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The Electrocardiograms of 200 Healthy Nigerian Soldiers

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Summary. Examination of the electrocardiograms of 200 healthy Nigerian soldiers revealed a high prevalence of high voltages as reflected by maximum R and S amplitudes in the praecordial leads. In addition there was a high prevalence of significant S–T elevation in these leads.

There is need for further studies to describe the frequency of ECG findings in the Nigerian population. Such studies will be useful in determining the criteria for the interpretation of the electrocardiogram in Nigerians.

Résumé. L'examen des ECG de 200 soldats nigérians en bonne santé a révélé une haute prédominance en haut voltage comme montré par les maxima d'amplitude R et S dans les câbles reliés à la poitrine.

En outre il y avait une haute prédominance significative d'élévation du S–T dans ces câbles.

Il faut pour des études plus poussées décrire la fréquence de ces ECG existant dans la population nigériane. Ces sortes d'études seront utiles pour la détermination des critères d'interprétation des électrocardiogrammes des nigérians.

INTRODUCTION

The existence of racial variants in the electrocardiogram and the possibility of their confusion with truly abnormal tracings has been stressed by Goldman (1953). Indeed several authors have recorded variants of the normal electrocardiogram in Africans (Grusin, 1954; Somers & Rankin, 1962; Seriki & Smith, 1966; Walker & Walker, 1969), people of African descent (Littmann, 1946; Goldman, 1953), and other non-European races (Srikantia, Padmavati & Gopalan, 1964; Dharmadasa & Nadarajah, 1968).

Although Seriki & Smith (1966) have reported a high prevalence of S–T segment elevation and of biphasic or inverted T waves in praecordial leads in young adults and schoolchildren in Nigeria, there is as yet very little information on the variants that may exist in West Africans. Thus, there are no firm criteria for the interpretation of the electrocardiogram of West Africans.

This paper records our findings in 200 healthy Nigerian soldiers. The work was carried out

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between October and December 1970. It was designed to provide preliminary data on the normal variants of the ECG that may exist in adult Nigerians.

MATERIALS AND METHODS

We examined infantrymen who were actively engaged in routine drilling and other exercises. Such individuals represent a uniform population of healthy adult males who are readily accessible.

Two hundred of them were chosen at random from one of the battalions of the Nigerian Army based in Ibadan. There was full co-operation. Each subject had had a screening medical examination before being recruited into the army.

When we saw them they were all in good health and none gave a history suggestive of past or current cardiovascular disease. Their ages ranged from 18 to 49 years, with a mean of 24·6 years and standard deviation of 4·02.

194 of them were normotensive. The remaining six subjects had a systolic pressure ranging from 140 to 155 mmHg and/or a fifth phase diastolic pressure between 90 and 95 mmHg.

Electrocardiograms were recorded in standard fashion with the subjects lying supine, using a portable Cardiopan-1 machine. The examinations were carried out in the early afternoon before lunch.

The tracings were read by two of us (U.B. and R.C.) who measured the values of several predetermined parameters. In order to assess observer variation, twenty recordings chosen at random were read by each of the two observers on two separate occasions. The results were subjected to analysis using the paired *T*-test. There was high consistency for each observer and close agreement between observers.

RESULTS

One hundred and ninety-six subjects had regular sinus rhythm. Four had ectopic beats, in one of whom these beats accounted for more than 10% of the total beats. The ECGs of these four subjects were otherwise normal.

The P–R interval, the Q–T interval, and the maximum duration of the P and QRS deflections in any lead were measured. The corrected Q–T interval (Q–Tc) was calculated

TABLE 1. Electrocardiographic parameters in 200 Nigerian soldiers

Parameter	Range (sec)	Mean	SE
P–R interval	0·08–0·24	0·16	0·002
Corrected Q–T interval (Q–Tc)	0·31–0·44	0·38	0·002
Maximum P-wave duration	0·06–0·14	0·09	0·0009
Maximum QRS duration	0·04–0·12	0·07	0·0007

SE, Standard error.

using the nomogram of Kissin, Schwarzschild & Bakst (1948). The range, mean and standard error for each of these parameters is shown in Table 1.

The frontal plane axes for the P, QRS and T deflections have been calculated to the nearest 10°. The results are summarized in Fig. 1a–c.

