Original Article

Dermatoglyphics – A Diagnostic Tool To Predict Ventricular Septal Defect In Children

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Abstract:

Current study is to evaluate the dermatoglyphs, which can be used as a diagnostic tool for an easy, economically viable and early detection of ventricular septal defect (VSD), a congenital heart disease in children with a family history. Hand prints were taken by the INK METHOD described by Cummins & Midlo (1961). The dermatoglyphs of 100 children with congenital heart diseases aged between 3 to 12 years were compared with dermatoglyphs of 100 normal children (controls – CON) of the same age group.

Present study showed statistically significant increased percentage of incidence of ulnar loops in children with VSD (74%) than in controls (56%). Whorls showed significantly decreased percentage of incidence in disease group than in controls (17% - VSD, 34% - CON).

Incidence of Hypothenar patterns showed statistically higher values in the disease group (34% - right hand & 23% - left hand) than in the control group (9% & 8%).

Children with VSD showed statistically wider atd angles (62% - right hand & 65% - left hand) than in control group (16% & 15%).

So Dermatoglyphs analysis may be used as a diagnostic tool to detect congenital heart diseases in children with a family history of congenital heart disease.

Keywords: Dermatoglyphics, Congenital heart diseases, Ventricular Septal Defect.

INTRODUCTION:

Dermatoglyphics is the scientific study of finger prints, epidermal ridges and different patterns of epidermal ridges. The dermal ridges formation occurs early in fetal development between 6-7 weeks of intrauterine life and gets completed by 21 weeks of intrauterine life. Cardiac embryogenesis also occurs during early gestation which coincides with the formations of dermatoglyphs. Interplay of genetic and environmental factors affect the formation of dermatoglyphs and also affects the development of heart. (Blanka Schaumann,Milton Alter. Dermatoglyphics in Medical disorders. P 1-7)[1]

Due to this coincidence dermatoglyphs can be used as an aid in the diagnosis of congenital heart diseases. Other factor which help dermatoglyphs usefulness as an aid in the diagnosis of medical disorders include 1) complete development of epidermal regions and patterns before birth itself and after birth they remain unchanged throughout the life, 2) Collection of dermatoglyphs is a rapid, inexpensive, non- invasive and safe procedure, 3) Immediate availability of results.

According Andres SC (1964)[2] - percentage incidence of arches (5 to 10%), Ulnar loops (60% - 70%), Whorls (15% - 30%), Radial loops (6% & 3-5%) both in disease and normal controls i.e. with no significant difference between two groups.

Milton A and Robert S (1970) [3] study showed no difference in the incidence of fingertip patterns between two groups but atd angles were wider in disease group.

Jason B (1972)[4] – study showed reduced whorls in VSD and no difference in other fingertip pattern incidence between VSD and normal controls.

According to David TJ (1981) [5] – No significant difference was observed in the incidence of fingertip patterns between two groups but disease group showed statistically increased frequency of Hypothenar patterns.

Study of Wanjari AN and Palikundwar KG (2002)[6] revealed significantly decreased whorls and increased Ulnar loops whereas radial loops showed decreased and arches showed increased incidence in disease group.

In Singh B et al (1996)[7] study statistically significant wider atd angles were observed in disease group.

Andres SC (1965)[8] study revealed and increased incidence of statistically significant wider atd angles (above 46^0).

Ahuja Y R et al (1982)[9] study showed wide and significant atd angles.

Brijendra Singh et al (2002) [10] study showed statistically significant wider atd angles.

METHODS:

Materials used were – 1) Big stamp pad, 2) White papers, 3) Spirit 4) Gloves, 5) Magnifying lens, 6) Protractor.

Method: using standard ink method, (Blanka Schaumann, Milton Alter. Dermatoglyphics in Medical disorders. P 13-24)[11] permanent finger and palm prints of 100 children with congenital heart diseases aged between 3 to 12 years whose diagnosis was first done by clinical examination, which later was confirmed by chest X-rays (PA view), ECG, 2D echo, cardiac catheterization and that of 100 normal children of the same age group were collected from CARE hospital, Hyderabad, from 2007 to 2009. The entire palm and fingers were inked using stamp pad. A sheet of white paper was placed on a firm and flat surface. Then palm and finger prints were obtained by placing the palmar side of hand on the paper and by pressing the back of hand firmly on the white paper.

After clinical examination and after necessary investigations, ventricular septal defect was diagnosed in 26 children out of 100 with congenital heart diseases.

