Selection Criteria for Kidney Laterality in Retroperitoneoscopic Living Donor Nephrectomy and the Usefulness of Pretransplant Intervention

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ABSTRACT

Objectives. To evaluate the selection criteria for kidney laterality and the usefulness of pretransplant intervention in living donor nephrectomy.

Methods. We compared conventional and revised criteria. The conventional criteria were that left kidneys were chosen in preference and provided the kidney with the fewest structural abnormalities and lowest functional decline and that most renal arteries remained in the donor. From April 2013, we allowed the use of left kidneys with double renal arteries. Patient characteristics and surgical outcomes were retrospectively compared between right and left retroperitoneoscopic living donor nephrectomies.

Results. We compared data for 30 right kidney and 222 left kidney nephrectomies. Right kidneys were selected because of multiple renal arteries (n = 18), structural abnormalities (n = 10) of the left kidney, or functional decline (n = 2) of the right kidney. Right retroperitoneoscopic nephrectomies were associated with significantly longer operating times (267 minutes vs 241 minutes), larger blood losses (240 g vs 55 g), and higher open conversion rates (10% vs 0.9%). Pretransplant intervention was necessary for structural abnormalities in right kidneys, but the amended selection criteria resulted in fewer right nephrectomies. Pretransplant intervention was still necessary by ex vivo arterial anastomosis for multiple left renal arteries, which increased the total ischemia time (94 minutes vs 64 minutes); however, post-transplantation renal function was not significantly different.

Conclusions. Pretransplant intervention was beneficial both for repairing structural abnormalities and for reducing the difficulties of retroperitoneoscopic living donor nephrectomy.

ALTHOUGH the safety of the living donor is the highest priority in kidney transplantation, the removed kidney must function effectively as a graft. Typically, the left kidney is preferred in living donor nephrectomy, whereas the right kidney is avoided for both the donor and the recipient because the right renal vein is anatomically shorter than the left renal vein [1]. In endoscopic living donor nephrectomy, which has become the preferred surgical choice, the renal vein is made even shorter due to the limited access inherent to endoscopic surgery and the limitations of endoscopic instruments [2]. Surgery using the right kidney has also been associated with higher complication rates, including renal vein thrombosis and graft loss [3]. Therefore, right-sided donor nephrectomy has been cited as a common reason for choosing open nephrectomy in Europe [4]. However, it is important that the best kidney be retained in the donor, which means that the right kidney should still be selected where this is preferable for the safety of the living donor [3].

In this study, we investigated the reasons for selecting the right kidney to graft in retroperitoneoscopic living donor nephrectomy and detailed the operative outcomes. In addition, we assessed the usefulness of pretransplant intervention for both the donor and the recipient.

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MATERIALS AND METHODS

Study Design

From April 2003 to June 2016, we preoperatively evaluated consecutive living kidney donors by abdominal echography, 3-dimensional computed tomography, and renal scintigraphy with ^{99m}Tc-mercaptoacetyltriglycine. Conventional criteria were used to select the kidney to be donated. If both kidneys were in the same condition, the left kidney was chosen. If structural abnormality (except malignancy) was present in one kidney, then that kidney was chosen. If functional decline was present, we chose the kidney with a difference >20% in split function by scintigraphy. Finally, we chose the kidney with fewest renal arteries. If we removed a kidney with structural abnormality from the donor, pretransplant intervention (repair) was considered, and the least invasive procedure was selected. From April 2013, the selection criteria were modified, and we selected left kidneys with multiple renal arteries instead of the kidney with the fewest renal arteries (new criteria).

Surgical Method

The method for retroperitoneoscopic living donor nephrectomy has been previously described by our colleagues [5,6]. Briefly, living donor nephrectomy was performed by a retroperitoneal approach with 3 operating ports maintained by CO_2 insufflation under a pressure of 10 mm Hg. Hand assistance was only necessary for transecting the renal vessels and harvesting the kidney (Fig 1). If uncontrolled bleeding occurred during surgery, retroperitoneoscopic living donor nephrectomy was converted to open nephrectomy.

