Renal Hilus Ligation With Single Stapler in Laparoscopic Donor Nephrectomy

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ABSTRACT

Background. Ligation of renal hilus is the most important stage of laparoscopic donor nephrectomy. Laparoscopic staplers are securely used for renal pedicle control. We present our donor nephrectomy cases in which we used 1 stapler for renal artery and vein ligation.

Methods. Demographic data, number of arteries and veins, ligation types, operation time, and complication rates are recorded.

Results. One hundred twenty laparoscopic donor nephrectomy cases who were operated between December 2017 and August 2018 in İstinye University Hospital and İstanbul Aydın University Hospital were retrospectively evaluated. All of the operations were done by 2 surgeons with a fully laparoscopic method. None of the cases were converted to open nephrectomy. There was 1 renal artery in 110 (91.7%) cases, 2 renal arteries in 9 (7.5%) cases, and 3 arteries in 1 (0.8%) case. Renal artery and vein were ligated with single stapler in 115 (95.8%) cases. Double stapler was used in 5 (4.2%) patients. There were no major complications for donors and no implantation problems for grafts.

Discussion. Laparoscopic donor nephrectomy is the most used technique for living donor operations. Vascular stapler is securely used for renal artery and vein ligation with high costs. Two or, due to the number of vessels, sometimes 3 staplers are used in the standard technique. In our study, the operation was finished securely in 95.8% of the patients with single stapler use. Single stapler use for ligating renal hilus is safe in kidneys even with suitable multiple arteries and veins in laparoscopic donor nephrectomy.

PURE or hand-assisted laparoscopic/retroperitoneoscopic living donor nephrectomy is strongly recommended as the preferential technique for donor nephrectomy in renal transplantation guidelines [1]. The first laparoscopic living donor nephrectomy (LLDN) was performed by Ratner et al in 1995 [2]. LLDN is significantly better for postoperative pain and analgesic requirements, hospital duration, time to return to work with similar rates of graft function, rejection rates, urological complications, and patient and graft survival compared with open surgery [1]. According to a systematic review by Kortram et al, among 32,038 donors most of the donors were operated with pure laparoscopic approach (57.4%) and hand-assisted laparoscopic approach (25.3%) [3,4]. Overall outcomes of laparoscopic donor nephrectomy were 1.1% for conversion to open surgery, 0.4% for bleeding requiring transfusion, 0.6% for surgical reintervention, and 0.01% for mortality [4].

Ligation of renal hilus is the most important stage of laparoscopic donor nephrectomy. Hemorrhage caused by technical problems is a rare but severe complication with significant morbidity and mortality. The mortality rate was

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0.01% with only 3 cases reported in review articles, but there were 8 perioperative deaths that not recorded in these articles [4]. Hem-o-lok clips were used in laparoscopic nephrectomies with fatal complications, so now they are not recommended in laparoscopic donor nephrectomy due to safety concerns [4,5]. Laparoscopic staplers are securely used for renal pedicle control, and stapling has become the gold standard for laparoscopic donor nephrectomy [4].

Separate staplers are used for the division of the renal artery and vein in most of the transplantation clinics. We used a single stapler for the renal artery and vein ligation regardless of the number of vessels if possible. Also, the graft was extracted by hand without the use of an endobag.

In this study, we have presented our donor nephrectomy cases in which we used 1 stapler for renal artery and vein ligation.

METHODS

One hundred twenty laparoscopic donor nephrectomy cases who were operated between December 2017 and August 2018 in İstinye University Hospital and İstanbul Aydın University Hospital were retrospectively evaluated. Demographic data, number of arteries and veins, ligation types, operation time, and complication rates are recorded. All of the operations were done by 2 surgeons (MT, EE) with a fully laparoscopic method. None of the cases were converted to open nephrectomy. Operation time was measured from the first incision to the extraction of the graft.