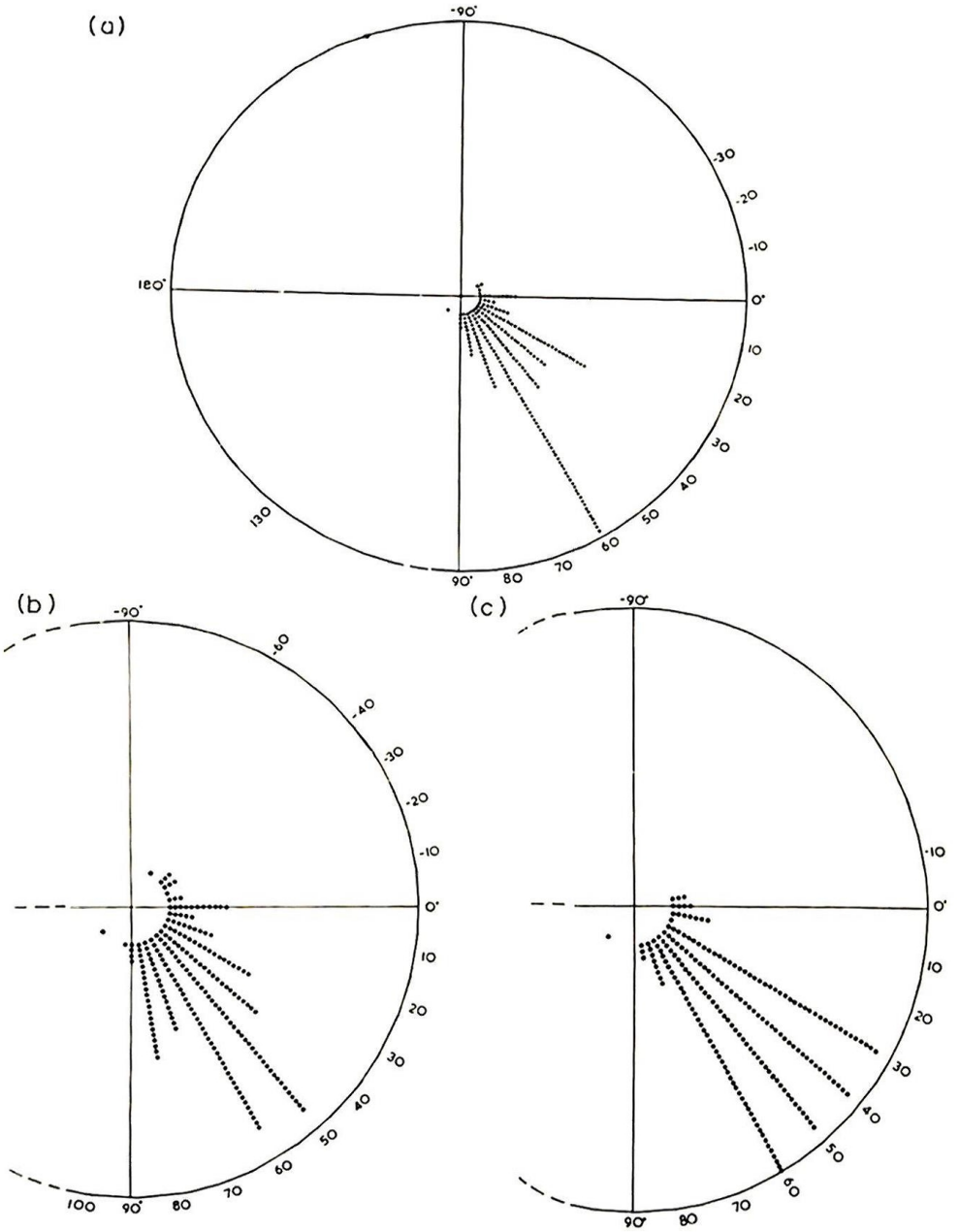

FIG. 1. Results for 200 healthy Nigerian soldiers (a) P-wave elevation. (b) QRS elevation. (c) T-wave elevation. Each dot represents one subject.

Amplitudes

The maximum amplitudes of the R and S waves in leads AVL and V1 to V6 have been calculated correct to the nearest 0·5 mm. The maximum amplitude of the R-wave in lead AVL was 14 mm in one subject and 11 mm in another. In all the others it was below 11 mm. The mean value for the whole group was 2·85 mm, and the SD and SE were 2·39 and 0·17 respectively.

