Electrocardiogram of the Healthy Adult Negro

By Charles R. Greene, M.D., and John J. Kelly, Jr., M.D.

The T waves of the precordial electrocardiograms are upright in healthy adult white subjects. On the other hand, several reports have drawn attention to T-wave inversion "juvenile pattern" in adult Negroes free of organic heart disease. This study demonstrated no increased incidence of the "juvenile pattern" in healthy adult Negroes. The standards for normality are identical for both white and Negro. When abnormalities of the T wave are found in Negroes, an explanation other than that of race should be sought.

The T waves of the precordial electrocardiograms of infants and children are usually inverted in leads V1 to V4. This inversion of the T waves over the surface of the right ventricle is frequently referred to as the "juvenile pattern." As the child ages, the negativity of the T waves in this area diminishes. By maturity upright T waves are found in leads V3 and to the left in healthy white subjects.

Several groups of investigators have reported the persistence of the "juvenile pattern" in a significant percentage of adult Negroes free of heart disease. Another study could demonstrate no difference between the precordial electrocardiograms of healthy adult whites and Negroes. Because of the importance of establishing normal standards for a healthy Negro population, a reevaluation of this problem was undertaken.

Materials and Methods

One hundred and forty-four Negroes varying in age from 18 to 69 were studied. All were free from disease as determined by history and physical examination. This group was composed of hospital employees, nurses, and resident physicians. The majority of the subjects were either native or long-time residents of New York. The dietary histories obtained from this group revealed no evidence of an inadequate diet either at the present or during the past. There were 105 females and 39 males. The age distribution is given in table 1. More females than males were deliberately studied because of the reported higher frequency of the "juvenile pattern" in adult women than in men. The age distribution is about the same in the 2 sexes, 44 per cent of the females and 51 per cent of the males were under 30 years of age.

Standard 12-lead electrocardiograms were taken in the recumbent position 2 or more hours postprandially. The precordial electrodes were placed in accordance with the recommendations of the American Heart Association. All electrocardiograms were recorded on a Sanborn Viso-Cardiette by one or the other of the authors. The subjects appeared to be at ease and not disturbed by the procedure.

Results

The electrocardiograms of the entire group were within the limits of normal. No abnormalities of the QRS complexes or S-T segments were encountered. In tables 2 and 3 are presented the distribution of the electrical axis and position of the hearts in this group of subjects. A normal axis is defined as one that lies between 0° and 90°. Although not indicated in table 2, the degree of axis deviation when present was usually slight. A vertical or semivertical electrical position of the heart was present in 40 per cent of the females and 57 per cent of the males studied. Other observers had noted a higher frequency of the persistence of the "juvenile pattern" in adult Negroes with this position of the heart than with other positions. A high percentage of subjects with the vertical or semivertical position in this population should
favor a high incidence of T-wave abnormalities in this study.

The data pertaining to the T waves of the precordial leads are summarized in Table 4. Results for both sexes are included in this table. Only 1 subject, a 20-year-old girl, exhibited a diphasic T wave in V3. The T wave of V2 was inverted in this same person. These results are similar to those found in healthy white adults. Inversion of the T wave of the right ventricular epicardial leads has been noted to be more frequent in young women than in older women or men. All subjects with either inverted or diphasic T waves in V2 were women between the ages of 18 and 21 years. Upright T waves in V1 were present in 80 per cent of the male subjects but only in 40 per cent of the females.

**DISCUSSION**

The term "juvenile pattern" is an expression used to describe the negativity of the T waves in the right precordial leads present in infants and children.2 As the child ages, right ventricular predominance yields to left ventricular domination, resulting in greater positivity of the T waves of the precordial leads.1-4

The T waves are usually upright in all unipolar precordial leads except in V1 and occasionally in V2 in healthy adult white subjects.8 Most electrocardiographic authorities are in agreement that the T waves should be upright from V3 leftward. Some would allow a negative T in V29 as within the limits of normal, whereas others would not.

Reports of the persistence of the "juvenile pattern" in adult Negroes free of heart disease would seem to challenge both the standards of normality and the usual explanation for the disappearance of the negative right precordial T wave with age. The first of these reports was by Littman, who found an 8-per cent incidence of diphasic or inverted T waves in the CF4 lead of Negro women and a 3 per cent incidence in Negro men.8 These subjects were free of heart disease as determined by a clinical examination. Littman offered no explanation for these observations other than that the persistence of the "juvenile pattern" seemed to occur in subjects with a tendency to right axis deviation, thin chests, and small hearts. The high incidence of inverted T waves over the right side of the chest observed by Littman can be explained in part by his use of the bipolar CF leads. In subjects with vertical hearts, the sum of a low precordial T wave and a high T wave in the leg lead should result in a negative value. We have checked this and found it to be true. In more recent reports on the persistence of the "juvenile pattern" in the adult Negro, unipolar leads have been employed.

