

Renal Transplant in Patient with Low Ejection Fraction and Diastolic Dysfunction Grade III: A Case Report

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ABSTRACT

Aim and background: Chronic kidney disease (CKD) patients on hemodialysis with ejection fraction (EF) <30% are reported to have a nine times higher risk of mortality rate than those with EF >60%. Patients with diastolic dysfunction also have an increased incidence of cardiac events. Kidney transplant provides better quality of life and prevents further deterioration of cardiac function as compared to dialysis. The intraoperative period is challenging in these patients as adequate renal perfusion has to be delivered to achieve good urine output while sustaining cardiac parameters within the optimal range.

Case description: A 35-year-old male was posted for a live donor renal transplant. The two-dimensional (2D) echocardiography reported global hypokinesia of the left ventricle with severe left ventricular (LV) dysfunction. The EF was 25–30%. Diastolic dysfunction grade III with E/A 1.36, E/E 24.02, and DT 82 ms. Intraoperatively increased blood pressure was managed with nitroglycerine infusion, which was titrated to 0.4 mg/hour. The patient was hemodynamically stable throughout the procedure. The fluid infusion was guided by central venous pressure (CVP), which was maintained at 10–12 mm Hg at the time of declamping. The transplanted kidney functioned well immediately.

Conclusion: Preoperative optimization of cardiac status, invasive monitoring for various cardiac parameters, carefully tailored anesthesia, and intense postoperative care are essential for successful transplants in such cases. Providing adequate renal perfusion while maintaining various cardiac parameters in optimal range is challenging but crucial.

Clinical significance: Various studies have reported posttransplant normalization of lower EF due to uremic cardiomyopathy in the absence of cardiac ischemia. Increased incidence of major adverse cardiovascular events (MACE) has been reported in surgical patients having diastolic dysfunction; hence increased vigilance is required. Renal transplants can be carried out in patients with these parameters.

Keywords: Case report, Diastolic dysfunction, Ejection fraction, Left ventricular, Renal transplantation, Ventricular.

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INTRODUCTION

Kidney transplant recipients often have cardiovascular diseases like arrhythmias, coronary artery disease (CAD), left ventricular diastolic dysfunction (LVDD), and pulmonary hypertension, a major cause of morbidity and mortality in these patients.¹ CAD is predictive of posttransplant coronary events, which can adversely impact the function of the transplanted kidney. Chronic kidney disease (CKD) patients on hemodialysis with ejection fraction (EF) <30% are reported to have a nine times higher risk of mortality rate than those with EF >60%.¹ Patients with diastolic dysfunction also have an increased incidence of cardiac events.² Incidence of pulmonary artery hypertension is also higher in CKD patients.¹ Kidney transplant provides better quality of life and prevents further deterioration of cardiac function as compared to dialysis. The intraoperative period is challenging in these patients as adequate renal perfusion has to be delivered to achieve good urine output while sustaining cardiac parameters within an optimal range.

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CASE DESCRIPTION

A 35-year-old male was posted for a live donor renal transplant. He was a known case of type 1 diabetes mellitus for 20 years, hypertension, and end-stage renal disease for 6 years. He was started on maintenance hemodialysis for 1 month through a hemodialysis catheter inserted in the right internal jugular vein. His blood investigations were in concordance with renal failure. The two-dimensional (2D) echocardiography reported global hypokinesia of the left ventricle with severe LV dysfunction. The EF was 25–30%. The left atrium was dilated (50 × 52 mm), the left ventricle was dilated (55 mm), and the right atrium was dilated (38 × 48 mm). Pulmonary artery pressure was 70 mm Hg. Moderate mitral regurgitation, mild aortic regurgitation, grade II/IV tricuspid regurgitation, and mild pulmonary regurgitation were reported. A thin rim of pericardial effusion was noted. Diastolic dysfunction grade III with E/A 1.36, E/E 24.02, and DT 82 ms. Reversal of pulmonary venous flow was noted. Coronary angiography reported normal coronaries. His medications included Insulin, prazosin 5 mg, bisoprolol 5 mg, frusemide 100 mg, and a combination of sacubitril 24 mg with valsartan 26 mg.

