COMPARISON OF THREE ALTERNATIVES FOR LIVING DONOR NEPHRECTOMY

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Abstract

Background. We re-started living kidney transplant in June 2006 after 20 years of interval at Hirosaki University Hospital. We sequentially changed procedure of living donor nephrectomy. First, donor nephrectomy was carried out by open surgery with a small incision (10 cm). We then introduced laparoscopic retroperitoneal approach followed by laparoscopic intraperitoneal approach. Here, operative and clinical outcome of the three alternatives of donor nephrectomy was evaluated.

Methods. Twenty-seven cases who underwent living donor nephrectomy between June 2006 and July 2011 at Hirosaki University Hospital were enrolled. There were 12 males and 15 females with a mean age of 54.3 years. We performed 7 open donor nephrectomy with a small incision, 5 laparoscopic retroperitoneal donor nephrectomy, and 15 laparoscopic intraperitoneal donor nephrectomy.

Results. Operation time was 155 min., 250 min., and 214 min., respectively. Estimated blood loss was 310 g, 100g, and 95g, respectively. Warm ischemic time was 2.0 min., 3.0 min., and 3.0 min., respectively. Patients who underwent laparoscopic donor nephrectomy cloud start to walk significantly earlier than those who underwent open donor nephrectomy. There were no surgical complications, nor conversion to open donor nephrectomy from laparoscopic donor nephrectomy. There were no significant difference with post-operative serum creatinine concentration in the donors among the three operation procedures.

Conclusions. Safety procedure is the most important for living donor nephrectomy. Laparoscopic donor nephrectomy is safe and associated with early recovery of the donors. Longer and careful observation is necessary for renal function of the donors.

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Introduction

Dialysis and kidney transplantation are treatment strategies used for end-stage kidney disease. Transplantation is superior to dialysis in its ability to improve the quality of life, overall survival, and cost effectiveness.[1-3] Thus, transplantation is accepted as the optimal treatment strategy for end-stage kidney disease.

Living donor nephrectomy is performed in healthy individuals who themselves receive no direct therapeutic benefit. Safety and efficacy of this procedure are important to the donor. Maximum donor safety must be achieved without compromising functional outcomes of grafts.

Since the first laparoscopic living donor nephrectomy (LDN) performed in 1995,[4] this procedure has been shown to alleviate postoperative pain, shorten hospital stay, reduce graft loss, and improve cosmesis while hastening donor recovery.[5-7] Long-term follow-up revealed no significant differences in recipient graft function and allograft survival after LDN compared to open living donor nephrectomy (ODN).[8,9] However, laparoscopic nephrectomy

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is a technically difficult procedure, and most studies have reported significantly longer operative and warm ischemic times in LDN than in ODN.[10, 11)]

The preferred procedure for nephrectomy has been changed 3 times at our hospital. First, mini-incision ODN (10 cm) was performed. After which laparoscopic retroperitoneal donor nephrectomy (LRN) and laparoscopic intraperitoneal donor nephrectomy (LIN) were introduced. Here the operative and clinical outcomes of these 3 alternatives for donor nephrectomy were compared and evaluated.

Materials and Methods

Donors

From June 2006 to July 2011, 27 LDNs were performed at Hirosaki University Hospital. Patients were divided into ODN (n = 7), LRN (n = 5), and LIN (n = 15) groups. All donors underwent routine preoperative evaluations, including a renal scan, glomerular filtration rate measurement, and computed tomographic angiography. When the kidneys were equal in suitability, the left kidney was selected to take advantage of the longer renal vein.

Preoperative demographic data of donors are shown in Table 1. The mean ages in ODN, LRN, and LIN groups were 58.6 (41–75), 49.4 (25–71), and 55.9 (35–76) years, respectively. The gender ratios (male:female) in ODN,

LRN, and LIN groups were 1:6 (14.3%:85.7%), 4:1 (80.0%:20.0%), and 7:8 (46.7%:53.3%), respectively. Right nephrectomy was performed in only 2 patients in the LIN group. Serum creatinine levels of donors were measured before surgery and on days 1, 2, 7, 180, and 365 after surgery.