Sir Francis Galton (1982) classified the epidermal ridge patterns, depending upon the presence of triradius or delta into three basic types which include the arches, loops and whorls. A triradius or delta is defined as the meeting place of 3 ridge systems of the triradius point which make an angle of 120^0 with each other.

According Galton system of classification, dermatoglyphs can be analysed in two ways.

1) Qualitative analysis
2) Quantitative analysis

In the present study parameters analysed by Qualitative analysis included:

- Fingertip patterns
- Thenar / first interdigital patterns –
- Hypo thenar patterns
- Palmar flexion creases

By Quantitative analysis

- atd angle, were analysed (atd angle – the angle between the two lines drawn from digital triradii 'a' and 'd' to the axial tri radius 't'. normal atd angle measures about 45^0 or less).

Arches, ulnar loops, radial loops and whorls were the fingertip patterns observed.

For fingertip pattern analysis each individual is counted only once. Analysis was done by summing the occurrence of each type of fingertip patterns on the five digit of both right and left hands together.

Each fingertip pattern percentages were calculated by:

$$\frac{\text{Summed value of a pattern}}{\text{Total No. of patterns}} \times 100$$

Other parameters under qualitative analysis, were analysed separately for both right and left hands in disease and control group and were placed in 2 categories.

First category included children who have patterns and the second category included children not having those patterns.

Same method was followed for analysis of palmar flexion creases

First group included children with abnormal palmar crease i.e., single or simian palmar crease. The second group included with normal palmar crease.

atd angle – analysis of atd angle, was done by dividing children both in the disease and control groups, into 2 categories according to the range of atd angle.

In the first category, atd angle is between 30^0 to 45^0 and in the second category, atd angle ranged between 46^0 to 70^0 i.e. wider atd angle.

Statistical significance of the observations was done by chi- square test and 'p' value.

RESULTS & DISCUSSION:

Present study revealed no significant difference between disease and control groups, regarding percentages of arches (6% in VSD and 7% in CON) and also Radial groups (3% in VSD and CON).

Ulnar loops were 74% in VSD and 64% in CON, significantly increased in the disease group. Whorls 17% in VSD and 34% in CON, significantly decreased in the disease group.

With regard to Thenar / first interdigital patterns no significant difference was found between disease and control groups. Incidence of Hypothenar patterns is statistically significant in disease group. Palmar flexion creases are normal both in disease and control groups. Statistically highly significant wider atd angles were observed in disease group.

Observations of the present study are shown in table No.1 & 2.

Table 1: Qualitative Analysis

Parameter		VSD		CON		Significance
Fingertip patterns	Arches	6%		7%		No significant difference
	Ulnar loops	74%		56%		Significantly increased in VSD
	Radial loops	3%		3%		No significant difference
	Whorls	17%		34%		Significantly decreased in VSD
Thenar/ first interdigital patterns		Rt. Hand 19%	Lt. hand 12%	Rt. Hand 16%	Lt. hand 15%	Statistically insignificant
Hypothenar patterns		Rt. Hand 35%	Lt. hand 23%	Rt. Hand 9%	Lt. hand 8%	Statistically significant in VSD
Palmar flexion creases		Rt. Hand Normal	Lt. hand Normal	Rt. Hand Normal	Lt. hand Normal	

Table 2: Quantitative Analysis:

Parameter	VSD		CON		Significance
atd angle range 46^0-70^0	Rt. Hand 62%	Lt. hand 65%	Rt. Hand 16%	Lt. hand 15%	Highly significant in VSD

The Observations of the present study and previous studies parameter wise are shown from Table No. 3 to Table No.7.

Table 3: Comparative study of fingertip patterns in VSD

Author	Arches	Ulnar loops	Radial loops	Whorls
Andres S C (1964)[2]	No significant difference	75%-VSD, 60-70% controls	No significant difference	No significant difference
Milton A (1970)[3]	No significant difference	No significant difference	No significant difference	No significant difference
Jason B (1972)[4]	No significant difference	No significant difference	No significant difference	Reduced
David T.J. (1981)[5]	No Significantly increased	No significant difference	No significant difference	No significant difference
Wanjari et al (2002)[6]	Increased	Significantly increased	Decreased	Significantly decreased
Present study	6%-VSD, 7%-CON No significant difference	74%-VSD, 56%-CON significantly increased	3%-VSD, 3%-CON No significant difference	17%-VSD, 34%-CON significantly decreased

As per the observations shown in the table No.3.

