A Case of Successful Horseshoe Kidney Transplantation: Extending the Cadaveric Donor Pool

Başarılı Atnalı Böbrek Nakli Olgusu: Kadavra Donör Havuzunu Genişletme İmkânı

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ABSTRACT The number of patients waiting for renal transplants has increased rapidly over the past few decades, but the pool of available deceased donor kidneys has increased only slightly. Horseshoe kidney is the most common congenital anomaly of the kidney, and utilizing horseshoe kidneys from cadavers for renal transplantation would provide more organs and increase the donor pool for transplant recipients. Here, we report a successful case of horseshoe kidney transplantation from a cadaveric donor that was split and transplanted into two recipients successfully, and is the first case reported from our organ transplantation center. Horseshoe kidneys from cadaveric donors can be used for kidney transplantation provided that the kidney is in good condition and that an appropriate surgical technique is implemented according to the renovascular and ureteral anatomy of the kidney.

Key Words: Kidney transplantation; unrelated donors; abnormalities

ÖZET Son yıllarda kullanılabilir kadavra donör böbrek havuzu çok az artarken, böbrek nakli bekleyen hasta sayısı hızla artış göstermiştir. At nalı böbrek en sık görülen doğumsal böbrek anomalisidir ve böbrek nakli için kadavradan at nalı böbrek kullanımı donör havuzunu artıracaktır. Bu yazıda, organ nakli merkezimizde ilk defa gerçekleştirilen, iki alıcıya başarı ile nakledilen at nalı böbrek olgusu sunulmuştur. İyi durumda olması şartıyla kadavra donörlerden at nalı böbrek, nakil bekleyen hastalar için kullanılabilir. Cerrahi sırasında böbreğin renovasküler ve üreter anatomisine göre uygun teknik tercih edilmelidir.

Anahtar Kelimeler: Böbrek transplantasyonu; akraba olmayan donörler; anormallikler

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Horseshoe kidney, which is fusion of both kidneys together to form a horseshoe-shape kidney during intrauterine development, is the most common congenital anomaly of the kidney and affects about 1 in 400-800 people.[1,2] The overall incidence of horseshoe kidney is 1/333 in 9665 cases (urologic patients or autopsy cases) from Turkey.[3]

Kidney transplantation is the ultimate and most cost-effective treatment for end-stage renal disease.[4] Due to the increase in overall life expectancy and improved recipient outcome, the number of patients waiting for renal transplants has been increasing rapidly over the past few decades, but the pool of available deceased donor kidneys has increased only slightly, resulting in increased waiting time and mortality for transplant candidates.[5] According to data from the Turkish Ministry of Health, 20 800 patients with

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end-stage renal disease were waiting for cadaver kidney transplantation on the National Organ Waiting List as of November 2013 (https://organ.saglik.gov.tr/). Therefore, it is crucial to evaluate opportunities to increase the donor pool. Utilizing horseshoe kidneys from cadavers for renal transplantation would provide more organs and increase the donor pool for transplant recipients. The first horseshoe kidney transplantation was reported in 1975 by Nelson and Palmer.[2] Although there is an increasing number of reports on successfully transplanted horseshoe kidneys, the total number of horseshoe kidney transplantation cases remains limited.[6-8] More reports of horseshoe kidney transplantation cases will encourage surgeons to use kidneys with this anomaly, which will in turn extend the donor pool.

In this report, we present a successful case of horseshoe kidney transplantation. This is the first case reported from our organ transplantation center based in Ankara, Turkey.

CASE REPORT

The donor was a 21-year-old male who was brain dead from a suicidal gunshot. The family of the patient gave consent for organ donation. Surgical abdominal exploration for organ harvesting revealed that the patient had horseshoe kidney. After evaluating the cases of horseshoe kidney transplantation in the literature, we decided to transplant this horseshoe kidney to appropriate recipients. The recipients provided written consent after being informed that the horseshoe kidney would be split and transplanted as half. Recipient candidates did not hesitate to take the risk, as they had for many years expected to have a cadaver kidney transplant.

The kidney was removed *en bloc* by a surgical team at Ankara Numune Training and Research Hospital and was sent to our organ transplantation center immediately.

The last serum creatinine and urine levels before removal of the kidney were 1.2 mg/dL and 250 mL/h, respectively.

The parenchyma of the horseshoe kidney was in good condition at the isthmus and there were two arteries, one vein, and one ureter on each side (Figure 1). The horseshoe kidney was split into two kidneys by cutting the isthmus on the back table. The edges of the isthmus were sutured watertight with 3/0 polydioxanone sutures (Figure 2).

