a e a ra a lt L In ., C l n x 2018, 3 i T
l DO: 10.4172/2475-7640.1000121

# Change in QTC Interval after Kidney Transplantation; Mechanisms and Outcomes

**Lai EJ, Acharya V*, Nguyen DT, Graviss EA, Gaber AO and Suki W**

*Houston Methodist Hospital, Houston, Texas, USA*

**Abstract**

transplant. Cardiac deaths occurring within the first year after transplantation were assessed.

the first year post transplantation had QTc prolongation at the time of transplantation and represented 2.7% of those

than myocardial injury. Three out of four cardiac deaths in the first year post-transplantation occurred in those patients

**Keywords:** Renal transplant; QTc; Sudden cardiac death; End stage renal disease

## Introduction

Cardiovascular disease (CV) is the leading cause of mortality in Chronic Kidney Disease (CKD) and End-Stage Renal Disease (ESRD) patients [1]. Sudden Cardiac Death (SCD), the most common cause of cardiac death in ESRD patients, is de ned as sudden cessation of cardiac mechanical activity with hemodynamic collapse, o en due to sustained ventricular tachycardia or ventricular brillation. In the general population above the age of 35, the annual rate of SCD is 0.1%-0.2%, with at least half of these individuals having evidence of Coronary Artery Disease (CAD) on postmortem examination [2]; whereas the annual rate of SCD in ESRD patients is far greater, estimated to be 7% [2]. is increased risk is not due predominantly to CAD [3]. Unlike non-ESRD patients, the risk of SCD in ESRD patients has not been shown to be improved greatly post percutaneous coronary intervention or coronary artery bypass gra , or with improvement of traditional CV risk factors [2-4].

Prolongation of the QT interval, de ned as the timrimd a4(h)3r8l nryp3ie ne tii[2x0 -1.2 rs the ttl o[ (t)6 (o).4o-5 (r)1e tii[2x0 -1.2 r63f6[s to prolonged QT interval corrected for heart rate, [QTc]), is a known risk factor for ventricular arrhythmias, speci cally Torsades de Pointes, which can quickly degenerate into ventricular brillation and death.

***Corresponding author:**

**Received** **Accepted** **Published**

**Citation:**

A retrospective chart review was performed on all patients who received kidney transplants at Houston Methodist Hospital (Houston, Texas) between 1/1/2014 until 12/31/2015. Conventional machine automated 12-lead Electrocardiograms (EKGs) were used to record QTc. e machine-generated EKG used Bazett's formula (QTc = QT/√RR) to correct the QT interval for the patient's heart rate to generate the QTc. All QTc data was recorded on EKGs done 1 day before kidney transplant, and 2 days, 2 weeks, 1 month, 3 months and 6 months post-

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Donor eGFR*(ml/ min/1.73m2), median (IQR)** | | | | | | | | | | |
| **Donor BMI, median (IQR)** | | | | | | | | | | |
| **Donor history of diabetes** | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **Donor history of hypertension** | | | | | | | | | | |
| | | | | | | | | | | |

**Table 1:**

| Follow-up time point | Non-prolonged pre-op QTc (N=196) | | Prolonged pre-op QTc (N=113) | |
|---|---|---|---|---|
| | Mean (ms) (95% CI) | p | Mean (ms) (95% CI) | p |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Follow-up time point | Living donor (N=144) | | Deceased donor (N=165) | |
| | Mean (ms) | p | Mean (ms) | p |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Follow-up time point | Prompt Graft Function (N=247) | | DGF* (N=62) | |
| | Mean (ms) | p | Mean (ms) | p |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**Table 3:**

significant (p<0.001, 95% CI 17.3, 26.5). From baseline to 6 months, multivariate analysis suggested no statistically significant difference in the mean change of QTc

58 years. All of these patients had been dialysis dependent prior to transplant (three on hemodialysis, one on peritoneal dialysis). ese patent averaged 2759.5 days on dialysis prior to transplantation. All these patients were male, and three out of four had DGF. e average number of days from transplant to time of cardiac death was 104 days.

e average pre-transplant QTc in this group was 466.25 ms. While three out of four had a prolonged pre-transplant QTc, only one of the four deaths had a prolonged QTc at the time most proximate to the date of death while the others improved.

## Discussion

Prolongation of the QTc interval in patients with end stage renal disease undergoing dialysis is correlated with increased risk of cardiovascular death. e purpose of the present study was to investigate changes in the QTc interval following renal transplantation.

e study data demonstrate a lasting shortening in the QTc interval following kidney transplantation. is observation of QTc shortening post-kidney transplant is consistent with another small study by Monfared, et al. in which the QTc from 26 kidney allogra recipients was compared to the QTc of 26 patients who were on hemodialysis [13].

e post-transplanted patients had an average maximum QTc of 436.3 ± 19 ms, while the hemodialysis patients had an average maximum QTc of 464.7 ± 23 ms. e di erence in these two cohorts was thought to be due to normalization of electrolytes and acid base status [13].

In the present study, one interesting result on multivariate analysis was the relationship between magnesium and QTc change. Traditionally, hypokalemia, hypocalcemia, and hypomagnesemia have all have been associated with prolongation of QTc. Our model showed that hypokalemia and hypocalcemia were both indeed associated with prolonging post-transplant QTc; however, hypomagnesemia appeared to be associated with shortened post-transplant QTc. e p value for the magnesium-QTc association was less robust when compared to the other 2 electrolytes, but remained statistically signi cant. It is unclear if we can draw any de nitive conclusions about this association due to the large number of missing magnesium values recorded in the pre-transplant time point. Of interest however is the observation that despite our patients being started on multiple potentially QTc-prolonging medications (i.e. tacrolimus, trimethoprim-sulfamethoxazole, famotidine, azoles, etc) a er transplant, the QTc still shortened at all follow-up time points. Tacrolimus is known to cause hypomagnesemia through renal magnesium wasting, and a prior study by Navaneethan et al. demonstrated that serum magnesium levels correlated inversely with tacrolimus concentrations and creatinine clearance [14]. Despite hypomagnesemia, a known consequence of tacrolimus therapy, shortening of the QTc occurred post-transplant nevertheless.

Of note QTc shortening was more robust in the deceased donor living donor recipients at 2 days post-transplant. is is likely a consequence of statistically and clinically signi cantly higher pre-transplant QTc in the recipients of deceased donor kidneys (455 ms . 440 ms in recipients of living donor kidneys), re ecting their longer time on dialysis. Consistent with the prior subgroup analysis, patients starting with a prolonged pre-transplant QTc appear to bene t more in terms of rapidity and degree of QTc shortening as compared to patients that started with a normal pre-transplant QTc.

e observation that in the DGF prompt recovery subgroup (no DGF), the nding of QTc shortening being more robust in the no DGF group at 2 weeks and 3 months post-transplant is informative. ese ndings highlight the importance of gra function on QTc changes post-transplant. is along with the rapidity of shortening of the QTc a er transplantation (2 days) suggests an important role for