

Case Report

Small Incision Kidney Transplantation with Living Related Donors

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ABSTRACT

INTRODUCTION: Due to improvements in technique and the use of mechanical devices, small incision kidney transplantation (SI-KT) with living related donors was developed in our institution to reduce post-operative pain and improve cosmesis. In this study, we describe this approach specifically in regard to Japanese patients, and compare it with ordinary incision kidney transplantation (OI-KT).

PATIENTS AND METHODS: We performed SI-KT on 13 patients between August 2012 and March 2020. A 6 to 9 cm Gibson's incision was made to approach the iliac fossa where the graft was placed. An historical OI-KT group was selected to match the SI-KT group in regard to age, gender, BMI, donor and recipient characteristics. Factors affecting the operation and management of the patient were compared between the SI-KT and OI-KT groups.

RESULTS: The average skin incision was 7.6cm and 13.2cm in the SI-KT and OI-KT groups, respectively. The operating time, estimated blood loss, graft weight, and recipient body mass index (BMI) were comparable in both groups. The average length of both veins and arteries in the SI-KT group were significantly longer. There were no statistical differences in the use of analgesics. No functional differences or complications were observed in the two groups.

CONCLUSIONS: Although the length of the skin incision depends in part on recipient BMI and the size of the graft kidney, SI-KT from living donor can be performed successfully. In this study, there were no differences comparing OI-KT and SI-KT, but the amount of analgesics used tended to be less, and the satisfaction of the recipients tended to be higher in the SI-KT group.

(KEY WORDS: Living Related Donors, Minimally Invasive, Small Incision Kidney Transplantation)

INTRODUCTION

Minimally invasive surgery, also known as the laparoscopic approach, has become important in kidney transplantation. Laparoscopic living donor nephrectomy is now widely practiced, but the recipient operation typically requires a 15cm oblique or curvilinear incision known as the "Gibson incision" for placing the kidney in the pelvic floor (1). After the first report by Øyen et al, minimally invasive approaches for kidney transplantation were described from several institutions (2-5). These reports recommend lower oblique or transverse incisions. The location and the length

of the incision is altered depending on not only the graft kidneys, but is also based on recipient characteristics. In Japan, many recipients require long periods of hemodialysis due to the inadequate supply of cadaveric donors, and have severe calcification of the arteries and disused atrophic bladder. Very few recipients have the chance to receive a cadaveric kidney graft, and living related kidney transplantations is usually necessary. Based on these considerations, we describe in detail the procedure for SI-KT with specific considerations in regard to living related kidney transplantation, and compare it with OI-KT to

demonstrate the feasibility of this approach.

This study was conducted as a part of one which approved by the Institutional Review Board of Jichi Medical University Hospital (approval number: 23-067).

MATERIAL AND METHODS

Surgical Technique

To perform SI-KT from living donor, careful harvest and reconstruction of the graft kidney on the back table is required prior to transplantation. The renal artery and vein from living related donors are usually short compared with those of brain dead donors, and require dissection of all minor blood vessels, which are ligated and divided to effectively lengthen each vessel. We prefer to remove the left kidney, which potentially has adequate length vessels, even if there are multiple renal arteries needing reconstruction at the back table.

A 6 to 9 cm right Gibson's incision is made to approach the right iliac fossa where the graft will be placed (Figure a, b). The location and the length of the incision are determined by careful consideration regarding the arterial calcification and volume of the bladder. To be more precise, the incision should be made as close as possible to the symphysis pubis in the case of a disused bladder to make

the vesico-ureteral anastomosis easier. In the case of severe arteriosclerosis obliterans, incision placement depends on the location of the calcifications in order to avoid them. The incision length also depends on the accessibility of these anastomoses and the recipient's BMI. After the skin incision, to lessen the likelihood of developing a surgical site infection, and create a wide workspace, a wound retractor (Alexis Retractor[®]) and a self-retracting system (BookWalter Retractor[®]) are placed for vascular exposure. The internal iliac vein is routinely dissected to mobilize the external iliac vein. During the vascular anastomosis, the graft kidney is placed into the abdomen with careful attention to avoid prolonged warm ischemia time (Figure c). After the anastomosis, the kidney is placed in the appropriate position by checking the blood flow using doppler ultrasonography. The vesico-ureteral anastomosis is then performed by moving the operative window inferiorly (Figure d).

All SI-KT were performed by the single surgeon Y.S, and the other OI-KT procedures were performed by the other surgeons who were belonged to the Institute of Kidney Disease.

