AN ANALYSIS OF QRS INTERVAL OF THE ELECTROCARDIOGRAM IN ASYMPTOMATIC NORMAL NIGERIANS

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ABSTRACT

Objectives: This cross-sectional study of the 12-lead electrocardiogram (ECG) was undertaken to establish the normal QRS interval of the adult Nigerian from Jos; to find significant correlation coefficients for QRS interval and the various anthropometric measurements and also to establish prediction equations for the QRS interval of the electrocardiogram.

Methods: The QRS interval was measured in 109 young healthy adult Nigerians. Males numbered ninety-five and females numbered fourteen. They were aged between 19 years and 30 years.

Results: The mean values for QRS interval in the 12-lead ECG were: Sec ± S.D (Lead 1:0.06 ± 0.01; lead II: 0.07 ± 0.01; lead III 0.07 ± 0.01; lead aVR: 0.07 ± 0.01; lead aVL: 0.07 ± 0.01; lead aVF: 0.08 ± 0.02; lead V_1: 0.10 ± 0.04; lead V_2:0.10 ± 0.01; lead V_3: 0.08 ± 0.01; lead V_4:0.07 ± 0.02; lead ± V_5: 0.07 ± 0.01; lead V_6: 0.07 ± 0.02).

Significant inverse correlation was found between:

(1) QRS interval and age in lead aVR.
(2) QRS interval and weight in lead V_3.
(3) QRS interval and the systolic blood pressure in lead V_1.
(4) QRS interval and the diastolic blood pressure in leads aVR and V_1.
(5) QRS interval and the chest circumference in lead V_3.

Conclusion : This study has demonstrated the normal range (0.06 ± 0.01 sec in lead 1 to 0.10 ± 0.01 sec in level V_2) for the QRS interval in young adult normal Nigerians in Jos and thus provided a precise guide for the interpretation of QRS interval in this city.

Key words: QRS interval, Electrocardiogram, asymptomatic, Cross-sectional study.

INTRODUCTION

Large-scale population studies of the 12-lead electrocardiogram (ECG) has been performed in various human races ascertaining the normal range for the multitudes of ECG parameters[1-8]. The QRS interval is the time required for complete ventricular depolarization and is measured from the beginning (Q or R) to the end of the QRS group of deflection[9-12]. The normal range for the QRS interval for adults is from 0.06 to 0.10 second [6, 9]. Occasionally in precordial leads V_2 or V_3 this interval may be 0.12 second[6,13]. It has been reported that the depolarization of the septum and ventricular muscle is broad or widened in bundle branch block, in ventricular hypertrophy and in ventricular ectopic beats[9,14].

In this study, we sought to determine quantitatively the QRS interval of the 12-lead

electrocardiogram of the young adult Nigerian. In addition we correlated these data with age and anthropometric measurements with a view to establishing significant correlations and predictable equations.

SUBJECTS AND METHODS

One hundred and nine adult Nigerian students of the University of Jos were involved in the study. They were aged between nineteen and thirty years (mean age 21.7 years). Males numbered ninety-five and females numbered fourteen. The study population consisted of students, from a wide range of tribes and ethnic groups in Nigeria. The findings then may not be peculiar with what should occur in Jos residents. Requirements for participation were absence of a history of heart disease and absence of previous or present treatment with cardiac drugs. Other exclusion criteria were evidence of any systemic illnesses, pregnant subjects and those with chest deformities, cigarette and tobacco smokers and alcohol users. Included in the study were all ambulant, asymptomatic subjects who voluntarily presented themselves for the electrocardiogram after informed consent was sought. Approval for the study was granted by the Research Grant and ethical Committee of the faculty of Medical Sciences University of Jos. We adhered strictly to the Code of Ethics of the Declaration of Helsinki for selecting and carrying out experiments on human subjects. We followed the American Heart Association criteria for collecting and analyzing ECG data.

The ECGs were recorded in the research laboratory of the department of Human physiology. The 12-lead ECGs were recorded using Grass model 7D Polygraph (Grass instrument, Co. Quincy, Mass. U.S.A.). Preceding each ECG recording, the medical history, height, weight, pulse rate, chest circumference and the blood pressure of each subject were taken and recorded. The ECGs were recorded while the subjects were lying in the supine position on a comfortable couch. A paper speed of 25 mm/sec was used during the recording. The ECG machine was non-portable and was standardized at regular intervals to show a stylus deflection of 10mm per millivolt. The QRS duration was measured in sec. from the onset of the QRS complex (whether the initial wave be negative or positive i.e. Q or R) to the end of the QRS complex (whether the final wave be negative or positive)[3,10,11].

