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Dermal ridge patterns of palms of children with congenital heart diseases in comparison to normal children: A case control study

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ABSTRACT

Background: The dermatoglyphic patterns of dermal ridges that constitute human fingerprint are formed during the early intra-uterine life, between 7th and 21st week of gestation and mature at about seventh month of fetal development. Dermatoglyphics, once matured, remain unchanged throughout the life of an individual and are not influenced either by environmental or by age-related factors. The heart and cardiovascular system develop between 4th weeks to 4th month of intrauterine life. So, any defect in heart development by any reason may affect development of dermal ridges.
Aims and Objectives : To study and compare the quantitative parameters of palmar dermatoglyphics of normal children with those of congenital heart diseases.
Materials and Methods: It was a case control study conducted at Basaveshwara Hospital, Mahadevappa Rampure Medical College, Gulbarga and Jayadeva Institute of Cardiology, Bangalore.
Inclusion criteria: Children having congenital heart diseases (cyanotic and acyanotic) proven by echo-cardiography.
Exclusion criteria: Children with doubtful congenital heart diseases, Children with acquired heart diseases, Children with deformities of the hand.
Results: It is a Case-control study consisting 100 congenital heart disease patients and 100 controls. The atd angle in right and left hand, a-b ridge count in right and left hand of congenital heart disease children were significantly increased when compared to the normal children with p-value < 0.001. Distribution of Simian crease and Sydney line is statistically similar in two groups of children with p=1.000
Conclusion: Dermatoglyphics can be used as a predictive indicator about congenital cardiac diseases in population studies, easy to carry out with minimum time and expenses.

1. Introduction

The study of epidermal ridges with their configurations involving palms, soles and fingers is called as dermatoglyphics.[1] The word dermatoglyphics is taken from Greek language. 'Derma' means skin and 'glyphics' means carvings.[2] In human beings the rough skin on the palms and soles shows epidermal ridges with various configurations,[3] During development, the dermal ridges appear between 7^{th} to 21^{st} weeks and mature at around 7^{th} month of intrauterine life. These ridges constitute the finger print patterns. These patterns are not affected by age or environmental factors and remain constant for life.[2] But these patterns are influenced by genetic factors and also some environmental factors before the mature. Therefore, in a person with a particular genetic or chromosomal defect, the dermatoglyphics is considered as easy and cost-effective method for complementing the diagnosis.[4]

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The 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 patterns along with defective outcome in that particular system like cardiovascular system of foetus/baby in form of congenital cardiac diseases. The heart and cardiovascular system develop between 4th weeks to 4th month of intrauterine life. So, any defect in heart development by any reason may affect development of dermal ridges.[5] Certain definitive dermatoglyphic patterns were released when many workers observed that significant deviations were present on dermatoglyphic pattern in some conditions which are thought to be genetically influenced like Mongolism, Turner's syndrome, Mental retardation and Leukemia. The dermatoglyphic patterns were also studied in Cardiovascular disorders, Diabetes, Schizophrenia and ABO blood groups, which are thought to have genetic influence.[6] The present study is undertaken to study the dermal ridge pattern of palms in children with congenital heart diseases (CHD) in comparison to normal children without congenital heart diseases.

2. Aims and Objectives

To study and compare the quantitative parameters of palmar dermatoglyphics of normal children and in children with congenital heart diseases.

3. Materials and Methods

This was a case control study which was conducted at Basaveshwara Teaching and General Hospital, Mahadevappa Rampure Medical College, Gulbarga and Jayadeva Institute of Cardiology, Bangalore, Karnataka, India.

3.1. Inclusion criteria

Children having congenital heart diseases (cyanotic and acyanotic) proven by echo-cardiography were included in the study.

3.2. Exclusion criteria

Children with doubtful congenital heart diseases, Children with acquired heart diseases, Children with deformities of the hand were excluded from the study.

For each of congenital heart disease child included in the study, detailed history including consanguinity, birth order of child, drug intake during prenatal period and family history of congenital heart diseases were taken. Electrocardiogram, X-Ray chest were obtained. A provisional diagnosis of congenital heart disease was made and later confirmed by echocardiography. The control group consisted of healthy children, both males and females, who were thoroughly examined clinically for any congenital anomalies or having acquired heart diseases. The dermatoglyphic patterns of palms were studied and the information was recorded systematically.