The two kidneys were transferred separately into the right iliac fossa of two adult recipients. One of the two renal arteries was anastomosed end-to-side to the common iliac artery, and the other was anastomosed to the external iliac artery. Perfusion was perfect without any bleeding after the anastomosis. The ureter was implanted into the bladder using the Lich technique. A double-J catheter was inserted, a silicon drain was placed in the surgical area, and the operation was ended.

Standard immunosuppressive treatment was administered to both recipients. After transplantation, sufficient urine output was obtained in the first recipient and there were no significant adverse events during postoperative follow-up. The patient was discharged when the creatinine level became normal. The second recipient developed acute tu-

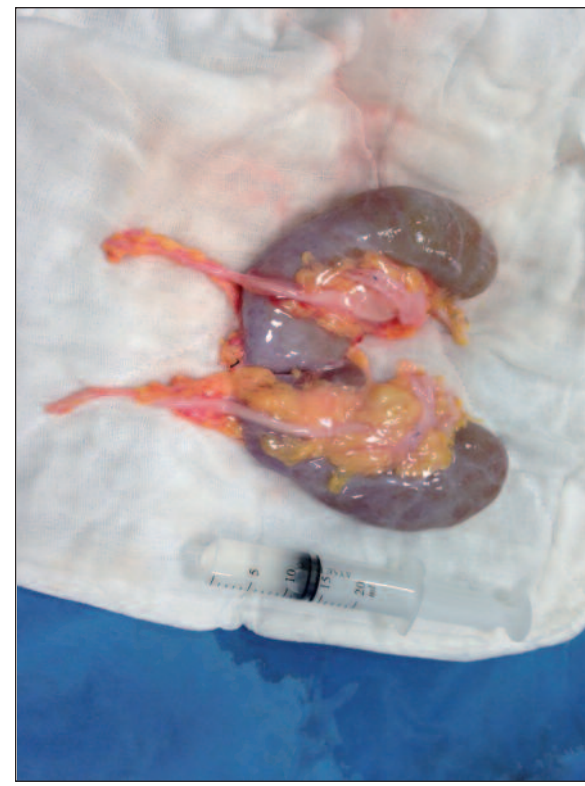

FIGURE 1: Horseshoe kidney on the back table after harvesting.

