DERMATOGLYPHICS IN CONGENITAL PROFOUND SENSORINEURAL HEARING LOSS: A DISEASE MARKER ?

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ABSTRACT

A dermatoglyphic profile was carried out in 108 cases of congenital profound sensorineural hearing loss (SNHL) with delayed development of speech and language (DDSL). Rolled finger prints and palmar patterns were obtained by the ink method and analysed by the Galton system. In the genetic group (Group A) triradii 6 was present whereas it was absent in the nongenetic (Group B) group and their controls ($p<0.001$). Loop pattern in interdigital areas did not vary significantly from controls. The average 'atd' angle in Group A was 41° and that in the Group B was 46° ($p>0.5$). Ulnar loops predominated over the radial loops. Absence of CPW on thumbs of Group A was noted. Total ridge count in the Group A was 98.84 and 109 in the Group B ($p<0.05$). It was observed that no definite pattern existed in a constant fashion and it also exhibited a great degree of variation, hence their role in detection of hearing loss is questionable.

Key words: *Dermatoglyphics, Congenital hearing loss.*

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Received for publication: March 3, 1992; Accepted: January 15, 1993

The term dermatoglyphics (derma = skin, graphics = carvings) implies the scientific study of epidermal pattern and was coined by Cummins and Midlo(1). The dermatoglyphic peculiarities in various disorders like Mongolism, Turner's syndrome, phenylketonuria, epilepsy, leukemia(2), congenital cataracts(5), rubella embryopathy(6) and differentiation between mono and dizygotic twins(3) has been long since established. The idea of carrying out this study was to know whether dermatoglyphics could aid as a diagnostic tool in diagnosis of congenital sensory neural hearing loss (SNHL).

Material and Methods

This study was carried out in the Department of Otorhinolaryngology, M.G. Institute of Medical Sciences, Sevagram, in the period between February 1990 and December 1991. A group of 108 cases with congenital SNHL with delayed development of language and speech (DDSL), were studied and compared with equal number of age and sex matched controls. The cases were divided into Group A with a genetic and early (0-12 wks) antenatal etiology, and Group B with a non-genetic, perinatal and postnatal etiology.

A detailed general ear, nose, throat examination followed by audiological, pediatric, ophthalmological, psychiatric evaluation, blood and urine analysis along with ECG and skiagrams were carried out to exclude other congenital anomalies. Dermatoglyphic patterns of the 108 cases in age group of 2-30 years along with equal number of controls were collected by the ink method. The Chi square (χ^2) test was used for statistical analysis.

Classification of patterns were as follows (*Figs. 1* and *2*).

A. ***Palmar Patterns*** (*Fig. 1*)

1. Triradius (T) is formed by the confluence of three ridge systems positions of axial triradii forming angles greater than 56° are designated distal.
2. Interdigital areas ($I_{2,3,4}$) are found in the distal palm in the region of the heads of the metacarpal bones.
3. 'atd' angle is formed from lines drawn from distal triradius 'a' to axial triradius 't' and from this triradius to distal triradius 'd' (*Fig. 1*).

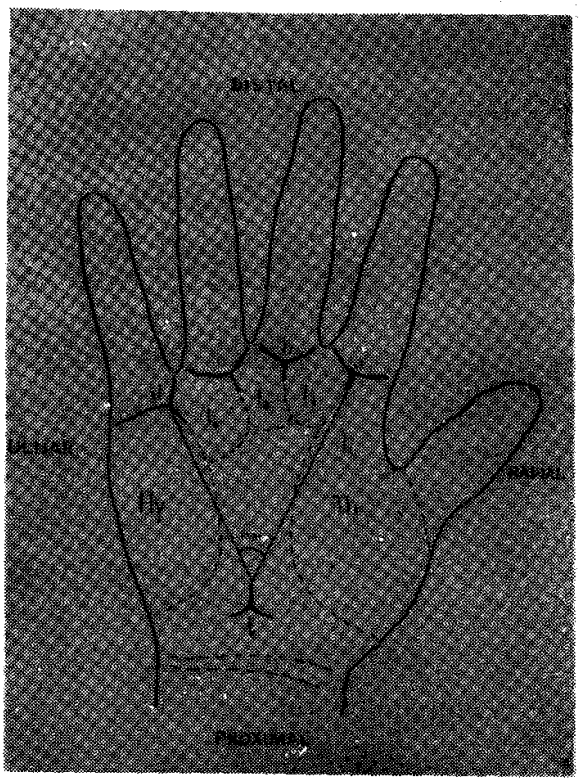

Fig. 1. Palmar Patterns.