3.3. Method of recording dermatoglyphic patterns

The 'ink method' was used to record the palmar dermatoglyphic patterns, because it is less time consuming, simple Technique, low cost and good clarity of prints. The hands of the subject are first cleaned with soap and water and dried. Subsequently the hands are wiped with spirit lightly to remove any greasy particles. A smaller amount of ink is placed on the ink slab and spread with the roller to a thin film-not too thick nor too light. The subject is made to relax, giving the operator complete freedom in manipulations. The whole of the palm is covered with ink using the roller directly. While inking the following areas require special attention- the zone of flexion creases on the wrist, the Ulnar margins, the Flexor creases where the finger join the palm and the central hollow of the palm. After inking, the operator brings the ulnar margins of the subject's hand, rolled palm downwards, against the paper on the curved pressure pad. Pressure is exerted specially over the central region of the hand over the knuckles, to ensure printing of the hollow of the palm and distal border. Soon after the print is taken, it should be examined for details and clarity in the palmar areas. The ink is easily removed from the hand by washing with soap and water.

The prints are studied for the following features (Figures 1 and 2)

1. 'a-b' ridge count
2. 'atd' angle measured separately for each hand.
3. Presence of Simian creases and Sydney lines.

3.4. Statistical methods

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups Inter group analysis) on metric parameters, Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

4. Results

The present case control study was conducted to analyse and compare the palmar ridge patterns in 100 children with congenital heart disease with 100 normal children taken as control. In this study the males and females are equal in

number both in congenital heart disease and control groups.

Present study showed 50% of males and 34.8% of females had ventricular septal defect as most common congenital heart disease. The next common congenital heart disease was atrial septal defect seen in 20.4% of males and 39.1% of females (Table 1) Children with congenital heart disease showed a significant increase in atd angle and a-b ridge count in both hands in comparison to normal children, with p-value < 0.001. Axial tri-radius is distally placed in children with congenital heart disease. (Table 2) There was a significant increase in atd angle and a-b ridge count in both hands of male children with congenital heart disease in comparison to normal male children, with p-value < 0.001. (Table 3) There was a significant increase in atd angle and a-b ridge count in both hands of female children with congenital heart disease in comparison to normal female children, with p-value < 0.001. (Table 4) There was no significant increase in atd angle and a-b ridge count in both hands of children with acyanotic congenital heart disease in comparison to children with cyanotic congenital heart disease (Table 5)

Simian crease and Sydney line were present in two percent of normal children and children with congenital heart disease. Distribution of Simian crease and Sydney line is statistically similar in two groups of children with p=1.000.

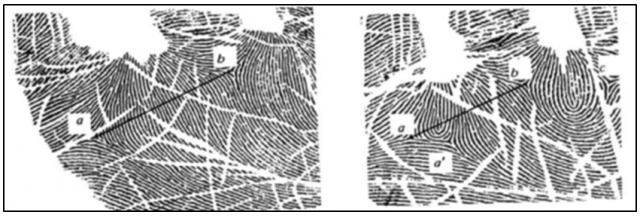

Fig. 1: Method of a-b ridge count

Table 1: Distribution of congenital heart diseases according to the gender.

Type of CHD	Total	Male	Female
Ventricular septal defect	43(43%)	27(50%)	16(34.8%)
Atrial septal defect	29(29%)	11(20.4%)	18(39.1%)
Tetralogy of Fallot	14(14%)	7(13%)	7(15.2%)
Patent ductus arteriosus	4(4%)	3(5.6%)	1(2.2%)
Transposition of great vessels	4(4%)	1(1.9%)	3(6.5%)
Double outlet right ventricle	2(2%)	1(1.9%)	1(2.2%)
Aortic stenosis	3(3%)	3(5.6%)	0(0%)
Anomalous left coronary artery from pulmonary artery	1(1%)	1(1.9%)	0(0%)
Total	100(100%)	54(100%)	46(100.0%)