Statistical Analysis

All data in this study were summarized using the means as a measure of central tendency. Tests of measure of dispersion included analysis of standard deviation, variance and the coefficient of variation. T-tests for significance were determined as well as the correlation and regression analysis. Results in this study are presented as means ± standard deviation and the significance level or (or P value) were taken at the 95% confidence level. Results in this study were taken to be significant if $P<0.05$.

RESULTS

The subjects comprised a hundred and nine students of the University of Jos. Table I presents the mean values (± SD) for the QRS interval in seconds for all the study subjects in the 12 lead ECG. The mean age of the subjects was 21.7 (19-30) years.

The range for the mean (±SD) QRS interval in both sexes was 0.06 ± 0.01 sec. in lead 1 to 0.10 ± 0.01 sec. in lead V_2 (mean: 0.08 ± 0.01 second in males and 0.072 ± 0.02 second in females).

Table 2 presents the correlation coefficient between QRS interval and age and anthropometric measurements: weight, systolic blood pressure, diastolic blood pressure and chest circumference. Findings of note observed from table 2 are the following:

(i) There was a significant inverse correlation between QRS interval and age in lead aVR ($r = -0.29$; $p<0.01$).

(ii) There was a significant inverse correlation between QRS interval and weight in lead V_3 ($r = -0.19$; $p<0.05$).

(iii) There was a significant inverse correlation between QRS interval and the systolic blood pressure in lead V_1 ($r= -0.20$; $p<0.05$).

(iv) There was a significant inverse correlation between QRS interval and the diastolic blood pressure in lead a VR ($r = -0.19$; $p<0.05$).

(v) There was a significant inverse correlation between QRS interval and the diastolic blood pressure in lead V_1 ($r = -0.19$; $p<0.05$).

(vi) There was a significant inverse correlation between QRS interval and the chest circumference in lead V_3 ($r = -0.26$; $p<0.01$).

DISCUSSION

Results presented from this study are from a heterogeneous Nigerian population living in the Jos Plateau of Nigeria for more than two years. Most of the subjects consisted of students of the University of Jos. The subjects came from several geographical areas that constitute the Nigerian nation, hence our study can adequately represent data from Nigeria.

Results of the present preliminary study show that the mean QRS interval was 0.08 ± 0.01 second. The range of values for the QRS interval was 0.06 to 0.10 second. The recorded value in this study for the QRS interval agrees with Araoye's[8] previous study, who recorded value of the QRS complex of 0.06 – 0.11 second in adult Nigerians. The QRS interval reported in this study does not differ significantly from the values quoted by Ganong[15] for Americans of comparable age (0.80 sec. to 0.10 sec.). The occasional minor variations in these comparative results may be attributed to racial, ethnic and body build differences. Edemeka and Ojo[16] whose work was confined to Nigerian children, reported QRS duration of 0.071 ± 0.02 second for males and 0.063 ± 0.01 second for females.

In our study, the results (table 2) show that a relationship exists between QRS interval and age and this is a low degree of negative correlation. In addition, there were imperfect negative correlations between QRS interval and weight, the systolic blood pressure, diastolic blood pressure and the chest circumference. However, there was no significant prediction equation between QRS interval and these variables. One would be cautious in interpreting the correlation coefficient in these cases.

The results of the present study has demonstrated that in the bipolar leads, the greatest QRS interval of 0.07 ± 0.01 second was found in leads II and III. In the unipolar chest leads, the greatest QRS interval of 0.10 ± 0.01 second was found in lead V_2. In the unipolar limb leads the greatest value of QRS interval of 0.08 ± 0.02 second was found in lead aVF.

In conclusion, our study has established normal values for the QRS interval of the 12-lead electrocardiogram. These normal values may provide a reference guide for the interpretation of ECG studies in this environment and in Nigeria.

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Table 1: Mean Values for QRS Interval

Leads	QRS Interval ± SD (Sec)
I	0.06 ± 0.01
II	0.07 ± 0.01
III	0.07 ± 0.01
AVR	0.07 ± 0.01
AVL	0.07 ± 0.01
AVF	0.08 ± 0.02
V_1	0.10 ± 0.04
V_2	0.10 ± 0.01
V_3	0.08 ± 0.01
V_4	0.07 ± 0.02
V_5	0.07 ± 0.01
V_6	0.07 ± 0.02

Table 2: Correlation coefficients between QRS Interval and age and Anthropometric Measurements.

Leads	Age (yrs)	Weight (kg)	Systolic BP (mmHg)	Diastolic BP (mmHg)	Chest Circumference (cm)
Avr	-0.2986**	NS	NS	-0.1948*	NS
V_1	NS	NS	NS	-0.1990*	NS
V_3	NS	-0.1982*	-.2033*	NS	-0.2694**

*p< 0.05; ** p<0.01; NS = Not significant