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Case Report

Complete recovery of acute kidney injury in native kidney following heart kidney transplantation

Vanji Karthikeyan [a,b,*], *K.K. Venkat* [a,b]

[a] *Division of Nephrology and Hypertension, Department of Medicine, Henry Ford Hospital, Detroit, MI, USA*
[b] *The Transplantation Institute, Henry Ford Hospital, Detroit, MI, USA*

ARTICLE INFO

Article history:
Received 1 February 2015
Accepted 14 October 2015
Available online 18 November 2015

Keywords:
Acute kidney injury
Heart transplantation
Kidney transplantation

ABSTRACT

We report the case of a 23-year-old female who developed severe acute kidney injury (AKI) in the setting of recent onset congestive heart failure secondary to viral cardiomyopathy, cardiogenic shock unresponsive to placement of a biventricular assist device with continued requirement of multiple intravenous pressors, recurrent ventricular tachycardia/fibrillation, and rhabdomyolysis secondary to ischemic necrosis of left leg muscles. Daily slow, low-efficiency dialysis was instituted shortly after admission. Given the possibility of irreversible AKI and the inferior outcomes following heart transplantation alone in patients with perioperative renal dysfunction, she was listed for urgent combined heart-kidney transplantation. Dual transplantation was performed after 9 days of AKI and 7 days on dialysis. Both organs functioned well soon after transplantation. One month post-transplant, recovery of native kidney function with nearly equal contribution to renal function by the native kidneys and the allograft was documented by radioisotopic renography. This case report highlights the difficulty in deciding which patients with severe AKI in the setting of acute heart failure may recover renal function with heart transplantation alone and the need for developing guidelines to help in choosing between heart versus heart-kidney transplantation in such patients.

1. Introduction

Acute kidney injury (AKI) frequently complicates congestive heart failure (CHF), and the term type 1 cardio-renal syndrome (CRS type-1) is used to describe AKI occurring in the setting of acute CHF.[1,2]

Multiple factors contribute to AKI in this setting: low cardiac output, renal vasoconstriction, ventricular arrhythmias, cardiac arrest, over-diuresis, and nephrotoxins.[1–3] Although left ventricular assist devices may improve renal function in severe CHF, these devices have also been implicated in the development of AKI.[4]

Request for simultaneous heart-kidney transplantation may come up in patients with severe CRS type-1 for these reasons (1) severe AKI, especially in those with preexisting kidney dysfunction, who are at higher risk for non-recovery of AKI[5]; (2) outcomes in heart transplant recipients with kidney dysfunction are inferior compared to those with good renal function[6,7]; (3) listing for combined heart-kidney gives higher

* *Corresponding author.*
E-mail address: vkarthi1@hfhs.org (V. Karthikeyan).
http://dx.doi.org/10.1016/j.ijt.2015.10.011

priority for organ allocation, compared to heart transplant alone.[8] This might motivate the cardiac transplant team to request dual transplantation in order to help a very ill patient.

Requests for dual heart-kidney transplantation in this setting impose on the renal transplant team the problem of determining which of these patients may recover renal function with heart transplantation alone. We report such a case in which we recommended simultaneous heart-kidney transplantation because we thought that severe AKI was unlikely to recover. However, native kidney function did recover following heart-kidney transplantation. We review the decision-making problems in such patients and the need for developing guidelines to assist in choosing heart alone versus heart-kidney transplantation.

2. Case report

A 23-year-old, previously healthy female presented to an outside hospital with severe dyspnea following upper respiratory infection. Examination revealed severe CHF and episodic ventricular tachycardia, requiring ventilatory support, intravenous (IV) epinephrine, norepinephrine, procainamide, and amiodarone infusion. She was transferred to our institution with a diagnosis of acute viral cardiomyopathy. Echocardiogram revealed biventricular systolic dysfunction with ejection fraction of 10–15%. Emergent percutaneous implantation of a left ventricular assist device (Impella, Abiomed, Danvers, MA) did not improve her condition (procedure complicated by several episodes of ventricular fibrillation requiring multiple electrical cardioversions). This was followed by cardiopulmonary bypass and placement of a biventricular assist device (BVAD)-Centrimag (Thoratec, Pleasannton, CA). Postoperative hemorrhage necessitated reoperation: 3 L of blood were evacuated and red cell transfusions were given.