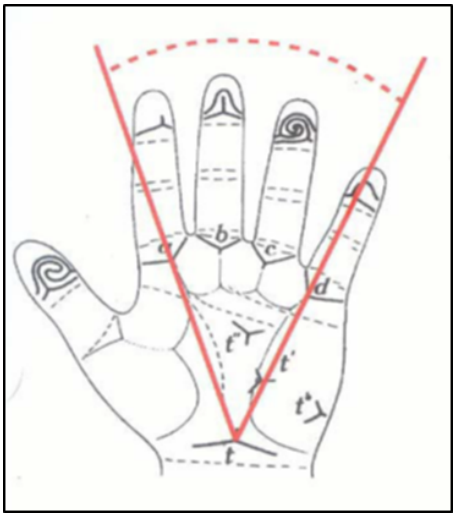

Fig. 2: Method of measuring atd angle.

Table 2: Comparison of dermatoglyphic parameters in Normal and CHD children

Dermatoglyphic parameters	Normal	CHD	P value
atd angle RT	38.04±2.68	47.00±5.55	<0.001
atd angle LT	38.37±2.81	167.01±36.55	<0.001
a-b RC, RT	33.07±3.89	37.21±4.87	<0.001
a-b RC, LT	33.61±3.65	37.98±4.52	<0.001

Table 3: Comparison of dermatoglyphic parameters in normal and CHD male children

Dermatoglyphic parameters	Normal	CHD	P value
atd angle RT	37.98±2.56	47.74±5.43	<0.001
atd angle LT	38.07±2.93	47.58±4.77	<0.001
a-b RC, RT	32.00±3.79	36.94±4.30	<0.001
a-b RC, LT	32.46±3.24	37.94±4.79	<0.001

Table 4: Comparison of dermatoglyphic parameters in normal and CHD female children

Dermatoglyphic parameters	Normal	CHD	P value
atd angle RT	38.11±2.84	46.12±5.62	<0.001
atd angle LT	38.72±2.66	46.78±6.63	<0.001
a-b RC, RT	34.33±3.65	37.52±5.48	<0.001
a-b RC, LT	34.96±3.68	38.02±4.25	<0.001

Table 5: Comparison of dermatoglyphic parameters in acyanotic and cyanotic children

Dermatoglyphic parameters	Normal	CHD	P value
atd angle RT	47.35±5.72	45.50±4.69	0.209
atd angle LT	47.76±5.81	45.05±4.69	0.056
a-b RC, RT	37.03±4.98	37.95±4.38	0.450
a-b RC, LT	37.83±4.60	38.60±4.26	0.496

Table 6: Comparison of atd angle increased in CHD children by various authors

Study	No of cases	'atd' angle in CHD children compared to controls	
		Right	Left
Brijendra Singh et al	150	Increased	Increased
Vaishali S et al	100	Increased	Increased
Anjali W et al	100	Increased	Increased
Durgawale J et al	102	Increased	Increased
Present study	100	Increased	Increased

5. Discussion

Many studies have showed association between variations in palmar ridge patterns and congenital disorders including congenital heart disease. In our study there was significant increase in 'atd' angle of both palms of children with congenital heart disease compared to normal children due to distal placement of tri radius. Similar results were seen in previous studies conducted by Vaishali S et al,[6] Brijendra Singh et al,[7] Anjali W et al,[8] and Durgawale J et al[9]. (Table-6) The present study showed significant increase in a-b ridge count of both hands of children with congenital heart disease. Study conducted by Brijendra Singh et al, and Durgawale J et al. also showed similar results. There was no significant change in Simian crease and Sydney line in children with congenital heart disease compared to normal children. Study conducted by Renuka Nair et al[10] and Anita khalil et al showed similar results.

6. Conclusion

In our study various palmar dermatoglyphics were studied in children with congenital heart disease and compared with the normal children. Study showed significant increase in atd angle and a-b ridge count in children with congenital heart disease compared with normal children. These observations can provide an additional help in the diagnosis of congenital heart diseases when combined with other clinical parameters. Dermatoglyphics can be used as a predictive indicator about congenital cardiac diseases in population studies, easy to carry out with minimum time and expenses. A large-scale study should be undertaken to draw more useful and definitive conclusions regarding the value of dermatoglyphics in congenital heart diseases.

7. Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

8. Source of Funding

None.

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