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Research Article

Dermatoglyphic's in Congenital Cardiac Disease

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Abstract

Background: Study of epidermal ridges and their configuration on the tips of fingers, palm & soles is called as dermatoglyphic study or Dermatoglyphics, is a typical clue for personal identification. If any influences which are acting either in form of factor or drugs which act prior to particular intrauterine period when finger print pattern is developing, it is bound to cause changes in these patterns like in cardiovascular system of foetus in form of congenital cardiac diseases.

Material and Method: Various dermatoglyphic parameters like finger print pattern, atd angle, absolute ridge count & ab, bc, cd, and ad ridge counts were observed in 150 cases of congenital cardiac disease, comprising of 72 cases of Ventricular Septal Defects (VSD), 60 cases of Atrial Septal Defects (ASD), 9 cases of Co-arctation of Aorta (COA) & 9 cases of Tetralogy of Fallot's (TOF). Same dermatoglyphic parameters were also studied in 300 controls and statistical comparison of cases and controls was done.

Result and conclusion: It was observed that the congenital cardiac disease cases exhibited preponderance of whorls (55.8%) with decrease in loop pattern (36.2%) as compared to those of controls and the difference was highly significant ($p < 0.001$). The difference in the mean total finger ridge count (TFRC) of the controls and of the cases of Congenital Cardiac Diseases (CCD) was found to be highly significant ($p < 0.001$), while the mean atd angle in the cases of Congenital Cardiac Disease (CCD) was widen up and was statistically significant too. The mean ab, the mean bc ridge, the mean cd ridge and the mean ad ridge counts were also higher in the various type of CCD as compared to that controls and on statistical comparison, the difference was found to be highly significant.

Keywords: atd angle, axial tri radius, palmar print, Dermatoglyphics, congenital cardiac disease, finger prints, ridge counts

1. Introduction

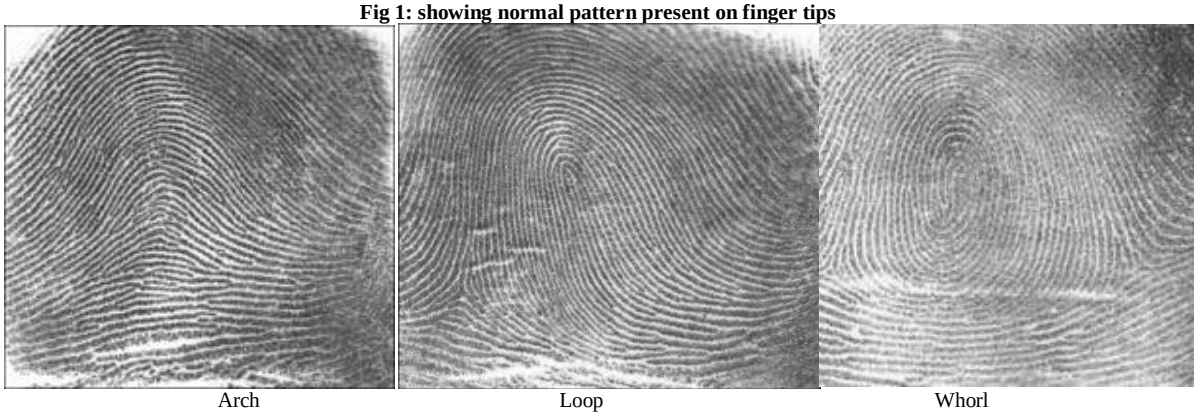
Study of epidermal ridges and their configuration on the tips of fingers, palm & soles is called as dermatoglyphic study or Dermatoglyphics. Once formed in their final form, the dermatoglyphic patterns exhibit no change except in their size, thus they form a typical clue for personal identification. Study of Dermatoglyphics was pioneered way back by Galton (1892) and since then Dermatoglyphics has been evaluated in various disease and disorders in medical field by Von O el *et al*[1]and Jalali F *et al*[2].

For population studies and embryological basis Dermatoglyphics play important role. Because around 6-7 weeks of intrauterine life foetal volar pads appear and at 10-13 weeks dermo-epidermal ridges/ absorption unfolding develop which is reflected at skin surface as pattern around 20-21 weeks of intra uterine life. These ridges become permanent after 4 months and then they remain same without any change throughout the life of person.

So if any influences which are acting either in form of factor or drugs which act prior to this particular intrauterine period when finger print pattern is developing, it is bound to cause changes in these patterns and will be cause of some changes in these pattern along with defective outcome in that particular system like cardiovascular system of foetus/baby in form of congenital cardiac diseases. We know that heart and cardiovascular system develops between 4thweek to 4th month of intrauterine life. So any defect in heart development by any reason may affect development of dermal ridges[3,4].

In normal population most common type of finger prints are loops either right or left are present in 62- 70%, second common are whorls of composite (2 tri radii) type, symmetrical and double loop type are present in 23- 28%, arches either simple (no tri radius) or tented in 4- 8% and composite in 0- 2% type of pattern are present (fig 1)[5,6]. In the present study we have studied and observed palmar dermatoglyphics in the various types of congenital cardiac diseases (CHD).

