Evaluation of Right Versus Left Laparoscopic Donor Nephrectomy

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Abstract

Objectives: With the advent of laparoscopic donor nephrectomy, there has been a general underuse of right laparoscopic donor nephrectomy versus left because of concerns regarding higher complication rates and poorer outcomes. We performed a retrospective analysis of our laparoscopic donor nephrectomy series with an emphasis on the side of the kidney retrieved and the outcomes of donors and recipients.

Materials and Methods: Data on 94 consecutive donor-recipient pairs (188 patients) were reviewed. All donor nephrectomies were performed by pure laparoscopy. There were 74 left laparoscopic donor nephrectomies and 20 right laparoscopic donor nephrectomies. Intraoperative parameters and graft outcome were recorded and the data were analyzed to compare right laparoscopic donor nephrectomy versus left laparoscopic donor nephrectomy using a computer software system. Follow-up ranged from 1 to 6 years (mean, 3.4 years).

Results: There were no significant differences in any intraoperative or postoperative parameters, except in a slightly higher warm ischemia time in right laparoscopic donor nephrectomy versus left laparoscopic donor nephrectomy, but this did not translate into an adverse effect on renal recovery. Acute graft rejection was observed in 2 of 74 patients who had a left laparoscopic donor nephrectomy (2.7%) and none of the patients who had a right laparoscopic donor nephrectomy.

Chronic graft loss was observed in 2 of 74 patients who had a left laparoscopic donor nephrectomy (2.7%); 1 of recurrent pyelonephritis and sepsis and 1 renal oxalosis. No graft losses were observed in any patient who had a right laparoscopic donor nephrectomy. Mean serum creatinine levels in recipients at 1, 3, 6, 9, and 12 months were equivalent for right laparoscopic donor nephrectomy versus left laparoscopic donor nephrectomy; they were 120, 110, 110, 110, 110 µmol/L, versus 110, 110, 110, 110, 110 µmol/L. (1.35, 1.21, 1.24, 1.21, 1.26 mg/dL versus 1.22, 1.17, 1.17, 1.17, 1.23 mg/dL).

Conclusions: This single center study demonstrates equivalent results with left laparoscopic donor nephrectomy and right laparoscopic donor nephrectomy with no adverse effects of right laparoscopic donor nephrectomy on donor-recipient outcome or renal function.

Key words: Kidney retrieval, Minimally invasive surgery, Transplant

Introduction

The introduction of laparoscopic donor nephrectomy has helped narrow the gap between organ supply and demand, mainly by removing some of the deterrents kidney donors may have with regard to a flank incision. This is achieved by a reduction in postoperative pain, better cosmesis, and shorter convalescence.1, 2, 3 Although several series report a longer operating time and longer warm ischemia time as disadvantages of the laparoscopic approach, available evidence (albeit from retrospective case series), suggests that these 2 factors do not affect graft survival and outcome. Nevertheless, this argument...
warrants both the laparoscopic and open approach be considered as standards of care in experienced hands.4

Despite the ongoing debate, laparoscopic donor nephrectomy is now the standard for kidney retrieval at many transplant centers in the Western hemisphere. After the first laparoscopic radical nephrectomy was performed by Clayman and associates in 1990,5 Gill and associates confirmed the feasibility of laparoscopic donor nephrectomy in a porcine model in 1994.6 This was followed by the first live donor nephrectomy, performed in 1995 by Ratner and associates.7 Since then, laparoscopic donor nephrectomy has proven to be a safe and effective way of kidney procurement.

The techniques for left and right donor nephrectomies are now well established and have been extensively described; however, there continues to be an underuse of the right kidney versus the left kidney at most transplant centers worldwide.8, 9 Data from a few centers reveals the exclusive use of the left kidney, probably owing to the longer renal vein obtained and subsequent lower need for vascular grafts. In a recent retrospective analysis on 1200 patients published by Leventhal and associates out of Northwestern University in Chicago IL, the authors report that more than 99% of the kidneys retrieved were left-sided kidneys.10 Because early series reported higher complications rates for right-sided kidneys, many centers initially favored, and still do, use of the left kidney.9 This may hold true even if multiple arteries are present on the left side.11 Although many transplant surgeons initially felt this to be less cumbersome than obtaining a right-sided kidney, others have shown an increased rate of ureteral complications in transplants with multiple arteries.12, 13

