

## Successful Transplantation Using Donor Cross-Fused Renal Ectopia

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### ABSTRACT

End-Stage Renal Failure (ESRF) is the irreversible loss of kidney function which, without treatment is likely to lead to fatal complications. Kidney transplantation is the treatment of choice for most patients with ESRF. Transplantation offers improved quality of life as well as reducing the mortality rate of patients with ESRF when compared with being on dialysis.

The UK waiting time to receive a kidney transplant has dropped by 18% over the past five years (an average of 944 days in 2017 compared to 1,153 days in 2012). However there is still a severe shortage of donor organs and many patients die without ever receiving the transplant they need.

To help bridge the gap between supply and demand, kidneys are routinely used from donors after brain death (DBD), Donors after Circulatory Death (DCD) as well as from Extended Criteria Donors (ECD); defined from donors after brain death who are either 60 years and older, or aged 50-59 years of age with at least two of the following three criteria; death due to a cerebrovascular accident, a past medical history of hypertension or a terminal serum creatinine of  $>133\mu\text{mol/L}$ . Despite using such organs, kidneys are still discarded and this is occasionally due to unexpected renal anatomy including vascular and congenital anomalies.

Kidneys with urological congenital abnormalities include horseshoe kidney, ectopic kidneys and crossed fused renal ectopia. As the need for donor organs continues to expand transplant centres have become more adept at using selected kidneys with congenital abnormalities. Horseshoe kidneys may be used for transplantation either as a single or split grafts. Renal ectopia describes the failure of a kidney to locate in development to its normal position. Crossed Fused Renal Ectopia (CFRE) is when one kidney crosses the midline during development, resulting in both kidneys residing on one side of the midline and in most cases they fuse. Although these kidneys have an increased rate of vascular and ureteral anatomical anomalies, it is possible to successfully transplant these organs, as we present in this case.

### INTRODUCTION

End-Stage Renal Failure (ESRF) is the irreversible loss of kidney function which, without treatment is likely to lead to fatal complications. Kidney transplantation is the treatment of choice for most patients with ESRF. Transplantation offers improved quality of life as well as reducing the mortality rate of patients with ESRF when compared with being on dialysis [1,2].

The UK waiting time to receive a kidney transplant has dropped by 18% over the past five years (an average of 944 days in 2017 compared to 1,153 days in 2012) [3]. However there is still a severe shortage of donor organs and many patients die without ever receiving the transplant they need.

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Kidneys with urological congenital abnormalities include horseshoe kidney, ectopic kidneys and crossed fused renal ectopia. As the need for donor organs continues to expand transplant centres have become more adept at using selected kidneys with congenital abnormalities. Horseshoe kidneys may be used for transplantation either as a single or split grafts [5]. Renal ectopia describes the failure of a kidney to locate in development to its normal position. Crossed Fused Renal Ectopia (CFRE) is when one kidney crosses the midline during development, resulting in both kidneys residing on one side of the midline and in most cases they fuse. Although these kidneys have an increased rate of vascular and ureteral anatomical anomalies, it is possible to successfully transplant these organs, as we present in this case.

## CASE REPORT

### Donor & recipient details

A 32 year old male was found by a relative unconscious at home after a seizure. He suffered a Pulseless Electrical Activity (PEA) arrest followed by return of spontaneous circulation with a downtime of 34 minutes leading to irreversible hypoxic brain damage. His past medical history included spina bifida with a neuropathic bladder treated by ileocystoplasty. He was noted to have a “horseshoe” kidney on previous imaging. He proceeded to be a donor after brainstem death.

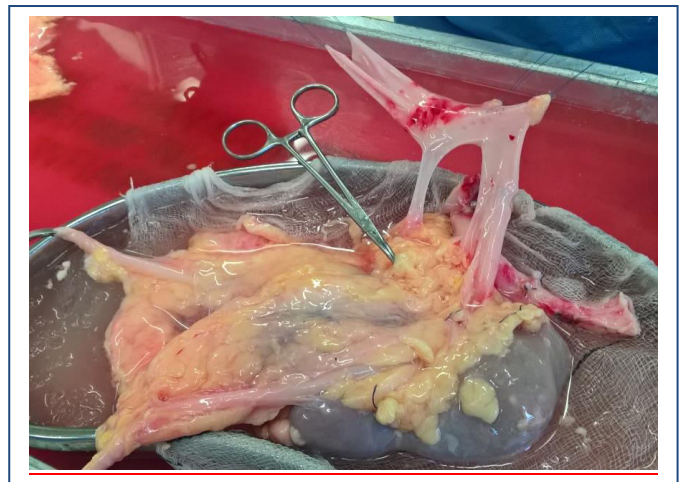
A “horseshoe” kidney was originally offered and accepted by another transplant unit but due to recipient issues was re-

offered during organ retrieval to our unit. At retrieval, the kidney was again described as “horseshoe”. The organ was accepted for inspection in our unit.

