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Original Article

A Prospective Study on QT Dispersion in Neonates: A New Risk Factor

N. Pishva, H. Khosrojerdi

Abstract

Background: QT dispersion (QTd) especially after ischemic heart disease and myocardial infarction is a prognostic predictor of mortality, in adult medicine.

Objective: This study was undertaken to determine the correlation between QT dispersion and neonatal stress. Neonates were divided into 3 groups: normal term (30 cases), normal preterm (30 cases) and sick neonates (36 cases), born between October 2001 and June 2002 in Hafez and Nemazee Hospitals affiliated to Shiraz University of Medical Sciences. Electrocardiogram (12 leads) was obtained and QTd was calculated.

Result: QT dispersion in sick neonates was significantly higher than normal neonates. The mean QTds in normal term group were 52.4± 24.47 ^{ms} in normal preterm, 69.3 ± 17.94^{ms} and 100.8 ± 29.01^{ms} in sick neonates. In sick neonates, QTd correlated with the incidence rate of mortality.

Conclusions: It is concluded that QTd might be a prognostic factor for estimation of neonatal mortality.
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Keywords • QT dispersion • infant, new born, diseases • mortality • preterm infant • full term

Shiraz University of Medical Sciences
Department of Pediatric Nemazee Hospital

Correspondence: N. Pishva M.D.,
Shiraz University of Medical Sciences
Department of Pediatric Nemazee Hospital
Tel: +98-711-6265024
E-mail: *pishva@sums.ac.ir*

Introduction

QT dispersion (QTd) is a predictor of sudden cardiac arrhythmia in adult medicine. QTd calculated from the 12-lead ECG has emerged as a noninvasive measure for the degree of myocardial repolarization inhomogenity[1]. It is a risk indicator for cardiac death in patient populations having coronary artery disease, myocardial infarction,[1,2] sustained ventricular arrhythmias[3], ventricular fibrillation[4], congestive heart failure [5], diabetes mellitus[6], Kawasaki disease [7]and hypertrophic cardiomyopathy.[8] We did not find any study addressing QTd in the neonatal period as a predictor of the disease severity in the literature.

The aim of this study was to find if there were any correlation between dispersion of myocardial repolarization and stress in the neonatal period and also the gestational age of the newborns. We also tried to determine whether QT dispersion makes an independent contribution to the mortality risk among the newborns.

Table1: Comparison of QT dispersion between healthy and sick neonates

Group QTd	Mean (±SD)
Normal term	52.4(±24.47)
Normal Preterm	69.3(±17.94)
Stress Group	100.8(±29.01)

Table 2: Comparison of QT corrected dispersion between healthy and sick neonates

Group QTcd	Mean (±SD)QTcd
Normal term	80.3(±30.64)
Normal Preterm	95.0(±28.67)
Stress Group	148.4(±33.38)

Patients and Methods

We studied three groups of neonates with a total number of 96 who were born at two teaching hospitals during October 2001 to June 2002 period.

Group 1: Normal term neonates who were born following 38-42 wks of gestation (n=30)

Group 2: Normal preterm neonates who were < 37 wks (n=30)

Group 3: Neonates, who incurred neonatal stress, such as sepsis, respiratory distress syndrome, asphyxia or metabolic disorders. Seventeen neonates were diagnosed as RDS based on history, physical examination and, radiological findings in serial chest x rays. They showed no evidence of metabolic disorder, infection and cardiovascular disease. In group 3, the mean QTd was 69.7. Fourteen neonates were highly suspected to septicemia according to clinical presentation, CRP>10 and/or positive blood culture, without evidence of any respiratory or metabolic disorder. In this group mean QTd was 68.8. Three neonates were admitted with poor Apgar score (less than 2 in first and 10 minutes after birth). Brain CT scan showed brain edema in two of them. Mean QTd was 70.7 in this group. Two neonates were diagnosed as congenital pneumonia by clinical presentation and radiological findings. The mean QTd was 67.3 in these patients.

None of these 96 neonates had congenital heart disease (been ruled out by echocardiographic study in those who had tachypnea, tachycardia, heart murmur and/or cyanosis). No case of electrolyte imbalance was included in the study.

We obtained a 12-leads standard ECG with electrocardiograph Cardiotest-EK-51 and paper speed of 25 mm/s. Then QT intervals were measured in each of the 12 leads from the onset of the QRS complex to the end of the T-wave (i.e. the return of T-wave to TP-line) in milliseconds. The intervals were corrected according to the heart rate with the available formula for QT correction, as:

$QTc = QT/\sqrt{RR}$ (Bazett's formula)

To calculate QT dispersion we chose the maximum and minimum QT intervals in each ECG and defined their difference as QT dispersion. The same rule was applied for QTcd. Then we compared these variables between the three groups with the analysis of variance and multiple range test.

Results

None of 96 ECGs showed QT prolongation, conduction disturbance or atrial and ventricular arrhythmias.

We showed that QT dispersion differs significantly ($p<0.0001$) between group 3 (stress group), with the other 2 groups (Table 1). The difference between term and preterm newborns was not statistically significant. The same results were obtained for QTcd comparisons (Table 2). Also, we found that 7 out of 36 newborns in stress group had QTd≥120ms while 6 of them died during the first 24hours of ECG recording. None of those with QTd≤ 100 ms died.

Discussion

QT variability studies on the surface electrocardiogram are not a technical artifact but rather reflect regional myocardial electrical recovery. Homogeneity of recovery time protects against arrhythmias whereas dispersion of recovery time is arrhythmogenic. Reliable non-invasive access to dispersion could alter our concepts and prediction of arrhythmogenesis, and the precision of prognosis.[9]

Very limited studies are available for measurement of QT dispersion during infancy and childhood. One of these studies measured a mean value for QTd in infancy through teenage years and showed that QTd did not change significantly with increasing age.[10,11] The difference we observed between term and preterm infants seem to be related to the difference in cardiac repolarization in preterm infants. It is because after birth there is continued development of the cardiac conduction system and increase in sympathetic innervation of the heart [12,13].

It might be an index of subtle difference in the incidence of sudden infant death between term and preterm infants. In our study the difference is not statistically significant, and the same results were observed in a previous study.[10]

We also observed early mortality between stress group in 6 newborns of 7 who had QTd ≥120 ms. It seems that QT dispersion could be a good non-invasive predictor of mortality in sick newborn infants.

It was better to perform QTd analysis of stress group, after resolving their stresses, to show that if QTd returned to normal or not. This field is an open way to further research.

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