



Cardiac Remodeling in Structure and Function Six Months After Kidney Transplantation

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ABSTRACT

Background. Cardiovascular disease accounts for 35% to 50% of the causes of mortality in chronic kidney disease. The majority of patients in substitution therapy in Mexico are subdialyzed owing to limited economic resources. This produces more cardiac deterioration than described in the statistics and has a direct impact on the prognosis of kidney transplantation. The aim of this work was to demonstrate and to quantify the improvement in the echocardiographic parameters 6 months after renal transplantation in patients with stable renal function.

Methods. This was an observational, analytic, prospective study of 23 patients with chronic kidney disease who received transplants in 2016 and had a glomerular filtration rate ≥ 80 mL/min (Chronic Kidney Disease–Epidemiology Collaboration) 6 months after transplantation.

Results. Echocardiographic results showed an increase in the left ventricular ejection fraction from $57.17 \pm 10.46\%$ to $64.09 \pm 9.8\%$, an increase in the right ventricular ejection fraction from $0.56 \pm 0.09\%$ to $0.60 \pm 0.08\%$ and a reduction of the pulmonary arterial systolic pressure from 44.57 ± 13.88 mm Hg to 39.74 ± 11.04 mm Hg. There were also decreases in mitral regurgitation from 1.0 to 0.43, tricuspid insufficiency from 1.35 to 0.43, pulmonary insufficiency from 0.48 to 0.04, and aortic insufficiency from 0.35 to 0.04, all of these significant with $P < .05$.

Conclusions. There was a significant improvement in cardiovascular function in our population 6 months after transplantation, despite the fact that renal transplantation is performed with greater cardiac deterioration than described in patients in other countries.

CARDIOVASCULAR disease accounts for 35%-50% of all causes of mortality in chronic kidney disease (CKD). In Mexico, a population of patients with kidney disease of limited economic resources is treated and therefore suboptimally dialyzed. This factor produces greater cardiac deterioration than described in the statistics, and affects the prognosis of kidney transplantation. An example of this is the cardiorenal syndrome, in which an acute or chronic dysfunction of the kidney can cause acute or chronic cardiac dysfunction and vice versa [1]. CKD

triggers a series of structural and functional changes in the cardiovascular system. One of these manifestations is left ventricular hypertrophy (LVH), an established marker of cardiovascular risk. The prevalence of LVH increases as the progression of chronic renal damage and is present in 74%

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of patients with CKD, 35.8% of whom have left ventricular (LV) dilation and 14.8% left ventricular ejection fraction (LVEF) reduced to a minimum, events that are progressive during the 1st year in substitution therapy [2]. Even after renal transplantation, cardiovascular diseases account for 35%-50% of all causes of mortality in these patients [3,4]. In kidney transplant recipients, mortality rates from cardiovascular disease are at least twice as high as the healthy age group, but lower than the age group in alternate therapies such as dialysis or hemodialysis [5,6].

The aim of the present work was to demonstrate that there is a significant improvement in echocardiography parameters related to structural and cardiac function 6 months after renal transplantation in patients with stable renal function.

METHODS

This was an observational, analytical, longitudinal, prospective study.

Population

Patients were 18–60 years of age and kidney transplant recipients in our hospital, received transplants in the period from April 1 to May 31, 2016, and had echocardiograms from before and 6 months after transplantation.

Sample Size

The mean difference was calculated with the use of the G Power 3.1 program, taking the improvement of LVEF as the main outcome variable. For having a greater availability of patients and to increase the statistical power, 20 participants were included.

Inclusion Criteria

Patients were 18–60 years of age with complete pre-transplantation echocardiographic report, stable renal function, and informed consent.

Exclusion Criteria

Patients were not included if: incomplete chart, absence of echocardiographic report, acute myocardial infarction before transplantation or during the study period, other cardiomyopathy or congenital cardiac anomalies, pregnancy, graft dysfunction due to rejection, chronic allograft nephropathy, infection, recurrence of renal disease, or refused consent.

Procedure

We studied patients with end-stage renal disease (ESRD) stage V (Kidney Disease Improving Global Outcomes), who were sent to the Transplantation Department of Mexico's General Hospital "Dr Eduardo Liceaga" by the Nephrology Department and who received a kidney transplant from a living or deceased donor. All of the patients had completed the pre-transplantation protocol, including a cardiovascular consultation. The following tests were performed: electrocardiography (Sokolow-index for ventricular hypertrophy), echocardiography (LVEF, systolic pulmonary artery pressure [sPAP], width of interventricular septum, LV mass index, and mitral, tricuspid, pulmonary, and aortic valve insufficiency were measured), chest x-ray (cardiothoracic index). Arterial blood

pressure and antihypertensive medication use also were recorded. All of these tests were performed ≥ 1 month before transplantation. Six months after surgery patients who participated in the study were sent to the cardiologist and the same measurements were recorded. The results were compared and analyzed. The echocardiography was performed with the use of a Philips model HDIIXE 53–1.

Statistical Analyses

Owing to sample size and the fact that not all patients had a normal distribution, a Wilcoxon test was used to analyze the main variables. To compare categoric variables before and after transplantation, a McNemar test was used. A bimarginal *P* value of $<.05$ was established as statistically significant. The data were analyzed with the use of the SPSS 21.0 software (IBM Corp, Armonk, NY) and Graphpad Prism 5.0, (Graphpad Software, La Jolla, CA). For sample size calculation, the GPower program was used.

Variable Description

Sex, age, weight, height, body mass index (BMI), type of transplant, time after transplantation, renal replacement therapy, residual urine output, LVEF (expressed as percentage, calculated with the use of echocardiography), sPAP (calculated with the use of echocardiography), thickness of intrventricular septum, LV mass index, Sokolow index, cardiothoracic index, mean arterial pressure before and after transplantation (constant blood pressure that with the same peripheral resistance would produce the same cardiac volume/minute generated by variable blood pressure), glomerular filtration rate, serum albumin, serum creatinine, and antihypertensive medication use.

RESULTS

Clinical, biochemical, and echocardiographic data were analyzed from the 24 patients who received a renal transplant. One patient was excluded because she presented with a pulmonary infarction 2 months after transplantation. Of the 23 remaining patients, 65.2% were male, overall mean age was 32.4 ± 10.8 years, and overall mean BMI was 23.06 ± 2.41 kg/m². Most transplants were from living donors. Only 17.4% had diabetes mellitus (Table 1).

Owing to sample size and the fact that not all patients had a normal distribution, a Wilcoxon test was used to analyze the main variables. Echocardiographic results 6 months after transplantation showed changes in the following parameters: increased LVEF from $57.17 \pm 10.46\%$ to $64.09 \pm 9.8\%$; increased right ventricular ejection fraction (RVEF) from $0.56 \pm 0.09\%$ to $0.60 \pm 0.08\%$; reduction in sPAP from 44.57 ± 13.88 mm Hg to 39.74 ± 11.04 mm Hg; increase in the tricuspid annular plane systolic excursion

Table 1. General Characteristics of the Study Population

Variable	Mean \pm SD or <i>n</i> (%)
Age (y)	32.4 \pm 10.8
Male sex	15 (65.2%)
Body mass index (kg/m ²)	23.0 \pm 2.4
From living donor	15 (65.2%)
In hemodialysis previously (%)	16 (69.5%)
Diabetes type 2 (%)	4 (17.4%)

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