

## Review Article

# Laparoscopic Donor Nephrectomy with Terminal Hand Assisted Technique: Experience in 60 Donors and Recipients

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**Abstract:** Introduction: The limitation of cadaveric organ donations and the rapidly increasing number of patients with end stage renal disease awaiting kidney transplantation made living kidney donation indispensable. An important contribution to the revolution in living nephrectomy technique is hand assisted donor nephrectomy. Herein, we report our experience in hand assisted donor nephrectomy technique and its effect on the graft outcome. Methods: During the period from January 2012 till December 2015, 60 cases of hand-assisted laparoscopic donor nephrectomies were performed including 35 females and 25 males with a median age of  $46.3 \pm 11.6$  years. Results: Our mean operative donors' time was  $93 \pm 21.8$  minutes, and mean warm ischemia time was  $48 \pm 9.1$  seconds. Donor hospitalization time was between 3 and 5 days (mean 4 days). Follow up of the graft function after one year revealed mean serum creatinine of  $1.56 \pm 1.03$  mg/dl, mean GFR of  $39.8 \pm 10.9$  ml/min/1.73m and renal Doppler resistive index of  $0.62 \pm 0.15$ . Conclusion: Laparoscopic donor nephrectomy with terminal hand assisted technique is a minimally invasive surgery that may improve donor acceptance and can become the procedure of choice in the near future. Also this technique has a good outcome concerning both warm ischemia time and graft outcome.

**Keywords:** Renal Transplantation, Nephrectomy, Donor, Donor Nephrectomy, Laparoscopy, Hand Assisted

## 1. Introduction

After the first kidney transplantation in Boston, Massachusetts in 1954 between identical twins, living donor transplantation increased among others including siblings, children, husbands and wives, close friends and volunteers. Increased number of patients with end stage renal disease waiting for transplantation raised the need for cadaveric renal transplantation. [1, 2] In the era of minimally invasive surgery, laparoscopic living donor transplantation became more attractive among both donors and recipients especially in the

last few years. [2] In addition, living donor transplantation has many advantages over deceased donor transplantation including decreasing the waiting time and duration of dialysis; less cold ischemia time with improved graft function. [3] After the first laparoscopic nephrectomy in 1991 by Clayman, laparoscopic donor nephrectomy (LDN) has become standard practice for living kidney donation at many centers. [2]

A healthy donor must be chosen and evaluated carefully for transplantation. [4] The transplantation team responsible for the patient includes urologists, nephrologists, anesthesiologists, and immunologists. Full investigations are done, and then

submitted to the Ethical Committee before the decision for living donation is confirmed. [2] Generally, the decision of choosing the right or left kidney depends on the investigations. The donor keeps the better kidney and the recipient takes the other one. [5-7] Laparoscopic donor nephrectomy has become comparable to open nephrectomy in safety and feasibility at many centers. [8]

Herein, we report our experience with LDN with terminal hand assisted technique and its effect on both donor and graft outcome.

## 2. Patients and Methods

During the period from January 2012 till December 2015, 60 cases of LDN with terminal hand assisted technique were performed in Martin-Luther University, Halle (Saale), Germany. These included 35 females and 25 males with median age of  $46.3 \pm 11.6$  years. The immunosuppressive regimen included calcinurin inhibitors, mycophenyl and methylprednisolone. The indications for LDN were followed in all patients.

Twenty recipients were smokers. Nine patients required preemptive renal transplantation while the remaining patients underwent prior dialysis with mean duration of  $2.10 \pm 3.15$  years. Fifteen patients were diabetic and 22 patients were hypertensive. One patient had encephalopathy since birth. The mean body mass index for the patients was  $26.4 \pm 2.9$  kg/m<sup>2</sup>. Primary kidney pathology was glomerulonephritis in 26 patients, hypertensive nephropathy in 6, diabetic nephropathy in 3, polycystic kidney in 3 and small sized kidneys in one patient. Five patients had prior nephrectomy (3 of them bilateral), 3 had prior transurethral resection of the prostate, three were redo transplantation, one patient had radical prostatectomy, and 9 patients had other non-urollogic surgeries before the donor nephrectomy.

