

## Hand-assisted Laparoscopic Living Donor Nephrectomy

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### Abstract

**Introduction:** Laparoscopic living donor nephrectomy (LDN) for renal transplantation is increasingly being performed to improve donor outcomes, by reducing perioperative morbidity without adversely impacting on allograft function in the recipient. We report our initial experience with hand-assisted LDN. **Materials and Methods:** From March 2002 to January 2003, 10 hand-assisted LDNs were performed in 2 institutions. Potential donors were evaluated for suitability, which included a renal angiogram. Only donors with uncomplicated vascular arrangements of the left kidney were offered this technique. During surgery, dissection of the donor kidney was performed laparoscopically, aided by the surgeon's non-dominant hand inserted into the abdominal cavity through a hand-assist device via a 7-cm abdominal incision. The graft was subsequently delivered through the incision. **Results:** The mean operating time was  $163.5 \pm 32$  minutes and the mean warm ischaemic time was  $2.16 \pm 0.72$  minutes. There were no conversions to the open nephrectomy technique or requirement for perioperative transfusions. Postoperatively, patients returned to normal diet by  $1.8 \pm 0.8$  days and needed opiate analgesia up to a maximum of 48 hours. On average, the patients started ambulation at  $2.1 \pm 0.9$  days and were discharged  $4 \pm 1.5$  days after surgery. There were no significant complications other than 3 superficial wound infections. All grafts had immediate graft function. Serum creatinine levels of all recipients fell within 24 hours and reached baseline at a mean of  $5.7 \pm 4.6$  days. **Conclusions:** Hand-assisted LDN is safe, feasible and can be performed with minimal morbidity. It also allows for excellent allograft function.

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### Introduction

Minimally invasive donor nephrectomy using laparoscopic techniques has become a very attractive method of procuring kidneys from live donors, compared to the traditional standard open surgical approach.<sup>1-5</sup> The laparoscopic approach to live donor nephrectomy has advantages of decreased postoperative pain with lesser analgesic requirement, less surgical trauma, shorter hospitalisation stay, decreased donor recovery time and better cosmetic results.<sup>1-3,5-7</sup> However, standard laparoscopic

live donor nephrectomy has been suggested to be technically difficult and to potentially compromise allograft function by increasing warm ischaemic times.<sup>6,8</sup> The use of a hand-assisted laparoscopic technique allows the postoperative benefits of laparoscopic surgery, with added advantages of tactile sensation, which shortens the surgeon's learning curve and increases safety during laparoscopic dissection.<sup>5,9-11</sup> It takes advantage of the incision necessary for organ removal to facilitate the laparoscopic procedure.<sup>5,7,8,12</sup> In comparison to the fully laparoscopic technique, the hand-

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assisted approach may have lower warm ischaemic times.<sup>6</sup> Ultimately, this new technique, in view of all its benefits over the open technique, may help to increase the pool of kidney donors.<sup>5,13-17</sup> We report our early results of 10 consecutive hand-assisted laparoscopic donor nephrectomies (HALDNs).

### Materials and Methods

Between March 2002 and January 2003, 10 living donor HALDN were performed in 2 institutions. All potential live donors were evaluated preoperatively to determine anaesthetic risks, suitability for transplant (using tissue typing and crossmatching techniques such as ABO blood typing and human leucocyte antigen matching), to exclude transmissible diseases, and to assess renal anatomy, which included a conventional or computed tomography renal angiogram. Only patients with a single left renal artery and uncomplicated vascular arrangements were offered the option of laparoscopic hand-assisted technique. The potential living donors were free to opt for either HALDN or conventional open donor nephrectomy. Informed consent was obtained together with detailed explanations provided by both the surgeon and the renal physician, and a patient information sheet was given preoperatively. Approval of the laparoscopic donor programme was also sought from the individual hospital's ethics committees and the Ministry of Health, Singapore.

