Case Report

Transplantation of Crossed Fused Renal Ectopia

Soon-Khai Lee, Bibombe Patrice Mwipatayi, Manzoor Abbas, Sathya Narayan and Kishore Sieunarine,
Department of Vascular Surgery, Royal Perth Hospital, Perth, Western Australia, Australia.

Crossed fused renal ectopia is a type of congenital fused anomaly of the kidney. This type of kidney, when encountered, can be used as a donor organ to provide useful solution to the critical shortage of available organs for transplantation. [*Asian J Surg* 2007;30(1):82–4]

Key Words: crossed fused renal ectopia transplantation, organ shortage

Introduction

The incidence of crossed fused renal ectopia worldwide is about one in 1,000 and it is the second most common renal fusion anomaly after horseshoe kidney.[1,2] The average wait for a kidney from a deceased donor is about 4 years in most Australian states.[2] Due to this critical shortage of available organs for renal transplant, a cadaveric crossed fused ectopic kidney, when encountered, may have to be used as a donor organ. We report a successful case of crossed fused renal ectopia transplantation. We discuss the variations of this fused renal anomaly and the various surgical options to allow best use of this anomaly as a donor organ both as a cadaveric kidney and as a living donor kidney.

Case report

A 56-year-old man on the Organ Donation Registry for kidney donation was diagnosed to have a single right kidney on abdominal ultrasound. He had normal renal function and serum creatinine was 80 μmol/L (normal, 60–150). His human leucocyte antigen (HLA) typing was A1, 2; B8, 24; DR4, 103 and he was also found to be cytomegalovirus positive. He had no known history of urinary tract infection, renal calculi or other congenital defects.

He succumbed to head injury from a gunshot wound in a suicide and was pronounced brain dead in the intensive care unit.

During organ harvest, the kidney was noted to be a crossed fused ectopic kidney, lying entirely on the right with its lower pole encroaching the pelvic brim. It was harvested *en bloc* with complete aorta and inferior vena cava segments (Figure 1).

The recipient was a 38-year-old man with end stage renal disease secondary to glomerulonephritis. His HLA typing is A1, 24; C62, 57; DR1, 4. Two Ags matched with the donor's kidney. His preoperative serum creatinine and urea were 878 μmol/L and 19.1 mmol/L, respectively.

Bench dissection of the harvested kidney demonstrated two main renal arteries arising from the aortic segment. The proximal renal artery had three main branches to the isthmus, while the distal renal artery ran solely to the lower part. There was a single dominant renal vein draining into the inferior vena cava. Two ureters were noted to arise from the renal pelvis (Figure 2).

The distal end of the aortic segment was sutured and all other branches of the aorta like lumbar arteries were ligated. The proximal aortic segment was sutured to the right external iliac artery in an end-to-side manner providing revascularization of both the renal arteries. The renal vein was sutured end-to-side to the right external iliac vein.

Address correspondence and reprint requests to Dr Soon-Khai Lee, Department of Surgery, Kuala Lumpur Hospital, 50586 Jalan Pahang, Kuala Lumpur, Malaysia.
E-mail: eskaylee2@hotmail.com • Date of acceptance: 16 January 2006

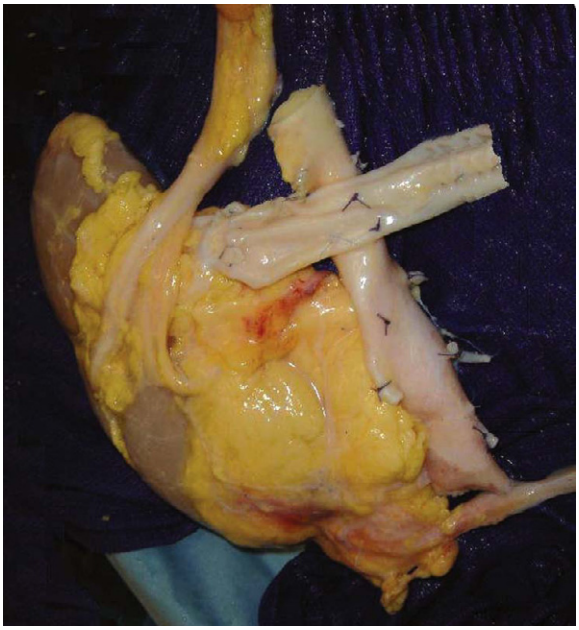

Figure 1. Prepared crossed fused renal ectopia prior to transplantation.