Standard work and follow up was done for donor and recipient. Standard operative details, pre and post operative management were similar to that reported by others. [4]

Follow up of the graft function was measured by serum creatinine, GFR and resistive index on intervals of one, 3, 6, 9, and 12 months postoperatively. Other follow up of laboratory

parameters like hemoglobin level, random blood glucose level, WBCs and platelet count were also followed in the same intervals. Donors were discharged between 3 to 5 days (average fourth postoperative day).

Statistical analysis of the data was performed by using SPSS<sup>®</sup> version 21 software package (Chicago, IL, USA) under Windows 7 operating system. Categorical data parameters were presented in the form of frequency and percent. Quantitative data were expressed in the form of mean  $\pm$  SD. One-way ANOVA test was used to test the significance among months for quantitative data. Mann-Whitney U test was used to test the significance between right and left side of donated kidney for quantitative data. Chi-squared test was used for analysis of categorical variables. Probability level (p value) was assumed significant if less than 0.05 and highly significant if p value was less than 0.001. P-value was considered non-significant if greater than or equal to 0.05. T-test calculator was used to compare between our results and some previous studies regarding mean operative and warm Ischemia time (by inserting the mean, SD and the number of cases of every study in the calculator and obtaining the significance).

## 3. Results

Sixty cases of hand-assisted laparoscopic donor nephrectomies (HALDN) performed including 35 females and 25 males with a median age of  $46.3 \pm 11.6$  years.

Our mean operative time was  $93 \pm 21.8$  minutes, and the mean warm ischemia time (WIT) was  $48 \pm 9.1$  seconds. Donor's hospitalization time was between 3 and 5 days. Follow up of the graft function after one year revealed mean serum creatinine of  $1.56 \pm 1.03$  mg/dl, mean GFR of  $39.8 \pm 10.9$  ml/min/1.73m and renal doppler resistive index of  $0.62 \pm 0.15$ .

There was a significant difference in serum creatinine between the first month and one year after transplantation ( $p=0.007$ ) Creatinine decreased significantly during the first 3 months postoperatively, while there was no statistically significant difference during the rest of the year ( $p=0.127$ ). Same results were seen regarding GFR of the graft during the first year postoperative ( $p=0.550$ ) (table 1).

**Table 1.** Follow-up laboratory data after renal transplantation using laparoscopic donor nephrectomy with terminal hand assisted technique.

Parameter	Months of examination					p value
	1 <sup>st</sup> mo (M $\pm$ SE)	3 <sup>rd</sup> mo (M $\pm$ SE)	6 <sup>th</sup> mo (M $\pm$ SE)	9 <sup>th</sup> mo (M $\pm$ SE)	12 <sup>th</sup> mon (M $\pm$ SE)	
Creatinine (mg/dL)	$2.13 \pm 1.52$	$1.78 \pm 1.47$	$1.54 \pm 0.75$	$1.54 \pm 0.79$	$1.56 \pm 1.03$	0.127
GFR (ml/min/1.73m)	$35.9 \pm 0.04$	$37.7 \pm 12.3$	$39.5 \pm 11.1$	$39.6 \pm 10.9$	$39.8 \pm 10.9$	0.550
Resistive index	$0.63 \pm 0.12$	$0.64 \pm 0.11$	$0.64 \pm 0.12$	$0.62 \pm 0.13$	$0.62 \pm 0.15$	0.881

**Table 2.** Follow-up of graft survival.

Graft survival	Months of examination					p value
	1 <sup>st</sup> mo	3 <sup>rd</sup> mo	6 <sup>th</sup> mo	9 <sup>th</sup> mo	12 <sup>th</sup> mo	
Normal creatinine	54 (90%)	55 (91.7%)	58 (96.7%)	58 (96.7%)	57 (95%)	0.810
Impaired creatinine	6 (10%)	4 (6.6%)	2 (0.3%)	2 (0.3%)	3 (5%)	
Lost graft	0	1 (1.7%)	0	0	0	

Patient and graft survival were measured by both clinical and laboratory parameters on the same intervals (table 2).