Procedures

Initially, ODN was the preferred procedure for nephrectomy at our hospital. Mini-incision (10 cm) ODN was performed using the standard retroperitoneal flank approach without rib resection. LRN was then introduced, followed by LIN. LRN and LIN were performed through 4 ports. After identification and careful dissection of the ureter, renal artery, and renal vein, a pararectal incision was made and LapDisc® (Hakko Co. Ltd., Nagano, Japan) hand access device was inserted (Fig. 1). The renal artery and vein were divided using an endoscopic stapler. The kidney was placed in the hand access device and extracted through the LapDisc.

RESULTS

Data regarding the 3 types of nephrectomies are shown in Table 2. Mean operative times in each group were 155 min, 250 min, and 214 min, respectively, and a significant difference was observed between LDN and ODN groups (p = 0.00). Median estimated blood loss was 310

Table 1 Characteristics

	Laparoscopic surgery (n=20)		Open surgery (n=7)
	LIA (n=15)	LRA (n=5)	ODA (n=7)
Mean age (range)	55.9 (35-76)	49.4 (25-71)	58.6 (41-75)
Sex male:female	7:8	4:1	1:6
Lt:rt	13:2	5:0	7:0
Serum creatinine (mean ± SD)	0.8 ± 0.1	0.8 ± 0.1	0.6 ± 0.1
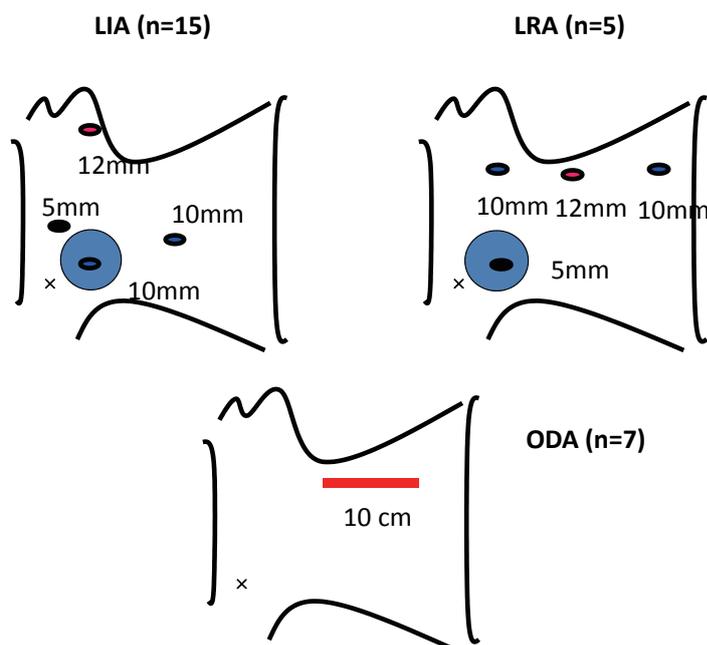
Fig. 1. An example of port insertion in LRN and LIN approaches used in our hospital.

Table 2 post-operative results

	LDN(n=20)		ODN (n=7)	
	LIA (n=15)	LRA(n=5)		P-value
Operation time (min) (median)	214.0 (175-261)	250.0 (198-254)	155.0 (137-204)	0.00
Blood loss (g) (median)	95.0 (10-350)	100.0 (50-180)	310.0 (180-590)	0.00
WIC (min) (median)	3.0 (3-22.5)	3.0 (1-4)	2.0 (1-4)	0.02
Start to walk (day) (average)	1	1	1.5 (1-3)	0.01
p/o CRN (mg/dl) (mean±SD)	1.1±0.2	1.3±0.1	1.0±0.2	0.17

p/o CRN; postoperative serum creatinine
WIT; warm ischemic time
TIT; total ischemic time

g, 100 g, and 95 g in the ODN, LRN, and LIN groups, respectively, and a significant difference for was observed between LDN and ODN groups (p = 0.00). Median warm ischemic times were 2.0 min, 3.0 min, and 3.0 min in ODN, LRN, and LIN groups, respectively, and a significant difference was found between LDN and ODN groups (p = 0.02). Patients who underwent LDN were ambulant significantly earlier than those who underwent ODN (p = 0.01). No significant differences were found between LIN and LRN groups for any parameters.

