INCIDENCE OF NORMAL PINEAL GLAND CALCIFICATION IN SKULL ROENTGENOGRAMS OF BLACK AND WHITE AMERICANS*

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HUMAN pineal gland calcification, which was reported in autopsy specimens about 300 years ago, was first described in the plain skull roentgenogram in 1918 by Schüller, and who remarked that the gland “very often shows a calcium deposit from the third decade and occasionally even in children.” Subsequent workers confirmed Schüller’s observation and established the influence of age on the incidence of pineal gland calcification. From a summary of several of these works, the estimated frequency of pineal shadow was found to be 2 per cent in those 3 to 12 years of age; 46 per cent from 13 to 40; and 69 per cent after the age of 40. All the above studies were carried out mainly in Caucasians, and racial differences were not mentioned.

In recent years, a much lower incidence of pineal gland calcification has been reported in other races: 9.9 per cent in Japanese; 15.6 per cent in Fijians, and 19–24 per cent among Indians. In Africa, one of the first hints of a low incidence of pineal shadow was made by Odeku and Janota in their study of brain tumors at the University College Hospital, Ibadan, Nigeria. They mentioned a surprising rarity of calcified pineal gland on skull roentgenograms in West Africans. At the same hospital, where an average of about 2,000 skull roentgenographic examinations are made every year, Adeloye and Odeku encountered less than 10 cases of roentgenologically visible calcified pineal gland in the neurosurgery unit during a period of 10 years. These impressions have been confirmed by Daramola and Olowu, who, in their study of 952 skull roentgenograms obtained in Nigerians in Lagos, found a calcified pineal shadow in 5 per cent. In East Africa, Murphy, a radiologist at the Mulago Hospital in Kampala, Uganda, found only 2 examples of calcified pineal gland in a series of 100 consecutive skull examinations obtained from 88 East Africans, 9 Asians, and 3 Europeans between 17 and 62 years of age. Although he did not identify the racial origin of the 2 patients, any mode of mathematical manipulation would still make the incidence of pineal gland calcification remarkably low in the East African.

Pineal gland calcification is not necessarily indicative of pineal gland atrophy, at least by biochemical and histologic evidence. A recent pathologic study showed that microscopic pineal gland calcification occurs in Nigerian Africans in every decade from the first to the ninth. The paradoxical rarity of gross, roentgenographically visible pineal gland calcification remains unexplained.

The purpose of the present study is to compare the incidence of the calcified pineal gland shadow between black and white populations living in a similar environment, to determine if there is truly a lower incidence of visible pineal gland calcification among blacks and if so, to seek an explanation for it.

MATERIAL AND METHOD

Five hundred consecutive normal plain skull roentgenographic examinations performed on patients in the Emergency Room of the Cincinnati General Hospital between

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February and May 1973 provided the material for this study.

There were 300 blacks and 200 whites in the series; of the blacks, 162 were males and 138 females; 127 males and 73 females comprised the white group. The age, sex, and racial distribution of the patients is shown in Table 1.

The Cincinnati General Hospital is a 691 bed teaching hospital in which all the medical specialties are represented. Patients in the humbler categories of the socioeconomic stratum of the population predominate among the patients of this hospital. Most patients in the city of Cincinnati who require emergency care are taken to the General Hospital.

Three standard views of the skull were routinely obtained: lateral; anteroposterior (Towne); and posteroanterior. In view of the frequent inability of these patients to cooperate, a number of films were less than optimal. Patients with technically inadequate films were rejected from the series. If the lateral projection was of good quality, however, the patient was included. If anything, then, the prevalence of visible pineal calcification was slightly underestimated.

The pineal shadow was recorded as visible when seen either on the lateral or one of the frontal projections. Calcification in the falx cerebri and choroid plexus was also recorded. Habenular calcification, when recognized, was tabulated separately and is not included in the pineal statistics. Skull thickness was also recorded on all the roentgenograms used in this series. These will form the basis of a separate report.¹

FINDINGS

Of the 500 patients in the entire series, 61 (12.2 per cent) showed a calcified pineal gland (Table 1). None of the 125 patients in the first decade of life showed pineal gland calcification.

