

T Wave Alternans Threshold Late After Repair of Tetralogy of Fallot

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TWA Threshold After TOF Repair. *Introduction:* Sustained microvolt-level T wave alternans (TWA) is a marker of increased risk for malignant ventricular arrhythmia. There is a significant risk of arrhythmia and sudden death after repair of congenital heart disease. The aim of this study was to determine the prevalence and characteristics of TWA after repair of tetralogy of Fallot (TOF).

Methods and Results: TWA was evaluated during bicycle exercise in 49 subjects who had consecutively undergone transatrial-transpulmonary repair. Median values for age, age at repair, and follow-up duration were 14.9 years (11.5–20.8), 1.6 years (0.2–4.9), and 11.6 years (9.4–17.2), respectively. All patients were in New York Heart Association functional class I and were asymptomatic. Median QRS duration was 120 msec (80–150). Sustained TWA was detected in 7 (23%) of 31 subjects with adequate tests. In these 7 subjects, median onset heart rate (HR) was 120 (98–155). Median HR threshold as a percentage of predicted maximum HR ($220 - \text{age}$) was 58% (48–77). Sustained TWA prevalence was not significantly different compared with normal subjects (7/31 vs 9/83; $P = 0.1$). Onset HR in the TOF group was significantly lower [mean (SD) of 122 (20) vs 139 (12), $P < 0.05$]. In the TOF group with sustained TWA, the TWA occurred in 4 of 7 at $<60\%$ predicted maximum HR versus 1 of 9 normal subjects ($P < 0.05$); 3 of 7 had onset HR <120 versus 0 of 9 normal subjects ($P < 0.03$). There was no significant difference in age, gender, transannular patch use, restrictive right ventricular physiology, QRS duration, QTc, QT/QRS dispersion, or nonsustained ventricular tachycardia in subjects with or those without sustained TWA.

Conclusion: The onset HR for sustained TWA is significantly lower after repair of TOF. Further study is required to determine whether this represents an increased risk for arrhythmia in this patient group. (*J Cardiovasc Electrophysiol*, Vol. 13, pp. 657-661, July 2002)

T wave alternans, tetralogy of Fallot, arrhythmia

Introduction

After repair of tetralogy of Fallot (TOF), there is an incremental risk of late sudden death.^{1,2} A recent study of patients after operation for common congenital heart defects found that during 45,857 patient-years of follow-up, 30 of 41 sudden cardiac deaths were likely due to arrhythmias.³ The incidence of sudden death for patients within 25 years of TOF repair was $4\% \pm 1\%$. Identification of patients at increased risk of ventricular arrhythmias is highly desirable, considering the rapidly increasing population of survivors of surgery for congenital heart disease. T wave alternans (TWA) at the level of a single cell has been linked to the pathogenesis of ventricular fibrillation.⁴ Measurement of microvolt-level TWA during bicycle exercise is a novel technique that is showing considerable promise as a predic-

tor of malignant ventricular arrhythmias in adults.⁵⁻⁷ We previously studied the prevalence and heart rate (HR) thresholds of TWA in normal children.⁸ The aim of this study was to determine the TWA prevalence and characteristics in a homogeneous group of patients who have undergone transatrial-transpulmonary TOF repair.

Methods

Study Design

Consecutive patients who had undergone transatrial-transpulmonary repair for TOF were invited to participate in the study. Patients with AV septal defect or trisomy 21 were excluded from the study. Informed consent was obtained from all patients. The study protocol was approved by the ethics committee of the Royal Children's Hospital Melbourne.

Electrocardiography

A standard 12-lead ECG was obtained from all patients. All measurements were made under magnification. QRS duration and QT interval were measured in lead V₅, because normative data are only available for this lead.⁹ QT dispersion was measured from the resting exercise data, as this allowed vertical alignment of leads.

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