No surgical complications or conversions to ODN from LDN were necessary. No significant

CRN (mg/dl)
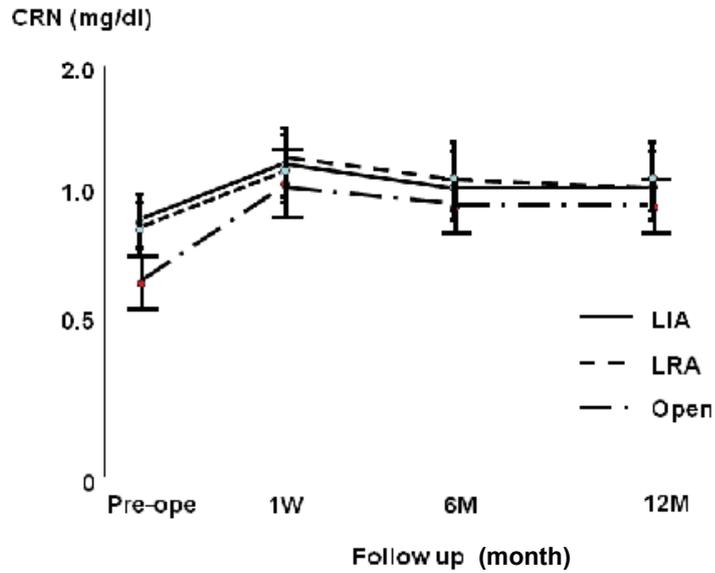
Fig. 2. Postoperative serum creatinine concentrations in donors examined in this study.

differences were observed in postoperative serum creatinine concentrations in donors among the 3 groups (Fig. 2).

DISCUSSION

Since the first kidney transplantation in 1950, ODN has proved to be a safe successful method of harvesting kidneys from donors.[11] For many years it was the gold standard technique.[12] However, ODN is associated with significant postoperative problems, including scarring, hernias, and subcostal nerve injury.[13] In 1995, Ratner et al. reported their first experience with LDN.[4] This procedure has been shown to alleviate postoperative pain, shorten hospital stay, reduce blood loss, and improve cosmesis while hastening donor recovery.[5-7] In previous studies, long-term follow-up revealed no significant differences for recipient graft function and allograft survival between LDN and ODN.[8,9] However, LDN is a technically difficult procedure, and most studies have reported significantly longer operative and warm ischemic times for LDN than for ODN.[10-12]

Living donor kidney transplantation was resumed at our hospital in June 2006 after a 20-year interval. First, mini-incision ODN was performed for safety reasons. This procedure was proposed as an acceptable alternative to LDN. Later, LRN and LIN procedures were introduced. In cases requiring laparoscopic nephrectomy for kidney cancer, urologists often select a retroperitoneal approach. Because we were more experienced in this procedure and the chance of injury to the intestines is very small, LRN was adopted in our hospital. However, LRN is inferior to LIN in terms of topography and amount of working space. Therefore, LIN is now the procedure of choice at our hospital.

Niels et al. compared LDN (n = 50) and mini-incision ODN (n = 50), and found that operating and warm ischemic times with LDN were significantly longer than those with mini-incision ODN.[13] However, blood loss was significantly less. Donor serum creatinine concentrations were not significantly different. Gao et al. compared LIN (n = 19) and LRN (n = 28) and found that operating and warm ischemic times with LIN were significantly

shorter than those with LRN.[14] Differences in duration of hospital stay, blood loss, and donor serum creatinine concentrations at discharge were not significant. In our study, between LIN and LRN groups, values for parameters were similar to those reported previously.[14] Operative and warm ischemic times with ODN were significantly shorter than those with LDN, but time to ambulation was significantly longer. Blood loss with LDN was significantly less. No significant differences were observed in postoperative serum creatinine concentrations in donors. These results were similar to those in other studies.[8, 13] Overall donor complication rates in ODN and LDN reported in other studies were not significantly different（0%–26%）.[8, 15] No surgical complications or conversion to ODN from LDN were observed.

In conclusion, donor safety is crucial in nephrectomy. LDN is safe and associated with early donor recovery.

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