consensus about for the first experience to start RT teams [9]. The present study is aimed to exhibit the results of a surgical team that had performed LDN operations initially and the appropriateness of the laparoscopic method for beginners for the surgical procedure is discussed also early surgical results are discussed in the light of current literature data.

MATERIALS AND METHODS

This study was approved by the Sakarya University Ethics Committee (No:71522473/050.01.04/503) and was complied with the 1964 Helsinki declaration and its later amendments. Medical records of LDN surgeries performed in Sakarya University Faculty of Medicine, Department of General Surgery were retrospectively reviewed. While evaluating the eligibility criteria for LDN candidates, adults with compatible ABO blood group, normotensive systemic blood pressure, no DM or nonurological anomaly, acceptable HLA match and without
any systemic disease, and negative crossmatch were accepted as suitable donors. All donors were informed in LDN and live donor renal transplantation procedures, and their consents were obtained. In the preoperative period, LDN candidates had psychiatric evaluation, CT angiography was performed to reveal the renal vascular anatomy. In the absence of a renal parenchymal or vascular obstruction, extraction of the left kidney was preferred. Patient demographic characteristics, BMI level of proximity to the recipient, HLA compatibility, donor kidney side, renal vascular and ureteral system variations, hot-cold ischemia time, bleeding volume, postoperative complication rates, hospitalization day and need for re-operation were examined.

Surgical Technique

Operations were performed in the lateral decubitus position as shown in Figure 1A and 1B.

The first 10 mm trocar was placed into the abdomen with lateralized periumbilical mini incision and Hasson technique, than a total of 3 more trocars of 15 mm and 2, 5 mm were placed with direct vision as shown in Figure 2A and 2B.

For left nephrectomy, the splenic flexure was mobilized and the colon was tilted over medially. After releasing of the ureter and gonadal vascular structures on the left, the Gerota fascia was opened and the renal vein and renal artery were exposed. The next step was the separation of the perinephritic fatty tissue and the disruption of the splenorenal ligament and the overturning of the kidney to the medial and the 15 mm port was turned into an 8 cm incision with the peritoneum safe. Gonadal vessels were closed and cut with hem-o-lock vascular clips® (Wech; Teleflex Inc., Liminch, PA, USA). The ureter was closed with a double hem-o-lock vascular clip and cut. The renal artery and renal vein were closed and cut, respectively, using an Endo-GIA III vascular stapler® (Autosuture; US surgical, Norwach, Cl, USA) with 30 mm-2.5 mm, 3-row punch technology. The kidney was taken out of the abdomen by enlarging the suprapubic incision with the hand force, and perfused with Ringer’s lactate infusion. The layers were closed in the anatomical plan and the abdomen desufled. After the bleeding control, a Jacksonn-Pratt silicone drain was placed via by a 5 mm trocar space and the surgery was terminated. When extracting the right kidney, unlike this order an additional 5 mm trocar was inserted for the liver retractor, the gonadal vein on the right was protected, other maneuvers were performed in the same technique.

Statistical Analysis

Data analysis was performed by using SPSS-22 for Windows (Statistical Package for Social Science, SPSS Inc. Chicago IL, USA®2). The variables were investigated using visual (histograms, probability plot) and analytical methods (Kolmogorov-Simirnov/Shapiro-Wilk’s test) to determine whether or not they are normally distributed. We performed
analyses to describe and summarize the distributions of variables. Student’s t test was used to compare normally distributed variables such as GFR results at admission and discharge. In addition, Repeated measures ANOVA (general linear model) method was used to compare different period results such as creatinine results. The statistically significant two tailed p-value was considered as <0.05.

RESULTS

Fifty-one LDN operations were performed between April 2019 and August 2020 by the team with more than 200 advanced laparoscopic surgery experience in minimal invasive techniques annually in a tertiary medical faculty hospital. The mean age of donors was 44.6±11.6 (22-69) years and 25 patients (49%) were women. Thirty-six of the donors (70.6%) were 1° relative of the recipient. Preoperative parameters are shown in Table 1.

Left nephrectomy (80.4%) was performed in 41 donors. The mean operation time was 130 minutes (120-160) and warm ischemia time was 149 seconds (113-180) mean. The patients were discharged on the third postoperative day. HLA tissue compatibility among the recipient-donors was most common in 3/6 and was seen in 17 transplants (33.3%). There were double arteries in 7 (13.7%) of the donor kidneys, double veins in 2 (3.9%) and three veins in 1 (2%) donor. Lumbar vein was present in 18 (35.5%) of the patients, all lumbar veins were closed with hem-o-lock clips. A double ureteral system was in one patient (2%). In the postoperative period, 1 patient (1.9%) was re-operated due to bleeding, active bleeding was not detected. Chylous acid (1.9%) fluid was detected from the drain as a complication in one patient, the patient was followed up conservatively, the drain was removed on the 12th day after spontaneous regression. In one patient, graft dysfunction occurred due to diffuse venous thrombosis on the postoperative 1st day and the transplanted kidney was removed. Perioperative-postoperative parameters are shown in Table 2. While glomerular filtration rates of donors were measured as 111.0±11.7 ml/min/1.73 m² in the preoperative period and 75.0±18.2 ml/min/1.73 m² after nephrectomy, there is no statistically significant difference between the two measures (p <0.001) as shown in Table 2.

There is no statistically significant difference in the creatinine levels of the donors on the postoperative 1st, 2nd and 3rd days (p <0.001). Postoperative creatinine levels are shown in Figure 3.