The patients were anaesthetised and positioned either in the right lateral decubitus position or supine and strapped securely, dual arm boards and table rotated 40 degrees laterally to the right (Fig. 1). In all cases, the transperitoneal approach was used. A midline abdominal incision or paramedian abdominal incision adjacent to the umbilicus

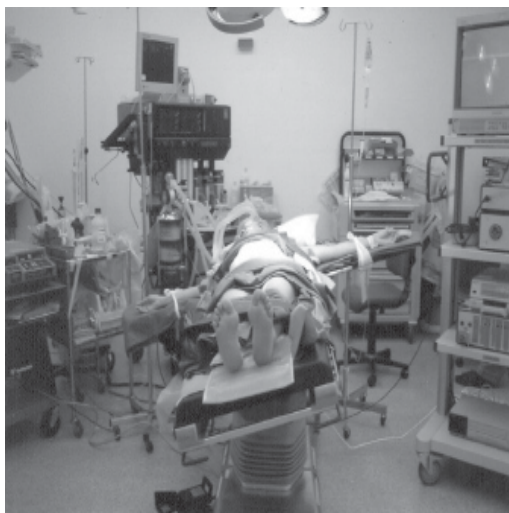


Fig. 1. Patient placed supine, strapped securely, with dual arm boards and table rotated 40 degrees laterally to the right.

to accommodate the hand-assist device was then performed (Fig. 2). The skin wound sizes were tailored to the size of the surgeon's hand (usually about 7 cm to 8 cm in length). Either the Lapdisc (Ethicon Endosurgery Inc., Cincinnati, Ohio, USA), or GelPort (Applied Medical Inc., Rancho Santa Margarita, California, USA) was used as the hand-assist device. Pneumoperitoneum was created after placement of the hand-assist device. Placement of additional ports was either under direct vision or by guidance of the surgeon's non-dominant hand (left) inserted into the insufflated abdominal cavity via the hand-assist device. The two 12-mm ports were placed at the left lumbar area of the abdominal wall, along the midclavicular line and the left subcostal area along the anterior axillary line, respectively.

After mobilising the descending colon medially and dissecting the lateral attachments to the spleen, Gerota's fascia was incised with exposure of the renal vessels. The adrenal, lumbar and gonadal veins were each ligated with clips and divided. Maximal intravenous fluids were given together with mannitol to maintain perfusion to the kidneys. After intravenous mannitol was given, the vascular pedicle was dissected and the renal artery freed down to the aorta. The ureter and its investing tissues were dissected to the level of the pelvic brim. Caution was taken to avoid excessive stripping and ischaemia to the ureter. The kidney was fully mobilised within Gerota's fascia. Under laparoscopic vision, the distal part of the ureter was transected. With the hand elevating the left kidney to facilitate rapid ligation and division of the vessels, the vein and the artery were doubly ligated with clips at the aortic end, ensuring adequate length for transplantation. Weck hem-o-lok (Weck Closure system, Research Triangle Park NC, USA) clips were used routinely for all vessels as they provided adequate haemostasis and contributed to the



Fig. 2. Paramedian abdominal incision for the hand-assist device and 2 port site incisions.

preservation of renal vein length.<sup>18</sup> Division of the vessels was followed by delivery of the kidney via the hand-assist device site. The kidney graft was placed in an ice bath, flushed and prepared for transplantation. The warm ischaemia time was measured from the time of arterial ligation to the time of placement of the kidney on ice. Pneumoperitoneum was re-established in the donor to check for haemostasis, drainage tube was inserted, wound closed in the standard fashion and patient reversed from anaesthesia. All analyses were performed using the SPSS statistical package (SPSS Inc., Chicago, Illinois, USA); mean and standard deviations were reported.

## Results

The mean donor age was  $39.3 \pm 6.7$  years, (range, 26 to 48 years). All were single artery left kidneys, except 1 which had an additional upper polar artery. There were no intraoperative conversions to open surgery. The mean total operating time and warm ischaemic time were  $163.5 \pm 32$  minutes (range, 115 to 215 minutes) and  $2.16 \pm 0.72$  minutes (range, 1 to 3.8 minutes) respectively. The abdominal hand incisions did not exceed 8 cm in length. Postoperatively, patients returned to diet at a mean of  $1.8 \pm 0.8$  days (range, 1 to 3 days) and needed parenteral opiate analgesia up to 48 hours postoperatively. The patients started ambulating after  $2.1 \pm 0.9$  days (range, 1 to 3 days) and were discharged  $4 \pm 1.5$  days (range, 2 to 7 days) after surgery. There were no significant intraoperative complications. Postoperatively, the patients were followed up at a mean of 6.8 months (range, 3 to 13 months). There were no significant postoperative complications other than 3 patients who developed superficial wound infection and were treated conservatively. There was no case of vascular, renal or ureteral injury during the procurement process. In all harvested kidneys, the renal artery, vein and ureter provided adequate length for transplantation. All recipients had immediate graft function post-transplantation and the serum creatinine levels reached baseline or near baseline levels at a mean of  $5.7 \pm 4.6$  days (range, 1 to 15 days). There was no incidence of vascular or ureteral complications in the recipients.

