

## ARIC Manuscript Proposal # 908

PC Reviewed: 09/10/02  
SC Reviewed: 09/13/02

Status:   A    
Status:   A  

Priority:   2    
Priority:   2  

**1.a. Full Title:** Description of the T wave axis deviations distribution and correlates in the ARIC population.

**b. Abbreviated Title (Length 26 characters):** T wave axis descriptive Epidemiology

### 2. Writing Group (list individual with lead responsibility first):

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### 3. Timeline:

Processing of the ARIC ECG data is using measurements from the MARQUETTE 12SL ECG program. Estimates of T axis/lambda are complete. It is anticipated that final analysis and the draft manuscript will be completed by December 15, 2002.

### 4. Rationale:

Experimental and electrophysiological studies have shown that an abnormal ventricular repolarization is associated with arrhythmogenesis and cardiac events. At present there are few clinical and epidemiologically applicable noninvasive measures of ventricular repolarization. Electrophysiological studies have shown that T wave axis deviations, rather than QT dispersion, are an early manifestation of increased true dispersion of ventricular repolarization. A previous report from the Rotterdam study suggest that frontal plane T axis deviation is a strong independent indicator of the risk of coronary heart disease and total mortality. This finding was confirmed in the CHS study with respect to spatial T wave axis. However, both of these studies examined the T wave axis deviations as predictors of cardiovascular and all cause mortality in cohorts of older adults. We propose to assess the distribution and population correlates of this

potential novel coronary risk factor/marker in the population-based, biethnic cohort of middle-aged adults in the ARIC study. Main points of interest will be gender, race/ethnicity, cardiovascular risk factors, the presence of subclinical and manifest cardiovascular disease, pharmacologic agents, and the degree to which a single measurement of spatial T wave axis is indicative of a characteristic that individuals retain over time.

Due to its complexity, if the spatial aspects of the T wave axis are to be implemented into routine epidemiological and clinical studies, digitally recorded and interpreted ECGs are needed. In this respect the ARIC study offers an opportunity to learn about this novel measure from high quality, digitally processed ECG records. This proposal complements the work on spatial T axis as a predictor of coronary events (MS# #766) and the recently submitted proposal to quantify the short-term variability of T wave axis deviations (Vaidean et al).

## **5. Main Hypothesis/Study Questions:**

This study will explore the descriptive epidemiology of the T wave axis in the ARIC study population, focusing on the following aims:

- a. To estimate the distribution of the spatial T wave axis by age, race/ethnicity and gender in subjects with and without coronary heart disease at baseline (visit 1). It is expected that the T wave axis deviations have a different distribution by age, gender and ethnicity-groups.
- b. To assess the association of the T wave axis with three categories of risk factors : i) socio-demographic variables, ii) cardiovascular risk factors such as high blood pressure, diabetes, hyperlipidemia, smoking, overweight, and iii) other ECG markers of myocardial damage (left ventricular hypertrophy, premature ventricular beats, ST-T segment depression, T wave inversion). It is expected that the T wave axis deviations parallel the distributions these traditional cardiovascular factors, in a dose- response fashion. Analysis will be carried out separately for subjects with and without coronary heart disease at baseline.
- c. To asses if T wave axis deviations are associated with intima-media-thickness in subjects without in subjects without coronary heart disease at baseline. The rationale is that the T wave axis deviations are part of or an index of atherosclerotic subclinical disease.

## **6. Data (variables, time window, source, inclusions/exclusions):**

This study proposes to make use of the information available in the ARIC Visit 1 prevalence data. The following variables will be used: age, gender, ethnicity, prevalent coronary heart disease, hypertension, educational attainment, current smoking status, diabetes, body weight, low and high density lipoproteins, ECG estimate of left ventricular hypertrophy, ST-T segment, T wave inversion, premature ventricular beats, intima media thickness measured ultrasonographically. Exclusions: inadequate ECG quality, atrial fibrillation or flutter, ventricular conduction defects (QRS greater than 120ms), pacemakers, renal failure. Separate analysis for subjects with and without prevalent coronary heart disease is proposed.

7.a. Will the data be used for non-CVD analysis in this manuscript?  Yes  No

b. If Yes, is the author aware that the file ICTDER02 must be used to exclude persons with a value RES\_OTH = "CVD Research" for non-DNA analysis, and for DNA analysis RES\_DNA = "CVD Research" would be used?  Yes  No

(This file ICTDER02 has been distributed to ARIC PIs, and contains the responses to consent updates related to stored sample use for research.)

8.a. Will the DNA data be used in this manuscript?  Yes  No

8.b. If yes, is the author aware that either DNA data distributed by the Coordinating Center must be used, or the file ICTDER02 must be used to exclude those with value RES\_DNA = "No use/storage DNA"?  Yes  No

9. The lead author of this manuscript proposal has reviewed the list of existing ARIC Study manuscript proposals and has found no overlap between this proposal and previously approved manuscript proposals either published or still in active status. ARIC Investigators have access to the publications lists under the Study Members Area of the web site at: <http://bios.unc.edu/units/csc/ARIC/stdy/studymem.html>

Yes  No

10. What are the most related manuscript proposals in ARIC (authors are encouraged to contact lead authors of these proposals for comments on the new proposal or collaboration)?

MS# 897: Repeatability of the Spatial T Wave Axis Deviation Measures: The ECG Repeatability Study (Vaidean et al)

MS #766 " Primary repolarization abnormalities and the risk of incident cardiac events. The ARIC study (Rautahrju et al )

Attachment 1.

**Definition of variables related to the spatial T axis.**

Eight ECG leads are first transformed into the orthogonal leads using the inverse Dower transform matrix. The integrated values of the XYZ lead amplitudes of QRS and T complexes are used to determine the following spatial angles in the frontal (XY) and horizontal (XZ) plane:

1. Alpha, the mean frontal plane T axis ( $0^\circ$  left,  $90^\circ$  down,  $-90^\circ$  up, and  $\pm 180^\circ$  right, referring to the chest of a standing subject)
2. Beta, the T axis azimuth or the mean horizontal plane T axis ( $0^\circ$  left,  $90^\circ$  front,  $-90^\circ$  back,  $\pm 180^\circ$  right)
3. Epsilon, the T axis elevation ( $0^\circ$  down along the positive Y axis,  $90^\circ$  horizontal,  $180^\circ$  up)
4. Lambda, the spatial T axis deviation from the normal reference direction ( $x=1/\sqrt{3}$ ,  $y=1/\sqrt{3}$ , and  $z=-1/\sqrt{3}$ , where x,y and z are the unit vector components in X,Y and  $-Z$  directions)
5. Phi, the mean frontal plane QRS axis
6. Rho, the QRS axis azimuth or the mean horizontal plane QRS axis