Original Article

Received on 02.08.2016, **Accepted on** 10.08.2016

Indian Journal of Anatomy
Volume 5 Number 3, September - December 2016
DOI: http://dx.doi.org/10.21088/ija.2320.0022.5316.15

Digital Dermatoglyphics in Carcinoma Breast

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Background and Objectives: Dermatoglyphics is the science that deals with the study of carvings over the volar aspect of skin of palm, sole, fingers. The patterns are due to underlying interlocking dermal papillae with overlying corresponding epidermal ridges. The present study was carried out to analyze the digital dermatoglyphic patterns in carcinoma breast group and to compare it with control group. *Materials and Methods:* In the present study, the digital dermatoglyphic patterns were taken by INK METHOD of 100 breast cancer cases, confirmed on histopathology and 100 control cases were studied. The qualitative analysis of patterns like whorls, arches, loops, and composites as well as quantitative analysis of absolute finger ridge count, total finger ridge count were studied. Statistical analysis: the data was tested for its significance using the chi-square test and Student's t-test. *Results*: Number of whorls showed significant increase in the breast cancer group. Number of arches was decreased significantly in the cancer group in right hand and right plus left hand together. Ulnar loops were decreased while radial loops were increased in cancer group. Furuhata's index increased in cancer group whereas Dankmejer's index lowered in cancer group. Interpretation and conclusion: Digital dermatoglyphics may play an important role in identifying high-risk breast cancer population in developing country like India.

Keywords: Digital Dermatoglyphics; Carcinoma Breast; Whorls; Loops; Arches; Histopathology.

Introduction

Dermatoglyphics has an important role in clinical medicine. Its value will be enhanced as we acquire a better understanding of the ontogenetic development of dermal patterns particularly in relation to abnormal growth [1]. Dermatoglyphics is the study of carvings over the volar aspect of skin of palm, sole, fingers. The patterns are due to underlying interlocking dermal papillae with overlying corresponding epidermal ridges [2]. The dermal ridges develop in relation to volar pads, which are formed by 6th week of gestation and reach maximum size between 12th and 13th week [3]. The dermal pattern once formed, remains constant throughout the life. Many authors studied dermatoglyphic patterns in blood groups, diabetes, Turner's syndrome and many other conditions [4]. Pattern / intensity on fingertips like Absolute finger ridge count (AFRC) and Total finger ridge count (TFRC) gives an indication of complexity of ridge configuration. It is expressed by counting number of triradii present. Arch has no triradius so that it has zero pattern intensity, loop has one while pattern intensity of whorl is two. Furuhata's and Dankmejer's index were calculated in relation of dermatoglyphics in various other diseases [5,6].

Identification of people at increased risk of cancer before its development is an important objective of any cancer research study. Similarly many genetic studies were carried out to see breast cancer and identification of a high-risk group. About 90% of hereditary breast cancer involves mutation of the BRCA1 and BRCA2 genes [7]. Considering these factors the current study was undertaken.

Materials and Methods

The present study was carried out for the period of

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three years in the department of Anatomy, Indira Gandhi Government Medical College and Hospital, Nagpur. Permission from the institutional ethical committee was obtained. This study was carried out to analyze the digital dermatoglyphic patterns in carcinoma breast group and to compare it with control group. In this study, 100 female cases diagnosed as carcinoma breast on histopathology were taken from IGGMC and RST regional cancer hospital, Nagpur. The exclusion criteria were any other major illness, family history of any cancer or genetic disorder. Age of patients was between 20 to 80 years. The control group was of 100 females, selected from the age group of 20 to 80 years, who were not having history of carcinoma breast and any other hereditary disorders in the family. The fingerprints of study group and control group were obtained. INK Methods [8] was followed to take palmar and digital finger prints.

Written consent was taken, and then patient was asked to wash her hands with soap and water. She was also asked to dry her hands leaving some moisture for clear prints. Kores duplicating ink was spread uniformly on thick glass sheet by rubber roller, asked to put her hands on the inked slab. For smearing the ink uniformly on hands, special ball was used which was prepared from cotton gauze and linen. Clean smooth hard surface was used to take prints. The inked palmar aspect of hand was placed slowly on the paper with all fingers abducted to their maximum extent.

Each fingertip was rolled from side to side for the complete imprint of the pattern. If the print patterns coalesce either due to excess ink or pressure, second imprint was obtained (Figure 1A and 1B). The prints were studied with the help of hand lens, pencil, needle and protractor, and then analyzed. Fingertips were classified as per Henry's classification into elementary pattern types - whorls, ulnar loops, radial loops, and arches [9, 10]. Method of counting: In a loop: A line was drawn from the core to the triradius and the ridges crossing the line were counted. If the loop opens towards to ulnar side is labeled as ulnar loop and if it opens towards radial side is labelled as radial loop (Figure1C).). 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 [11]. Composite: The composite is combination of more than one pattern i.e. arch, loop, and whorls. It is further classified as central pocket loop, twinned loop and accidental loop [7].

