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Palmar dermatoglyphics in carcinoma breast of Indian women

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Abstract

The present study was planned to assess the relationship of palmar dermatoglyphic patterns of hands in women with breast cancer and or at risk for developing breast cancer. This study was conducted on 100 histopathologically confirmed breast cancer patients in women and their digital dermatoglyphic patterns were studied to assess their association with the type and onset of breast cancer. Simultaneously 100 age-matched controls were also selected with no self or familial history of a diagnosed breast cancer and the observations were recorded. The differences of qualitative (dermatoglyphic patterns) data were tested for their significance using the chi-square test, and Student's *t*-test was used for quantitative (ridge counts and pattern intensity index) data analysis. The results of the study indicated statistically significant changes in finger ridge count and fingertip pattern in cases of carcinoma breast as compared to the control group. Palmar dermatoglyphics is simple, inexpensive, anatomical and non-invasive and may be used as a reliable indicator for screening of high-risk population in developing country like India, for early detection and early therapy, thus reducing the morbidity and mortality in cases of carcinoma breast.

***Keywords*:** breast cancer, dermatoglyphics, finger ridge count, palmar prints, fingertip pattern.

Introduction

Dermatoglyphics is relatively a new science, which involves the study of fine patterned dermal ridges on digits, palms and soles. Cummins and Midlo coined the term dermatoglyphics (*derma* – skin; *glyphos* – carvings), for the scientific study of ridge patterns [1]. Each individual's ridge configurations are unique and remain unchanged from womb to tomb has been utilized as means of personal identification. Widespread interest in epidermal ridges developed only in last several decades when it became apparent that many patients with chromosomal aberrations had unusual ridge formations. Dermatoglyphic studies of many genetically inherited diseases like Down's syndrome, leukemia, schizophrenia, diabetes, hypertension, epilepsy have been studied. Breast cancer is one of the most extensively studied cancers and its genetic basis is well established [2, 3].

Inspection of skin ridges, therefore, promised to provide a simple and inexpensive means of determining whether a patient had a particular chromosomal defect but also in patients with single gene disorders and in some, in whom the genetic basis of the disorder is unclear [1]. The annual incidence of breast cancer in India is 28.6/100 000 women and forms 24.7% of all cancers [4]. Considering the high mortality and high morbidity rate due to breast cancer in India, the present study aims to assess whether there is a set of pattern of dermatoglyphics in patients with carcinoma breast. If a meaningful association can be established, dermatoglyphics may be of use in screening inexpensively and non-invasively populations at risk so that anticipation and early detection of symptoms can help in averting the disease or complications associated with the disease.

Material and Methods

This cross-sectional study was carried out among 100 female patients within the age group of 30–60 years, histopathologically confirmed carcinoma breast from M. S. Ramaiah Hospital, Kidwai Memorial Institute of Oncology and Bangalore Institute of Oncology, Bangalore. The controls were women of 30–60-year-old with no signs and symptoms or a family history of carcinoma breast attending hospital for other minor illness. Patients with diabetes mellitus / hypertension / cardiac disease / neurological disorders / psychiatric illness / blind / deaf / tuberculosis / asthma / skin disorders were excluded. The study was conducted after informed consent was obtained from the subjects and approved by the Ethical Committee of the institution.

The method adopted for printing palm was modified ink method by Purvis-Smith SG [5]. The materials used were the printers duplicating ink from Kores, Cardboard roller, gauze pads and sheets of paper. The patients and

controls were asked to wash their hands with soap and water to remove grease and dirt present over the palm. The hands were dried after wiping them with clean cloth. A small quantity of ink was applied over the palm and fingers with a gauze piece and smeared thoroughly in light strokes uniformly. A sheet of paper was kept at the edge of the table. The finger ridges were printed starting from thumb to little finger in the same order. The fingertips were rolled manually to ensure the full prints of the ridges, then the palm was rolled on cardboard roller with paper taking care that the cupped regions of the palm were printed properly.