Statistical Analysis: All results are expressed as the mean. Comparisons between groups are performed by Student's t-test, and differences between proportions compared using

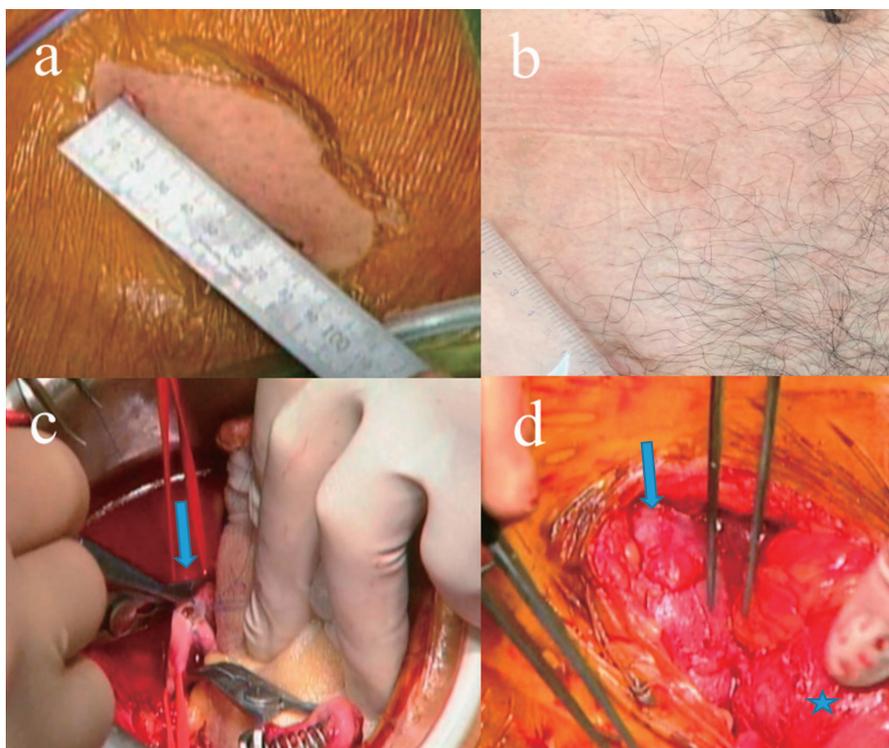


Figure: Surgical technique.

A 6 to 9 cm right Gibson's incision is made to approach the right iliac fossa where the graft will be placed (a). Skin incision at 3 months with a final length of 6.5cm in this patient (b).

The kidney is slipped into the pelvic floor. After stretching the operative window in the left and cranial directions, the arterial anastomosis (arrow) is performed in this position (c). After revascularization, the kidney is placed in the appropriate position by checking the blood flow using Doppler ultrasonography. The vesico-ureteral anastomosis is then performed by moving the operative window inferiorly (d). (arrow: kidney, star: bladder)

Fisher's exact test. The Chi square test was performed when both the variable and outcome were nominal values. All comparisons are two-tailed. A p-value <0.05 is considered to be statistically significant.

RESULTS

We performed SI-KT on 13 patients between August 2012 and March 2020. Twelve OI-KT procedures performed prior to the period of SI-KT were matched for age, sex, BMI, donor and recipient characteristics in this study. Table 1 summarizes the recipient characteristics and the graft kidney, respectively. Each kidney was harvested from the left side and the number of reconstructed arteries was comparable. Even if the length of the renal artery showed no statistical difference, the renal vein was significantly longer in the SI-KT group when compared to the OI-KT group (21.8 mm vs. 18.9 mm; $p=0.002$) (Table 1). In regard to other donor characteristics, including duration of hemodialysis and bladder volume, no differences were observed between the two groups.

The skin incision was 7.6cm and 13.2cm in the SI-KT and OI-KT groups, significantly shorter in the SI-KT group ($p<0.001$). The operating time, estimated blood loss, and graft weight were comparable in both groups (Table 2). The average operating time in the SI-KT group tended to be

longer due to re-anastomosis of the renal vein in one patient who required the skin incision was extended 2 cm. There were no significant differences in the use of analgesics. Although a questionnaire was not completed, the results were satisfactory from a cosmetic point of view in the SI-KT group. No complications were observed, and the serum creatinine level at discharge was also comparable in the two groups.

