

Original Article **Hand-Assisted Laparoscopic Live-Donor Nephrectomy (HALDN) Improves Outcomes and Results in Increased Kidney Donation**

M. Abdelshafy

Urology Department, Al-Azhar University, Cairo, Egypt

ABSTRACT

Objective: Laparoscopic live-donor nephrectomy (LDN) has acquired an important role in the era of minimally invasive surgery. Modifications such as hand assistance may improve surgical outcomes with increase in organ donation. This study was performed to evaluate the impact of hand-assisted laparoscopic live-donor nephrectomy (HALDN) on kidney allograft function, peri-operative complications and organ supply.

Patients and Methods: The results of 34 HALDN procedures carried out between July 2004 and January 2006 were evaluated retrospectively. Serum creatinine at discharge, length of hospital stay, estimated blood loss, operative time, warm ischemia time, use of analgesia and peri-operative complications were analyzed in donors and recipients. Also the number of volunteers for kidney donation was recorded.

Results: The mean values for donors and recipients subjected to the procedure were as follows: 1.2 and 1.3 mg/dL for creatinine at discharge, 2.7 and 7.4 days for length of hospital stay, and 77.8 and 98.2 mL for estimated blood loss, respectively. No major complications were encountered in the donors. Immediate diuresis after renal re-perfusion was observed in 97.1% of the recipients. Following implementation of the laparoscopic program the number of living kidney donors has increased by 90% compared to the mean of the previous 4 years.

Conclusion: HALDN is a safe and minimally invasive procedure, giving the chance to use tactile sense to facilitate dissection, retraction and exposure, thus improving the outcome and resulting in excellent allograft function and significantly increased donation.

Keywords : hand-assisted laparoscopy, live-donor nephrectomy, renal transplantation

Corresponding Author: Dr. Mohamed Abdelshafy, Urology Department, Al-Azhar University, Cairo, Egypt
E-mail: abdelshafy157@yahoo.com

Article Info: Date received : 3/6/2007

Date accepted (after revision): 12/9/2007

INTRODUCTION

In 1996, hand-assisted laparoscopic donor nephrectomy (HALDN) was reported in a porcine model using a prototype hand-access device¹. Later that year, the first successful HALDN was performed in a human². In this technique, the surgeon's non-dominant hand is introduced into the surgical field through a hand- access device, while the dominant hand uses laparoscopic instruments that are introduced through standard laparoscopic trocars. By introducing the non-dominant

hand dissection is facilitated, it provides the surgeon with a tactile feedback and enables manual retraction³. The concept of hand-assisted laparoscopy was introduced to reduce the technical challenges of conventional laparoscopy and has been adopted in many academic centers ever since.

The aim of our study was to evaluate the use of HALDN and its impact on kidney allograft function, peri-operative complications, and

organ supply at Saad Specialist Hospital, Saudi Arabia.

PATIENTS AND METHODS

We retrospectively evaluated 34 kidney donors and their recipients undergoing HALDN at Saad Specialist Hospital, Saudi Arabia between July 2004 and January 2006. Age, sex and other parameters, such as hospital stay, estimated blood loss, surgical time, warm ischemia time, intra-operative and post-operative complications were analyzed for all donors, and they were followed regularly for 3 months. In the recipients, graft function was evaluated for the presence of immediate diuresis after renal perfusion and for serum creatinine on the 7th post-operative day. There is a complete and continuous follow-up of all recipients. Immediate onset of graft function is defined as peri-operative urine production with lowering of serum creatinine on the first post-operative day and no necessity for dialysis in the first week following renal transplantation. The number of volunteers for kidney donation was also calculated during this period and compared with the previous 4 years before introduction of HALDN.

Description of the technique used for HALDN:

Unless the preservation of the left kidney had a clear benefit for the donor, left nephrectomy was preferably performed, since the left kidney has a longer renal vein, which significantly facilitates graft harvesting. Surgery was performed using the retroperitoneal approach. Left nephrectomy was done as follows: The patient was anesthetized using endotracheal intubation. A Foley catheter and an oral gastric tube were inserted. The patient then was placed in the right lateral position with the exposed left flank in hyperextension. The operation started with an inferior midline incision of the same size in centimeters of the glove used by the surgeon, approximately 7 to 8 cm. The incision was initiated in the mid line below the umbilicus, extending downwards longitudinally towards the symphysis pubis.



Fig. 1: The hand-assist device: Omniport™ (ENDC4, 50 mm – ASC Ltd., Bray, Co. Wicklow, Ireland).

The linea alba was opened and both rectus muscles were divaricated laterally. A hand-assist device was placed in the wound. The hand-assist device used to perform the procedure was the Omniport™ (ENDC4, 50 mm - ASC Ltd., Bray, Co. Wicklow, Ireland) (Fig. 1).

