Dermatoglyphics in idiopathic (primary) dilated cardiomyopathy in South Southern Nigeria

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This study was carried out to determine any dermatoglyphic pattern associated with idiopathic dilated cardiomyopathy in South Southern Nigeria. Digital and palmar dermatoglyphic analysis of 49 patients with primary Idiopathic (primary) dilated cardiomyopathy (IDC) and 49 normal subjects from Kalabari ethnic group of Rivers State were carried out. The numbers of male and female subjects in each group were 27 and 22 respectively. It involved the digital patterns, ATD angle, DAT angle and ridge count. The results showed that on the right digits of males there was no significant difference (zero) in the digital patterns between the IDC and normal subject (p > 0.05) while on the left hand, IDC patients showed significantly higher whorl pattern (81.48%) on the first digit than the normal subjects (39.63%) (p < 0.05). Radial loop was observed on the second left digit of male IDC patients while no such pattern was observed on any of the digits of the normal male subjects. In females, arch pattern was observed on the second and third right digits of the IDC patients but absent in normal subjects. Also whorl pattern was observed on the 5th right and left digits of IDC patients with percentages of 18.18 and 36.36% respectively. This was however absent in normal female subjects. On the right palm of male IDC patients the mean ATD angle (39.22°) was significantly smaller than the mean ATD angle (41.29°) of the normal male subjects (p < 0.05). Similarly, significant differences were observed on left palm. Amongst female subjects also there was a significant difference (p<0.05). Significant difference was observed in the mean total ridge count of the male IDC and normal subjects (369.3 and 429.1 respectively) (p < 0.05). There was however no difference between the female IDC and normal subjects. The study has shown that IDC presents characteristic dermatoglyphic features which could be used for early diagnosis of the disease.

Key words: Dermatoglyphics, Idiopathic dilated cardiomyopathy.

INTRODUCTION

Idiopathic (primary) dilated cardiomyopathy (DC) is a primary myocardial disease of unknown cause (WHO, 1980). The mode of inheritance in most families appears to be autosomal dominant (Michels et al., 1992). The chief morphologic feature of IDC is dilatation of both ventricles (Roberts et al., 1987; Ferrans, 1989). Most patients present for the first time between the ages of 20 and 50 years (Johnson and Palacios, 1982; Komajda et al., 1990) with heart failure as its initial manifestation in 75 to 85% of cases (Sugrue et al., 1992; Diaz et al., 1987).

The reported annual incidence varies from 5 to 8 cases per 100,000 populations (Gillum, 1986; Bargger et al., 1984; Williams and Olsen 1985). It also accounts for 10,000 deaths annually in United States (Gillum 1986) and Blacks have a 2.5 times fold increase risk compared to the Whites (Coughlin et al., 1990).

Dermatoglyphic pattern has positive correlation in some disease conditions most especially the genetically related. Such conditions include those associated with organic mental retardation (Stevenson et al., 1997; Than et al., 1998). It also hypothesized that dermatoglyphics may aid in the diagnosis of such conditions (Schmidt et al., 1981). Nervous system disorders of functional ethiopathogenesis have also been positively correlated with dermatoglyphics, these include schizophrenia and schiz-
Table 1. Percentage (%) of digital patterns of the right hands of idiopathic dilated cardiomyopathy (IDC) and normal (n) male subjects (control).

<table>
<thead>
<tr>
<th>Patterns</th>
<th>R_{IDC}</th>
<th>R_{1}</th>
<th>R_{II IDC}</th>
<th>R_{N}</th>
<th>R_{III IDC}</th>
<th>R_{1}</th>
<th>R_{IV IDC}</th>
<th>R_{N}</th>
<th>R_{V IDC}</th>
<th>R_{1}</th>
<th>R_{IDC}</th>
<th>R_{1}</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULNAR LOOP (UL)</td>
<td>66.67</td>
<td>70.37</td>
<td>59.25</td>
<td>40.74</td>
<td>74.07</td>
<td>70.07</td>
<td>81.84</td>
<td>62.96</td>
<td>92.59</td>
<td>70.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RADIAL LOOP (RL)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>14.81</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARCH (A)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHORL (W)</td>
<td>33.33</td>
<td>29.63</td>
<td>40.74</td>
<td>44.44</td>
<td>25.93</td>
<td>25.93</td>
<td>18.52</td>
<td>37.04</td>
<td>7.41</td>
<td>29.63</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sample Size = 27; i-v- 1^st. to 5^th. digits; R- right hand.

zotypal personality (Bolgir, 1973; Oladipo et al., 2005; Gengenelli and Thrasher, 1979; Weinstein et al., 1999) Genetic linkage and determination of dermatoglyphics is apparent (Panchekina et al., 2000) and has been described as one of the best diagnostic tools in genetic disorders (Bosco et al., 2001).