Method of counting

In a loop: A line was drawn from the core to the triradius and the ridges crossing the line were counted. The opening of the loop to ulnar or radial (side was noted as *Lu* or *Lr*). **In a whorl**: A whorl has two triradii and hence the counting was done with both triradii. From the core, a line was drawn to one triradius and in the same manner to other triradius and counting was done. **In an arch**: The triradius is the core and hence the count is zero. ***Atd*, *adt*, *dat* angles**: A line was drawn from axial triradius 't' to the digital triradii 'a' and 'd' and all the three angles in the triangle were measured using a protractor. ***A–b* ridge count**: The number of ridges crossing the line drawn from 'a' to 'b' was counted. Total finger ridge count (TFRC) was recorded by adding the finger ridge counts taking the highest count of a whorl, of all ten fingers. Absolute finger ridge count (AFRC) was recorded by adding the finger ridge counts, of all ten fingers, taking both the counts of a whorl, if present, into consideration. In the present study, only palms and fingertips were studied. **Parameters observed** are finger ridge count *a–b* ridge count, Total finger ridge count, Absolute finger ridge count, *atd*, *adt* and *dat* angles (Figure 1).

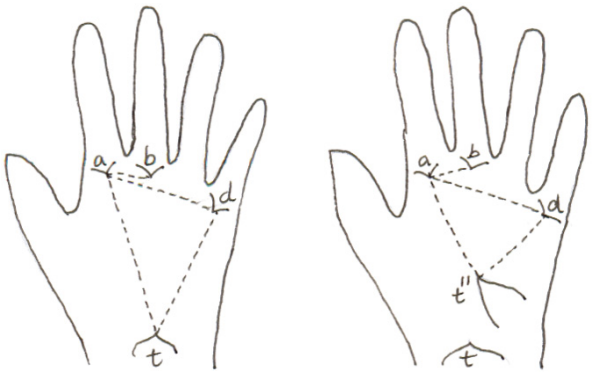

Figure 1 – ***Maximal and minimal atd, dat, and adt angles with a–b ridge count.***

Statistical analysis

Student's *t*-test (independent) two-tailed has been used to find the significance of finger ridge counts, total finger ridge counts, absolute finger ridge count, angles of triradii in palm between cases and controls. Chi-square and Fisher's exact test has been used to find the significance of frequencies of fingertip pattern between cases and controls. Statistical software viz., SPSS 11.0 and Systat 8.0 were used for the analysis of the data.

Results

In the present study it was observed that the finger ridge counts in each digit in each hand (Table 1) reveals the difference between cases and controls were statistically significant ($p<0.001$) indicating that there is a significant increase in finger ridge count in cases when compared to controls. The mean of total and absolute finger ridge count in cases were more than the controls, the difference in total finger ridge count and absolute finger ridge count between cases and controls were statistically significant ($p<0.001$ and $p=0.003$) indicating a significant increase in total and absolute finger ridge count in cases when compared to controls. The mean *a–b* ridge count in right hand of cases and controls were 36.79±7.51 and 31.40±4.91 respectively and left hand of cases and controls showed 35.18±5.94 and 29.74±5.53 respectively, which were also significantly different between the cases and controls ($p<0.001$).

Table 1 – ***Mean pattern of finger ridge counts of cases and controls in digits and hands***

Finger ridge counts	Mean±SD (Min.–Max.)		*p*-value
	Cases	Controls	
Right hand			
Thumb	14.37±3.28 (8–28)	11.56±2.84 (4–22)	<0.001*
Index	12.07±3.44 (5–27)	9.79±2.80 (3–16)	
Middle	12.18±3.22 (6–27)	9.64±2.71 (4–16)	
Ring	13.16±3.18 (6–26)	10.55±2.95 (3–17)	
Little	10.66±2.86 (5–23)	8.84±2.69 (3–14)	
Total	60.97±14.09	47.41±14.11	
Left hand			
Thumb	14.02±3.26 (7–24)	11.33±2.44 (5–18)	<0.001*
Index	12.06±3.07 (5–23)	9.90±2.59 (3–16)	
Middle	12.11±2.94 (4–21)	10.23±2.51 (4–17)	
Ring	13.05±3.54 (6–25)	10.78±3.01 (3–18)	
Little	10.84±2.79 (6–21)	9.39±2.35 (4–15)	
Total	59.36±14.54	47.48±14.01	

*Significant at 1%.

