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Case Report

Kidney transplantation from a brain-dead heart transplant candidate treated with biventricular assist device: 12-month follow-up

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Introduction

The continuing disparity between the demand for kidney transplants and the supply of organs has necessitated the use of organs from an extended criteria donor pool [1–3]. Clearly, organs that would have been previously thought unsuitable are currently used for transplantation. In this study, we report the successful kidney transplantation from a heart transplant candidate who had received therapy with a biventricular assist device for terminal heart failure complicated by severe pulmonary hypertension, and who died because of a fatal cerebral haemorrhage.

Case report

Donor

The donor was a 63-year-old female patient with end-stage bilateral heart failure due to ischaemic heart disease, considered for listing for heart transplantation. The patient met all indication criteria, apart from an exceedingly high fixed pulmonary hypertension. A biventricular pulsatile assist device (Thoratec PVAD, Thoratec Corporation, Pleasanton, CA) was implanted in a biventricular fashion in order to reduce the pulmonary resistance to measures matching the criteria for subsequent heart transplantation. Anticoagulation therapy, required due to the implanted mechanical circulatory support (MCS), was established with warfarin (INR 2.0–2.5). The patient's previously deteriorated renal function improved after biventricular assist device implantation (serum creatinine 1.87 mg/dL → 0.97 mg/dL and GFR 29 mL/min → 62 mL/min). Thirty-five days after surgery, the patient complained of a sudden onset of severe headache and coma rapidly developed. Despite a moderate level of anticoagulation at the time of the event (INR 2.1), CT scan verified a vast haemorrhagic stroke in the left cerebral hemisphere with propagation to the cerebral ventricular system and malignant brain oedema. In view of the lethal neurological prognosis, organ donation was taken into consideration, as the patient had a relatively well-preserved function of other organs because of adequate circulatory perfusion. Having received negative brain perfusion at the angiography, after laparatomy and perfusion with 2000 mL of UW solution, a bilateral transabdominal nephrectomy was performed and the kidneys were shown to be suitable for transplantation. The MCS was maintained for the duration of the kidney procurement and thus the procedure was performed under the same conditions as a normal beating heart. At that time, the patient's kidney function was satisfactory (Cr 0.97 mg/dL, GFR 62 mL/min). The backtable wedge kidney biopsy showed acute tubular necrosis along with mild benign nephrosclerosis with focal interstitial fibrosis and tubular atrophy of both kidneys (Figure 1). The allocation of these kidneys to recipients over 60 years old was suggested. Prior to surgery, both kidney transplant recipients were informed about the possible limitations and signed informed consent.

Recipients

The recipient of the left kidney was a 62-year-old female with end-stage renal failure due to tubulointerstitial nephritis, who had undergone chronic haemodialysis therapy for 2 years. The surgery was complicated with the external iliac endarterectomy. Since acute tubular necrosis was suspected, a polyclonal antithymocyte globuline single shot (ATG-Fresenius S, Fresenius Biotech GmbH, Grafelfing, Germany, 9 mg/kg) prior to reperfusion was given, followed by mycophenolate mofetil and steroids. Cyclosporine A was delayed until Day 6. On Day 14, a renal biopsy was performed (Figure 1) that confirmed mild regenerating acute tubular necrosis and transfer of mild benign nephrosclerosis without any evidence of acute rejection. The patient was discharged on Day 16 with stable renal function (Cr 2.17 mg/dL, GFR 24 mL/min).