Genetically determined idiopathic (Primary) dilated cardiomyopathy (Michels et al., 1992; Towbin et al., 1993) is the cause of considerable mortality of about 25,000 per annum in most African countries (Gillum, 1986). At present, most investigative procedures of IDC are post-natal and are carried out from the age- 20 upwards when the initial manifestations of heart failure appear. Such investigative procedures are rather too late at this age for any meaningful management of this disease.

However, because dermatoglyphic patterns existed prenatally, early post-natal dermatoglyphic analysis may aid in the early diagnosis of idiopathic (Primary) dilated cardiomyopathy. This study, henceforth designed to elucidate possible diagnostic value of the dermatoglyphic features and to further test this hypothesis in 49 patients diagnosed with IDC by comparing them with normal subjects of both sexes from Kalabari ethnic group of Rivers State in the same environment.

**MATERIALS AND METHODS**

Forty nine (49) patients with idiopathic (Primary) dilated cardiomyopathy (IDC) comprising 22 females and 27 males from University of Port-Harcourt Teaching Hospital (UPTH) and Braitwaite Memorial Specialist Hospital (BMH) Port-Harcourt and 49 students (normal subjects) comprising 22 females and 27 males of College of Health Sciences of the University of Port-Harcourt were screened for dermatoglyphic analysis. The subjects were twenty one (21) years and above. They were all from Kalabari ethnic group in Rivers State (South Southern Nigeria) by both parents and grand parents.

The normal subjects had blood pressure of not more than 120/80 mmHg on the average with normal pulse rate, ranging from 60 to 100 beats per min. We scrutinized the clinical records of the IDC patients properly to ensure that these IDC cases were idiopathic in nature and not secondary to any underlying diseases or life styles conditions. Such as, long-term alcohol intake, diabetes, hypertension, heart valve disease, coronary artery disease, congenital heart defects, pregnancy (as in the case of female patients), viral infections etc, as all these are likely to cause other forms of dilated cardiomyopathy such as alcoholic, peripartum or ischemic cardiomyopathy. We also calculated the cardiothoracic ratios of the chest X-rays of the IDC patients to ensure that all the patients in the inclusive criteria had gross (ratios ≥ 80%) and not mild or moderate cardiomegaly (Schroeder et al., 1989).

Palmar and fingerprints were made with white paper and purple pad. With both hands (Right and left) initially washed with water, soap, and later wipe dried before prints taken in order to remove dirt from the hands. We carried out screening on the white duplicating paper containing the prints with the aid of magnifying gloss in accordance with Cummin’s method (Cummins et al., 1929). Digital patterns recorded as whorl (W), ulna loop (UL), radial loop (RL) and arch (A). The ATD angles (angle formed by straight lines joining A, B and T tri-radii) of both hands were mapped out with meter rule and marker, and these angles were then measured with the aid of a protractor (Figure 1).

Digital ridge counts were made by counting the number of ridges that cross a straight line drawn from the core of a digital pattern (that is, loop and whorl) to the digital triradius. Total ridge count (TRC) calculated as the total ridges over all ten fingers. All measurements are as defined by Penrose (1965).

The various digit were designated as follows: Thumbs–I; Index Finger – ii; Middle Finger – iii; Ring Finger – iv; Little Finger – v. ‘L’ and ‘R’ stand for left and right respectively.

**Statistics**

The students ‘t-test and chi-square were used for the statistical analysis in this study. Significant level of 0.05 was used (p == 0.05).

**RESULTS**

The results showed that on the right digits of males (Table 1) there was no significant difference in the digital patterns between IDC and normal subjects (P>0.05) while on the left hand (Table 2), the IDC patients showed a significantly (P < 0.05) higher whorl pattern (81.48%) on the first digit than that found in the normal subjects (39.63%). The radial loop observed on the second left digit of male IDC patients (14.82%) was lacking in any of the left digits of normal subjects but present in the second right digit in 14.8% normal subjects.