Absolute finger ridge count (AFRC): It is the sum of ridge counts from all the separate triradii on the fingers taking both the counts of a whorl. It reflects pattern size as well as pattern intensity which depends on the pattern type. Numbers are given to digits from thumb to little finger. Thumb - digit 1, Index finger - digit 2, Middle finger - 3, Ring finger - 4, Little finger - 5 in both hands. To some extent ridge count reflects the pattern type.

Total finger ridge count (TFRC): It is the sum of ridge counts of all 10 fingertips taking the highest count of a whorl. TFRC gives an idea of pattern. A low ridge count corresponds to small loop while high ridge count is more likely indicative of whorl. It expresses size of pattern[11].

Furuhata's and Dankmejer's index were calculated as: -

Dankmejer's index = % arches / %whorls X 100.

Furuhata's Index = %whorls / %loop X 100

Results

The dermatoglyphic patterns in breast cancer group and control group were analyzed. Fingertip patterns were classified as per Henry's classification into elementary pattern types - whorls, ulnar loops, radial loops, arches and composites. Absolute Finger Ridge Count (AFRC) and Total Finger Ridge Count (TFRC) were calculated. Table 1 shows frequency distribution of fingertip patterns among breast cancer and control groups, Furuhata's index increased in cancer group whereas Dankmejer's index lowered in cancer group. The distribution of various whorl patterns is as shown in Table 2. Percentage of whorls is increased in cancer group; percentage of composites was slightly increased in cancer group. Table 3 showed distribution of arch patterns. Percentage of arches was decreased in cancer group. The percentage of loops was decreased on each hand of cancer group as compared to controls as shown in Table 4.

Finger print patterns were subjected to statistical test to evaluate identifiable differences whether significant or not. The distribution of fingertip patterns was assessed with the help of chi-square test as shown in Table 5. There was statistically significant difference for whorl pattern among cancer group and control group ($p < 0.05$). For arches the difference was found to be significant among cancer and control group for right hand, right hand plus left hand in cancer and control group ($p < 0.05$). For loops difference was significant in both hands in cancer and control group ($p < 0.05$). Comparison of ridge count i.e. AFRC and TFRC among the study groups

which were genetically important was compared with the help of student's t test and the difference was not statistically significant ($p > 0.05$).

Table 1: Frequency distribution of fingertip patterns among breast cancer group and control group

Group	Side	Total Whorls	Total Arches	Total Loops	Compo-sites	Furuhata's Index	Dankmejer's Index
Breast	RT	227	18	250	5	90.8	7.92
Cancer	LT	239	15	238	8	100.42	6.27
	RT+LT	466	33	488	13	95.49	7.08
Controls	RT	183	38	278	1	65.82	19.67
	LT	191	41	262	6	72.90	21.46
	RT+ LT	374	79	540	7	69.25	21.12

(RT- right, LT- left)

Table 2: Frequency distribution of whorl patterns on fingertip among breast cancer group and control group

Cases	Side	Concentric Whorls		Spiral Whorls		Composite		Total Whorls	
		No	%	No	%	No	%	No	%
Breast Cancer	RT	166	33.20	51	10.20	10	2.00	227	45.40
	LT	162	32.40	68	13.60	9	1.80	239	47.80
	RT+LT	328	32.80	119	11.90	19	1.90	466	46.60
Controls	RT	157	31.40	22	4.40	4	0.80	183	36.60
	LT	102	20.40	84	16.80	5	1.00	191	38.20
	RT+ LT	259	25.90	106	10.60	9	0.90	374	37.40

(RT- right, LT- left)

Table 3: Frequency distribution of arch pattern on fingertip among breast cancer group and control group

Cases	Side	Plain Arches		Tented Arches		Total Arches	
		No	%	No	%	No	%
Breast Cancer	RT	9	1.80	9	1.80	18	3.60
	LT	8	1.60	7	1.40	15	3.00
	RT+LT	17	1.70	16	1.60	33	3.30
Controls	RT	21	4.20	17	3.40	38	7.60
	LT	25	5.00	16	3.20	41	8.20
	RT+ LT	46	4.60	33	3.30	79	7.90

Table 4: Frequency distribution loop pattern on fingertip among breast cancer group and control group

Cases	Side	Ulnar Loops		Radial Loops		Total Loops	
		No.	%	No.	%	No.	%
Breast Cancer	RT	234	46.80	16	3.2	250	50.00
	LT	225	45.00	13	2.6	238	47.60
	RT+LT	459	45.90	29	5.8	488	48.80
Controls	RT	255	51.00	23	4.6	278	55.60
	LT	245	49.00	17	3.4	262	52.40
	RT+LT	500	50.00	40	8.0	540	54.00

Table 5: Significance test for different patterns on fingertips breast cancer

Type	Comparison	χ^2 Value	Significance at 5% level
/ Whorl	RB X RC	8.0033	Significant
	LB x LC	9.4002	Significant
	RB + LB X RC +LC	17.272	Significant
Arches	RB X RC	7.0077	Significant
	LB x LC	0.4490	Not significant
	RB + LB X RC +LC	21.275	Significant
Loops	RB X RC	3.1459	Not significant
	LB x LC	2.3000	Not significant
	RB + LB X RC +LC	9.7588	Significant