RACIAL VARIATION

There were 29 blacks and 32 whites with a calcified pineal gland shadow—a racial incidence of 9.7 and 16.0 per cent, respectively. The ratio of visible pineal shadow in white and black Americans is thus about 1.6 to 1, a difference which is statistically significant (chi square, 4.49; p < .05).

This racial difference is also seen if the comparisons are limited to adult age groups: 16.1 per cent of the blacks and 26.4 per cent of the whites from the third decade on.

AGE

The youngest black with a calcified pineal shadow was a boy of 16; the youngest white was a woman of 21. Among both blacks and whites, the frequency of calcified pineal gland shadow increased with age, but this was more striking among

<table>
<thead>
<tr>
<th>Table 1</th>
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<td><strong>AGE, SEX, AND RACIAL INCIDENCE OF PINEAL CALCIFICATION</strong></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Age Groups (yr.)</th>
<th>Under 10</th>
<th>10-19</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
<th>70+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>M</td>
<td>F</td>
</tr>
<tr>
<td>No. of black subjects</td>
<td>51</td>
<td>33</td>
<td>28</td>
<td>20</td>
<td>28</td>
<td>31</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>No. with calcified pineal gland</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>No. of white subjects</td>
<td>26</td>
<td>15</td>
<td>23</td>
<td>15</td>
<td>26</td>
<td>17</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>No. with calcified pineal gland</td>
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<td>0</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>1</td>
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NORMAL PINEAL GLAND CALCIFICATION

TABLE II
RACE AND AGE DISTRIBUTION OF CALCIFIED PINEAL GLAND

<table>
<thead>
<tr>
<th>Age (yr.)</th>
<th>Black Subjects</th>
<th>White Subjects</th>
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<tr>
<td></td>
<td>No. of Subjects</td>
<td>Calcified Pineal Glands</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>Per cent</td>
</tr>
<tr>
<td>Under 10</td>
<td>84</td>
<td>0</td>
</tr>
<tr>
<td>10-19</td>
<td>48</td>
<td>2</td>
</tr>
<tr>
<td>20-29</td>
<td>59</td>
<td>2</td>
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<tr>
<td>30-39</td>
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<td>40-49</td>
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<td>2</td>
</tr>
<tr>
<td>50-59</td>
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<tr>
<td>60-69</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>70+</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>29</td>
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</tbody>
</table>

whites (Table II). Under the age of 40, a calcified pineal gland was encountered with more or less equal frequency among black and white populations; thereafter, the predominance among whites was clearly shown (Table III). It was also noted that the calcifications were generally larger and more inclined to be multiple in the older patients.

SEX

Among the blacks, the pineal shadow was visible in 15 (9.3 per cent) of the 162 males and 14 (10.1 per cent) of the 138 females. The sex ratio of the patients with calcified pineal gland did not appear to be influenced by age. Among the whites, pineal gland calcification was seen in 21 (16.5 per cent) of the 127 males and in 11 (15.1 per cent) of the 73 females. Thus, no significant sex differences in incidence of pineal gland calcification were found in either the whites or blacks. Beyond age 40 in the white group, pineal gland calcification was seen in 47 per cent of the males and 58 per cent of the females. Corresponding figures among the blacks were 15 and 25 per cent, respectively.

OTHER INTRACRANIAL CALCIFICATIONS

A striking preponderance of calcified falx cerebri was noted in the blacks. There were 32 examples (16 per cent), with 18 females and 14 males. In the whites, only 6 instances of this were seen (3 per cent), 3 in men and 3 in women. Choroid plexus calcification was found in 7 blacks (4 men and 3 women) aged 40 to 70, and in 4 white men between 24 and 60. There were 6 examples of habenular calcification, with equal racial distribution.