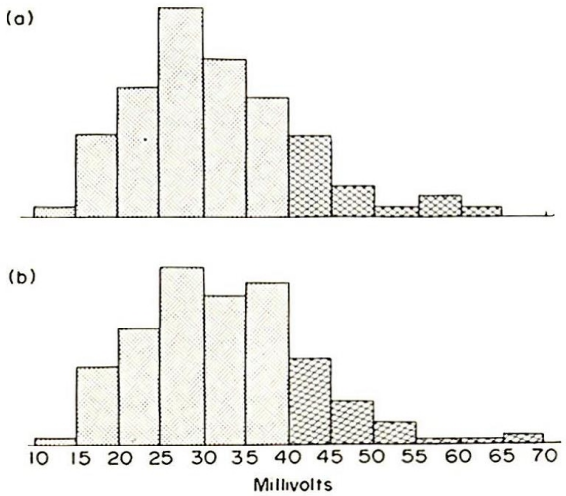

FIG. 2. Voltage criteria in 200 healthy Nigerian soldiers. (a) Sv2 + Rv6. (b) Sv1 + Rv5.

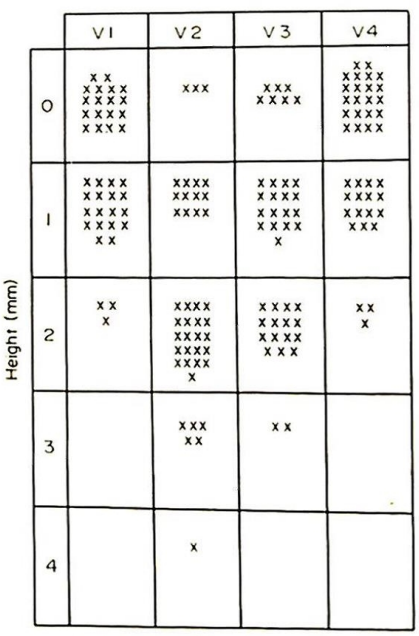

FIG. 3. ST-segment elevation in frontal leads in 200 healthy Nigerian soldiers.

The following criteria for recognizing left ventricular hypertrophy have been calculated: Sv1 + Rv5, and Sv2 + Rv6. The distribution of these sums is shown in Fig. 2. In young adults below the age of 25 years, Grubschmidt & Sokolow (1957) recommend 40 mm as the upper limit of normal for these criteria. Because most of our subjects were below the age of 25 years, we have decided to indicate this arbitrary limit in Fig. 2. The results of our subjects falling below this limit have been stipple-shaded and those above cross-hatched.

S–T segment elevation

The maximum elevation of the S–T segment in leads V1 to V4 have been measured to the nearest millimetre, and the results are summarized in Fig. 3. S–T segment elevation equal to or greater than 2 mm, with an upward slope ending in a tall positive T-wave was common. It occurred in 129 subjects (64·5%) in lead V_2, and in eighty-three subjects (41·5%) in lead V3. It occurred much less frequently in leads V1 and V4. A typical ECG showing this feature is reproduced in Fig. 4.

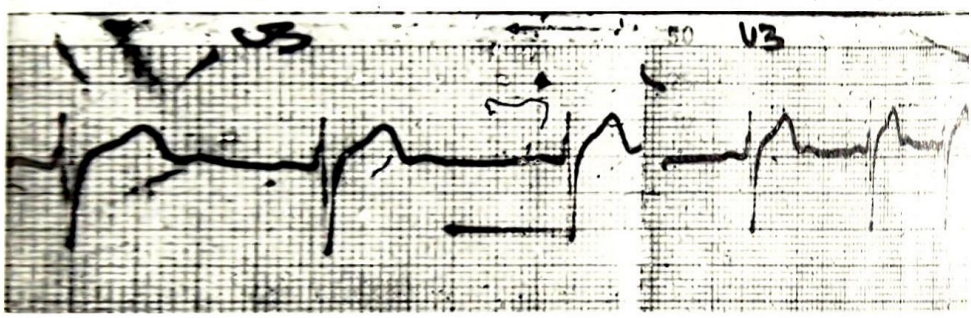

FIG. 4. ST-segment elevation in praecordial leads in 200 healthy Nigerian soldiers.

