Is Severe Electrolyte Imbalance a Contraindication for Heart Transplant?

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Abstract

Owing to the increasing numbers of patients with end-stage congestive heart failure awaiting heart transplant and the limited number of suitable donor organs, a decrease in stringency of donor criteria has become widely accepted over the last decade. Here, we present a case of a heart donor with severe electrolyte imbalance, specifically severe hypokalemia, and severe hypernatremia. Despite this, heart transplant was a success, and the recipient was discharged from the hospital in good general condition. We recommend further study of this issue with a larger sample size.

Key words: *Donor screening, Heart graftings, Potassium, Sodium, Electrolytes, Water Electrolyte Imbalance*

Introduction

Brain death results in impairment of cerebral regulatory processes, often leading to a rapid depletion of antidiuretic hormone and development of central diabetes insipidus because of pituitary failure. The clinical consequences are characterized by inappropriate diuresis, severe hypovolemia, hyperosmolality, and a serum sodium level above the normal range.[1, 2] Elevated donor serum sodium levels have been identified as an independent risk factor for early allograft dysfunction by several groups in the field of liver transplantation.[3-6] However, others state that there is no correlation between hypernatremia and outcome in transplanted patients.[7] Potassium is also a major intracellular cation that plays a significant role in cardiac electrical activity. A literature review revealed that the effect of hypernatremia on outcomes after heart transplant remains a matter of debate. In the *International Society of Heart and Lung Transplantation Guidelines for the Care of Heart Transplant Recipients* published in 2010, electrolyte imbalance is not mentioned.[8] Here, we report a successful case of heart transplant in which the donor had severe electrolyte imbalance (ie, severe hypokalemia and severe hypernatremia). Recovering the organ and transplanting it were performed at the same hospital.

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Case Report

The recipient was a 48-year-old man with a history of ischemic heart failure who was not suited for revascularization. He also had diabetes mellitus without end-organ damage, as well as dyspnea on minimal exertion that was refractory to maximal medical treatment. On evaluation, the patient had normal sinus rhythm with a QS pattern in leads V2 to V6. Results of transthoracic echocardiography showed a left ventricular ejection fraction (LVEF) of 10%, with a thin interventricular septum and a large clot in the left ventricle. Right heart catheterization showed pulmonary artery pressure of 63 mm Hg, which was decreased to 30 mm Hg after nitroprusside injection. The donor was a 47-year-old woman who was transferred from another hospital 12 hours before the operation. The diagnosis was brain death secondary to intracranial hemorrhage. Her previous laboratory data showed severe electrolyte imbalance ($Na+$ = 190 mmol/L, K^+ = 2.2 mmol/L, Hb = 13 g/dL, blood glucose = 371 mg/dL, creatinine = 3.26 mg/dL, and

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blood urea nitrogen [BUN] = 33.6 mg/dL). After medical treatment, values were Na^+ = 170 mmol/L and K^+ = 2.5 mmol/L. Her hemodynamic function deteriorated despite infusion of 10 μg/kg/min dopamine. Therefore, we decided not to delay the operation with further electrolyte correction.

Recovering the organ and transplanting it were performed according to the Shumway (biatrial) technique,[9, 10] cardiopulmonary bypass time (CPB time) was approximately 80 minutes, and ischemic time was 115 minutes. The patient came off CPB easily with low-dose dobutamine (5 μg/kg/min) in sinus rhythm, with no need for cardioversion. The recipient had an uneventful recovery, and experienced no significant arrhythmia or electrolyte imbalance during the postoperative course. After 48 hours in the intensive care unit, he was transferred to the surgery ward. He was discharged from the hospital in good condition on the 14th postoperative day.

Discussion

Because of the increasing number of patients with end-stage congestive heart failure awaiting heart transplant and the limited number of suitable donor organs, a decrease in the stringency of donor criteria, to include using so-called "marginal" organs, has become widely accepted over the last decade. Whether the acceptance of marginal organs might result in adverse outcomes is still a matter of debate. Several donor-derived risk factors, such as age, are well known to have an effect on recipient survival.[11]

Brain death may result in disturbed electrolyte homeostasis, leading to an excessive sodium level.[12, 1] A review of the current literature revealed an uncertain effect of hypernatremia on outcome after heart transplant; most reports are of liver transplant and are of limited sample size. Several authors have reported hypernatremia to be a risk factor for adverse outcome after liver transplant.[3, 4, 7, 13-16] However, others found no influence of donor sodium level on the outcome.[5, 17, 18] Limited data have been reported concerning cardiac transplant.

Kaczmarek and associates reported no effect of donor sodium level on outcome in their single-center analysis consisting of 336 heart transplant recipients, but the rather low donor sodium levels in their high-risk group (162 ± 6.6 mmol/L) was a limitation.[19] In another multicenter trial, the division of donor serum level into 4 quartiles might have led to underestimation of extreme donor sodium levels.[20] Hoefer and associates investigated the influence of donor sodium level on 1-year survival in 4641 patients in a large, retrospective, cohort study.[21]

By multivariate analysis, recipients receiving a heart from a donor with a serum sodium level less than 130 mmol/L or greater than 170 mmol/L had a 1.25-fold higher risk for 1-year posttransplant mortality than did patients with normal donor sodium ranges. Limitations of that study included the retrospective setting and the fact that the donor sodium levels were not necessarily obtained immediately before organ procurement. Other parameters, such as inotropic support or detailed evaluation of heart function, were not analyzed. In the present case, the donor had severe hypokalemia and severe hypernatremia (190 mmol/L) that was reduced to 170 mmol/L before the operation, and this had no adverse effect on the short-term results of the heart transplant. A prospective study considering other variables and also extreme donor electrolyte levels is needed to clarify the effect of electrolyte imbalance on heart transplant.

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