In females, the arch patterns observed on the second and third right digits of the IDC patients were obviously absent in the normal subjects as seen in Table 3. In addition, 18.18% and 36.36% of whorl patterns found on both the fifth right and left digits of IDC patients respectively Table 4 in comparison to the normal subjects.

There was significant difference in the mean ATD angles in both groups as shown in Table 5, such that on the right palm of the male IDC patients, the mean ATD angle

Table 2. Percentage (%) of digital patterns of the left hands of idiopathic dilated cardiomyopathy (IDC) and normal male subjects (control).

<table>
<thead>
<tr>
<th>Patterns</th>
<th>L_{IDC}</th>
<th>L_{I N}</th>
<th>L_{II IDC}</th>
<th>L_{II N}</th>
<th>L_{III IDC}</th>
<th>L_{III N}</th>
<th>L_{IV IDC}</th>
<th>L_{IV N}</th>
<th>L_{V IDC}</th>
<th>L_{V N}</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULNAR LOOP (UL)</td>
<td>18.52</td>
<td>55.56</td>
<td>55.56</td>
<td>66.67</td>
<td>74.07</td>
<td>81.48</td>
<td>66.67</td>
<td>55.56</td>
<td>88.89</td>
<td>51.85</td>
</tr>
<tr>
<td>RADIAL LOOP (RL)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>14.82</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>ARCH (A)</td>
<td>0.00</td>
<td>14.81</td>
<td>0.00</td>
<td>7.41</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>WHORL (W)</td>
<td>81.48</td>
<td>29.63</td>
<td>29.63</td>
<td>25.93</td>
<td>25.93</td>
<td>18.52</td>
<td>33.33</td>
<td>44.44</td>
<td>11.11</td>
<td>48.15</td>
</tr>
</tbody>
</table>

Sample Size = 22; i-v-1st to 5th digits; L-left hand.

Table 3. Percentage (%) of digital patterns of the right hands of idiopathic dilated cardiomyopathy (Idc) and normal (n) female subjects (control).

<table>
<thead>
<tr>
<th>Patterns</th>
<th>R_{IDC}</th>
<th>R_{I N}</th>
<th>R_{II IDC}</th>
<th>R_{II N}</th>
<th>R_{III IDC}</th>
<th>R_{III N}</th>
<th>R_{IV IDC}</th>
<th>R_{IV N}</th>
<th>R_{V IDC}</th>
<th>R_{V N}</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULNAR LOOP (UL)</td>
<td>45.46</td>
<td>22.73</td>
<td>36.36</td>
<td>63.64</td>
<td>27.27</td>
<td>63.64</td>
<td>18.18</td>
<td>63.64</td>
<td>18.18</td>
<td>90.91</td>
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<tr>
<td>RADIAL LOOP (RL)</td>
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<td>0.00</td>
<td>14.81</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>ARCH (A)</td>
<td>31.82</td>
<td>27.27</td>
<td>36.36</td>
<td>0.00</td>
<td>27.27</td>
<td>0.00</td>
<td>9.09</td>
<td>4.55</td>
<td>18.18</td>
<td>9.09</td>
</tr>
<tr>
<td>WHORL (W)</td>
<td>22.73</td>
<td>50.00</td>
<td>27.27</td>
<td>36.36</td>
<td>45.46</td>
<td>63.64</td>
<td>18.18</td>
<td>63.64</td>
<td>18.18</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Sample Size (n) = 22; i-v-1st to 5th digits; R-right hand.

Table 4. Percentage (%) of digital patterns of the left hands of idiopathic dilated cardiomyopathy (idc) and normal (n) female subjects (control).

<table>
<thead>
<tr>
<th>Patterns</th>
<th>L_{IDC}</th>
<th>L_{I N}</th>
<th>L_{II IDC}</th>
<th>L_{II N}</th>
<th>L_{III IDC}</th>
<th>L_{III N}</th>
<th>L_{IV IDC}</th>
<th>L_{IV N}</th>
<th>L_{V IDC}</th>
<th>L_{V N}</th>
</tr>
</thead>
<tbody>
<tr>
<td>ULNAR LOOP (UL)</td>
<td>18.18</td>
<td>27.27</td>
<td>27.27</td>
<td>31.82</td>
<td>27.27</td>
<td>40.91</td>
<td>54.55</td>
<td>40.91</td>
<td>63.64</td>
<td>0.00</td>
</tr>
<tr>
<td>RADIAL LOOP (RL)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>ARCH (A)</td>
<td>45.46</td>
<td>13.64</td>
<td>18.18</td>
<td>27.27</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>WHORL (W)</td>
<td>36.36</td>
<td>59.09</td>
<td>54.55</td>
<td>50.00</td>
<td>45.46</td>
<td>59.09</td>
<td>45.46</td>
<td>59.09</td>
<td>36.36</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Sample Size = 22; L = left; i-v-1st to 5th digits; IDC = idiopathic dilated cardiomyopathy.

