

Dermatoglyphics In Congenital Heart Diseases In Children

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Abstract: Dermatoglyphics is the scientific study of fingerprints, epidermal ridges and different patterns of epidermal ridges. Dermatoglyphs are the patterns or configurations of epidermal ridges on polar aspects of hand and feet. The present study aims to analyse the dermatoglyph in congenital heart diseases and compare them with that of normal controls. 100 children with congenital heart diseases were used as cases and 100 children without any history of cardiac illness were included in the study. Children having congenital heart diseases proven by clinical, ECG & 2D echo are included in the study. Children with deformities of hand are excluded from the study. Their dermatoglyphs analysed and discussed. Variations in the percentages of finger tip patterns, increased frequency of hypotenar patterns and wide atd angles are associated with certain forms of congenital heart diseases. This supports the view that some of the cardio vascular anomalies are genetically determined. So dermatoglyph analysis may be used as a screening procedure for identifying congenital heart diseases.

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I. Introduction :

Dermatoglyphics is the scientific study of fingerprints, epidermal ridges and different patterns of epidermal ridges. Dermatoglyphs are the patterns or configurations of epidermal ridges on polar aspects of hand and feet. Originally fingerprints were used for personal identification. This dates back to 3000 BC in China and other eastern countries. The emperor of china used his thumb print as an official seal. During 500 BC, Chinese potters used thumbprints to mark their ownership. During same period, Babylonian businessman used fingerprints in their business transactions on clay tables.[1] Dr Harold Cummins (1926) coined the term "Dermatoglyphics" which is derived from two greek words: Derma - Skin; Glyphics - Carvings.[2]

Dr Harold Cummins was the first person, who suspected genetic abnormality in children with mongolism during his study in 1936.[3] This was proved in 1959 and from that time onwards dermatoglyphics moved from obscurity to be used as a parameter in the diagnosis of medical disorders. Factors that help dermatoglyphics useful as an aid, in the diagnosis of certain disorders are due to full development of epidermal ridges and their patterns at birth, which remain unchanged for life. 2. Recording of fingerprints is a rapid inexpensive and safe procedure. 2. Immediate obtainability of results. [4]

Dermatoglyphics as a screening method: 1. For identifying patients with genetic abnormalities 2. To screen relatives of patients with chromosomal aberrations. 3. To evaluate the effects of toxins on intrauterine environment. 4. To evaluate children with suspected genetic disorders, diseases with long latency, slow progression and late onset, dermal ridge formation occurs early in fetal development, between 6-7 weeks after conception and gets completed by 21 weeks after conception. Their formation is affected by Genetic factors and environmental factors. Cardiac embryogenesis also occurs during early gestation. So, any abnormality with the above two factors, not only lead o development of abnormal dermatoglyphics, but also the development of congenital heart diseases. The present study aims to analyse the dermatoglyph in congenital heart diseases and compare them with that of normal controls.

II. Methodology :

100 children with congenital heart diseases were used as cases and 100 children without any history of cardiac illness were included in the study. Children having congenital heart diseases proven by clinical, ECG & 2D echo are included in the study. Children with deformities of hand are excluded from the study.

Recording of permanent impressions or prints are one by Standard methods that include Ink Method, Inkless method, transparent adhesive tape method and photographic method. Certain special methods like Hygrography, radiodermatography and plastic mold method are also used in certain cases.

The Palmar imprint is taken by classic ink method. The ink roller or applicator with ink is applied to cover the entire palm including the wrist creases, the thenar & hypothenar borders and digits. Then the wrist is placed on a sheet of paper over a foam pad on a flat table and the hand is gently, uniformly & firmly moved

forwards to press on the paper. The foam pad is used to fill the concavity of the palm when pressed firmly on the paper. Then each digit is pressed and rolled gently to get their prints. The dermatoglyphics patterns of palms and fingers will be studied and the information will be recorded systematically using the parameters that are used to study the dermatoglyphics.

In each diagnostic group the following were compared between patients and controls. (1) Finger print patterns on individual digits. (2) Thenar patterns (3) Hypothenar patterns. (4) Palmar flexion creases. (5) atd angle.

III. Results :

Finger prints and palm prints of one hundred children with congenital heart diseases and one hundred normal children of the same age group as control were collected. Children with congenital heart diseases were categorized in to four groups :

1. Atrial septal defect (28 cases) 2. Ventricular septal defect (26 cases) 3. Tetralogy of fallot (28 cases) 4. Other congenital heart diseases (18 cases).

Finger tip patterns :

In children with Atrial septal defect, Ulnar loops showed an increased percentage, whorls showed a decreased percentage, than in control. Radial loops and arches showed no significant differences between children with atrial septal defect and controls.

Children with Ventricular septal defect showed an increases percentage of ulnar oops and decreased percentage of whorls, than in controls. Radial loops and arches showed no significant differences in the disease control groups.

In children with tetralogy of fallot a decreased percentage of ulnar loops and increased percentage of whorls were observed, than in controls. Radial loops and arches showed no significant difference etween disease and control groups.

Children with other congenital heart diseased (pulmonary stenosis, Paten Ductus arteriosus, AV canal defect) showed an increased percentage of arches and decreased percentage of whorls, than in controls. Radial loops and ulnar loops showed no significant difference between disease and control groups.

All children with congenital heart iseases considered as a whole, when compared with control group showed an increased percentage of ulnar loops and decreased percentage of whorls than in controls. Radial loops and arches sowed no significant difference between control and disease groups. Observation of the present study are correlating with previous studies.