Fig 1: showing normal pattern present on finger tips



Arch Loop Whorl

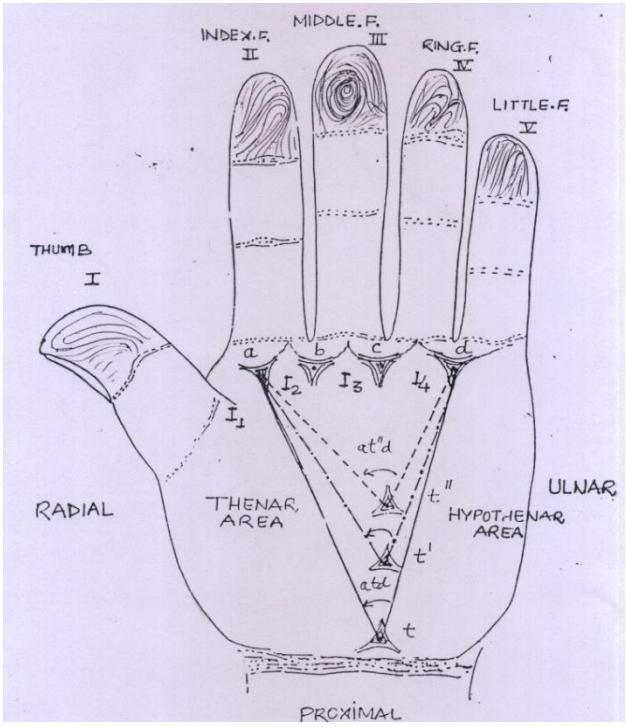
2. Material & Methods

In the present study 150 cases of congenital cardiac diseases CHD, comprising 72 cases of ventricular septal defect (VSD), 60 cases of atrial septal defect (ASD), 9 cases each of co-arctation of aorta (COA) & tetralogy of fallots (TOF) were selected from the department of Cardiology, Paediatrics & Medicine from MLB Medical College, Jhansi (UP), Hamdard Institute of Medical Sciences & Research New Delhi & Rajiv Gandhi Super Specialty Hospital Tahirpur, New Delhi.

Diagnosis of the cases was based on detailed history, clinical examination, chest X- ray and was confirmed by ECG & Echocardiography. Three hundred healthy subjects free from any congenital diseases were selected as control.

Finger prints and palm prints of the cases and control were taken by Ink & paper method and studied with the help of hand lens of 4D power for the following parameters (fig 2):

Fig 2: measurment of atd angle, ab, bc, cd and ad ridge count



(a) m atd angle
(b) m ab ridge count
(c) mbc ridge count.
(d) m cd ridge count
(e) m ad ridge count

Palmar landmarks were taken for all digits except thumb, tri radii 'a', 'b', 'c', 'd' from radial to ulnar side and for axial tri radius 4th metacarpal has taken as long axis because it is situated in between thenar and hypothenar area of the palm. Any displacements proximal/ distal on the basis of atd angle or lateral/ medial were observed.

Student "t" test was employed for statistical analysis.

2.1 Ethical considerations

Informed consent was taken from the parents of patients prior to procedure and for the inclusion to the study. The study was performed according to the Declaration of Helsinki, and the Institutional Ethical Board approved it.

3. Result

The normal pattern of both the hands of 300 controls and 150 cases of CHD were observed and mean percentages for Right and Left hand combined were calculated and compared statistically.

The cases of CHD showed different type of pattern than normal population which were highly significant (table 1 & table 2).

Table 1: Pattern in study group and control

	Controls	Cases	p value: significance
Loops	69%	36.2%	< 0.001*
Whorls	25%	55.8%	< 0.001*
Arches	06%	08.0%	> 0.05

* Highly significant

Table 2: distribution of patterns according to disorders

Pattern	VSD (in 72 cases)	ASD (in 60 cases)	Control (300 cases)
Loops	33.8 %	37.5 %	69 %
Whorls	54.4 %	57.5 %	25 %
Arches	11.8 %	05.0 %	06 %

9 cases of TOF had loop – 40%, whorls – 53.3% and arches – 6.7%.

9 cases of CoA had loop – 13.3%, whorls – 86.7% and arches – 00.

The atd angle for both the hands of 300 controls and 150 cases of CCD were observed and mean atd angle for Right and Left hand combined were calculated and compared statistically.

The mean atd angle for controls observed was $43.04^0 \pm 4.50^0$.

The cases of CCD (as a whole group), VSD, ASD, COA & TOF exhibited widened up of the atd angle the observed higher values when compared with that of controls were found to be highly significant in cases of CCD & VSD, statistically significant in ASD while they were insignificant in the cases of TOF & COA (table 3).