The surgeon's left hand was placed between the abdominal wall and the peritoneum in order to shield the peritoneum and viscera. A blunt 12 mm working port was then placed immediately to the left of the hand port. CO₂ was insufflated into the pre/post-peritoneal space and the gas pressure was kept at a maximum of 12 mm Hg. A second 12 mm blunt port was introduced high on the sub-costal margin which allows access for a 30°-video laparoscope, again with the surgeon's hand shielding the peritoneum and viscera. A third 5 mm blunt port was placed in the flank below the costal margin. The peritoneum was left intact and a pre-peritoneal space was created through blunt manual dissection. The dissection started in a direction towards the iliac vessels, and the peritoneum was then gradually loosened from the posterior and anterior abdominal wall in a cranial direction to above the upper pole of the kidney. The operation was performed in essentially the same manner as the traditional technique. The renal vein was dissected from the hilum towards the vena cava proximal to the adrenal vein. The gonadal, lumbar and adrenal veins were divided between double clips. The artery was freed down to the aorta. The ureter was dissected, often together with the gonadal

Table 1: Demographic data and surgical results observed in 34 donors submitted to HALDN.

Demographic Data and Surgical Results	
Sex	
Male	21
Female	13
Nephrectomy side	
Left	23 (67.6%)
Right	11 (32.3%)
Age (years)	
Mean (range)	37.5 (22-55)
Duration of surgery (min)	
Mean (range)	135.5 (63-201)
Warm ischemia time (min)	
Mean (range)	4.8 (3-12)

vein, down to the iliac vessels. A good amount of tissue was kept around the ureter in order not to compromise its circulation and it could therefore not always be ligated with clips. The harmonic scalpel - UltraCision® (Ethicon Endo-Surgery, Cincinnati, USA) - was used for the dissection and coagulation of vessels and perirenal structures. As soon as the vein and artery had been divided, the kidney was taken out by hand in order to minimize ischemic time. The ports were removed under direct vision in order to detect any bleeding from the port sites. The wound was not drained. The 12 mm ports were closed, but the 5 mm port in the flank was left without closure and the abdominal wall was closed with a running suture. The extra-peritoneal approach obviates mobilizing the colon and spleen. The splenocolic ligament was left intact.

The surgical approach for the right kidney used in our series was the same as for the left kidney, however, the liver was retracted through a subcostal portal.

RESULTS

The demographic data and surgical results observed in our patients are shown in Table 1.

Our patient group consisted of 21 males and 13 females with a mean age of 37.5 years (range 22 - 55 years). Left HALDN was performed in 23 and right HALDN in 11 cases. The duration of surgery defined as the time elapsed from the moment of skin incision until specimen removal and skin closure ranged from 63 to 201 minutes (mean 135.5 minutes). The estimated blood loss was 30 to 300 mL (mean 70.3 mL), and no patient needed transfusion. The warm ischemia time ranged from 3 to 12 minutes (mean 4.8 ± 2.5 min); it was related in some situations to the vascular complexity found in 6 patients (17.6%) with renal artery duplication. There were no significant intra-operative complications. The mean hospital stay for the donors was 3.8 days (range 2.7 to 7.4 days). Post-operatively, the patients (donors and recipients) were followed up for a mean of 6 months (range 3-12 months). There were no significant post-operative complications, but 3 patients developed superficial wound infection and were treated conservatively. Two donors complained of testicular pain, one of prolonged subcostal and flank pain and another one of pain at the trocar site. A CT scan carried out in all 4 patients did not demonstrate any abnormalities, and the pain resolved over time without any further intervention.

Immediate diuresis after renal re-perfusion was observed in 97.1% of the recipients. The serum creatinine observed on the 7th post-operative day ranged from 0.8 to 6.4 mg/dL (mean 1.2 ± 1.1 mg/dL). All the patients presented satisfactory diuresis and a decline of creatinine to the base line or near base line levels at a mean of 4.8 ± 5.3 days (range 1-13 days). Only one patient had a delayed diuresis after renal perfusion for about 10 minutes without definite cause, then started diuresis normally.

Following implementation of the laparoscopic program the number of living kidney donors increased by 90% compared to the previous 4 years. At the beginning of the laparoscopic program there were 28 donors, while after HALDN this number went up to 53 volunteers for kidney donation per year (89.3%).

DISCUSSION

HALDN combines the advantages of minimally invasive surgery and the security and easiness of manual dissection. It preserves tactile sense during surgery. This increases safety, in addition to shortening the duration of operation and the learning curve⁴.

Sundqvist et al.⁵ compared HALDN with open and pure laparoscopic live-donor nephrectomy and found HALDN to be a safe and fast procedure subjecting the donors to little pain.

A recent study by El Galley et al.⁶ comparing hand-assisted and pure laparoscopic techniques demonstrated similar results in terms of complications, graft function, early recovery and time to return to normal physical activity. The hand-assisted technique reduces the operative time compared to open or pure laparoscopic techniques. Many surgeons fear that the retroperitoneal route for endoscopic donor nephrectomy might limit the working space. However, the relatively short operating time in the current series indicates that the working space is not limited and that the operation is in fact easier than via the transperitoneal route, even when gas leaks into the abdominal cavity⁷. Wadstrom, in his series of 110 consecutive cases of hand-assisted retroperitoneoscopic live donor nephrectomy, reported that the mean operative time was 132 (80-305) min.⁷ In our series, the mean operative time was 135.5 minutes, slightly higher than observed by other authors⁸.