Fifty-six grafts maintained normal serum creatinine after one year of follow up while 3 grafts had impaired renal function

after the same duration. Only one graft was lost after 3 months of transplantation due to acute rejection (mostly preformed antibodies that were not detected in the final cross match).

## 4. Discussion

The shortage of deceased donor organs and long waiting list of cadaveric renal transplantation increased the rate of living donation. Laparoscopic nephrectomy resulted in corresponding increase in living donation due to improving the quality of life and decreasing the stress on the donor. [9]

Comparison between terminal HALDN with LDN were available in 16 papers (2 RCT 70 patients vs. 70 patients and 14 Cohort studies 877 patients vs. 1085 patients), HALDN was better in WIT and operative time (ORT). No difference was found concerning the graft function. [10] Nine other studies revealed no significant differences between both techniques. [11]

In another terminal HALDN and LDN, one RCT and 3 cohort studies (55 vs. 222 patients), HALDN was better in WIT and ORT than LDN. No difference was found in graft function. [10] In 4 Cohort studies (165 patients vs. 480 patients), no differences were found in WIT and ORT. Graft function were not assessed. [10]

The laparoscopic living donor nephrectomy with terminal hand assisted technique decreased the WIT more or less similar to open donor nephrectomies. In our cases, the average WIT was 48 seconds. [12, 13] Our results regarding WIT correspond to those in the literature. [14, 15] Moreover, they showed that the use of the laparoscopic living donor nephrectomy with terminal hand assisted technique by an experienced surgeon, an average WIT of 48 seconds was attained confirming the advantages for patients undergoing a laparoscopic procedure with reduced operative trauma and a shorter postoperative donor course. [1] Our mean WIT of  $48 \pm 9.1$  seconds compares quite favorably with other series like Kercher et al, (2001) in which WIT was 72.5 seconds (range 30 to 165). [16] In our study it was found that there was a statistically significant difference ( $p=0.007$ ) achieving the lowest WIT with the terminal HALDN technique that is reflected later on the outcome of the graft. We achieved similar results to those of Hamza et al, (2008) 87 seconds ( $p=0.369$ ).

Further comparing our total and WIT ( $192 \pm 38.5$  minutes and  $48 \pm 9.1$  seconds) to other series of open live donor nephrectomy with 125 minutes total operative time and 1.6 minutes WIT, we found that although total operative time is less in open technique, WIT was less in our terminal HALDN technique resulting in a favorable effect on the graft outcome. [17] Also WIT was less than other series significantly (140.59 sec to 106.85 sec in Bum Sik Tae et al). [18]

In our series, graft extraction was done through a 7 cm periumbilical incision which helped the rapid recovery of the donors. That is supported by Yakup et al, declaring that published retrospective and non-randomized prospective studies have not clarified the advantages and disadvantages of periumbilical versus Pfannenstiel incisions in HALDN.

[19] with the safety of HALDN even with prior abdominal surgeries. [20]

## 5. Conclusion

Terminal HALDN is a minimally invasive technique that could improve the warm ischemia time and graft outcome or at least give a comparable outcome with standard laparoscopic donor nephrectomy and should be considered the procedure of choice. Improving the graft outcome will also improve both, the patients' acceptance for the operation and quality of life.

## Source of Funding

None.

## Conflict of Interests

All the authors do not have any possible conflict of interest.

## Abbreviations

BMI: Body mass index.

LDN: laparoscopic donor nephrectomy.

HALDN: hand-assisted laparoscopic donor nephrectomy.

ORT: operative time.

TURP: transurethral resection of prostate.

WIT: warm ischemia time.

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