DISCUSSION

Since sufficient number of cadaver transplants could not be performed in transplantation surgery to meet the increasing demand for kidney graft, it has become inevitable to move towards live donor kidney transplantation worldwide. Live donor nephrectomy technique has evolved from classical open nephrectomy to minimally invasive laparoscopic-robotic techniques with muscle-sparing mini-incision [10]. In an international report examined global live donor kidney transplantation trends in sixty-nine countries; it has been reported that in 62% of the countries, more than 50% of the transplants were performed with live donor nephrectomy in the last 10 years [11]. While the rate of live donor transplantation is 67.6% in Western countries, this rate is more than 95% in Asia and the Middle East [12,13]. Republic of

### Table 1. Preoperative clinical and demographic features

| Age, years (min-max) | 44.6 ± 11.6 (22-69) |
|----------------------|---------------------|
| Gender, F/M, n (%)   | 25/26 (49/51)       |
| BMI, kg/m²           | 27.34 ± 4.81        |
| Obesity, n (%)       | 14 (27.4)           |
| Relationship, n (%)  |                     |
| 1° degree relative   | 36 (70.6)           |
| 2° degree relative   | 13 (25.5)           |
| 3° degree relative   | 1 (2.0)             |
| 4° degree relative   | 1 (2.0)             |
| Blood group, n (%)   |                     |
| A Rh (+)             | 17 (33.3)           |
| A Rh (-)             | 1 (2.0)             |
| B Rh (+)             | 2 (3.9)             |
| B Rh (-)             | 1 (2.0)             |
| 0 Rh (+)             | 25 (49.0)           |
| 0 Rh (-)             | 5 (9.8)             |
| Glomerular filtration rate, mL/min/1.73 m² | 111.0±11.7 at admission, 75.0±18.2 at discharge |
| Statistical difference | p <0.001 |

*Abbreviation: BMI; body mass index.

*Continuous variables were expressed as means ± standard deviation and categorical variables as numbers with percentages for the description of baseline characteristics.

| Table 2. Perioperative and postoperative parameters of renal transplant donors |
|---------------------------------|---------------------------------|
| Donated kidney side, n (%)     | Left, 41 (80.4)                 |
|                                 | Right, 10 (19.6)                |
| Surgical time, minutes         | 130 (120-160)                   |
| Warm ischemia time, second     | 149 (113-180)                   |
| Cold ischemia time, minutes    | 65 (59-80)                      |
| Length of hospital stay, days   | 3 (3-3)                         |
| HLA tissue compatibility, n (%) | Full antigen (6) match, 6 (11.8) |
|                                 | 1 antigen mismatch, 2 (3.9)     |
|                                 | 2 antigen mismatch, 7 (13.7)    |
|                                 | 3 antigen mismatch, 17 (33.3)   |
|                                 | 4 antigen mismatch, 3 (5.9)     |
|                                 | 5 antigen mismatch, 7 (13.7)    |
|                                 | Full antigen (6) mismatch, 9 (17.6) |
| Anatomical abnormalities       |                                 |
| Number of arteries, n (%)      | 1, n (%) 44 (86.3)              |
|                                 | 2, n (%) 7 (13.7)               |
| Number of veins, n (%)         | 1, n (%) 48 (94.1)              |
|                                 | 2, n (%) 2 (3.9)                |
|                                 | 3, n (%) 1 (2.0)                |
| Number of ureters, n (%)       | 1, n (%) 50 (98)                |
|                                 | 2, n (%) 1 (2)                  |
| Lumbar vein presence, %        | 18 (35.3)                      |
| Postoperative complications    |                                 |
| Reopen for bleeding from ureteral artery, n (%) | 1 (1.9) |
| Transplant organ rejection     | 1 (1.9)                        |
| Chylous leak, n (%)            | 1 (1.9)                        |
| Ileus, n (%)                   | 1 (1.9)                        |

*Results for continuous variables were expressed as medians and interquartile ranges.
In the presence of incidental minor anomalies such as
simple cysts, we preferred to remove the kidney with anomaly in order to keep the healthy kidney in the living donor.

In the literature, rates varying between 0.3% and 0.01% are reported for mortality after donor nephrectomy [16]. Major intra-abdominal hemorrhage is cited as the main cause of mortality. In the studies of Simfroosh et al including 1834 cases where vascular clips were used for vascular control; The bleeding rate has been reported at a rate of 0.2%, it has been reported that the bleeding is caused by pseudo-aneurysms in the renal artery. According to the results of this study, it has been reported that the clips save $ 670 per case in the long term and are a safe and cost-saving option for vascular control in the hands of trained surgeons [25]. However, in the study published by Friedmann et al. in 2011, it has been reported that clips should not be used to control the donor renal artery, and all surgeons working on a living organ donor should choose safer vascular techniques that require tissue transfection [26]. We preferred the use of staplers for vascular control in our patients, and in our experience, we did not encounter subscriber hemorrhage and mortality.

There is more than one study in the literature evaluating the perioperative and short-term morbidity of more than 1000 LDN patient [27–30]. According to these studies, while the total complication rates of LDN including infection, ileus, arrhythmia and pneumonia varied between 5.6-7.9%, conversion rates were reported as 0.3-0.9%. While postoperative complications were detected in 2 patients (4%), in our experience one incisional hernia and one ileus, none of our patients conversioned to open surgery. In the study about 2500 cases published by Rally et al., which is one of the largest LDN series published in the literature, mean operation time is 140 minutes, average warm ischemia times are 4.4 minutes for the left kidney and 5.2 minutes for the right kidney [31]. Our operation times and warm ischemia times seem to be compatible with the literature. These findings are particularly important as a strong correlation has been demonstrated between ischemia times and functional outcomes of the transplanted kidney [3].

The retrospective structure of the study and the smaller number of cases can be considered as its limitations.

CONCLUSION

Transabdominal laparoscopic donor nephrectomy technique, provided that experienced surgical team with graft survival and acceptable morbidity in donor transplantation can be safely applied also in the beginner’s unit.

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