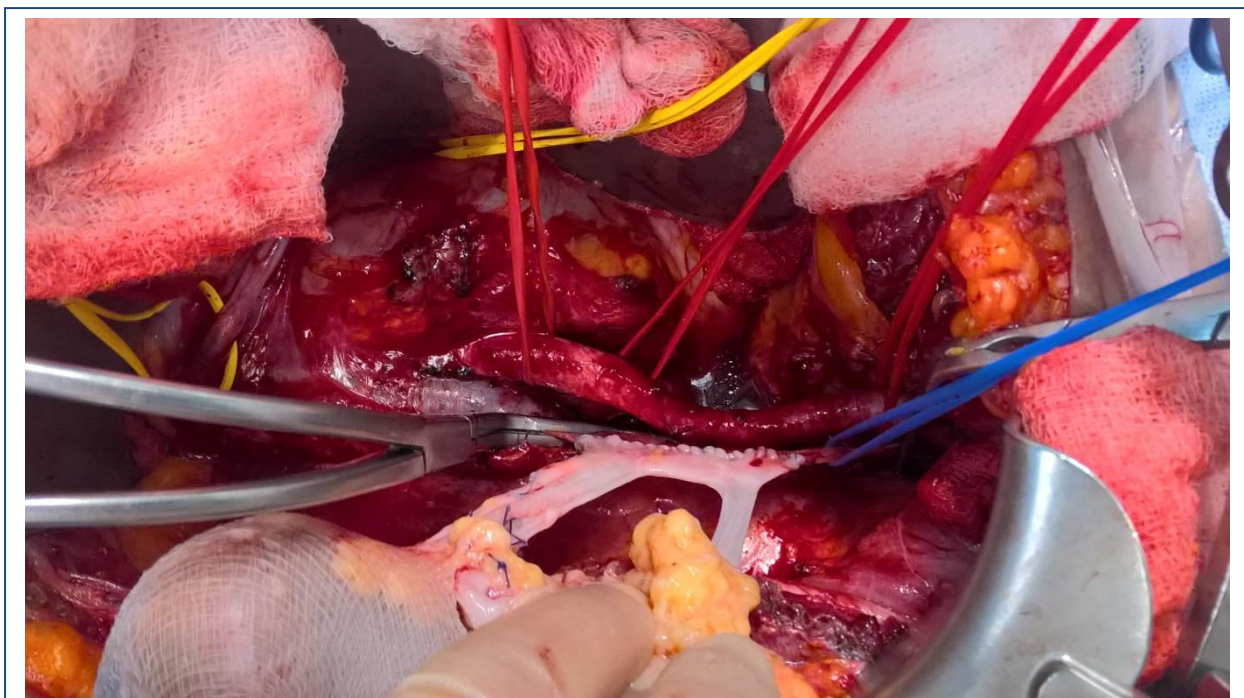
Our potential recipient was a 58 year old female with ESRF secondary to hypertension. She was on peritoneal dialysis, had undergone no previous transplants and had been on the waiting list for 708 days. We explained in detail to the recipient that the kidney had congenital abnormalities and the recipient accepted this organ for transplant with this knowledge.

## PROCEDURE

Bench dissection of the harvested kidneys revealed two fused kidneys. Each kidney had a single renal artery arising from the same side of the aortic patch. There were two renal veins, both draining into the inferior vena cava, and two ureters. It was transplanted en-bloc, as the extent of fusion would have made dissection to separate into 2 kidneys difficult and risk damaging the organ.



The transplant was performed with a right iliac fossa extra-peritoneal approach. Lymphatics were ligated. Two deep internal iliac veins were ligated and divided to mobilise the right iliac vein which was then lateralised to permit a long venotomy and anastomosis of the two renal veins on a common IVC patch.



The aortic patch with both renal arteries was anastomosed end to side to the right common iliac artery.

The upper ureter (ureter 1) was spatulated and anastomosed end to end to the distal right native ureter with 4/0 PDS over a 6Fr 24cm JJ stent.

The lower ureter (ureter 2) was shortened, spatulated and anastomosed to the bladder over a 7Fr 16cm JJ stent with a modified Lich-Gregoir technique.

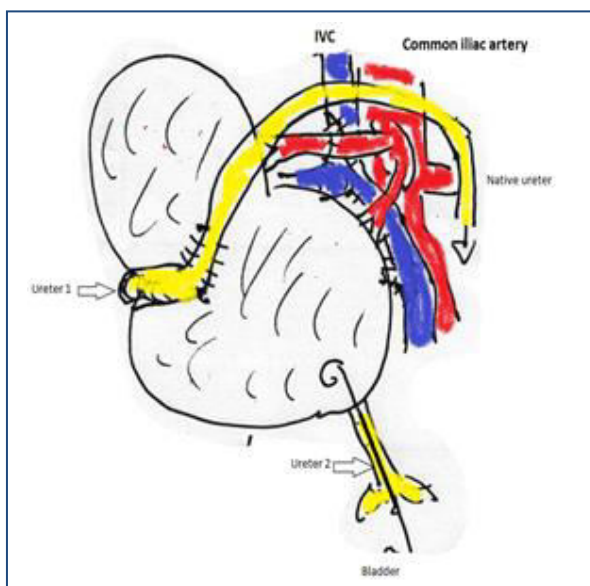


Figure 1: Diagrammatic representation of anatomy.

