Trauma and reconstruction

Transplanting a horseshoe kidney: A case report and review of surgical strategies

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Introduction

Currently, most countries face a shortage of kidney, while a progressive increase in transplant waiting lists occurs. Measures such as the use of expanded criteria donors or continuous machine perfusion for organs aim to reduce the wastage of potentially usable kidneys. In such a scenario, transplanting a donated horseshoe kidney (HSK), although infrequent and technically challenging, could save more patients.

The use of HSKs in transplantation has been hindered mostly by the complex anatomical features. HSKs commonly have multiple vessels, along with duplicated or anomalous collecting system, atop an isthmus (that may or not be vascularized) connecting both lower poles. A HSK may be implanted \textit{en bloc} or split in two, which could be transplanted into two recipients. Either way, some kind of vascular or urinary reconstruction is likely. Few publications report the transplant of HSKs.

In this paper we describe a transplant of a HSK and review technical strategies.

Case presentation

A 60-year old male victim of trauma without comorbidities or previous history of kidney disease with normal creatinine was the donor. Upon inspection, the donated kidneys presented a thin isthmus connecting the lower poles with ureters crossing anteriorly. During evaluation of the vessels, four renal arteries and one single renal vein were identified in the left unit (Fig. 1). The right unit had two arteries and a single vein. There were no collecting system abnormalities.

Initially, the left and right kidneys were separated dividing the isthmus, and its edges were sutured with 3.0 chromic catgut (Fig. 2). As the left kidney presented three nearby arteries in the upper-pole region, we chose to anastomose them into a single barrel (Fig. 3), leaving a fourth lower pole artery to be implanted separately. Perfusion of the left kidney was uneventful. Conversely, the right kidney had to be discarded due to vascular injury.

The recipient was a 34-year-old male, with CKD due to diabetes mellitus, in dialysis for 1.5 years and 300ml residual urine output. His serum creatinine value was 7.5 mg/dl before transplant. Surgery was performed through a Gibson incision in the RIF. In order to facilitate the vascular anastomosis, we chose to position the kidney upside-down. End-to-side anastomosis of the vein in the right external iliac vein was performed. The three-artery barrel anastomosis was performed to the right external iliac artery, and the lower pole renal artery to the right
Fig. 1. Horseshoe kidney, left unit with 3 main arteries from the hilum and 1 single artery from the lower pole.

Fig. 2. Isthmus sutured with chromic catgut.

Fig. 3. Single barrel artery formed with 3 hilum arteries from left unit showed before.
common iliac artery. Reperfusion was uneventful, after a 27 hours cold ischemia. The ureteric reimplant followed the Lich-Gregoir technique.

The patient had good postoperative outcome, and was discharged after 18 days, 3900ml of daily urine output and creatinine of 2.3 mg/dl. After 6 months, he maintained creatinine at 1.1 mg/dl.

Discussion and conclusion

HSK is the most common kidney fusion defect. Arterial and ureteric variation are present in 30 and 10% respectively.

The first kidney transplant with a HSK reported in the literature was performed in 1975. HSK are complex and this leads to increased time of cold ischemia and vascular thrombosis rates. There is little information in the literature regarding the retrieval and preparation of this type of kidney.

It is important to get information about the donor to assess signs of urologic pathology associated with HSK; 13% have urinary tract infection or pain, 17% present with kidney stones. Hydronephrosis can be present, caused by vesicoureteral reflux or PUJ obstruction. If there is a suspect of a HSK before retrieval, an image exam should be performed.

Regarding procurement, some aspects of anatomy and embryology are important to avoid injury. 95% of HSK are united by the inferior pole by an isthmus located at the third or fourth lumbar. Pelvis and ureter are usually preceding the isthmus. Small portion isthmus connects the upper pole and ureteric duplication can also be found. Because they have a lower position, ureter usually have a smaller length and we recommend to perform ureteric section as closest as possible to the bladder. The isthmus usually keeps anterior to the aorta and vena cava, but can be positioned between the aorta and inferior vena cava. Renal arteries can come from the aorta, iliac artery or inferior mésenteric artery. Therefore, when identified this type of kidney it is advisable to place the perfusion hypothermic cannula distally, at the external iliac artery in order to minimize the chances of vascular injury.

When a HSK is found, our advice is to remove the kidney in block and to keep aorta and IVC with a big extension.

A detailed inspection of the HSK should be made on the bench surgery. This careful analysis will be important to determine whether transplant will occur in block or separately. If the number and position of the renal arteries and veins are considered to have high technical risk of causing failure, HSK can be transplanted in block. This prevents vascular lesions and decreases the cold ischemia time, since you do not need prolonged reconstruction. If the risk of technical failure is low, the kidney can be split into two. In such cases, we can find multiple arteries and anastomosis between them can be necessary, having as the main objective to achieve a single artery. The determination of a thin or thick isthmus depends on the surgeon’s assessment. During the isthmus section we can damage to the vasculature. A chance to minimize this type of injury would be injection of methylene blue by accessory artery of the isthmus to determine the circulation pattern, creating a line for incision. This technique can also be used to assess injury at collecting system. Complications include bleeding and urinary fistula. To avoid these types of complication, proper renal parenchymal suture should be performed.

When performed separately, surgical technique is not different from a ordinary kidney transplant. If we choose in block, similar technique is performed during children’s transplant when Aorta and IVC are used as input and output stream, respectively.

The success of HSK transplant depends on a good evaluation and accurate surgical technique. The strategies reviewed here should help to increase success.

Disclosure

The authors of this manuscript have no conflicts of interest to disclose.