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Original Article

Hand-assisted laparoscopic and laparoscopic donor nephrectomy: A comparison of surgical outcomes from two centres

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ABSTRACT

Objective: The aim of the study was to compare the different surgical approaches of two centers on outcomes of live donor laparoscopic nephrectomy.

Material and methods: The first 98 patients of each centre who underwent laparoscopic donor nephrectomy (LDN) or hand-assisted laparoscopic donor nephrectomy (HALDN) were included in the study. The following data were used for analyses: donor age, weight, height, body mass index (BMI), transfusion requirement, operative time, ischemia time and postoperative complications.

Results: Median age, BMI, operation time and estimated blood loss (EBL) was 47.29 years, 27.91 kg/m^2, 110.73 minutes, and 78.95 mL, respectively. Operation time was significantly shorter in the HALDN group (t=-3.554, p<0.01). EBL was not significantly different between the two groups. The difference in hospitalization time and warm ischemia times (WIT) was not significant between the two surgical technique groups (t=-1.554, t=1.258; p>0.05). No statistically significant difference was detected in the intraoperative and postoperative complication rates between two groups (p>0.05). The postoperative complication rate was 7.14% (n=7) and 6.12% (n=6) in the LDN and HALDN groups, respectively. There were two patients with conversion to open surgery in the HALDN group because of lumbar vein injury.

Conclusion: The operative and postoperative outcomes for the two techniques were found to be similar. The HALDN technique preserves the benefits of minimally invasive surgery. In experienced urologic laparoscopy centres both techniques promise similar success rates.

Keywords: Donor nephrectomy; hand-assisted laparoscopic nephrectomy; kidney transplantation; laparoscopic nephrectomy.

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Introduction

Laparoscopic donor nephrectomy (LDN) has become a widely used procedure for living kidney donation. Several randomized clinical trials have been conducted since the first LDN was performed in 1995.[1] These studies revealed that LDN was associated with fewer adverse complications than the open technique.[2-4] The advantages associated with LDN include less pain, quality of life benefits, and an equivalent number of perioperative complications compared to open donor nephrectomy due to its longer operative and warm ischemia times (WIT). The LDN approach does not increase intraoperative and postoperative donor complications or compromise graft function.[2,5] The technical difficulties associated with a pure LDN have led surgeons to develop modifications in laparoscopic surgical techniques. One of these modifications is the hand-assisted laparoscopic approach. Previous studies revealed that hand-assisted laparoscopic donor nephrectomy (HALDN) was superior to LDN with respect to bleeding, shorter operating time, and warm ischemia time.[6]

Approximately 60% of living donor nephrectomies are currently performed by hand-assisted procedures. However, the proportion of har-

vested kidneys with a pure laparoscopic approach is continuously increasing.[7] In this study, we reviewed the data of our centre with those of HALDN and compared these results with the results from a centre performing laparoscopic live donor nephrectomy.

Material and methods

In this study we compared the first 196 laparoscopic live donor nephrectomies performed in two experienced centres by two experienced surgeons. The surgeon performing LDN is a very experienced surgeon in a high volume centre performing every kind of urologic laparoscopic procedures. The surgeon performing HLDN is also experienced in laparoscopic surgery, but performed the hand-assisted laparoscopic technique firstly for donor nephrectomy. In one of the centres a LDN was performed in 98 patients and in the second centre 98 operations were performed with the HALDN technique. The patients were evaluated by the transplant committee of the centres and suitable candidates for kidney donation were selected. Ethical committee approval was not obtained for this study which is not mandatory for retrospective studies in our institution. However, informed consent was obtained from all study population. The procedure was thoroughly explained to the patient and his/her informed consent was taken. The preoperative evaluation included high resolution computed tomography (CT)-angiography to assess the presence of two normally functional kidneys and the anatomy of renal vasculature. Both surgical teams used Hem-0-Lock clip@ (Teleflex Medical, Research Trianglepark North Carolina, USA) for the left side, vascular stapler Articulate Endo-TA (Ethicon Endosurgery, Johnson and Johnson Cincinnati, OH, USA) was only used for the right sided patients. The left kidney was retained only if it was potentially favourable for the donor. We obtained the following data from chart reviews for analysis: donor age, sex, weight, height, body mass index (BMI), transfusion requirement, estimated blood loss (EBL), operative time, warm ischemia time (time from division of the renal artery to the time the kidney was placed on ice), and postoperative complications. The operative time was defined as the time between skin incision for placement of the first trocar and skin closure of the trocar wounds.