Bleeding is the most common reason for conversion to open surgery in conventional

laparoscopy. When the hand-assisted technique is used, the surgeon's fingers can compress the bleeding vessel immediately. In our study, the mean estimated blood loss was 70.3 mL, and no patient needed transfusion. While Jacobs et al.⁹ presented a conversion rate to open surgery of 1.6%⁹ with conventional laparoscopy, none of the cases of the present series had to be converted to open surgery.

HALDN also decreases the warm ischemia time, in addition to promoting better safety in its performance. In our series the mean warm ischemia time was 4.8 minutes, and 97.1% of the recipients had immediate diuresis with a mean serum creatinine of 1.2 mg/dL on the 7th post-operative day.

Several studies have demonstrated that a further advantage of HALDN is the reduction of post-operative pain. Sundqvist et al.⁵ concluded that the amount of parenteral analgesia given to donors after HALDN was significantly lower than that administered after open or pure laparoscopic donor nephrectomy ($p < 0.05$). Also, hospital stay and convalescence have been found to be significantly shorter with HALDN compared to pure laparoscopic or open living donor nephrectomy⁵.

All these advantages make the technique of HALDN very attractive, and may greatly increase the number of donors¹⁰. Early data suggest that the introduction of this technique is associated with up to 85% increase in the rate of donation from living donors⁴. Schweitzer et al.¹¹ reported that the availability of HALDN was associated with significant increases in both living donor volunteer rates and transplant rates. The percentage of patients who had at least one potential donor tissue-typed was 41% before the start of the HALDN program and 50% afterwards.

In conclusion, hand-assisted laparoscopic surgery is a useful alternative to conventional open or laparoscopic surgery. It has proved to be safe, technically feasible and effective for

living donor nephrectomy as it combines the finest aspects of open surgery with those of laparoscopy. The advantages of the hand-assisted technique include the ability to use the tactile sense to facilitate dissection, retraction and exposure. An evaluation of HALDN shows that it is a fast technique, the donors experience little pain, and convalescence is short with significantly decreased post-operative morbidity and excellent allograft function. These advantages result in a significant increase in kidney donation.

REFERENCES

1. Bannenberg JJG, Meijer DW, Bannenberg JH, Hodde KC. Hand-assisted laparoscopic nephrectomy in the pig: Initial report. *Minimally Invasive Ther. Allied Technol.* 1996;5(5):483-7.
2. Nakada SY, Moon TD, Gist M, Mahvi D. Use of the pneumo sleeve as an adjunct in laparoscopic nephrectomy. *Urology.* 1997;49(4):612-3.
3. Lee DI, Clayman RV. Hand-assisted laparoscopic nephrectomy in autosomal dominant polycystic kidney disease. *J. Endourol.* 2004 May;18(4):379-82.
4. Bloom RD, Goldberg LR, Wang AY, Faust TW, Kotloff RM. An overview of solid organ transplantation. *Clin. Chest Med.* 2005 Dec;26(4):529-43, v.
5. Sundqvist P, Feuk U, Haggman M, Persson AE, Stridsberg M, Wadstrom J. Hand-assisted retroperitoneoscopic live donor nephrectomy in comparison to open and laparoscopic procedures: A prospective study on donor morbidity and kidney function. *Transplantation.* 2004 Jul 15;78(1):147-53.
6. El Galley R, Hood N, Young CJ, Deierhoi M, Urban DA. Donor nephrectomy: A comparison of techniques and results of open, hand assisted and full laparoscopic nephrectomy. *J. Urol.* 2004 Jan;171(1):40-3.
7. Wadstrom J. Hand-assisted retroperitoneoscopic live donor nephrectomy: Reduced peri-operative risk and excellent outcome - Experience from the first 110 consecutive cases. *Transplantationsmed. Organ Dtsch. Transplantationsges.* 2006;18(1):15-20.
8. Ruiz Deya G, Cheng S, Palmer E, Thomas R, Slakey D. Open donor, laparoscopic donor and hand assisted laparoscopic donor nephrectomy: A comparison of outcomes. *J. Urol.* 2001 Oct;166(4):1270-3; discussion 1273-4.
9. Jacobs SC, Cho E, Dunkin BJ, Flowers JL, Schweitzer E, Cangro C, et al. Laparoscopic live donor nephrectomy: The University of Maryland 3-year experience. *J. Urol.* 2000 Nov;164(5):1494-9.
10. Nitin G, Pamposh R, Anant K. Laparoscopic donor nephrectomy. *J. Min. Access Surg.* 2005;1(4):155-64.
11. Schweitzer EJ, Wilson J, Jacobs S, Machan CH, Phillosophe B, Farney A, et al. Increased rates of donation with laparoscopic donor nephrectomy. *Ann. Surg.* 2000 Sep;232(3):392-400.