Thenar / First interdigital pattern :

Showed no significant differenc in the percentage incidence between children of congenital heart diseases and normal children.

Hypothenar pattern :

In the present study percentage incidence of hypothenar patterns showed statisitically significant values in children with congenital heart diseases than in normal children. Atrial septal defect (25%, 4%) , Ventricular septal defect (35%, 23%) , Tetralogy of fallot (50%, 39%), Other congenital heart diseases (39%,33%), all congenital heart diseases (37%, 27%) and controls (9%,8%).

Palmar Flexion creases : Palm prints of 00 children with congenital heart disease, either group wise or as a while showed no difference in the percentrageincidence of single palmar crease and noral palmar flexion creases between the disease groups and control group.

ATD Angle : Increased percentage incidence of wider atd angles were observed in children with ASD (50%,61%). VSD (62%,65%), Tetralogy of fallot (64%,61%) and all congenital heart diseases considered as a whole (52%,53%), than in normal controls(16%,15%), which are statisitically significant. No significant difference was observed between children with other congenital heart diseases (22%, 11%) and control group (16%,15%).

IV. Discussion :

Several previous studies of dermatoglyphics in CHD have been made. The earliest report by Hale and associates [5] was published in 1961. They compared 157 patients who had different types of CHD with 143 patients who had acquired heart disease. A distally displaced axial triradius was twice as common in those with CHD. Distal axial triradii cause widening of the atd angle. The same year, Rowe and Uchida [6] reported that mongoloid children with CHD had a higher frequency of distally displaced axial triradii than did mongoloid children with normal hearts. However, distal axial triradii were found with higher frequency in both groups of

mongoloids than in a normal population. Fried and Neel,[7] in a published abstract in 1962, commented on the higher frequency of wide atd angles and distal axial triradii in patients with CHD. Of 15 patients with CHD studied by Christensen and Nelson,[8] 11 (73%) had distal or multiple axial triradii whereas only six of 25 (24%) with acquired heart disease had this dermatoglyphic stigma. Sanchez Cascos [9-10] studied dermatoglyphics in 150 patients with CHD and in 50 controls. He observed a higher frequency of arches on finger tips in patients with pulmonary stenosis and an unusually high frequency of ulnar loops associated with ventricular septal defects. Radial loops were somewhat more common in patients with atrial septal defect, and whorls were more frequently associated with aortic stenosis, aortic coarctation, and tetralogy of Fallot. On the palms, wide atd angles occurred more often in patients with CHD, especially in the group with Fallot's tetralogy. Sanchez Cascos postulated that the patients with CHD who showed abnormal dermatoglyphics represented the fraction of CHD that was genetically determined. Weninger and her associates [11] reported a high frequency of whorls and a higher total ridge count in males with patent ductus arteriosus and in females with aortic stenosis. The A main line tended to follow a longitudinal course. In their series of CHD, the frequency of distal axial triradii was not significantly increased, but the frequency of hypothenar patterns was elevated. Takashina and Yorifuji,[12] studying Japanese and American subjects, observed a distal axial triradius in 64% of 44 patients with CHD compared with 16% of 362 patients with acquired heart disease. They had no normal control sample. In a series by Emerit and co-workers [13] consisting of 330 patients with CHD and 200 with acquired heart disease, distal axial triradii were present in about one third of the former and only one fifth of the latter. A single transverse palmar crease was significantly increased in those whose cardiac defect was associated with other congenital anomalies. Hypothenar patterns were increased in frequency. Arch patterns occurred less often in those whose cardiac defect was the only malformation detected. In 21 cases of familial cardiac defects, ulnar loops increased and whorl patterns decreased. The most recently reported series published by Burguet and Collard [14] consisted of 98 patients with CHD and 198 normal controls of similar age. Patients with ventricular septal defect and patent ductus arteriosus had distal axial triradii more often than did controls. Burguet and Collard pointed out that cardiac differentiation occurs embryologically between the third and the ninth week of gestation and dermatoglyphics differentiate between the seventh and twelfth week. Hence, anomalies which occur late in cardiac embryogenesis, such as ventricular septal defect, may logically be expected to be associated with dermatoglyphic abnormalities as was observed.

Dermatoglyphics develop during the end of the first trimester and the beginning of the second after much of the heart is already formed. However, the anlage of the ridges, the volar fat pads, are present earlier and it is conceivable that the factors present during a critical period of gestation may alter both the formation of the heart and the palmar ridges. Alternatively, a genetic factor may determine both the occurrence of certain types of heart disease like tetralogy of Fallot and ventricular septal defect and the position of the axial triradius. Evidence to support either of these conjectures is lacking at present. Of those investigators who have studied dermatoglyphics in specific types of CHD, Burguet and Collard [15] observed an increased atd angle or distal axial t in ventricular septal defect and patent ductus arteriosus. Sanchez Cascos [10] reported it in Fallot's tetralogy, and Emerit's group," in a variety of specific defects. In many of these series, the number of cases of each type of defect was small. Even in the present study, which included a rather large sample, sufficient cases of only a few of the cardiac defects were available to make a detailed statistical analysis worthwhile.

V. Conclusion :

Variations in the percentages of finger tip patterns, increased frequency of hypotenar patterns and wide atd angles are associated with certain forms of congenital heart diseases. This supports the view that some of the cardio vascular anomalies are genetically determined. So dermatoglyph analysis may be used as a screening procedure for identifying congenital heart diseases.

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