Urine output was 40–50 mL/h with blood urea nitrogen (BUN) level of 1.79 mmol/L (5 mg/dL) and serum creatinine (SCr) level of 61.88 μmol/L (0.7 mg/dL) upon arrival. Thirty-six hours later, urine output was less than 10 mL/h, and BUN and SCr levels were increasing rapidly with severe rhabdomyolysis, shock liver, and coagulopathy. Severe CRS type-1 was diagnosed. Slow low efficiency dialysis (SLED) was begun on the second hospital day.

She developed ischemic necrosis of all muscles in the left leg and above-knee amputation was performed (complication of left femoral arterial puncture for left ventricular assist device).

She was listed for cardiac transplantation because of refractory cardiogenic shock and frequent episodes of ventricular fibrillation. The listing was changed to simultaneous heart-kidney transplantation in a joint decision by nephrology and cardiac transplant teams because of anuria, daily SLED requirement, and likelihood of poor outcome with heart transplantation alone with high risk of irreversible AKI due to multiple renal insults.

Heart-kidney transplantation was performed on the ninth day of hospitalization. Ejection fraction increased to 53% on the tenth post-transplant day with no further cardiac arrhythmias. Dialysis was not required post-transplant. SCr increased from 109.62 μmol/L (1.24 mg/dL) pre-transplant to 341.22 μmol/L (3.86 mg/dL) on the fourth day post-transplant before falling steadily to 22.98 to 45.97 μmol/L (0.26–0.52 mg/dL) by post-transplant day 21 (most values <35.36 μmol/L [≤0.4 mg/dL]).

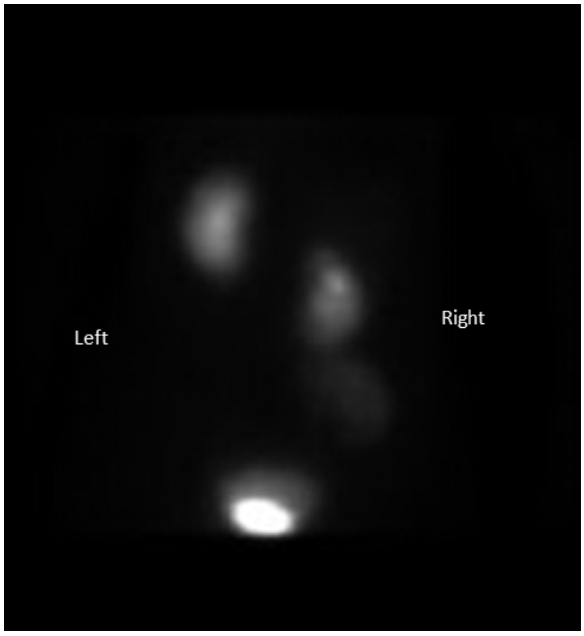

Fig. 1 – Frame from isotopic renography (posterior view) one month post-transplant. Prompt uptake of radioactivity by native and transplant kidneys and excretion into the urinary bladder is shown. Since the allograft is closer to the anterior abdominal wall and farther away from the camera, it appears fainter than the native kidneys in this view.

Isotopic renography (after administration of 5.4 mCi IV of Tc-99m mercapto-acetyltriglycine [MAG-3]) was performed 1-month post-transplant because of the unexpectedly low post-transplant SCr levels (even allowing for left above knee amputation and muscle loss due to critical illness) suggesting possible recovery of the native kidneys. Renography (Figs. 1 and 2) revealed blood flow to the native and transplanted kidneys. Split function was 38% from the allograft and 62% from the native kidneys, confirming complete native kidney functional recovery (3 kidneys were now contributing nearly equally). She was discharged after 2 months in the hospital for inpatient rehabilitation. Cardiac status was normal and the SCr level was 29.17 μmol/L (0.33 mg/dL) at discharge. Key clinical events on various hospital days are shown in Table 1.

3. Discussion

This patient had several kidney insults that suggested that AKI was likely to be irreversible: recurrent ventricular arrhythmias, refractory cardiogenic shock, massive hemorrhage after BVAD surgery, and myoglobinuria, all of which resulted in severe AKI with anuria requiring daily SLED. However, following factors favored renal recovery: young age, no past medical problems or renal dysfunction, and short duration of AKI and RRT (1 week). Balancing these factors, we thought that