Transplantation of a Horseshoe Kidney Found During Harvest Operation of a Cadaveric Donor: A Case Report

Sangchul Yun,1 Hee-Doo Woo,1 Seung-Whan Doo,2 Soon Hyo Kwon,1 Hyunjin Noh,3 and Dan Song1

Departments of 1Surgery, 2Urology, 3Internal Medicine, Soonchunhyang University College of Medicine, Seoul, Korea

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Address for Correspondence:
Dan Song, MD
Department of Surgery, Soonchunhyang University Seoul Hospital, Soonchunhyang University School of Medicine, 59 Dansagwan-ro, Yongsan-gu, Seoul 140-743, Korea
Tel: +82.2-709-9490, Fax: +82.2-749-0449
E-mail: badosa7@schmc.ac.kr

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INTRODUCTION

The horseshoe kidney is one of the most common anatomical variations of the kidney with an incidence of one in every 600-800 individuals (1, 2), and is twice as commonly in males (3). It results from anomalous fusion at the lower poles (95% of cases) or at the upper poles. The horseshoe kidneys vary widely in origin, number, and size of the renal arteries and veins. Comorbidities include ectopic ureteroceles, vesicoureteral reflux, ureteropelvic junction (UPJ) obstruction, polycystic kidney disease (PCKD) and ureter stone (4). The horseshoe kidney transplantation is associated with a higher percentage of primary nonfunction because of thrombosis of the vessels (5). Although these features make transplantation more difficult technically, it is not impossible to transplant the horseshoe kidney. In addition, it could be a good solution for the shortage of organ donors. We report a case of transplantation of a split horseshoe kidney from a cadaveric donor. To the best of our knowledge, this is the first case reported in Korea.

CASE DISCRIPION

A 34-yr-old female was diagnosed as being brain dead. Preoperative ultrasound revealed no abnormal focal lesions. However, the horseshoe kidney was identified during organ harvest. En bloc nephrectomy was performed. The kidney was divided at the midline of isthmus. The divided right kidney was discarded due to numerous arteries and veins. The divided left kidney was transplanted. After declamping, the kidney was well perfused and started clearing. Resistive index was 0.72. Glomerular filtration ratio was 84.69 mL/min on postoperative day 14. The horseshoe kidney can be successfully transplanted and could be a good solution for the shortage of organ donors.

Keywords: Horseshoe Kidney; Kidney Transplantation

A 34-yr-old female was diagnosed as being brain dead. Preoperative ultrasound revealed no abnormal focal lesions. However, the horseshoe kidney was identified during organ harvest. En bloc nephrectomy was performed. The kidney was divided at the midline of isthmus. The divided right kidney was discarded due to numerous arteries and veins. The divided left kidney was transplanted. After declamping, the kidney was well perfused and started clearing. Resistive index was 0.72. Glomerular filtration ratio was 84.69 mL/min on postoperative day 14. The horseshoe kidney can be successfully transplanted and could be a good solution for the shortage of organ donors.
The horseshoe kidney was identified. En bloc nephrectomy was performed. The left kidney had single renal artery (dark arrow) and vein, whereas the right kidney had numerous arteries (blank arrows) and veins (blank pentagons). The isthmus contained a broad band of normal parenchyma. Both kidneys showed no variation in urinary collecting system (blank triangle is the right ureter, dark triangle is the left ureter). In bench surgery, the kidney was divided at midline of isthmus, preserving its vasculature and urinary collecting system. The edges of the renal remnant (outer layer) were approximated using 2-0 absorbable polyglactin sutures after inner layer renorrhaphy. The divided left kidney was transplanted at recipient’s right iliac fossa. The renal artery was anastomosed to recipient’s right external iliac artery, and the renal vein anastomosed to the right external iliac vein, end to side fashion. Divided isthmus involving small part of kidney low pole remained dark red color and achieved hemostasis after declamping.