Table 3: Mean atd angle in study group and control

Study group	m atd angle (Rt. & Lt. hand)	Control m atd angle (Rt. & Lt. hand)	t	p - value
CHD	$47.90^0 \pm 7.79^0$	$43.04^0 \pm 4.50^0$	5.80	< 0.001*
VSD	$51.11^0 \pm 8.24^0$	$43.04^0 \pm 4.50^0$	8.16	< 0.001*
ASD	$44.87^0 \pm 6.19^0$	$43.04^0 \pm 4.50^0$	2.15	< 0.05 †
TOF & COA	$45.16^0 \pm 7.94^0$	$43.04^0 \pm 4.50^0$	1.29	>0.05

* Highly significant
† Significant

The mean ab ridge count of both the hands of 300 controls and 150 cases of CHD was observed. The mean ab ridge count for the controls observed was 25.80 ± 3.21.

The mean ridge count in the cases of CCD, VSD, ASD, TOF & COA was higher as compared to that of controls. On statistical analysis the difference observed in the mean ab ridge count with higher values in the cases of VSD, ASD, TOF& COA was found to be highly significant (table 4).

Table 4: Mean ab ridge count in study group and controls

Study group	Mean ab ridge count	Mean ab ridge count of controls	t	p- value
CHD	31.70 ± 4.74	25.80 ± 3.21	11.21	< 0.001*
VSD	30.10 ± 4.96	25.80 ± 3.21	6.71	< 0.001*
ASD	33.70 ± 3.77	25.80 ± 3.21	13.16	< 0.001*
TOF & COA	32.40 ± 4.61	25.80 ± 3.21	6.71	< 0.001*

* Highly significant

The mean bc ridge count of both hands for 300 controls & 150 cases of CHD were observed. The mean bc ridge count for the control was 19.40 ± 1.55.

The mean bc ridge count for the cases of CCD, VSD, ASD, TOF & COA was higher as compare to that of controls. On statistical analysis the difference observed in the mean bc ridge count in the cases of CCD, VSD, ASD with higher values was found to be highly significant (table 3), while the cases of TOF & COA exhibited higher value of mean bc ridge count but the difference was statistically significant (table 5).

Table 5: mean bc ridge count in study group and controls

Study group	m bc ridge count	m bc ridge count (controls)	t	p- value
CHD	21.70 ± 4.73	19.40 ± 1.55	3.66	<0.001*
VSD	22.60 ± 6.11	19.40 ± 1.55	4.33	<0.001*
ASD	21.40 ± 2.86	19.40 ± 1.55	3.96	<0.001*
TOF & COA	20.60 ± 2.48	19.40 ± 1.55	2.41	< 0.05 †

* Highly significant
† Significant

The mean cd ridge counts were observed in control as well as all cases. The increased mean cd ridge count in cases of CCD, VSD, ASD, TOF& COA was to be found highly significant (table 6).

Table 6: mean cd ridge count in study group and controls

Study group	m cd ridge count	m cd ridge count (in control)
CCD	31.7 ± 4.74	24.2 ± 4.06
VSD	31.6 ± 6.89	24.2 ± 4.06
ASD	32.8 ± 6.23	24.2 ± 4.06
TOF & COA	32.3± 3.42	24.2 ± 4.06

The mean ad ridge counts were observed in control as well as all cases. The difference noted with higher values of mean ad ridge count in cases of CCD, VSD, ASD, TOF & COA was found to be highly significant (table 7).

Table 7: mean cd ridge count in study group and controls

Study group	m ad ridge count	m ad ridge count (in control)
CCD	68.6 ± 5.17	61.6 ± 3.62
VSD	68.6 ± 6.53	61.6 ± 3.62
ASD	68.3 ± 4.56	61.6 ± 3.62
TOF & COA	69.5 ± 3.03	61.6 ± 3.62

4. Discussion

Hale & Phillip[7], Fried & Neel[8], Mangotra *et al*[9] and Ravindra *et al*[10] reported widening of atd angle in the cases of various type congenital heart diseases. In the present study atd angle was significantly widened up in the cases of various CCD's i.e. VSD & ASD, although the atd angle was widened in the cases of TOF & COA too, but statistically not significant.

Anitha Khalil[3] studied Dermatoglyphics in congenital heart diseases in 50 cases as compared to 50 normal children. This study showed increased frequency of ulnar loops patterns and decreased frequency of whorl patterns in male cyanotic and female cyanotic and acyanotic groups. Decrease TFRC was significant in CCD, more so in male patients.

In present study it were observed that print pattern were reversed ie number of loops are decrease while there was an increase in number of whorls tremendously.

The mean ab, mean bc, mean cd and mean ad ridge count in our study were higher in the cases of CCD as compared to that of control and statistically significant.

These observations can provide an additional help in the diagnosis of congenital heart diseases when combined with other clinical parameters and even in differential diagnosis i.e. in TOF and COA.

5. Conclusion

Finger print patterns and dermatoglyphics can be used as a predictive indicator about congenital cardiac diseases in population studies, easy to carry out with minimum time and expenses. atd angle is widened or increased in the cases of congenital heart defects/diseases as well as whorls are increased in number in these cases that is pdermatoglyphic pattern are reversed and abnormal, so dermatoglyphics may be used as a new predictive and diagnostic tool with practice and expertise for population studies for prediction of congenital cardiac diseases.

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