DISCUSSION

Kidney transplantation provides various benefits to patients with end stage renal disease, but requires a 15cm incision, which often precludes rapid recovery of the recipient. The small incision approach in abdominal surgery offers the benefits of less operative pain, better cosmesis, and a more rapid return to normal activity. Based on a review of the literature, only a few institutions have reported the details of a minimally invasive approach to kidney transplantation using a less than 10cm skin incision (2-5). From the point of view of cosmesis and wound healing, a lower oblique or transverse incision may seem superior to the small J-shaped incision described here. Based on the situation faced by patients in Japan, we have to overcome the problems of a disused atrophic bladder, arterial calcifications and the shortage of brain dead donors. In these situations,

Table 1: Characteristics of the recipient and graft kidney

| | SI-KT | OI-KT | P-value |
|------------------------------|------------------|------------------|---------|
| Gender (male/female) | 7/6 | 5/7 | N.S. |
| BMI (kg/m ²) | 20.3 (16.8-23.8) | 20.7 (18.0-23.6) | N.S. |
| Graft weight (g) | 191.1 (109-356) | 189.6 (124-265) | N.S. |
| Length of renal vein (mm) | 21.8 (15-30) | 13.9 (9-23) | 0.002 |
| Length of renal artery (mm) | 17.0 (10-20) | 21.1 (15-30) | 0.09 |
| Number of renal artery (1/2) | 11/2 | 10/2 | N.S. |

NS=not significant, BMI=body mass index
Values are median (range)

Table 2: Recipient Outcomes

| | SI-KT | OI-KT | P-value |
|---------------------------------|-------------------|-------------------|---------|
| Length of skin incision (cm) | 7.6 (6-9) | 13.3 (13-14) | <0.001 |
| Operating time (min) | 224.7 (182-360) | 218.8 (163-310) | 0.79 |
| Estimated Blood Loss (ml) | 350.0 (35-1800) | 280.2 (150-580) | N.S. |
| Total ischemia time (min) | 70.5 (53.5-130.3) | 57.0 (45.7-105.2) | 0.16 |
| Hospital stay (day) | 18.7 (14-32) | 20.5 (15-35) | N.S. |
| Rejection/complication | 1/0 | 2/0 | N.S. |
| Creatinine at discharge (mg/dl) | 1.3 (0.8-1.9) | 1.2 (0.7-1.8) | N.S. |

NS=not significant
Values are median (range)

the renal vessels from living donors are always short and we need to approach not only inferiorly for the anastomosis to the atrophic bladder but also superiorly to control the arteries and avoid areas of severe calcifications that are often present. Even if we could obtain sufficient length for the renal artery, using a lower oblique or transverse incision makes the vertical manipulation required quite difficult. Furthermore, as far as we experienced, the length of the renal vein is also the key to determine the location and the length of skin incision.

Previous studies using robotic surgery have demonstrated that high-BMI recipients are good candidates. In our institution, the indication for this approach is limited to patients with a BMI less than 25 (kg/m²). Based on this initial experience and other reports, the small incision approach is feasible from the point of view of cost-benefit for lower BMI recipients (6, 7). Another advantage of SI-KT is that it allows us to monitor both kidney warm ischemia and blood flow using the Doppler ultrasonography through the operative window. Although the total ischemic time has a tendency to be longer, renal function is favorable in patients undergoing SI-KT. Careful attention is necessary to avoid prolonged warm ischemia time.

We have shown that SI-KT from living donor can be performed successfully, but only see a tendency toward shorter hospital stay and less use of analgesia after transplantation. Larger studies of this procedure will be necessary to demonstrate a statistically significant difference.

Declaration On Interest

The authors have no financial conflicts of interest to disclose concerning in this article.

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小皮膚切開による生体腎移植

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要 約

目的) 様々な工夫により移植腎より小さい皮膚切開での腎移植手術を開始した。手術手技を紹介するとともに、従来手術との違いについて検討した。

方法) 右Gibson切開を6 cm～9 cmおき移植床を作成。外腸骨静脈の可動性を持たせるため全例で内腸骨静脈を結紮、切離している。腎臓を創内へ落とし込み静脈吻合、動脈吻合を行う。吻合終了後血流を確認し腎を腸骨窩へおさめ膀胱尿管吻合を行う。小切開での腎移植を2012年8月より開始し2020年まで13例に行い、その直前12例と比較、検討した。

結果) 小切開および従来手術における平均皮膚切開長は、それぞれ7.8cm/13.2cm、手術時間は、214分/218分、出血量268ml/261ml、グラフト重量190g/190g、総阻血時間70分/57分であった。

結語) 創の大きさは腎の大きさ、レシピエントの体格、手術既往に依存するところがあるが、今後も安全性を担保しながら検討を行っていく。

(キーワード: 生体ドナー, 低侵襲, 小切開腎移植)