Surgical techniques

All surgical procedures in both groups were performed with the patient in a 90-degree flank position. The patients undergoing HALDN had an infraumblical transverse 6-8 cm long incision for the hand port and a hand port (Endopath Dextrus, Ethicon) was fitted through the incision. After establishing pneumoperitoneum, a 15-mm trocar for another operating channel was inserted 5 cm medial to the spina iliaca anterior superior. The second 11-mm trocar was then inserted in the middle of the midclavicular line. A third trocar was placed under the tip of the 12^{th} ribs, if necessary. The pneumoperitoneum was maintained at 8 to 10 mmHg after the trocars and the hand port were placed. The peritoneal cavity was inspected using a 30° laparoscope which was placed through the midline port. The colon was dissected medially to enter the retroperitoneal space and expose the kidney. The gonadal vein was identified and tracked up to the renal vein. All branches of renal vein were carefully dissected and sacrificed. The adrenal gland was dissected off the superior pole of the kidney and preserved. The renal artery was then identified and dissected from surrounding lymphatic vessels. The ureter was dissected to the level of the common iliac artery after preparation of renal vessels was completed. The ureter was divided when the recipient was prepared to receive the donor kidney. A broad mesoureter was left intact to preserve the ureteric blood supply.

The patients in the LDN group were positioned in 90^0 left flank position. Then, a 5-6 cm oblique incision was made parallel to the inguinal ligament starting 5 cm medial to the left anterior superior iliac spine. A hand port (GelPort Applied Medical, Rancho Santa Margarita, CA) was inserted and pneumoperitoneum was established with 15 mm-Hg CO_2. The two 10 mm ports were inserted at the umbilical level on the lateral border of the rectus abdominis muscle. An additional port was placed 3 cm inferior to the costal margin at the lateral border of the rectus abdominis muscle. CO_2 pressure was reduced to 12 mmHg. The remaining operation was conducted in the same manner as described for the HALDN group.

The kidney extraction procedure was the same in both groups. The kidney was extracted from the hand port in both groups and immediately placed in the ice slush after the recipient preparation was completed. The wounds were closed in classical manner in both groups after bleeding was controlled and a drain was placed.

Statistical analysis

All data were presented as the mean and standard deviation for continuous and categorical data. We used chi-square test and independent samples t-test to compare the categorical and continuous variables. The results were considered statistically significant at $p<0.05$. All statistical calculations were performed using Statistical Package for the Social Sciences 17.0 software (SPSS Inc.; Chicago, IL, USA).

Results

This study examined 196 cases; ie 98 cases in the LDN and 98 cases in the HALDN groups. The following descriptive statistics of variables are shown in Table 1 age (mean, 47.29±11.75 years), BMI (mean, 27.91±3.70 kg/m^2), operative time (mean, 110.73±18.40 min), and estimated blood loss (EBL) (mean. 78.95±28.931 mL).

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The data indicated presence of homogeneity in variance for age, BMI, and ASA variables between patient groups in this study. We used the independent groups t-test analysis for these variables. We found that there was no statistically significant difference between groups regarding American Society of Anaesthesiologists (ASA) and BMI (t=1.344, t=0.43; p>0.05, respectively). However, there was a significant difference observed for patient age between groups (t=-0.2141, p<0.05).

Table 1. Descriptive statistics of the patient groups

Technique	Mean	SD
BMI (kg/m²)		
LDN	27.8041	2.10475
HALDN	28.0529	5.07437
Age (years)		
LDN	45.62	12.012
HALDN	49.43	12.889
EBL (mL)		
LDN	75.75	2.812
HALDN	83.03	3.457
Operative time (min)		
LDN	115.14	15.264
HALDN	104.82	29.504
Warm ischemia time (min)		
LDN	108.92	46.958
HALDN	98.98	57.763

BMI: body mass index; LDN: laparoscopic donor nephrectomy; HALDN: hand-assisted laparoscopic donor nephrectomy; BMI: body mass index; EBL: estimated blood loss; SD: standard deviation

Table 2. Early term postoperative complications of the two groups

	LDN (n=98)	HALDN (n=98)	Clavien-Dindo grading of classification
Urinary retention	1	1	1
Wound infection	0	1	1
Prolonged ileus	2	2	1
Scrotal swelling	0	1	1
Atelectasis	3	1	1
Subcutaneous emphysema	1	0	1
Total	7 (7.14%)	6 (6.12%)	

LDN: laparoscopic donor nephrectomy; HALDN: hand-assisted laparoscopic donor nephrectomy

The variables of operative time, EBL, and hospitalization time were equally distributed between groups. The operation time showed a statistically significant difference between groups (t=-3.554, p<0.01, respectively). The operative time was significantly shorter in the HALDN group. Statistical analysis did not reveal any significant difference between the two groups regarding EBL (t=1.234, p>0.05). The difference in hospitalization time was not significant between the two surgical technique groups (t=-1.554, p>0.05). There was no statistically significant difference in WIT between the two operation techniques (t=1.258, p>0.05) (Table 1). There was no statistically significant difference in the intraoperative complication rate between groups (p>0.05). There were two patients with conversion to open surgery in the HALDN group because of lumbar vein injury. There was one lumbar vein injury in the LDN group and it was managed laparoscopically. The postoperative complication rates were 7.14% (n=7) and 6.12% (n=6) in the LDN and HALDN groups, respectively. Any statistically significant difference was not observed between groups as for postoperative complications (p>0.05) (Table 2).