The mean of *atd* angle, *dat* angle are not being statistically significant in both right and left hand of both cases and controls but the mean of *adt* angle on the right hand and left hand of cases were statistically different from that of the controls (Table 2).

Table 2 – ***Mean pattern of angles of palmar triradii in right and left hand of cases and controls***

Angles	Mean±SD (Min.–Max.)		*p*-value
	Cases	*Controls*	
Right hand			
atd	43.51±5.07 (28–67)	43.29±6.07(31–60)	0.781
dat	58.11±4.95 (43–70)	57.29±4.89 (44–68)	0.240
adt	77.75±4.45 (63–88)	79.30±5.43 (61–90)	0.028**
Left hand			
atd	43.33±4.52 (33–60)	43.92±6.26 (33–65)	0.446
dat	58.34±4.99 (40–70)	56.14±4.97 (40–68)	0.002*
adt	77.61±3.89 (67–90)	79.41±4.72 (63–92)	0.004*

*Significant at 1%; **Significant at 5%.

The finger tip pattern of right hand of cases and controls, loops showed a statistically significant difference in digit III and IV ($p<0.05$) indicating a significant

increase in the number of ulnar loops in digit III and IV of right hand of cases. The finger tip pattern of left hand of cases and controls, ulnar loops showed a statistically significant difference in digit II (p<0.05) indicating an increase in the number of loops in digit II of left hand of cases when compared to controls (Table 3).

Table 3 – ***Fingertip pattern in digits and hands in cases and controls***

Digit	Type	Right hand		p-value	Left hand		p-value
		Cases (n=100)	*Controls (n=100)*		*Cases (n=100)*	*Controls (n=100)*	
		Number	*Number*		*Number*	*Number*	
Digit I	Loop	51	51	>0.05	60	55	0.474
	Whorl	47	44	0.487	39	43	0.565
	Arch	2	5	0.436	1	2	>0.05
Digit II	Loop	48	44	0.570	57	43	0.048**
	Whorl	43	42	0.670	37	43	0.386
	Arch	9	14	0.268	6	14	0.059[a]
Digit III	Loop	70	55	0.028**	75	65	0.123
	Whorl	23	31	0.203	20	25	0.397
	Arch	7	14	0.106	5	10	0.179
Digit IV	Loop	64	54	0.030**	61	52	0.199
	Whorl	34	41	0.336	39	45	0.390
	Arch	2	5	0.445	–	3	0.246
Digit V	Loop	91	87	0.366	88	86	0.674
	Whorl	9	13	0.366	12	13	>0.05
	Arch	–	–	–	–	1	>0.05

**Significant at 5%; [a]Near significant.

Fingertip pattern of both hands together in each digit where loops showed a near significant statistical difference (0.072) in digit II, indicating an increase in the loop pattern in digit II of cases when compared to controls. In digits II, III and IV arches showed a statistically significant difference (p≤0.05) indicating that there is a decrease in arch pattern in cases when compared to controls (Table 4).

Table 4 – ***Fingertip pattern in each digit of both hands in cases and controls***

Digit	Type	Cases	Controls	p-value
		Number	*Number*	
Digit I	Loop	111	106	0.616
	Whorl	86	87	>0.05
	Arch	3	7	0.200
Digit II	Loop	105	87	0.072[a]
	Whorl	80	85	0.612
	Arch	15	28	0.050**
Digit III	Loop	145	120	0.008*
	Whorl	43	56	0.132
	Arch	12	24	0.036**
Digit IV	Loop	125	106	0.054[a]
	Whorl	73	86	0.184
	Arch	2	8	0.055[a]
Digit V	Loop	179	173	0.356
	Whorl	21	26	0.438
	Arch	–	1	>0.05

*Significant at 1%; **Significant at 5%; [a]Near significant.