Grusin in a study of electrocardiograms of African Negroes found no relationship between the electrocardiographic pattern and the electrical position of the heart or the body habitus.10 In this study, 63 per cent

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**Table 1.—Age Distribution of the Subjects**

<table>
<thead>
<tr>
<th>Age</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>20-24</td>
<td>22</td>
<td>10</td>
</tr>
<tr>
<td>25-29</td>
<td>17</td>
<td>8</td>
</tr>
<tr>
<td>30-34</td>
<td>21</td>
<td>7</td>
</tr>
<tr>
<td>35-39</td>
<td>23</td>
<td>4</td>
</tr>
<tr>
<td>40-44</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>45-49</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>50-54</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>55-59</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>105</td>
<td>39</td>
</tr>
</tbody>
</table>

**Table 2.—Electrical Axis of the Heart**

<table>
<thead>
<tr>
<th>Female (%)</th>
<th>Male (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>1</td>
</tr>
<tr>
<td>Normal</td>
<td>83</td>
</tr>
<tr>
<td>Left</td>
<td>16</td>
</tr>
</tbody>
</table>

**Table 3.—Electrical Position of the Heart**

<table>
<thead>
<tr>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical and semivertical</td>
<td>40</td>
</tr>
<tr>
<td>Intermediate and indeterminate</td>
<td>51</td>
</tr>
<tr>
<td>Horizontal and semihorizontal</td>
<td>9</td>
</tr>
</tbody>
</table>
of the 150 hospitalized patients and 22 per cent of 50 apparently healthy African female nurses presented abnormal records. Grusin observed not only inverted T waves in the unipolar precordial leads but also S-T depression and S-T elevation with tall T waves. Clinical and postmortem examinations indicated that the electrocardiographic abnormalities were not due to organic heart disease. Because of the ubiquity of malnutrition in the African, these patterns are probably related to a metabolic or nutritional factor in that author's opinion.

Another report concerning the "juvenile pattern" in adult Negroes emanated from a midwest sanatorium.6 The subjects of this study were Negro men hospitalized for active tuberculosis. All were said to be anxious, tense, and fearful. Although not stated in the report, most were probably malnourished. Of 131 patients 11 per cent exhibited a "juvenile pattern." This pattern could be accentuated by hyperventilation and relieved by Probanthine and potassium salts. Wasserburger suggested that vagotonia is intimately related to this phenomenon of the "juvenile pattern." The reversal of the inverted T waves in these patients by potassium salts is not unexpected, as this substance will cause both the inverted T waves of children and those associated with organic heart disease to become upright.11

The only study comparable to the present one was carried out by Keller and Johnson.7 Their subjects were medical students and student nurses of Howard University. As in our study, the subjects were healthy, well nourished, and medically sophisticated. These investigators found no inverted or diphasic T waves except in V1 and V2. They reported a 1-per cent incidence of inverted and diphasic T waves in V2, and 47 per cent in V1. The age range of the subjects varied between 22 to 39 years. Our results would have been nearly identical if we had excluded the subjects in our study under 22 years of age. The 6 individuals of our study with inverted or diphasic T waves in V2 were women between 18 and 21 years.

It seems clear from our observations and those of Keller and Johnson that there is no electrocardiographic pattern peculiar to the healthy adult Negro. The persistence of the "juvenile pattern" and other reported electrocardiographic changes must be explained in terms other than of race. Indeed we have seen similar patterns in the Apache Indian.12 Investigation of subjects with the "juvenile pattern" is frequently rewarded with evidence of malnutrition, metabolic disturbance, or anxiety with hyperventilation. It appears probable that a gracile habitus with a vertical heart is not responsible for the persistence of the "juvenile pattern," although it may be a factor. Many of our subjects had this body build; 40 per cent of our female subjects and 57 per cent of the men had either a vertical or semivertical position of the heart.

This study has also confirmed previous observations that inversion of the T waves of the right ventricular precordial leads are more likely to occur in young women than in older women or men.

Summary

Precordial electrocardiograms of 144 healthy adult northern Negroes were analyzed. All curves were within normal limits. No inversion of the T waves was found in
leads V₃ through V₆. One individual exhibited a negative T in V₂ and a diphasic T in V₃. Five instances of diphasic T in V₂ were recorded, all were females between 18 and 21 years of age.

Eighty per cent of adult males presented upright T waves in V₁, whereas in only 40 per cent of the female subjects were T waves positive in V₁.

The T wave of the unipolar precordial electrocardiogram of the healthy, adult American Negro is no different from that of the healthy white adult.

**SUMMARIO IN INTERLINGUA**

Esseva analysate electrocardiogrammas precordial de 144 normal adultos negre habitante le nord del Statos Unite. Omne le curvas esseva intra le limites normal. Nulle inversion del unda T esseva trovate in le derivations V₃ a₆. Un subjecto exhibiva un unda T negative in V₂ e un unda T biphasic in V₃. Esseva notate cinque casos de unda T biphasic in V₂. In omnes il se tractava de femininas de etates de inter 18 e 21 annos.

Octanta pro cento del adultos mascule presentava positive undas T in V₁. Le mesme observation aleva pro solmente 40 pro cento del adultos feminin.

Le unda T del unipolar electrocardiogramma precordial de normal adulte negros american non differe ab illo de normal adulte americanos de racia blane.

**REFERENCES**

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