Donor selection may vary to a certain extent among different centers worldwide, but the policy must always be to leave the better kidney with the donor. This in some way preserves the uniqueness of this operation in that it is performed on healthy individuals. Reasons for choosing the right kidney are many and include multiple left arteries or veins, smaller right kidneys, and right renal artery stenosis. Multiple studies have shown that right donor kidneys are at no increased risk of complications, although associated with higher complication rates very early on.14 More recently, a prospective analysis by Dols and associates in which out of 283 laparoscopic donor nephrectomies, 159 (56%) were right-sided, the authors concluded that right-sided nephrectomy was the only factor that actually decreased complications.15

We sought to evaluate our experience with laparoscopic donor nephrectomy using a single center cohort, performed since the initiation of laparoscopic donation at our institution, and include within them the learning curve. To compare our results with others, and to determine our rate of use of right donors, we performed a retrospective analysis on our laparoscopic donor nephrectomy series, with emphasis on the side of kidney retrieved and the outcomes of donors and recipients.

**Materials and Methods**

Prior to the study, the protocol was approved by our local institutional ethics committee, and conforms with the ethical guidelines of the 1975 Helsinki Declaration. We collected and reviewed data on 94 consecutive donor-recipient pairs (188 patients) performed at our institution since the initiation of our laparoscopic donor nephrectomy program in 2001. All donor nephrectomies done since then have been purely laparoscopic. There were 74 left laparoscopic donor nephrectomies (79%), and 20 right laparoscopic donor nephrectomies (21%). When retrieving right-sided kidneys, our aim was to take as long a renal vein stump as possible. This was achieved by occasionally including a cuff of the vena cava. In addition, several technical modifications were introduced that allowed for faster organ retrieval as well as improved graft outcome, including lowering the intra-abdominal pressure from 15 mm Hg to 8 mm Hg and early introduction of the EndoCatch Bag (Covidien Autosuture, Dublin, Ireland).16 Intraoperative parameters and graft outcomes were recorded, and the data were analyzed using SPSS software for Windows (Statistical Product and Service Solutions, version 17.0, SSPS Inc, Chicago, IL, USA) to compare left laparoscopic donor nephrectomy with right laparoscopic donor nephrectomy. Any P value of less than .05 was considered statistically significant. The follow-up ranged from 1 to 6 years (mean, 3.4 years). Data are presented as means ± standard deviations or percentages. Bivariate comparisons of study parameters between right laparoscopic donor
nephrectomy and left laparoscopic donor nephrectomy were done using the independent samples t test for continuous variables and the chi-square test for categoric variables. All P values are 2-sided, with the level of significance set at <.05. Our selection criteria have not changed since the adoption of laparoscopic donor nephrectomy, with the smaller kidney always retrieved. For kidneys similar in size, the one with the simpler vascular and ureteral anatomy was chosen. Regardless of kidney chosen, we strictly observed the policy of keeping the better kidney in the donor.

All 94 recipients were induced with a single bolus of polyclonal antithymocyte globulin preoperatively at a dose of 2 to 3 mg/kg, and none were placed on a high-dose calcineurin inhibitor protocol preoperatively. All 94 recipients also were placed on triple maintenance immunosuppression therapy postoperatively with either cyclosporine or tacrolimus given along with both mycophenolate mofetil and prednisone. Our choice of calcineurin inhibitor was based primarily on sex and history of diabetes.

Results

In our series, the choice for right laparoscopic donor nephrectomy in 20 patients included 2 or more renal arteries on the left in 12 cases, early bifurcation of the left renal artery in 2, fullness of the right pelvicalyceal system in two, 2 renal arteries bilaterally with a smaller right kidney in 1, and a smaller right kidney in 3 patients. This shows that in 30% of the cases, the choice of the right kidney was based on suboptimal size and function compared to the left kidney. There was no significant difference in any operative or postoperative parameters, except in a slightly higher warm ischemia time in the right laparoscopic donor nephrectomy versus left laparoscopic donor nephrectomy. This did not translate into any adverse effect on renal recovery. This is in accordance with multiple studies done to compare open and laparoscopic donor nephrectomies that showed an increased warm ischemia time with laparoscopically retrieved kidneys, but with no adverse effect on eventual graft function and outcome.4, 8