RB- right hand in breast cancer case, LB –left hand in breast cancer case , RC- right hand in control case, LC- left hand ic control case

The Significant c^2 Value for df 1 at 5% level is = 3.84

Fig. 1A: Procedure of taking palmar print

Fig. 1B: Procedure of taking digital print

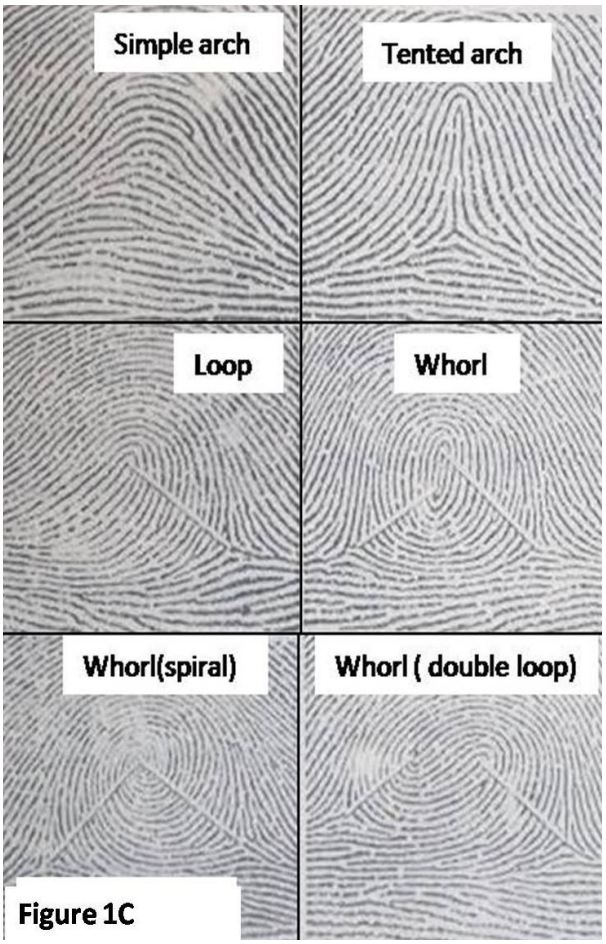

Fig. 1C: Digital dermatoglyphic patterns and scheme for ridge counting

Discussion

Qualitative and quantitative parameters were studied separately and observations were compared with previous studies in the literature. Seltzer MH [1982] noted that cases with six or more whorls are at high risk for carcinoma breast [12]. Sukre et al [13], Chintamani et al [14] showed that the whorls were increased in cancer patients as compared to controls. In the present study, percentage of whorls increased in cancer group than control group. The increased percentage of whorls was significant in right hand, left hand and right plus left hands than controls. It correlates with findings of previous studies. Seltzer MH[1990] quoted that 'the positive predictive value of 6 or more digital whorls is comparable to that of mammography and biopsy' [15]. However Raizada A et al found decreased number of whorls in relation to carcinoma breast cases [4].

Raizada et al [4], Sukre et al [13], Paranjpe et al[17] found increased arches in cancer group than control group. Arches were decreased in cancer patients than controls in the present study, which were similar to findings noted in previous studies by Chintamani et al [11], Birman et al [16]. However N.S.Sridevi et al [14] did not found any statistically significant difference in cases and control groups with respect to arches.

Birman HR et al [16] analyzed the four patterns of ulnar loops significantly associated with breast cancer and classified them as accidentals, transitionals, angled ulnar loops, and horizontal ulnar loops. Chintamani et al [11] also found more loops in breast cancer patients. Sukre et al [13], N.S. Sridevi [14], in their study found that ulnar loops were significantly more in breast cancer patients. P.E. Natekar et al [3] found more radial loops in left hand in breast cancer patients. In the present study, radial loops and ulnar lops were decreased in cancer group than controls, which correlates with the findings of Seltzer et al [12], Paranjpe et al [17].

Number of composites was slightly increased in cancer group than control group in present study; this finding was similar with the Bierman et al. Diversity of ridge count from finger to finger was under genetic control. Dissociation or distortion of dermal ridges was produced by chromosomal aberrations [16].

In the present study AFRC and TFRC were slightly increased in cancer patients than control group but statistically not significant ($p > 0.05$). Raizada A et al [4], Chintamani et al [11] in their study found significantly decreased TFRC and AFRC in breast

cancer patients. N.S. Sridevi et al [14] found increase in TFRC as well as AFRC in breast cancer patients. In the present study Furuhata's index increased in cancer group whereas Dankmejer's index lowered in cancer group.

Conclusion

Digital dermatoglyphics is simple, inexpensive, non-invasive, anatomical marker and may be used as a reliable indicator for screening of high-risk population in the developing country like India, for early detection and early therapy, thus reducing the morbidity and mortality in carcinoma breast. There is significant increase whorl pattern in breast cancer group. Six or more digital whorl pattern in carcinoma breast patient can be indicator for screening high risk population.

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