Table 5. Summary of mean and standard deviation of ATD angles (°) of the right and left hands of the palmar prints of idiopathic dilated cardiomyopathy and normal male and female subject (control).

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameters</td>
<td>R_{IDC}</td>
<td>R_{N}</td>
</tr>
<tr>
<td>MEAN±SD</td>
<td>39.22±0.5</td>
<td>41.29±0.82</td>
</tr>
<tr>
<td>SAMPLE SIZE</td>
<td>27</td>
<td>27</td>
</tr>
</tbody>
</table>

R – right; L – left; N – normal; IDC – Idiopathic dilated cardiomyopathy; i-v-1st to 5th digits.

(39.22°) was significantly (P<0.05) lower than the mean ATD angle (41.29°) of the normal subjects. We observed a significantly (P<0.05) greater mean ATD (39.85°) in the left palm of the IDC patients than that of the normal male subject (38.62°).

However, among the female subjects, similar findings were also noted such that the mean ATD angle (37.43°) on the right palm of IDC patients was significantly smaller (P<0.05) than that of the normal subjects (43.47°) as observed also on the left palm with mean ATD values (40.27°) in IDC lower significantly than that of normal patients (44.68°).

The mean total ridge count (Table 6) of the normal male subject (429.1) was significantly greater than that of the male IDC patients (369.3) (P<0.05). However, no significant difference was observed between the normal female and female IDC subjects (P>0.05).

DISCUSSION

A number of studies have indicated dermatoglyphic correlation in a large number of genetic disorders which include diabetes mellitus (Shield et al., 1995; Oladipo and Ogunnowo, 2004), schizophrenia (JimVan-os et al.,
congenital heart disease (David, 1981), Androgenic alopecia (Oladipo and Akanigha, 2005) and Down Syndrome (Boroffice, 1978). The variables implicated with dermatoglyphic correlation include: digital pattern, ATD angle, DAT angle digital ridge count and palmar crease pattern (Schaumann and Alter, 1976; Boroffice, 1978; Penrose, 1965; Shield et al., 1995).

Most of these authors agree that ulnar loop has the highest percentage followed by whorl, arch and radial loop among the normal individuals. Oladipo and Akanigha (2005) have however reported that whorl had the highest percentage among Alopecians. Our observation in this respect is partly in agreement with those of most authors and partly in agreement with that of Oladipo and Akanigha as the whorl has the highest percentage in the first left digit and second left digit of male and female IDC patients respectively. Similarly it also has the highest percentage in R_III, R_II, R_I, L_III, L_II, and L_IV of the normal female subjects.

The mean ATD angles of IDC patients in the present study averaged 35.04° and 38.85° for males and females respectively. However, these were significantly (P<0.05) smaller than those of the normal subjects 40.0° (male) and 44.08° (female). In addition, the obtained average ATD angles in this study is smaller than the average ATD angles of 41.8° reported for average Nigerians by Oladipo and Akanigha (2005).

The mean total digital ridge counts of male IDC patients (369.3) were also significantly (P<0.05) smaller than that of the normal male subject (429.1), suggesting a characteristic dermatoglyphic pattern for idiopathic dilated cardiomyopathy. Our observation on total ridge count agreed with findings of other authors on diabetes mellitus, who reported a higher total digital ridge count in diabetes mellitus than the normal population (Vera et al., 1995) but varies from those of others on other genetic disorders, who reported higher values (Penrose, 1963; Penrose, 1973).

**Conclusion**

The whorl patterns were seen on the second left digit of male and fifth left digit of females Kalabari IDC patient. In addition, the radial loop on second left digit of male IDC patients and other dermatoglyphic features such as significantly smaller total digital ridge count among the male Kalabari IDC patients have indicated that Idiopathic Dilated Cardiomyopathy (IDC) possesses characteristic dermatoglyphic patterns. These features could be used for early diagnosis and management of the disease.

**REFERENCES**