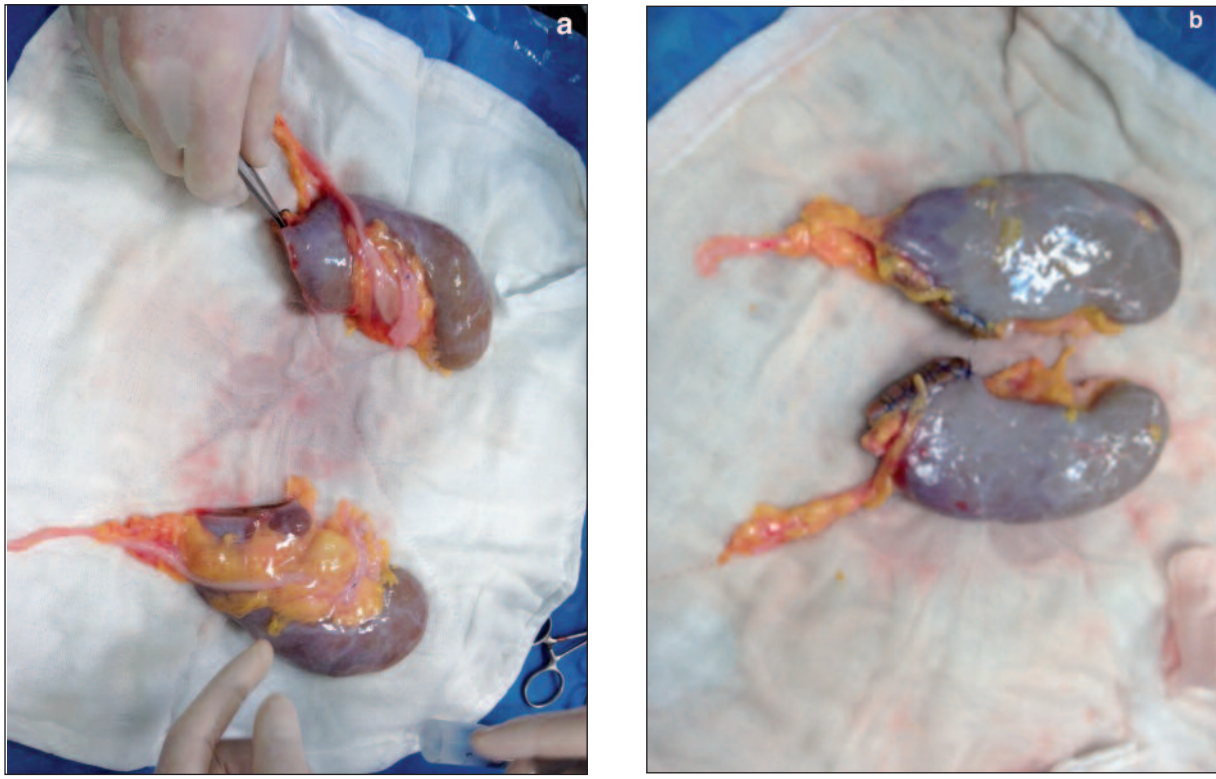

FIGURE 2: Division of isthmus on the back table **(a)** and suturing the edges of the isthmus **(b)**.

bular necrosis and delayed graft function following transplantation, but creatinine decreased to normal levels with medical treatment and hemodialysis, and the patient was discharged. The creatinine levels of the patients were 0.9 and 1.1 mg/dL at discharge, and no proteinuria was detected.

DISCUSSION

This is the first case report of horseshoe kidney transplantation from our organ transplantation center in Ankara, Turkey. Horseshoe kidney is the most common congenital anomaly of the kidney and a good candidate to expand the cadaveric donor pool. However, the utility of these kidneys is limited due to concern about complex vascular or ureteral anatomy and limited experience.[6] However, recent reports show that horseshoe kidneys can be used for transplantation.[6-8]

The horseshoe kidney transplant cases reported in the literature were either split from cadaveric donors and then transplanted, transplanted *en bloc*, or split from living donors.[6-11] As suggested by Nelson and Palmer, a horseshoe kidney should always be removed *en bloc* from cadaveric donors to preserve renal vessels.[2] The type of horseshoe kidney transplantation depends on donor age, renovascular and ureteral anatomy, and isthmus thickness. Stroosma et al. recommended *en bloc* transplantation when the urinary collecting system crosses the midline, otherwise, *en bloc* or split transplantation should be performed depending on the number and position of the arteries and veins.[9] The parenchyma was good at the isthmus in the present case, and there were two arteries associated with one vein and one ureter on each side without crossing the urinary collecting system at midline. Therefore, we decided that it was technically possible to split the horseshoe kidney for transplantation into two recipients. After splitting the horseshoe kidney, we sutured the edges of the isthmus to assure hemostasis and prevent urinary fistulas, as suggested by Foster and Morrissey.[7]

Acute tubular necrosis is observed in 34% of all cadaver transplant recipients who receive kidneys

with normal anatomy.[10] Stroosma et al. found no significant difference between horseshoe kidneys transplanted *en bloc* or split and kidneys with a normal anatomy in terms of primary nonfunction, graft survival, patient survival, and post-transplant serum creatinine values.[12] In our case, one of the two recipients developed acute tubular necrosis, which was managed effectively with medical treatment and hemodialysis. The other recipient had no adverse events after transplantation. We believe that the acute tubular necrosis occurred as a common post-operative event after transplantation, unrelated to the horseshoe kidney transplantation. However, further large series are needed to confirm graft and patient survival in patients undergoing horseshoe kidney transplantation compared to transplantation of kidneys with a normal anatomy.

Other common problems with horseshoe kidney transplantation reported in the literature are thrombosis and acute rejection, recurrent urinary tract infections, renal calculi and hydronephrosis, hemorrhage, and urinary fistula formation.[13] We did not encounter any of these complications.

Transplantation of a horseshoe kidney is technically challenging and requires a careful evaluation of tissues and special strategies for managing the complex vascular or ureteral anatomy.[7,14] We think that the best outcome can be obtained when the horseshoe kidney parenchyma is in good condition with no vascular abnormalities, when the transplantation is performed by experienced hands, and a close follow-up is performed focusing on signs of rejection, infection, renal calculi, and fistula formation. A few successful cases of living donor horseshoe kidney transplantation are available.[15-17] Thus, in addition to cadaveric donors, living donors of horseshoe kidney should be considered for transplantation.

In conclusion, the present case is an example of horseshoe kidney from a cadaveric donor that was split and transplanted into two recipients successfully. Horseshoe kidneys from cadaveric donors can be used for kidney transplantation provided that the kidney is in good condition and the appropriate surgical technique is implemented according to the renovascular and ureteral anatomy of the kidney.

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