The T-wave

Most of our subjects had positive T-waves well within the accepted normal limits. Only four subjects had tall positive T-waves with amplitudes equal to or more than 12 mm in any of the praecordial leads. Inverted or biphasic T-waves occurring beyond lead V2 was rare.

DISCUSSION

Our findings in respect of the P–R interval, the corrected Q–T interval, and the duration of the P and QRS deflections are comparable with values accepted as normal for these parameters in Caucasian populations. The distributions of the frontal plane axes for the P, QRS and T deflections are also comparable with the accepted limits for these criteria. However, the amplitudes of the R and S waves in the praecordial leads, and the elevation of the S-T segment in these leads present interesting features.

High amplitude R and S waves in the praecordial leads were very common in the electrocardiograms of our subjects. Two common criteria for recognizing left ventricular hypertrophy (*viz.* Sv1 + Rv5, and Sv2 + Rv6) have been calculated, and the distribution of these sums is shown in Fig. 2. For these criteria 40 mm has been recommended as the upper limit of normal in young adults below the age of 25 years (Grubschmidt & Sokolow, 1957).

Because most of our subjects were below this age, we have adopted this arbitrary limit. Thus, the sum of the amplitudes of the S-wave in lead V1 and the R-wave in lead V5 was equal to or greater than 40 mm in thirty-nine of our subjects (19·5%). Sv2 + Rv6 was equal to or greater than 40 mm in thirty-five subjects (17·5%). All these subjects were normotensive, i.e. had a sitting blood pressure less than 140/90 mmHg.

Our findings differ from those of Seriki & Smith (1966) who found the sum of the amplitudes of the S-wave in lead V1 and the R-wave in lead V5 to be in excess of 40 mm in only three out of 100 normotensive young adult Nigerians. Similar findings of high amplitude R and S waves in the praecordial leads of apparently healthy young adults have been reported from other parts of Africa (Grusin, 1954; Somers & Rankin, 1962; Fleishman, 1965; Walker & Walker, 1969).

Liu & DeCristofaro (1968) recommend an R-wave amplitude of 18 mm or more in lead V6 as the best criterion for recognizing left ventricular hypertrophy. Fifty-seven of our subjects (28·5%) had an R-wave in lead V6 equal to or greater than 18 mm. These authors observed that all the commonly used electrocardiographic criteria for predicting left ventricular hypertrophy are accurate in less than 50% of cases. This observation is borne out by all the published literature on the subject to date. Our results suggest a need for re-appraisal of the electrocardiographic criteria for recognizing left ventricular hypertrophy in adult Nigerians.

S–T segment elevation equal to or greater than 2 mm was common in leads V1 to V4 in our subjects. It occurred in 129 subjects (64·5%) in lead V2, in eighty-three subjects (41·5%) in lead V3, but was much less common in leads V1 and V4. These findings agree with those reported by Seriki & Smith (1966) who found S–T segment elevation in excess of 2 mm in lead V3 in 34% of fifty Nigerian male students. The common occurrence of S–T segment elevation in the praecordial leads has also been reported from other parts of Africa (Grusin, 1954; Powell, 1959; Somers & Rankin, 1962; Walker & Walker, 1969), in North American Negroes (Goldman, 1953) and in young adult Ceylonese (Dharmadasa & Nadarajah, 1968). The significance of this S–T segment elevation in apparently healthy individuals is obscure. Its high prevalence, especially in young adult males, needs to be recognized, as it may cause considerable diagnostic confusion.

Most of our subjects had positive T-waves well within the accepted normal limits. Only four subjects had tall positive T-waves with amplitudes equal to or more than 12 mm in any of the praecordial leads. Inverted or biphasic T-waves occurring beyond lead V2 was rare.

These findings differ from those of Seriki & Smith (1966) who found a high prevalence of inverted or biphasic T-waves in the praecordial leads of 100 young adult Nigerians and 202 Nigerian schoolchildren. This high prevalence diminished with increasing age. Our subjects were on the whole older than theirs, and this may account for the difference. Our findings are however similar to those of Dharmadasa & Nadarajah (1968) who examined 196 young adult Ceylonese whose ages were comparable to those of our subjects.

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