In our series, we had 4 conversions to the open approach, 1 during a right laparoscopic donor nephrectomy, and the other 3 during left laparoscopic donor nephrectomies. In all 4 cases, we did not attempt to laparoscopically control our bleeding and elected to immediately convert to open. Acute graft rejection was observed in 2 out of 74 left laparoscopic donor nephrectomy (2.7%), and none was seen in the right laparoscopic donor nephrectomy group. Chronic graft loss was observed in 2 of 74 left laparoscopic donor nephrectomies (2.7%), 1 owing to recurrent pyelonephritis and sepsis and 1 owing to renal oxalosis. On the other hand, no graft losses were observed in the right laparoscopic donor nephrectomy group. The mean serum creatinine in recipients at 1, 3, 6, 9, and 12 months of follow-up was equivalent for the right laparoscopic donor nephrectomy group versus the left laparoscopic donor nephrectomy group, and was 120, 110, 110, 110, 110 µmol/L, versus 110, 110, 110, 110, 110 µmol/L (1.35, 1.21, 1.24, 1.21, and 1.26 mg/dL versus 1.22, 1.17, 1.17, 1.17, and 1.23 mg/dL). Mean blood loss was equivalent in both groups, and there was no statistically significant difference in mean hospital stay between both groups as well. This is shown in Table 1.

Discussion

There is no doubt that since the advent of laparoscopic kidney donation, more and more people have been encouraged to come forward as potential donors. New techniques are constantly being tried and developed to help alleviate or even eliminate postoperative pain for the donor. These include laparoendoscopic single-site surgery, retroperitoneal laparoscopic live-donor nephrectomy, and more recently laparoscopic donor nephrectomy with vaginal extraction, with or without robotic assistance.17–21 Despite these advances, standard laparoscopic kidney donation remains the mainstay of transplant centers worldwide. Our analysis

| Table 1. Right versus left donor characteristics. |
|-----------------|----------------|----------------|---|
| Patient characteristics | Right laparoscopic donor nephrectomy | Left laparoscopic donor nephrectomy | P value |
| GFR | 113.88 ± 28.35 | 119.17 ± 27.65 | >.05 |
| Mean warm ischemia time (min) | 2.99 ± 2.22 | 2.32 ± 1.79 | <.05 |
| Convert to open | 1/20 (5%) | 3/74 (4.05%) | >.05 |
| Mean nadir serum creatinine (mg/dl) | 1.16 ± 0.19 | 1.12 ± 0.42 | >.05 |
| Mean time to nadir creatinine (days) | 6.5 ± 2 | 6.5 ± 2 | 1 |

Abbreviations: GFR, Glomerular filtration rate.
revealed that we used the right kidney 21% of the time. The literature reviewed showed that the percentage of right kidney used at different transplant centers worldwide varied from less than 1% of the total to about 56%. In fact, a more-detailed analysis of most large series looking into laparoscopic donor nephrectomy revealed that in the majority of institutions, the left kidney is almost always procured.

In a recent analysis by Harper and associates, only 7 of 750 laparoscopic donor nephrectomies were right-sided. The University of Maryland experience includes 738 patients, only 29 of which were right-sided donors (3.9%). Sundaram and associates report on their experience with 253 laparoscopic donor nephrectomies, with only 6.3% being right-sided (16 donors). This raises the question of whether some centers are discriminating against the donor by purposefully choosing the left kidney, which is easier to retrieve.

Up to 40% of kidneys have anatomic variations in their vasculature, and this variation is defined as anything other than the simplest possible renal pedicle vasculature: a single artery and single vein entering the kidney bilaterally. Supernumerary renal arteries occur more often on the left, while multiple renal veins are more common on the right, with a frequency of about 25%. The reported frequency of multiple left renal veins is around 1%. From this data, it is obvious that selecting the left kidney 100% of the time indicates selection bias. Regardless of the different donor selection criteria at various institutions, preferential use of the left kidney is apparently rampant. In an analysis by Harrison and associates, who studied anatomic variations in a select donor pool by renal arteriography, single renal arteries bilaterally occurred in 46% of patients, or less than half of those studied. A total of 13% of patients had multiple arteries on the left, and 13% had multiple arteries on the right. It can thus be inferred that at least 10% to 15% of donors must be right-sided to minimize or exclude the probability of selection bias. Anything lower than that is an indication of favored use of the left side. Thus, despite early reports indicating higher complication rates with right laparoscopic donor nephrectomy, it must be argued that high volume institutions (where several hundred donor nephrectomies have already been performed) must have reached a high level of proficiency, to an extent where more right laparoscopic donor nephrectomies must be performed.

Conclusions

This single center study demonstrates equivalent results with left laparoscopic donor nephrectomies and right laparoscopic donor nephrectomies with no adverse effects of right laparoscopic donor nephrectomy on donor-recipient outcome or renal function. Twenty-one percent of the kidneys retrieved at our institution were right-sided, and this is well within the acceptable range of use. Selection criteria should always favor the donor, especially since all the earlier drawbacks of right-sided donation are no longer an issue. Pure laparoscopic donor nephrectomy remains the standard approach for kidney retrieval at our institution, regardless of which side is retrieved.

References