DISCUSSION

In addition to its racial aspects, this study provides an opportunity to take another look at some of the viewpoints concerning the calcified pineal shadow that have been discussed in the literature. One of these is the increase in incidence of calcification with age. Our percentage age figures shown in Table II agree fairly closely with those which Wurtman et al.20 constructed from the several studies compiled earlier by Kitay and Altschule.7 The age effect was maintained up to age 70, after which most series (including ours) were limited by the paucity of subjects. Almost all reports indicate that the pineal...
shadow can be seen as early as the second decade of life. Its occurrence in the first decade is quite rare.6,7

Most reports on calcified pineal gland have underlined a male preponderance. Vastine and Kinney14 found that in every decade from the second on, males predominated, with an over-all incidence of 58 per cent. Dyke6 reported a male incidence of 54 per cent. A higher male incidence was also found among the Japanese4 and Indians,11,16 whereas among Fijians11 and Nigerians in Lagos,6 slightly more females were found to have calcified pineal glands. The sex distribution was about even in the present study.

The incidence of pineal gland calcification in our series is not as high as that reported in the literature. Our over-all incidence was 12.2 per cent. Over the age of 20 we found an incidence of 20.4 per cent. In studies reported before 1940, the incidence varied between 33 and 76 per cent among subjects of all ages;7 in persons over 20, the incidence was found to be about 60 per cent.8,10,13,17,18 Wakeley18 predicted that this percentage would rise even higher with improved techniques in radiology. The high figures recorded in these early studies might be explained in part by inclusion of habenular calcification, but the contribution of this factor must have been small, judging by the fact that we found only 6 examples among 500 subjects. The inconsistency is more likely the result of differences in age range. Many of our patients were under 20, an age group in which the incidence of pineal gland calcification is known to be low. Thus, two-thirds were in the first 3 decades as compared with one-third in the series of Vastine and Kinney14 and of Dyke,6 25 per cent of our patients were below the age of 10, in striking contrast to 1.5 per cent in the series of Vastine and Kinney and 6.5 per cent in the series of Dyke. However, decade by decade, our figures are clearly lower than theirs.

The most interesting aspect of this study is the significant difference in the frequency of pineal gland calcification between black and white Americans. This observation has not been made before. The subjects in our study were all Americans who live under similar environmental conditions and who belong to more or less comparable socioeconomic groups. Thus, environmental factors are probably not as important as constitutional ones in explaining the differences noted. We have not explored the biochemical factors which might control calcification in our patients (e.g., serum calcium, phosphorus, and protein). In a few patients so examined in their Nigerian series, Daramola and Olowu6 found that these values were normal.

An intriguing possibility has been raised that might relate to the racial differences in pineal gland calcification. Melatonin, the most potent skin lightening agent presently known, is elaborated only by the pineal gland.8 Increase in daylight inhibits melatonin synthesis, while a decrease of light has the opposite effect.6,14 Could increase in this hormone in the pineal gland be related to calcium formation in that organ as well as to the whiteness of the human skin?

When our figures are compared with those obtained among Africans living in Uganda12 and in Lagos, Nigeria,6 it is seen that the incidence of pineal gland calcification is higher in the American black than in the indigenous African. Since the American black and the African indigen are ethnomically related, it seems reasonable to look toward environmental factors to explain the difference in the incidence of calcified pineal shadow between them. Perhaps the better nutritional status of the American black accounts in some way for the discrepancy. Another possibility is the difference in age distribution between the 2 groups. In Nigeria today, as in most African countries, a considerable proportion of hospital patients are children and young people; older patients habitually shun the hospitals. Since age groups are not mentioned in Murphy's East African series,12 this might weight his figures, but could hardly account for the 2 per cent level. On the other hand, age by decades
Normal Pineal Gland Calcification

was recorded in the Nigerian series of Daramola and Olowu, and their age groupings were similar to our own. It thus appears that possibly the most important factor of all that might explain these differences is neither environmental nor socioeconomic. One wonders how black the American black of today really is. Racial admixture has probably created constitutional differences between the American black and his African cousin, of which a discrepancy in the incidence of pineal gland calcification is perhaps an expression.

SUMMARY

The incidence of roentgenologically visible pineal gland calcification is approximately twice as common in American whites as in blacks, a difference that is very striking after age 40. Comparison of this finding with reports in the literature shows that the incidence of pineal gland calcification is slightly higher in American blacks than in indigenous Africans, probably due to racial mixture among the American blacks we studied. It appears that the low incidence of calcified pineal shadow already observed in the African has a constitutional basis.

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