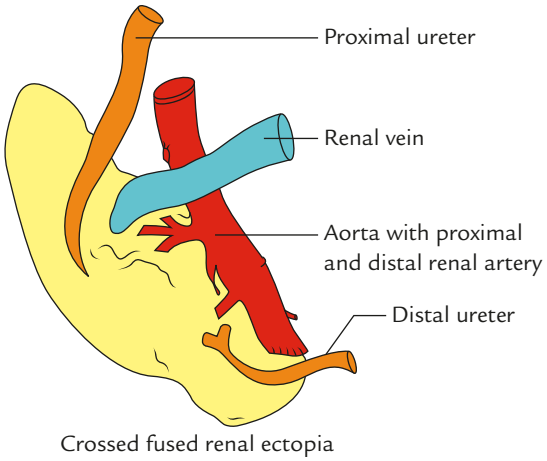

Figure 2. Diagrammatic representation of the prepared specimen.

The two ureters were sutured separately to the dome of the urinary bladder (Figure 3). Two 6F, 10 cm stents (Percuflex, Boston Scientific Corp.) were placed in the ureters at the time of the anastomoses.

Total cold ischaemic time was 10 hours, and serum creatinine and urea on the 5th postoperative day were decreased to 94 μmol/L and 7.4 mmol/L, respectively.

Postoperative ultrasound showed a well-perfused fused kidney. There were at least three major arteries supplying the kidney and all were patent with appropriate waveforms (resistive indices, 0.5–0.7). Arterial and venous waveforms within the renal transplant were normal. There was no evidence of obstruction or perinephric

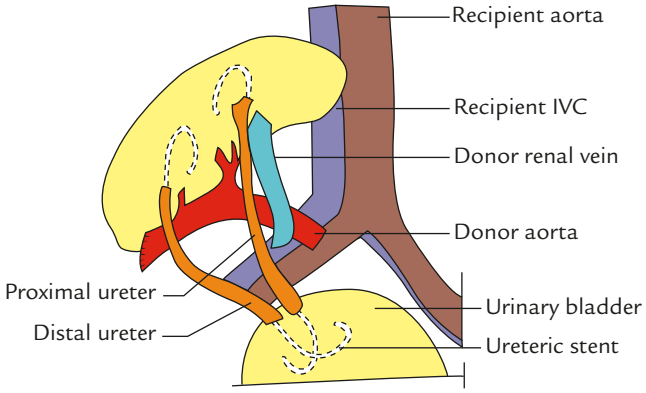

Figure 3. Transplantation of the kidney. The distal end of the aortic segment was sutured and the proximal aortic segment was anastomosed end-to-side to the right external iliac artery. The renal vein was sutured end-to-side to the right external iliac vein. The two ureters were sutured separately to the dome of the urinary bladder with two 6F, 10 cm stents in place. IVC = inferior vena cava.

collection. He was discharged home well on the 6th postoperative day.

Discussion

Congenital anomalies of the kidneys include a group called fusion anomalies, in which both kidneys are fused together in early embryonic life. Fusion anomalies of the kidneys can generally be categorized into two varieties: horseshoe kidney and crossed fused ectopic kidney.[3]

The most common fusion anomaly is horseshoe kidney followed by crossed fused renal ectopia. The incidence is one in 400 persons and one in 1,000 persons worldwide, respectively. Both are twice as common in males as it is in females.[2] We present a case of transplantation of a crossed fused ectopic kidney with successful result.

Crossed fused renal ectopia is generally differentiated from horseshoe kidney in which both fused kidneys lie on one side of the spine. The ureter of the crossed kidney crosses the midline to enter the bladder.

Left to right ectopia is three times more common than right to left, and the crossed kidney usually lies inferiorly to the other kidney. This was illustrated by our donor's kidneys.