Discussion

The inadequacy of deceased donor kidneys has led to greater demand for living donor kidney transplantation.[8] Thus increased use of living donors led surgeons to use minimally invasive approaches. Ratner and colleagues performed the laparoscopic donor nephrectomy successfully for the first time in 1995.[1]

Although LDN is now a well-established minimally invasive procedure, the operation has some limitations. A combination of technical difficulties and long learning curves for LDN resulted in the introduction of technical modifications to the original procedure (HALDN) to improve safety. The disadvantages of LDN including longer WIT, increased operative time and longer learning curve were expected to be minimized by the HALDN technique.[9,10]

The advantages of the hand-assisted technique are tactile sensation and better three dimensional spatial orientation, which leads to controlled blunt dissection and retraction of the tissues. Furthermore, digital compression can be employed for hemostasis in case of acute bleeding. Additionally, use of laparoscopic sponges may help to control bleeding. There are several reports favouring the HALDN technique due to better hemostasis.[11,12]

The presence of tactile feedback may positively impact the learning curve for this surgical technique. Previous studies reported that the advantages of HALDN are related to fewer complications, shorter hospital stay, and WIT. However, we could not determine any superiority of HALDN compared to LDN. The majority of studies reported lower EBL with HALDN than with LDN.[13,14] The mean EBL rates were similar for both groups

and comparable to previous literature data.[7] This could be attributed to the experience in laparoscopic urological surgery of both groups. The overall hospital stay was similar between the groups in our study. A recent meta-analysis reported shorter hospital stay with LDN relative to HALDN.[15]

The rate of intraoperative and postoperative complications was similar between the LDN and HALDN groups in our study. Bleeding is the most common reason for conversion to open surgery during a laparoscopic surgery and bleeding control can be difficult to manage using laparoscopic instruments alone.[12,16]

Thus, the conversion to open surgery should be higher in the LDN group. However, there was no higher rate of conversion observed in our study and both conversions to open surgery were performed in the HALDN group. This result can be attributed to the experience of our LDN group of our hospital which is a referral centre in urological laparoscopic surgery. Similarly, Türk et al.[17] reported no conversion to open surgery in their series of LDN. The surgeon preference in order to prevent unnecessary blood loss was the main issue for conversion to open surgery in the HALDN group.

Preserving the integrity of the kidney and optimal kidney function is crucial for donor nephrectomy. Although the long-term clinical significance of decreased warm ischemia remains debatable, decreasing warm ischemia and manipulation time is preferable when possible.[18] According to the WIT observed in our study, the HALDN group had shorter WITs than the LDN group. However, the difference did not reach to a statistical significance. A recent meta-analysis comparing HALDN with LDN analysed 16 studies for different parametres. The authors found that WIT was significantly shorter in the HALDN groups.[16] The reason for relatively short WIT in the LDN group in our study was probably associated with the insertion of a hand port at the beginning of the procedure. In the LDN group the hand port (Gelport) was inserted at the beginning of the operation. The procedure was continued solely laparoscopically through a 10 mm trocar placed into the Gelport. At the end of the operation the prepared hand-port provided rapid extraction of the kidney after the renal artery was clamped, which reduced the time needed for an extraction incision and bagging of the kidney.

The only variable that was in favour for HALDN in our study was operative time. We found that the operative time was significantly shorter for the HALDN group. This result is probably related to the faster sharp dissection and tactile sensation in the HALDN operation facilitating dissection of the renal vessels and the surrounding tissue. The operative time of both groups was relatively short compared to the literature.[15] This result can be attributed to the surgical experience of both groups of surgeons and the hand ports used for extraction.

The extraction incisions in LDN decreased to 5-6 cm over time.[19] The insertion of hand ports in the beginning of the operation in the LDN group caused longer incisions but led to shorter WIT. The extraction incision required for hand-assisted laparoscopic nephrectomy is reported to be 6-8 cm. Although this difference might be a disadvantage of both techniques the safety provided by the hand-port device is regarded as beneficial by our team.[20,21] The increased morbidity with the HALDN procedure compared to LDN may be expected because of the incisional manipulation during the procedure. However, no difference was observed between the two groups with respect to incisional morbidity. There were no extraction port hernias in the two series. The length and location of the extraction incisions do not appear to alter the postoperative analgesia requirements, length of hospital stay, and time to oral intake. Higher rates of postoperative ileus are expected in the HALDN group due to increased bowel manipulation throughout the procedure. Postoperative ileus was observed in two patients in each group. Both HALDN and LDN techniques have advantages compared to open donor nephrectomy, where the procedure requires a long flank incision which is related to significant postoperative pain and longer hospital stay. Wound complication including infection and hernia formation occur in 9% of the donors.[21]

The patient characteristics including ASA score and BMI were similar in both groups. Therefore, we could not compare the groups according to BMI. Previous studies reported that the HALDN approach have provided technical advantages in obese patients.[22,23]

In conclusion, the operative and postoperative outcomes for the two techniques were similar. The HALDN technique preserves the benefits of minimally invasive surgery. Our data revealed that LDN and HALDN are both safe and feasible approaches for centres with experience in urological laparoscopic surgery. Surgeons will have to choose the most suitable technique according to their surgical experience.

Ethics Committee Approval: Ethical committee approval was not obtained for this study which is not mandatory for retrospective studies in our institution.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

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