The fingertip pattern of all ten digits showed a statistically significant difference (p=0.005) in the arches of right hand where there is a decrease in arch pattern in cases when compared to controls. Loops in left hand showed an increase in cases when compared to controls (p<0.05). Fingertip pattern of both hands showed a statistically significant increase in loops in cases when compared to controls (p<0.05) (Table 5).

Table 5 – ***Fingertip pattern in all digits in cases and controls***

Digit	Type	Cases	Controls	p-value
		Number	*Number*	
Right hand	Loop	341	301	0.009*
	Whorl	147	169	0.135
	Arch	12	30	0.005*
Left hand	Loop	324	291	0.032**
	Whorl	156	171	0.312
	Arch	20	38	0.237
Combined	Loop	665	592	0.011**
	Whorl	303	340	0.076[a]
	Arch	32	68	<0.001*

*Significant at 1%; **Significant at 5%; [a]Near significant.

Discussion

Dr. Harold Cummins, in 1936, examined several children with trisomy 21 (Down's syndrome) and found consistent dermatoglyphic changes that were absent among controls [6]. The dermal patterns once formed remain constant throughout life. Dermatoglyphics is considered as a window of congenital abnormalities and is a sensitive indicator of intrauterine anomalies [1]. This earth-shattering discovery helped to move the budding science of dermatoglyphics from a place of obscurity to being acceptable as a diagnostic tool among medical personnel. Since then widespread interest in epidermal ridges developed in medical field since it became apparent that many patients with chromosomal aberrations had unusual ridge formations. Inspection of skin ridges therefore seemed promising, simple, non-invasive and inexpensive means for determining whether a given patient had a particular chromosomal defect.

The study conducted by Huang CM and Mi MP found no significant difference in total as well as absolute finger ridge count and an increase in radial

loops on left hand for postmenopausal women and significantly elevated ulnar loops on left hand in premenopausal women [7]. According to Bierman HR *et al.*, four patterns were significantly associated with breast cancer – accidentals, transitional, angled ulnar loops and horizontal ulnar loops [8]. The results of Seltzer MH *et al.*, indicates six or more digital whorls in cases when compared to controls [9], but in our study, a significant increase in the loop was noted in cases as compared to controls in all digits of left hand and combined count of both hands.

On examining dermatoglyphics in different cancers found more whorls to be present and in studying high-risk kindred also found more whorls [10]. Another study found an increased proportion of ulnar loops in cancer patients [11]. In the other study, cancer patients in general, there was an increase in whorls and a decrease in radial loops in 201 Turkish cancer patients [12]. Yet another study has indicated a decreased ridge count in patients with cancer was found [13].

It is suggested that many genes, which take part in the control of finger and palmar dermatoglyphic development, can also give indication to the development of premalignancy and malignancy [13], hence identifying high-risk people for breast cancer could be of great value to decrease the incidence of the same.

In the present study, there was a significant increase in the finger ridge count in both right and left hands of cases when compared with controls. The total finger ridge count and absolute finger ridge count also showed a significant increase in both right and left hand in cases when compared to controls. The *a–b* ridge count showed a significant increased in cases when compared to controls. The difference in *adt* angle was statistically significant in both right and left hand. The fingertip pattern with hands separate revealed a significant increase in the number of loops in digit III and IV of right hand of cases and in digit II of left hand of cases when compared to controls. A significant increase in the loop was noted in cases as compared to controls in all digits of left hand and combined count of both hands.

Conclusions

There is a possible genetic influence on the digital ridge patterns in carcinoma of breast patients in whom the digital ridge patterns are otherwise significantly affected. The use of dermatoglyphics is rather a unique approach at low cost for identifying such individuals. This relatively noninvasive anatomical technique could reasonably be used for screening breast cancer on selected non-symptomatic women as part of definitive risk assessment strategy and for guiding future research.

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