Outcomes

Characteristics and outcomes were retrospectively compared between patients undergoing surgery on right kidneys and those undergoing surgery on left kidneys. In addition, the influence of the change from the conventional to the new selection criteria was retrospectively evaluated concerning the prevalence of right kidney surgery and ex vivo anastomosis when multiple renal arteries were present.

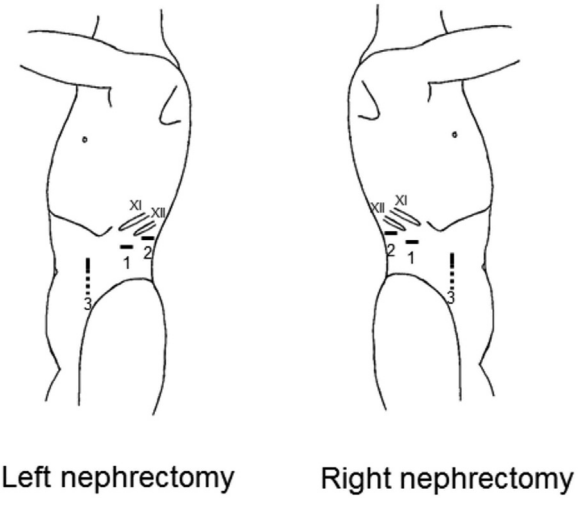

Fig 1. Patient positioning for nephrectomy and laparoscopic port placement. The patient is placed in the full lateral position. Three ports, spaced 4 to 5 cm apart, are created under the twelfth rib. The middle port (1) is used for the laparoscope. The two other ports (2 and 3) are used as the surgeon's working ports. After the kidney is mobilized and the renal vessels are prepared, a hand-port device (LapDisc, Hakko Co., Ltd., Tokyo, Japan) is placed through a 6-cm incision by vertically extending the inner port (3). The renal artery and vein are transected using an EndoGIA (Coviden, Tokyo, Japan) vascular stapler, and the kidney is removed by hand through the LapDisc.

Statistical Analysis

Statistical analysis was performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan) [7], which is a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria). Patient characteristics were compared between 2 groups as numbers, percentages, means with standard deviations, and medians with their ranges. Continuous variables were assessed by unpaired *t* tests or Mann-Whitney *U* tests, as appropriate. Comparisons between categorical variables were assessed using the χ^2 test with the Yates χ^2 test or by the Fisher exact probability test, as appropriate. A statistically significant difference was determined when the 2-tailed *P* value was <.05.

RESULTS

From April 2003 to June 2016, we evaluated the data for 252 consecutive living kidney donors. The numbers of right kidneys and left kidneys were 30 (12%) and 222 (88%), respectively. Reasons for selection of the right kidney were multiple renal arteries of the left kidney (n = 18; 60%), structural abnormality (n = 10; 33%), or functional decline (n = 2; 7.0%) of the right kidney. Structural abnormality of the right kidney comprised cases of renal artery stenosis (n = 4), renal stone (n = 2), complicated cyst (n = 2), renal artery aneurysm (n = 1), and arteriovenous malformation (n = 1).

The following pretransplant interventions were performed by bench surgery for right kidneys with structural abnormalities: renal stones were removed by ex vivo ureteroscopy (Fig 2), short right renal veins were extended using venous grafts obtained from another renal vein in the same kidney (Fig 3) or the donor gonadal vein, and complicated cysts and renal artery aneurysms were reconstructed. Renal artery stenoses did not need treatment because the artery was transected to exclude the stenosis. However, renal arteriovenous malformation was treated in the donor body 180 days before transplantation, using in vivo transcatheter arterial embolization (Fig 4).

In the cases undergoing retroperitoneoscopic living donor nephrectomy, right kidneys were associated with longer operating times, higher intraoperative blood losses, and higher open conversion rates compared with left kidneys (Table 1). Between April 2013 and June 2016, when the selection criteria had been amended, the number of procedures using right kidneys decreased by just less than half compared with the number performed under the conventional criteria (Fig 5A). In contrast, there was a more than fourfold increase in the rate of ex vivo anastomosis for multiple renal arteries (Fig 5B). Finally, although the requirement for ex vivo anastomosis increased the total ischemia time, no significant differences were observed in recipient renal function after transplantation between those