In the operation theatre, a 20 gauge cannula was inserted in the dorsum of the right hand, and an electrocardiogram, noninvasive blood pressure (NIBP), and pulse oximeter were attached. The NIBP was 160/90 mm Hg and the pulse rate was 70/minute. The right radial artery was cannulated under local anesthesia to monitor invasive blood pressure. The hemodialysis catheter was not used but was available for inotrope infusions during induction. Anesthesia was induced with fentanyl 100 µg of, propofol 60 mg of, and sevoflurane in oxygen. Atracurium was used for muscle relaxation. After intubation, the left internal jugular vein was cannulated with a 7.5 Fr triple-lumen catheter. A cardiac output monitor was attached and central venous pressure (CVP), stroke volume variation, systemic vascular resistance, cardiac output, and cardiac index were monitored. Anesthesia was maintained with sevoflurane in oxygen and air (50:50), atracurium, and fentanyl infusion. Arterial blood gas parameters were recorded and were within normal range intraoperatively. Intraoperatively increased blood pressure was managed with nitroglycerine infusion, which was titrated to 0.4 mg/hour. The patient was hemodynamically stable throughout the procedure. A fluid infusion was guided by CVP, which was maintained at 10–12 mm Hg at the time of declamping. The transplanted kidney functioned well immediately. At the end of the surgery, the hemodynamic parameters were stable; hence extubation was attempted and carried out successfully. The patient had an uneventful postoperative stay in the intensive care unit.

DISCUSSION

Kidney transplant is the treatment of choice for patients with end-stage renal disease. In these patients, physiological responses to pressure and volume overload and electrolyte

disturbances lead to hemodynamic alterations and changes in the cardiovascular system.³ Various studies have reported posttransplant normalization of lower EF due to uremic cardiomyopathy in the absence of cardiac ischemia.⁴ In the perioperative period, an EF of <50% is a risk factor for cardiac morbidity.⁴ These patients are known to be at high-risk and a challenge for anesthesia due to hemodynamic changes during transplant. Diastolic dysfunction is an additional risk factor for postoperative morbidity and mortality.³ Fluid infusion has been shown to be independently associated with deterioration of diastolic dysfunction intraoperatively during renal transplant. Diastolic dysfunction, especially grade III, has been shown to increase the risk of major adverse cardiovascular events (MACE).⁵ Risk of MACE is further increased as the LV-EF decreases.⁵

Although both ventricles develop dysfunction, greater morbidity is associated with LV dysfunction. Diastolic dysfunction is often asymptomatic, but it can become symptomatic in stressful conditions.⁶ LVDD is adversely affected by anesthetic agents and intraoperative hemodynamic changes. An increase in volume load is known to aggravate LVDD.⁷

General anesthesia, per se, has a negative inotropic effect. Venous dilatation due to anesthetic agents is known to decrease preload. Positive pressure ventilation by increasing the intrathoracic pressure reduces venous return, consequently, and cardiac output. Inflation of the lungs leads to an increase in pulmonary vascular resistance, therefore increasing the right ventricle afterload. This leads to dilatation of the right ventricle, which, compounded with decreased preload, leads to a reduction in LV filling.⁸ This increases morbidity and mortality in patients with low EF and diastolic dysfunction.

Various medications for hypertension, arrhythmias, and ischemic heart disease are continued in the preoperative period. Intraoperatively fluid is administered cautiously, and tachycardia, arrhythmias, hypoxia, hypercarbia, and acidosis are avoided. Although inhalational agents, opioids, and induction agents, including propofol and midazolam, have been reported to have no significant effect on diastolic function, however, the doses have to be titrated in low EF. Intraoperative blood pressure control is of utmost importance. Increased pulse pressure is known to alter ventricular contraction time and increase ventricular wall stress, thus impairing early diastolic filling of the ventricle; hence, it is kept below the diastolic blood pressure.⁹ In our patient, nitroglycerine infusion was used to manage intraoperative hypertension.

Fluid overload and hemodynamic instability may cause pulmonary edema in these patients. Control of blood volume and use of nitrates and diuretics help control end-diastolic pressures. The β-blockers, by reducing myocardial oxygen demand, reduce the incidence of cardiac events.^{7,10}

Emergence from anesthesia is a critical stage in these patients because the vascular sympathetic tone is restored and the central blood volume increases. This volume overload can

lead to pulmonary edema, tachycardia, and atrial fibrillation. Various studies have reported failure in weaning from mechanical ventilation in patients with LVDD due to the inability of patients with high LV filling pressures to accommodate an increase in preload during the switch from positive pressure ventilation to negative pressure (spontaneous) breathing.⁹ Low-dose nitroglycerine infusion has been shown to diminish these adverse events.⁹ This was another reason for using nitroglycerine to control intraoperative hypertension in our patient.

CONCLUSION

Patients with CKD are more prone to cardiac arrhythmias due to uremia, electrolyte imbalance, volume shifts, structural changes in the heart, etc. Providing adequate renal perfusion while maintaining various cardiac parameters in optimal range is challenging but crucial. Preoperative optimization of cardiac status, invasive monitoring for various cardiac parameters, carefully tailored anesthesia, and intense postoperative care are essential for successful transplants in such cases.

Clinical Significance

Various studies have reported posttransplant normalization of lower EF due to uremic cardiomyopathy in the absence of cardiac ischemia. Increased incidence of MACE has been reported in surgical patients having diastolic dysfunction; hence increased vigilance is required. Renal transplants can be carried out in patients with these parameters.

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