Frequency of arches in the present study showed (6% in VSD and 7 % in controls) no significant difference between the disease and control group. This coincided with the studies of Andres S C (1964)[2], Milton A (1970)[3], Jason B (1972)[4] and David T J (1981)[5], but results of Wanjari et al (2002)[6], showed increased arches. *Ulnar loop Frequency*

Showed statistically significant increase in the present study group (74% in VSD, 56% in control). This is in concurrence with the results of Sanchez Cascos (1964)[2] (75% in VSD and 60- 70% in controls) and Wanjari et al (2002)[6]. But differed with the results of Milton A et al (1970)[3], Jason B (1972)[4] and David T J (1981)[5] which showed no significant difference between the two groups. *Radial loops* Observations of the present study (3% VSD and 3% in controls) were in concurrence with the results of Andres S C (1964)[2], Milton A et al (1970)[3], Jason B (1972)[4], David T J (1981)[5], whereas Wanjari et al (2002)[6] study showed a decrease. *Whorls* in the present study were significantly decreased in the disease group (17% in VSD compared to control group 34%). This is in concurrence with the results of Jason B (1972) [4], Wanjari et al (2002)[6], whereas results of Andres S C (1964)[2], Milton A et al (1970)[3] and David T J (1981)[5] showed no significant difference between the two groups.

Table 4: Comparative study of Thenar and first interdigital in VSD

Author	Thenar/First Interdigital patterns	
	Right hand %	Left hand %
Milton A et al (1970) [3]	No significant difference	No significant difference
David T J (1981) [5]	No significant difference	No significant difference
Present study	No significant difference	No significant difference

As per the observations showed in table No.4.

The results of present study, in relation to Thenar / First interdigital patterns were in concurrence with the results of Milton A et al (1970)[3] and David T J (1981)[5].

Table 5: Comparative study of Hypothenar patterns in VSD

Author	Hypothenar patterns	
	Right hand %	Left hand %
David T J (1981) [5]	Increased frequency, significant	Increased frequency, significant
Wanjari A N et al (2002) [6]	Increased frequency	Increased frequency
Present study	Increased frequency, significant	Increased frequency, significant

As per the observations shown in the table No.5. The results of the present study in relation to hypothenar patterns were in concurrence with results of David T J (1981)[5], Wanjari A N et al (2002)[6].

Table 6: Comparative study of Palmar flexion creases in VSD

Author	Palmar flexion creases			
	Right Hand		Left hand	
	Simian line	Normal	Simian line	Normal
Milton A et al (1970) [3]	No significant difference		No significant difference	
David T J (1981) [5]	No significant difference		No significant difference	
Present study	No difference		No difference	

As per the observations shown in the table No.6. In the Milton A et al (1970)[3] study, there was no difference in simian line frequency between disease group and control group. David T J (1981)[5] observations showed incidence of single palmar crease 3% in disease group and 0.5% in the control group without statistical significance. In the present study single palmar crease was not observed in right and left hands of both in disease and control groups.

Table 7: Comparative study of atd angle in VSD

Author	atd angle
Andres S C (1965) [8]	Wide
Milton A et al (1970) [3]	Wide
Ahuja Y R (1982) [9]	Wide
Singh B et al (1996) [7]	Wide, significant
Brijendra S et al (2002) [10]	Wide, Highly significant
Present study	Wide, Highly significant

As per the table No. 7. Observations of the present study showed wider atd angle in diseased children, were in concurrence with the results of Andres S C (1965)[8], Milton A et al (1970)[3], Ahuja Y R (1982)[9], Singh B et al (1996)[7], Brijendra S et al (2002)[10].

CONCLUSION:

Children with ventricular septal disease showed an increased percentage of ulnar loops (74% VSD and 56% in controls) and a decreased percentage of Whorls (17% in VSD and 34% in controls), in the present study.

No significant difference in the percentages of Radial loops and Arches, was observed in both the disease and control group.

There is no significant difference found, in the percentage incidence of Thenar and first interdigital patterns between children with ventricular septal defect and normal children.

Incidence of Hypothenar patterns showed, statistically higher values in the disease group (35%, 23%) than in the control group (9%, 8%).

With regard to palmar flexion creases, only normal flexion creases are observed both in disease and control groups.

atd angle- statistically significant increased percentage incidence of wider atd angles (62%, 65%) were observed in the disease group than in control group (16%, 15%). So, by this, it can be concluded that dermatoglyphs analysis can be used as a screening procedure to identify congenital heart diseases in children with family history.

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Cite this article as: Pushpamala N. Dermatoglyphics – A Diagnostic Tool To Predict Ventricular Septal Defect In Children. MRIMS J Health Sciences 2015;3(2):222-226.

Source of Support: Nil. **Conflict of Interest:** None.