The First Decade of a Laparoscopic Donor Nephrectomy Program: Effect of Surgeon and Institution Experience with 512 Cases from 1996 to 2006

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BACKGROUND: Although the procedure is generally safe, significant morbidity and even mortality have occurred after laparoscopic donor nephrectomy (LDN). The learning curves for both surgeons and institutions with LDN have not been well delineated, and longterm donor data are not well reported.

STUDY DESIGN: A retrospective study of the initial 512 patients undergoing LDN performed at Mount Sinai Medical Center between October 1996 and March 2006 was performed. Intraoperative and immediate postoperative surgical outcomes were reviewed. Univariate analysis and multivariate logistic regressions were performed to identify predictors of outcomes, including the experience level of individual surgeons and of the institution. Longitudinal followup data of donor patients between 1 month and 9 years were obtained.

RESULTS: Mean donor age was 39.2 years, and 54.6% of patients were women. Left kidneys were procured in 84.0%. Operative time averaged 215.2 minutes, and warm ischemia time, 166.6 seconds. The conversion rate was 1.4%, and hand-assistance was used in 49.9%. The intraoperative complication rate was 5.5%, 30-day complication rate 9.4%, and 1.4% of patients required reoperation. Immediate graft survival was 97.1%, acute tubular necrosis occurred in 8.5%, and delayed graft function in 3.7%. At a mean followup of 37.2 months, delayed donor complications were infrequent, but included chronic pain, hypertension, incisional hernia, and small bowel obstruction. Although individual surgeons and our institution gained experience, operative and warm ischemia times decreased significantly, but complication rates were unchanged.

CONCLUSIONS: Although a learning curve was discovered for operative time and warm ischemia time, excellent results can be achieved during the early experience of both surgeons and institutions with LDN, and maintained over time. Younger, female, and nonobese donors were associated with fewer complications. Longterm donor morbidity is uncommon, but mandates better followup. (J Am Coll Surg 2009;209:106–113. © 2009 by the American College of Surgeons)

Kidney transplantation has been performed with excellent results for more than 50 years. Although graft and patient survival are better for recipients of live donor kidneys,[1,2] deceased donors significantly outnumber living donors in the US.

Laparoscopic procurement can offer advantages to living kidney donors; this may be a significant factor for patients deciding on donation.[3] Before the first laparoscopic donor nephrectomy (LDN) by Ratner and colleagues[4] in 1995 however, an increase in living kidney donation was seen in the US.

To date, several large series of LDN have demonstrated acceptable donor morbidity while maintaining excellent graft results.[5-7] Despite ever-increasing experience with

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Abbreviations and Acronyms
BMI = body mass index
LDN = laparoscopic donor nephrectomy
ODN = open donor nephrectomy

LDN, however, significant morbidity and even mortality have occurred, and cannot be ignored.[8]

An additional challenge with LDN is how to best teach this difficult operation to inexperienced surgeons, given the unique patient population involved. No operation is undertaken for completely benevolent reasons except for living organ donation; consequently, all attempts to minimize donor morbidity are essential. At odds with maintaining donor safety as paramount importance is the reality that LDN is largely performed at academic institutions charged with training responsibilities. In addition, personnel changes are inevitable at such centers, including our institution. All of these factors can potentially jeopardize an LDN program.

Finally, although immediate donor safety has been established with LDN, delayed complications are not well characterized because most studies lack longterm donor followup. With attention to both short-term and longterm donor safety, we report the comprehensive results of our LDN program from its first procedure in 1996 to the 512th, performed in March 2006. Seven different surgeons participated in this series, and only two had previous experience with laparoscopic donor nephrectomy. We hypothesized that our institution has maintained excellent donor and graft results over a 10-year period in the face of significant surgeon turnover while successfully training new surgeons to perform LDN.

METHODS

Patients

All patients having LDN performed at Mount Sinai Medical Center were identified, totalling 512 consecutive procedures from October 1996 to March 2006. After Institutional Review Board approval, computer records and databases were searched for donor demographics, body mass index (BMI), medical and surgical history, American Society of Anesthesiologists (ASA) score, and preoperative creatinine. Operative time, blood loss, intraoperative complications, and warm ischemia time, as defined by time from renal artery occlusion to immersion in iced saline bath, were recorded prospectively.

Intraoperative and postoperative blood transfusions were noted, as were length of stay, postoperative creatinine levels, and 30-day complications including reoperations and readmissions. Data on graft function and recipient outcomes were obtained from a prospectively maintained transplant database. Acute tubular necrosis was defined as failure to achieve a 25% decline in serum creatinine within 24 hours of transplantation. Delayed graft function was defined as the need for hemodialysis within the first week after transplantation. Followup data on donors were obtained from office visits, readmission records, and hospital databases, with attention toward delayed complications and current creatinine levels. In 2005, donor followup by telephone interview was begun, with office visits scheduled when indicated or requested.

Statistical analysis

Data are expressed as mean ± SD. Univariate analyses were performed using Pearson's chi-square and Fisher's exact test for categorical data (bleeding complications, operative complications, and postoperative complications) and the two-tailed, Student's *t*-test for continuous data (operative time, warm ischemia time, and blood loss). Logistic regression using multiple models was used to study the effect of donor factors (age, gender, BMI, side, medical history, and surgical history), individual surgeon, surgeon experience, institutional experience, and hand-assistance on outcomes. All calculations were done using commercially available software, with p values < 0.05 considered statistically significant.

Surgical technique

Donor operations were performed by an attending surgeon and either a laparoscopic fellow or a surgical resident. A second attending surgeon provided assistance in the first several operations performed by four of the seven surgeons. Two surgeons had exposure to LDN during fellowship training; the remaining five surgeons had no earlier experience. Patients were in a flexed, lateral decubitus position. Initial access to the peritoneal cavity included both open (Hasson cannula) and closed approaches (Veress needle, optical trocar entry). Three to five trocars were used with an angled telescope.

The intraabdominal pressure limit was 10 to 15 mmHg. Brisk urine output was maintained with 4 to 6 L of IV fluid, supplemented with mannitol with or without furosemide. When used, 2,500 to 5,000 U of unfractionated heparin were given before renal artery occlusion. The renal artery and vein were secured using either a linear stapler with a vascular cartridge (US Surgical Corporation or Ethicon Endo-Surgery) or two locking polymer clips (Weck Closure System). In accordance with manufacturer guidelines, polymer clips were no longer used to secure the renal artery or vein after 2006. Hand-assistance through a Pneumosleeve (Dexterity Inc), LapDisc (Ethicon Endo-Surgery) or