Three months after transplantation, a routine protocol biopsy was performed. Light microscopy demonstrated

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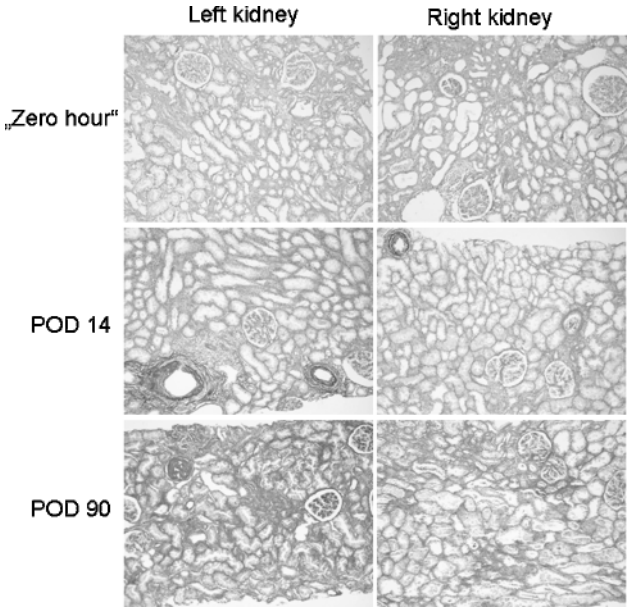

Fig. 1. Zero hour: mild benign nephrosclerosis with focal, superficially accentuated interstitial fibrosis and tubular atrophy of both kidneys. POD 14: Mild regenerating acute tubular necrosis and benign nephrosclerosis transferred from the donor with distinct arterial intimal fibroelastosis of both kidneys. POD 90: Transfer of benign nephrosclerosis, scarring is more extensive in the left kidney due to superficial sampling of the specimen. All images were made on slides stained with Sirius Red and elastica, under magnification 100×.

normal histological findings (Figure 1). Twelve months after transplantation, the patient's kidney function remains stable (Cr 1.88 mg/dL, GFR 29 mL/min).

The recipient of the right donor kidney was a 63-year-old female with end-stage renal failure due to chronic glomerulonephritis, who had undergone haemodialysis for the previous 8 months. An ATG-Fresenius single shot (9 mg/kg) prior to reperfusion was administered and followed by tacrolimus (0.2 mg/kg/day), mycophenolate mofetil (2 g b.i.d.) and prednisone (20 mg) since the peristaltic was noted. Despite the immediate use of tacrolimus due to higher frequency of PRA (48%), a kidney graft function was observed from the first postoperative day.

A biopsy performed on Day 14 revealed regenerating acute tubular necrosis and a transfer of mild benign nephrosclerosis without any evidence of acute rejection (Figure 1). The patient was discharged on Day 18 with a satisfactory renal function (Cr 1.79 mg/dL, GFR 30 mL/min) and having received lower tacrolimus exposure (trough blood level 6.7 ng/mL). At 3 months after renal transplantation, the graft had an excellent graft function (Cr 1.51 mg/dL, GFR 37 mL/min) and a routine protocol biopsy was performed. Light microscopy revealed only a transfer of benign nephrosclerosis (Figure 1). At 12 months after transplantation, an excellent kidney graft function was observed (Cr 1.41 mg/dL, GFR 40 mL/min).

Discussion

Over the last decade, MCS has become a relevant and effective option in the treatment of end-stage heart failure patients as bridge-to-transplantation, or as a permanent solution known as destination therapy. In the long term, this method diminishes the adverse processes connected with low cardiac output syndrome, by restoring adequate systemic and organ perfusion and reducing pulmonary vascular resistance [4–6].

Recently, an extended donor criteria pool program has been widely used in both the United States and Europe to solve the progressive disparity between the increasing number of patients waiting for kidney transplantation and a limited donor pool. The use of more and more marginal donors for kidney transplantation and transplantation from donors after cardiac death has often failed to give optimal results in the long term [7]. An MCS device which mediates well-perfused organs in deceased donors might be considered as acceptable for transplantation in the context of an organ shortage [8]. In contrast to successful kidney recovery in a donor after cardiac death, treated previously with a left ventricular assist device [9], we here present a satisfactory 1-year follow-up of kidneys transplanted from a brain-dead heart transplant candidate, treated during the kidney removal with a biventricular assist device. Because of the increasing usage of mechanical circulatory support in the treatment of terminal heart failure with the risk of fatal complications, we encourage transplant professionals to consider such donors to be suitable for kidney donation.

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Conflict of interest statement. None declared.

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