## Discussion

The standard operative approach for donor nephrectomy involves a long oblique flank incision of 13 cm in length through the bed of the 11<sup>th</sup> or 12<sup>th</sup> rib. The usual warm ischaemia times are generally <5 minutes; post-nephrectomy complications that occur in 0.23% of donors include postoperative atelectasis and pneumonia, pulmonary embolism following deep vein thrombosis, urinary tract infection, wound infection and pneumothorax. Intestinal function generally returns by the 4<sup>th</sup> or 5<sup>th</sup> postoperative day, by which time donors are able to tolerate full feeds and

can be discharged. In recent years, the laparoscopic approach for kidney harvesting is being increasingly reported by many centres. This technique gives well-documented postoperative advantages to the donor, including reduced morbidity from pulmonary complications, faster recovery of intestinal function and a less prominent scar in the lower abdomen. The disadvantages of the technique include a higher potential for ureteral complications and prolonged warm ischaemia time due to laparoscopic dissection rather than dissection under direct visualisation. Moreover, the learning curve for such a procedure can be steep and long, requiring extensive laparoscopic experience.

Laparoscopic donor nephrectomy has recently been modified by hand assistance. When laparoscopic living donor nephrectomy (LDN) was first described by Ratner et al in 1995, a laparotomy incision was made at the end of the procedure for graft removal.<sup>19</sup> In the modified hand-assisted technique, the laparotomy incision is created first, thereby allowing hand assistance to be provided from the outset; this can be advantageous as it removes the need for a Veress needle and increases the safety for port placement.<sup>7</sup> It also allows the laparotomy incision to be used for graft retrieval at the end of the operation.<sup>5,7,8,12</sup> As the operating surgeon places his hand into the abdomen throughout the HALDN procedure, this provides tactile sensation to the surgeon, aids dissection, allows gentle traction and increases the safety of the intra-abdominal surgery whilst preserving pneumoperitoneum. The procedure allows the surgeon's hand to provide slight traction to the renal vessels by lifting the kidney, facilitating rapid ligation and division of the vessels, and helps to ensure adequate vessel length for transplantation. Finally, retrieval of the kidney graft through the opening of the hand-assist device is easy, avoiding the need to manipulate the kidney into an extraction bag as in standard laparoscopic LDN.<sup>6,7,17</sup> The incidence of ischaemic ureteric complications can also be reduced by using hand-assisted blunt dissection of the ureter, thereby preventing excessive stripping of the para-ureteral tissues.<sup>9,12</sup>

Our initial experience of hand-assisted LDN has been very encouraging. All cases were successfully performed laparoscopically with hand assistance. The operating times are comparable to those reported by many centres, while warm ischaemic times were <4 minutes with a mean of 2.16 minutes. In our experience, we found that the midline or paramedian abdominal incision provided the surgeon with comfortable hand access to the kidney, and it did not prolong postoperative convalescence time or analgesic requirement. The Lapdisc or Gelport hand-assist device used in this series was suitable and easy to use. We also noticed a sustained gradual decrease in total operating time as compared with our first 2 cases, reflecting our progress on the learning curve. No major complications were

encountered in our series. All recipients had good immediate and prolonged graft function. The laparoscopic hand-assisted technique for LDN has become a standard practice in many centres and has been suggested to increase live donation rates at some transplant centres.<sup>14</sup> It is hoped that its advent in Singapore will also herald an increase in live donor renal transplantation. Although totally laparoscopic LDN without the use of a hand-assist device has been described, we have not chosen this for our initial series in view of our limited experience with laparoscopic techniques for donor nephrectomy and due to the issue of whether graft safety can be adequately ensured without hand assistance at this point of our learning curve. We hope that HALDN can help us shorten this learning curve such as to allow progress to a totally laparoscopic technique eventually.

### Conclusion

Our results show that hand-assisted LDN is a safe procedure, is technically feasible, helps to increase the safety of kidney procurement and increases the surgeon's confidence. It can be performed with minimal morbidity and allows for excellent immediate and long-term allograft function.

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