B. ***Finger Patterns*** (*Fig. 2*)

1. *Loops:* (*a*) ulnar loop (UL) when ridge patterns open on the ulnar side, (*b*) radial loop (RL) when ridge patterns open on the radial side (*Fig. 3*).
2. *Whorls:* (*a*) simple whorl (SW) a succession of concentric rings, (*b*) central

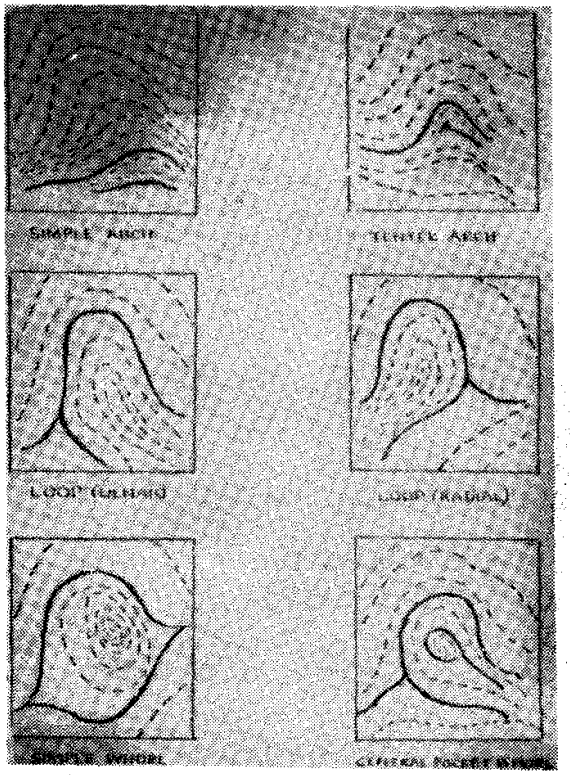

Fig. 2. Finger Patterns.

Fig. 3. Loops.

pocket whorl (CPW) when the pattern contains a loop within which a smaller whorl is located (*Fig. 4*).

3. *Arch:* (*a*) simple arch, (*b*), tented arch (*Fig. 5*).

C. Total count (TRC) is made by counting the ridges crossed by a line from triradius to core. The ridge forming the core is not counted.

Fig. 4. Whorls.

Results

A. *Palmar Patterns*

1. *Triradius:* Children in Group A exhibited triradius between 4 and 6, whereas in Group B and respective controls there was absence of triradius 6 (*Table I, Fig. 1*) and this was of statistical significance ($p<0.001$).
2. *Interdigital areas:* Loop pattern is seen to predominate in I_3 in Group A whereas open pattern predominate in controls. Loop patterns in Group B did not vary significantly from controls (*Table II*).
3. 'atd' *angle:* The 'atd' angle in Group A was 41° and that in control was 44.6° and this was not statistically significant ($p>0.5$) (*Table III*).

Fig. 5. Arch.

B. *Finger Patterns*

1. *Loops:* The UL (55.5% R; 55.5% L) in Group A predominated over RL (3.1% R; 0.4% L) and this was not statistically significant (*Table IV, Fig. 3*).
2. *Whorls:* CPW were absent on thumbs in Group A whereas they were present in controls and in Group B (6.3% R; 3.15% L) and this was not statistically significant (*Table IV, Fig. 4*).
3. *Arch:* The arch pattern (7.5% R; 8.44% L) in Group A did not vary significantly from controls ($p>0.5$,

TABLE I–*Triradius Distribution (n = 108)*

No. of Triradii	Group A		Group B	
	R	L	R	L
4	5 (2)*	4 (3)	7 (3)	3 (8)
5	36 (43)	36 (42)	55 (60)	60(55)
6	4 (-)	5 (-)	- (-)	- (-)

* Figures in parentheses indicate controls.

TABLE II–*Interdigital Loops (n = 108)*

Interdigital	Pattern	Left hand	Right hand
Group A	I_2	9 (7)*	10 (9)*
	I_3	36 (22)	21 (24)
	I_4	28 (23)	25 (21)
Group B	I_2	15 (14)	12 (20)
	I_3	35 (29)	20 (25)
	I_4	20 (15)	25 (16)

* Figures in parentheses indicate controls.