#### Outcome:

Our recipient had an uncomplicated post-operative recovery. At 4 months post-transplant creatinine has fallen to 76 $\mu$ mol/L (figure 2). Her post-operative CT IVU demonstrates the cross fused kidneys in the right iliac fossa (figure 3).

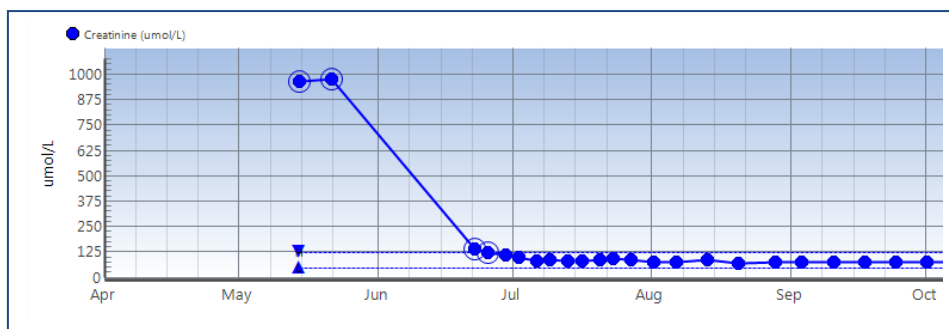


Figure 2: Graph representation of recipient creatinine post transplant.

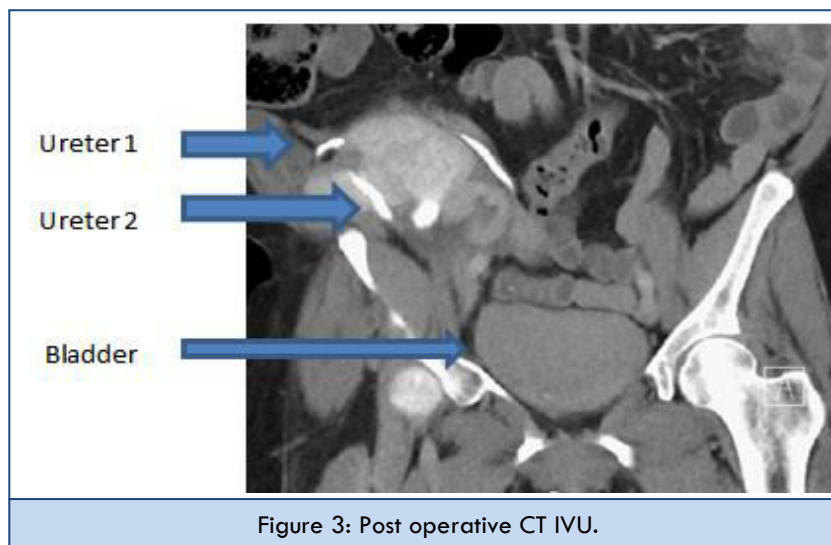


Figure 3: Post operative CT IVU.

## DISCUSSION

Crossed fused renal ectopia is a rare congenital malformation of the urinary tract and is the second most common renal fusion anomaly after horseshoe kidney [6]. The term “crossed renal ectopia” refers to one kidney crossing the midline to the opposite side of the spine, and the ureter of the crossed ectopic kidney re-crossing the midline and entering the bladder on the opposite normal side. If this ectopic kidney is fused with the opposite kidney then it is defined as “crossed fused renal ectopia”. 90% of crossed ectopic kidneys are fused to their contralateral part [7].

The estimated incidence is around 1 in 1000 births with a 2:1 male to female ratio [8,9]. It results as a consequence of abnormal renal ascent in embryogenesis with fusion of the kidneys within the pelvis. It is thought to occur at around the 4th-8th week of fetal life, whilst in normal development, at the end of the second month, the kidney reaches its appropriate position level with the 2nd lumbar vertebra.

With respect to CFRE, six anatomical variations have been described [9], namely, inferior CFRE, sigmoid kidney, lump kidney, disc kidney, L-shaped kidney, and superior CFRE. Inferior CFRE is the most common; the aberrant kidney is most often located inferior to the normally positioned kidney, and fusion occurs between the superior pole of the aberrant kidney to the inferior pole of the normal kidney [10].

Besides the abnormal location and fusion, CFRE often have abnormal vasculature and ureteral abnormalities. It is important to recognize the abnormality during organ retrieval and benching in order to preserve them for transplantation. The unusual anatomy can lead to a technically challenging case, but with careful consideration of the organ size, shape, vessels and ureters, successful transplant can be achieved.

Transplantation of a CFRE can be performed en-bloc in one individual, as in our case or 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 [5]. If

subsequent transplant nephrectomy is indicated, considerations can be made to consider removing the kidney en-bloc or to maintain renal function partially, as done by urologists for CRFE patients with RCC [11].

### CONCLUSION

For improved utilization of organs, all kidneys with congenital urological anomalies must be considered carefully for transplant. Our centre has successfully transplanted many horseshoe kidneys in the past and now has successfully transplanted cross fused renal ectopia kidneys with excellent outcome.

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