DISCUSSION

The classic features of the horseshoe kidney on a plain abdominal X-ray are low-lying position and location close to the vertebral column. It can have a vertical or outward axis with the lower poles being more medial than in the normal kidney (6). Ultrasound can detect the joining isthmus in the midline, but may not always be identified. In a previous analysis of 34 patients, 10 (29%) patients were diagnosed with horseshoe kidney in the initial sonogram. The others needed additional tools including excretory urography (n = 20) or computed tomography (CT; n = 14) for diagnosis (7). In our case, preoperative ultrasound showed normal parenchymal echogenicity. The ultrasound seemed to be dependent on the left kidney. We think it would have been better to inject the dye to identify the blood supply territory (9). At the time of separation, to reduce post operative parenchymal wound, cone-like excision of isthmus is recommended so that the wounded edge can be brought together. During organ harvest, to prevent from injury of vessels and urinary collecting system, en bloc extraction including the aorta and the inferior vena cava should be performed (10). In our case, close inspection was performed but contrast injection was not. The divided isthmus remained dark red in color and achieved hemostasis after declamping (Fig. 1C). Fortunately, the vascular supply of isthmus was sutured water-tight. A report from Europe described immediate discard of 27% kidneys and discard of 9.6% after division. The majority of discarded kidneys had complex vascular anatomy and urinary collecting system injury or had no suitable recipients (8).

Some procedures for a safe separation were introduced from previous reports. One is injecting methylene blue dye into the renal artery to identify the blood supply territory (9). At the time of separation, to reduce post operative parenchymal wound, cone-like excision of isthmus is recommended so that the wounded edge can be brought together. During organ harvest, to prevent from injury of vessels and urinary collecting system, en bloc extraction including the aorta and the inferior vena cava should be performed (10). In our case, close inspection was performed but contrast injection was not. The divided isthmus remained dark red in color and achieved hemostasis after declamping (Fig. 1C). Fortunately, the vascular supply of isthmus seemed to be dependent on the left kidney. We think it would have been better to inject the dye to identify the blood supply before separation.

There are some possible problems that interfere with the horseshoe kidney transplantation. The horseshoe kidney can show symptoms of urinary tract infection, vesicoureteral reflux, hydronephrosis, urine stasis, and nephrolithiasis. Also, comorbidities such as ectopic ureteroceles, UPJ obstruction, and PCKD can occur (4). Close identification of asymptomatic problems and be able to cope with possible difficulties is essential. An-
other problem is that the incidence of Wilm’s tumor in people who have the horseshoe kidneys is twice as high as in the general population. The isthmus tends to have an increased potential of carcinoma development (11, 12). No case has been reported, but it seems likely to be found in the future due to immunosuppressive therapies (2). In this respect, using mTOR inhibitors may be helpful; a low incidence of cancer in a meta-analysis of more than 30,000 renal transplant patients was reported (13).

Most importantly, the horseshoe kidneys vary in anatomy of renal vessels and ureteral anomalies. These features make them technically more challenging for transplantation. Despite the anatomical anomalies, the kidney is histologically normal and the graft functions well after transplantation. Previous studies showed that the transplantation of the horseshoe kidneys, either en bloc or split, produced the same results compared with
the transplantation of kidneys with a normal anatomy (8, 9).

In conclusion, we report a successful case of split horseshoe kidney transplantation from a cadaveric donor. This is the first transplantation case of a horseshoe kidney reported in Korea. Although the horseshoe kidneys have the potential for anatomical variation, careful inspection, imaging, and knowing the exact anatomy of the kidney could lead to successful transplantation. Despite the fact that it requires a highly surgical technique, the horseshoe kidney is suitable for transplantation as it could be effective as a normal kidney and could also be a possible solution for organ shortage.

ORCID

Sangchul Yun  http://orcid.org/0000-0002-6321-4319
Hee-Doo Woo  http://orcid.org/0000-0002-5065-9677
Seung-Whan Doo  http://orcid.org/0000-0002-5924-6908
Soon Hye Kwon  http://orcid.org/0000-0002-4144-4196
Hyunjin Noh  http://orcid.org/0000-0002-1904-1684
Dan Song  http://orcid.org/0000-0002-2417-9899

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