Surgical Procedure

The patient was placed in the lateral decubitus position, and the operative table was flexed. A 10-mm trocar for camera placement was inserted by the open technique into the periumbilical region, and pneumoperitoneum was established. Then, under direct vision, one 5-mm trocar was placed in the subcostal area and one 10-mm trocar was placed in the left lower abdomen quadrant for the left donor nephrectomy. On the right side, two 10-mm trocars were used for both subcostal and right lower abdomen quadrant trocar entrance. Dissection of the kidney was performed with Ligasure Maryland Jaw Device (Covidien, Minneapolis, MN). First, the colon was mobilized along the line of Toldt including the splenic or hepatic flexure. The gonadal vein was mobilized along with the ureter up to the renal vein. Adrenal and lumbar veins were ligated and divided by Ligasure. The spleen was partially mobilized at the left side. The ureter was dissected down to the iliac artery and lifted up. After dissection of the renal hilus, the kidney was dissected free of posterolateral attachments. After completing the dissection of the renal artery and vein from each other and surrounding lymphatic tissue, a Pfannenstiel incision was made and a 12-mm trocar replaced with a 10-mm trocar at the lower quadrant for the stapler entrance. Then the ureter was ligated by a hem-o-lok clip and divided. The renal artery and vein were ligated and divided together using a GIA-stapler and the kidney rapidly extracted by hand after the peritoneum was transected.

RESULTS

One hundred twenty cases were included in this study. The mean age was 44.3 (range, 18–75) years. Fifty-four of the patients were male (45%), and 66 of them were female (55%). The mean body mass index was 28.2 ± 5.9 kg/m^2, and the mean operation time was 34.6 ± 15.8 minutes. Ninety-four of the cases (78.3%) had undergone left donor nephrectomy, and 26 of the cases (21.7%) had undergone right donor nephrectomy. None of the cases were converted to open nephrectomy. A drain was used in only 7 (6.5%) patients. There was no bleeding requiring blood transfusion and no surgical reintervention. Demographic data of the patients are given in Table 1.

Table 1. Demographic Data of Patients

Mean age (years)	44.3 (18–75)
Sex	
Male	54 (45%)
Female	66 (55%)
BMI (kg/m^2)	28.2 (± 5.9)
Mean operation time (min)	34.6 (± 15.8)
Use of drain	7 (6.5%)
Conversion to open nephrectomy	0 (0%)
Side	
Left	94 (78.3%)
Right	26 (21.7%)

There was 1 renal artery in 110 (91.7%) cases, 2 renal arteries in 9 (7.5%) cases, and 3 arteries in 1 (0.8%) case. There was 1 renal vein in 102 (85%) cases, 2 renal veins in 17 (14.2%) cases, and 3 renal veins in 1 (0.8%) case. The renal artery and vein are ligated with single stapler in 115 (95.8%) cases. Double stapler was used in 5 (4.2%) patients. Vascular anatomy and ligation types are given in Table 2. Double stapler was used for 3 patients with 2 artery and 1 vein, 1 patient with 3 arteries and 2 veins, and 1 patient with 1 artery and 3 veins. Vascular anatomy of stapler preferences is given in Table 3.

There were no implantation problems and bleeding about the kidney grafts. Renal arteries of 7 cases with 2 renal arteries were anastomosed separately, and 2 upper polar arteries smaller than 2 mm were ligated. Two of 3 renal arteries were anastomosed separately, and upper polar artery was ligated in 1 patient. Fifteen renal veins of 18 cases with multiple renal veins were ligated because of low diameters of the vessels. Only 3 of them were anastomosed separately.

DISCUSSION

Kidney transplantation is the best treatment of choice for end-stage renal disease. In 2016, the number of patients who need renal replacement therapy (RRT) was 74,475 in Turkey, with the general prevalence of 933 person per million (ppm), and now 4.9 million people need RRT worldwide [6,7]. The number of incidents of RRT patients in 2016 was 11,169, and the general incidence was 139.9 ppm in Turkey [6]. Approximately 80% of kidney transplantations were performed from live donors due to lack of cadaveric donors in our country [6].