TABLE III–*'atd' Angle Distribution in Study Group A, B and Controls of Two Groups (n = 108)*

'atd' angle		30-34	35-40	41-45	46-50	51-55	56-60	>60
Group A	R	4	16	2	1	2	-	
	L	0	14	18	10	1	1	-
Group A	R	1	16	24	3	1	-	-
Controls	L	1	19	20	4	1	-	-
Group B	R	0	17	32	8	6	0	-
	L	0	18	29	8	8	0	-
Group B	R	-	13	35	7	5	3	-
Controls	L	-	15	37	5	3	3	-

$\chi^2 = 0.39$). The arch pattern in Group B (2.53% R; 5.09% L) did not vary significantly with both controls ($p < 0.5$; $\chi^2 = 1.1$) and Group A ($p < 0.1$; $\chi^2 = 3.2$) (*Table IV, Fig. 5*).

C. *TRC:* TRC in Group A was 98.84 and that in controls 121, and this was statistically significant ($p < 0.5$; z value = 2.013). The TRC in Group B showed a value of 109 and that in the con-

TABLE IV—*Digital Patterns in Group A and B Along with Controls of Each Group (n = 108)*

Digits	A		U		R		W		CPW	
	S	C	S	C	S	C	S	C	S	C
Group A										
Thumb	2 (4)*	2 (2)	22 (24)	20 (20)	- (-)	- (-)	21 (17)	19 (20)	- (-)	4 (3)
Index	2 (4)	5 (5)	20 (24)	22 (25)	7 (1)	2 (4)	11 (15)	14 (9)	5 (1)	2 (2)
Middle	5 (4)	4 (7)	34 (32)	31 (31)	- (-)	1 (-)	5 (6)	8 (7)	1 (3)	1 (1)
Ring	4 (4)	2 (2)	20 (24)	16 (20)	- (-)	- (-)	17 (11)	22 (20)	4 (6)	5 (3)
Little	4 (3)	2 (2)	29 (33)	36 (32)	- (-)	- (-)	9 (8)	5 (9)	3 (1)	2 (2)
Group B										
Thumb	2 (3)*	3 (4)*	35 (28)	36 (41)	2 (-)	- (3)	20 (30)	20 (12)	4 (2)	4 (3)
Index	4 (5)	3 (3)	36 (30)	30 (36)	4 (-)	5 (-)	16 (25)	22 (22)	3 (3)	3 (2)
Middle	2 (8)	5 (5)	41 (40)	32 (42)	- (-)	- (-)	18 (11)	23 (13)	2 (4)	3 (3)
Ring	- (-)	3 (5)	25 (20)	30 (35)	- (-)	1 (-)	34 (40)	25 (20)	4 (3)	4 (3)
Little	- (-)	5 (1)	35 (27)	37 (20)	- (-)	- (-)	27 (33)	21 (32)	1 (3)	- (-)

* Figures in parentheses indicate left hand.

S = Study group; C = Controls; A = Arch; U = Ulnar Loop; R = Radial Loop; W = Whorl; CPW = Central pocket whorl.

trol group was 118. The difference in TRC between Group A and Group B was statistically significant ($p<0.05$, z value = 2.12). The females in Group A had a TRC of 86.6 and males a TRC of 111 and this was statistically significant ($p<0.5$).

Discussion

Since the development of epidermal ridges (5-12 weeks) coincides with that of cochlea, the factors affecting the inner ear could influence the epidermal ridges as well(4). With this view in mind, the dermatoglyphic patterns in congenital SNHL with DDSL cases were analyzed.

Athanikar(4) has reported a low ridge count in SNHL with DDSL cases whereas an increased count was seen in normal population(7) similar to our study. The TRC in males is higher than females(2). Similar observations have been noted

by us. Ulnar loop shows predominance over radial group in the Group A and comparable observations have been noted(4). 'atd' angle of less than 40° is seen in affected cases(4) whereas our study reveals no correlation between 'atd' angle and hearing loss and 'atd' angle on its own is of no diagnostic value. Others have reported absence of arch pattern in 1st and 2nd digits of control group(4); we have not observed any such correlation.

The presence of 6 triradii, ridge count of around 98, absence of CPW on thumbs, 'atd' angle less than 34°, are occasionally exhibited in Group A, which are absent in Group B. Hence, dermatoglyphic peculiarities do exist, but not in a constant fashion, therefore, preventing us from using them as a diagnostic tool. The simplicity and ease, coupled with the inexpensiveness of the technique lures oneself to use dermatoglyphics as a diagnostic aid, but of course it is no substitute for periodic audiological evaluation of the cases, which offers a greater diagnostic precision.

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NOTES AND NEWS

XIII ANNUAL CONVENTION OF NATIONAL NEONATOLOGY FORUM

The XIII Annual Convention of National Neonatology Forum is to be held at Baroda from *December 17 to 19, 1993.* This Convention is organized jointly by the Department of Pediatrics, Medical College, Baroda and the Indian Academy of Pediatrics, Baroda Branch.

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