Six variations of crossed fusion have been described. In descending order of frequency, they are:[1]

- Type 1: Inferior crossed fused ectopia, the commonest type. The crossed kidney lies inferiorly. The upper pole of the crossed kidney is fused to the lower pole of the other kidney and both the pelves are directed anteriorly.

- Type 2: Sigmoid or S-shaped kidney. The crossed kidney lies inferiorly with its pelvis directed laterally. The pelvis of the other kidney is directed medially.
- Type 3: Unilateral lump kidney. The two kidneys are completely fused to form an irregular lump. Both renal pelves are directed anteriorly.
- Type 4: Unilateral disc kidney. The kidneys are fused along their medial border. The crossed renal pelvis is directed laterally. The renal pelvis of the normal kidney is directed anteromedially.
- Type 5: L-shaped kidney. The crossed kidney lies inferiorly and transversely.
- Type 6: Superior crossed fused ectopia. The crossed kidney lies superior to the other kidney. Both renal pelves are anteriorly rotated.

The fusion of two kidneys is believed to result from the fusion of the metanephric blastema across the midline at around the 4th week of gestation. Fusion probably occurs at this embryonic stage when the kidneys are in the true pelvis and the renal capsule has not yet matured. Lateral flexion of the lumbosacral spine may push one of the developing kidneys to the opposite side causing fusion. Some have suggested that teratogenic factors are responsible for the abnormal migration of nephrogenic and fusion.[4]

Besides the abnormal location and fusion, they often have abnormal vasculature and ureteral abnormalities. It is important to recognize the abnormality during organ procurement in order to preserve them for transplantation.

Transplantation of a crossed fused renal ectopic kidney can be performed *en bloc* in one individual or it can be split and transplanted into two recipients, depending on the number and location of the vessels and the anatomy of the urinary collecting system.

The kidneys should be removed *en bloc* with a large segment of the aorta and vena cava. The course and number of ureters should be identified and, to obtain maximal ureteral length for reimplantation, they should be divided at the level of the bladder.

The decision to split the organs depends on many variables such as the vascular and urinary collecting system anatomy and the degree of fusion of the renal parenchyma. The fusion defects may range from thin fibrous band, an isthmus that contains functional renal tissue to extensive parenchyma intermingling. Later, it will preclude the separation of the two organs.

In our harvested kidneys, bench dissection showed a pair of short proximal and distal renal arteries, single renal vein and two reasonably long ureters. The kidneys showed fused parenchymal tissue and, as a result, it was transplanted *en bloc*.

The aorta can be used as a tube whereby the distal end of the aortic segment is sutured, and the proximal aortic segment sutured to the recipient aorta or iliac artery in an end-to-side manner providing revascularization of both the renal arteries. This can be an alternative solution to a short donor renal artery.

The renal vein was sutured end-to-side to the recipient iliac vein or the vena cava. Similarly, the donor vena cava can be used as a tube if the donor renal veins are short.

Although the number of patients awaiting kidney transplantation is rapidly increasing, with a 6% growth rate in dialysis programmes each year, kidney availability in Australia remains low. The trend seems to be worsening, with 6.8% of those on dialysis receiving transplants in 2002 compared with 11.7% a decade earlier. In most Australian states, the average wait for a kidney from a deceased donor is about 4 years, and some patients wait much longer.[2] In an attempt to increase this pool, kidneys with congenital anomalies such as crossed fused ectopia can provide a useful solution to the ever-increasing gap between demand and supply.

References

1. Medcyclopedia/medical/volumeIV: Crossed fused ectopic, renal. (http://www.amershamhealth.com/medcyclopaedia/medical/article.asp?vol = Volume%20IV%202&article = CROSSED_FUSED_ECTOPIA_RENAL)
2. Mathew T, Faull R, Snelling P. The shortage of kidneys for transplantation in Australia. Desperate people seek desperate remedies. *Med J Aust* 2005;182:204–5.
3. Decter R. Renal duplication and fusion anomalies. *Pediatr Clin North Am* 1997;44:1323–41.
4. Bauer SB. Anomalies of the kidney and ureteropelvic junction. *Campbell's Urology*. Philadelphia: Saunders, 1998:1709–39.