The techniques used for minimally invasive living donor nephrectomy are considered safe with an overall

Table 2. Vascular Anatomy and Ligation Types of Patients

Renal artery	
One artery	110 (91.7%)
Two arteries	9 (7.5%)
Three arteries	1 (0.8%)
Renal vein	
One vein	102 (85%)
Two veins	17(14.2%)
Three veins	1 (0.8%)
Ligation technique	
Single stapler	115 (95.8%)
Double stapler	5 (4.2%)

complication rate of 16.8% in a systematic review and meta-analysis [1,8]. Compared to open surgery, minimally invasive donor nephrectomy improved operative variables, postoperative pain control, wound cosmesis, patient satisfaction, and reduced hospital stay [4,9].

Pure laparoscopic donor nephrectomy is the most common technique used for living donor operations [3,4]. Ligation of renal hilus is the most important stage of this operation in order to extract the kidney without any harm. Vascular staplers are securely used for renal artery and vein ligation separately with high costs. Two or, due to the number of vessels, sometimes 3 staplers are used in the standard technique. We have used only 1 stapler for renal hilus control regardless of the number of renal vessels if possible.

The incidence of multiple renal arteries has been reported as 25% in cadaveric studies [7]. In our study, the prevalence of multiple renal arteries was 8.3%. Also, the most common reason for right side donor nephrectomy is the prevalence of multiple vessels on the left kidneys [7]. Left donor nephrectomy is performed 8 times more than right donor nephrectomy in the United States [7]. In our study, we performed left donor nephrectomy 4 times more than right donor nephrectomy. Twelve transplantation centers perform only left laparoscopic donor nephrectomy in Europe [7].

Mean operation times were reported as 188 minutes for single artery donor and 214 minutes in multiple arteries donor in a meta-analysis [7]. Although mean operative times in donors with multiple renal arteries were longer (approximately 15 minutes) than in those with single renal artery, there were no significant differences between multiple renal arteries and single renal artery in terms of hospital stay, blood loss, and surgical complications for kidney donors [7,9].

Table 3. Vascular Anatomy of Stapler Preferences

Single stapler	
One artery, 1 vein	93 (80.9%)
Two arteries, 1 vein	6 (5.2%)
One artery, 2 veins	16 (13.9%)
Double stapler	
Two arteries, 1 vein	3 (60%)
Three arteries, 2 veins	1 (20%)
One artery, 3 veins	1 (20%)

Genc et al reported a series of 85 cases of single stapler technique in laparoscopic donor nephrectomy [9]. Their total operative time was 76.1 (60–115) minutes for 1 artery, 100.3 (82–112) minutes for 2 arteries, and 120.6 (112–138) minutes for 3 or more renal arteries [9]. They did not report any conversion to open surgery and major complications [9].

In our study of 120 patients, the operation was finished securely in 95.8% of the patients with single stapler use. The most common indication for double stapler use was lower polar arteries that were far away from the renal hilus. We used only 3 trocars for both sides of donor nephrectomy. Our mean operation time was much shorter than those reported in previous studies because we calculated it from the first incision to the extraction of kidney and we also used a single stapler for hilar control and did not use an endobag. We did not face any stapler malfunction, bleeding requiring transfusion, and conversion to open surgery and any other major complications. We used a drain in only 7 (6.5%) patients. There were 2 wound infections, 2 atelectasis, and 1 spontaneously resolved subcutaneous hematoma for donors. Also, there were no implantation problems due to length of renal vessels in the recipients.

In our opinion, single stapler use for ligating renal hilus is safe, fast, feasible, and especially cost effective in kidneys even with suitable multiple arteries and veins in laparoscopic donor nephrectomy with 3 trocars in experienced hands.

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