Fingerprint patterns, a novel risk factor for breast cancer in Egyptian populations: a case–control study

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Received: 17 October 2019
Revised: 12 November 2019
Accepted: 3 December 2019
Published: 14 February 2020

The Egyptian Journal of Surgery 2020, 39:247–251

Context
Every single person has got a unique dermal ridge pattern; this pattern is genetically determined. Dermal ridge patterns once established become fixed all throughout life. Fingerprint patterns offer a simple, convenient, and economical technique for recognition of some diseases.

Aims
The aim of this study is to find a relation between dermal ridge patterns and breast cancer among female Egyptian populations.

Patients and methods
A total of 500 patients with breast cancer and 500 women without cancer were included in our study. The fingerprints of all fingers of both hands of our patients and control group were obtained, using classic method of ink and paper.
The fingerprints were then examined by a forensic medicine specialist for identification of the patterns and ridge count.

Results
The whorl pattern was the commonest pattern among the diseased group, representing 46%; this pattern was significantly increased when compared with the same pattern in the control group. It was found that the mean ridge count of the diseased group was less than that of control group. The frequency of six or more whorls was more common in the diseased group (46%) when compared with the same number in control group (13.4%).

Conclusion
Fingerprint patterns and ridge counts are easy, simple, noninvasive, cheap, and applicable methods for screening high-risk groups of breast cancer.

Keywords:
breast cancer, fingerprint, finger ridge count

Egyptian J Surgery 39:247–251

1110-1121

Introduction

Breast cancer is rated as the most prevalent cancer among women worldwide, and in excess of half a million fatalities were documented as casualty of this disease in the past decade [1]. The hereditary propensity of this disease was first discussed more than 300 years ago when a young woman got affected, with a history of the disease being discovered in her aunt and grandmother [2].

Approximately 10% of patients with breast cancer have inherited predilection, and even a higher percentage already has a first-degree relative with the same disease [3,4]. This was first experienced following the discovery of BRCA1 and BRCA2 in addition to PTEN and TP53 [5–8].

Every single person has got a unique dermal ridge pattern; this pattern is genetically determined. Fingerprint pattern is regarded as an indicator of congenital and intrauterine anomalies. Dermal ridge patterns once established become fixed all throughout life. Fingerprint patterns offer a simple, convenient, and economical technique for recognition of some diseases.

However, human fingerprints, being formed in the embryonic stage and having a unique characteristic pattern, are controlled genetically. Three basic fingerprint patterns are well recognized: 'loop' (radial and ulnar), 'whorl,' and 'arch' [9,10]. as in Figures 2–6. Several research studies have reported the genetic diversity of individual fingerprints being linked to various disorders of genetic origin too (e.g. Down's syndrome and other pediatric hematological and psychological disorders) [11–13].

The distribution of fingerprint differs among individual fingers. Similarity between the 23

 DOI: 10.4103/ejs.ejs_189_19

populations from different countries is called 'universal distribution' for the 10 fingers. The ulnar loop or the whorl is always the most common fingerprint pattern type in any country around the world (whorl–whorl–ulnar loop–whorl–ulnar) from thumb to pinky. The highest 'pattern intensity index' in the world is present in populations located in Oceania, who have whorls to represent the most common fingerprint pattern, and in many (east) Asian countries, a likewise tendency is seen, whereas in most other areas worldwide, loops are clearly the most common. The lowest 'pattern index' in the world is found in populations located in the south of the Africa [14].

In this research, we planned to disclose the relationship between fingerprint patterns and ridge count and breast cancer among Egyptian female citizens.

Aim

The aim of this study is to find a relation between dermal ridge patterns and breast cancer among Egyptian female populations.

Patients and methods

This case–control study was conducted at General Surgery Department between April 2018 and Aug 2019. The study was approved by local ethical committee of our faculty, and informed consent was obtained from all patients.

A total of 500 patients with breast cancer and 500 women without cancer were included in our study.

Inclusion criteria

The following were the inclusion criteria:

(1) All patients newly diagnosed as having breast cancer and admitted to our unit.
(2) All patients with breast cancer who came for follow-up at the outpatient clinic.
(3) Control group included 500 women without cancer, with no family history of breast or ovarian cancer.

Exclusion criteria

Patients or women's with skin disease, burn, scar or any deformities affecting fingerprint were excluded.

The fingerprints of all fingers both hands of our patients and control group were obtained using classic method of ink and paper.

The fingerprints were then examined by a forensic medicine specialist for identification of the patterns and ridge count.

Examination was done using magnifying lens to identify the specific pattern of the fingerprints and for the ridge count.

Results

The current study was conducted on 500 patients with breast cancer and 500 healthy women, with no family history of breast cancer.

The fingerprint patterns in the right hand of both diseased and control groups are summarized in Table 1; the whorl pattern was the commonest pattern among the diseased group, representing 46%; this pattern was significantly increased when compared with the same pattern in the control group.

The fingerprint pattern in left hand of both diseased and control groups are summarized in Table 2; the whorl pattern was the commonest pattern among the diseased group, representing 48%; this pattern was significantly increased when compared with the same pattern in the control group.

The finger ridges in each finger in the right hand were calculated in both diseased and control group. It was found that the mean ridge count of the diseased group was less than that of the control group, as shown in Table 3 and Figure 1.

The SD and *P* value were calculated in Table 4; it shows that there was a significant difference between ridge counts in both groups (P=0.014) in the right hand.

The finger ridges in each finger in the left hand were calculated in both diseased and control group. It was found that the mean ridge count of the diseased group was less than that of control group, as shown in Table 5.

The SD and *P* value were calculated in Table 6; it shows that there was a significant difference between ridge counts in both groups (P=0.014) in the left hand.

The count of whorl pattern in all fingers of diseased and control groups is summarized in Table 7.

The frequency of six or more whorls was more common in the diseased group (46%) when

Table 1 Fingerprint pattern in right hand

Patterns	Diseased group [*n* (%)]	Control group [*n* (%)]	χ^2	*P*
Whorl	230 (46)	120 (24)	62.4538	<0.00001
Radial loop	210 (42)	300 (60)		
Arch	20 (4)	40 (8)		
Ulnar loop	30 (6)	20 (4)		
Compound	10 (2)	20 (4)		

Table 2 Fingerprint pattern in Lt hand

Patterns	Diseased group [*n* (%)]	Control group [*n* (%)]	χ^2	*P*
Whorl	240 (48)	110 (22)	93.5635	<0.00001
Radial loop	210 (42)	270 (54)		
Arch	20 (4)	70 (14)		
Ulnar loop	20 (4)	20 (4)		
Compound	10 (2)	30 (6)		

Table 3 Ridge count in right hand

Digit	Diseased group		Control group		*z* score	*P* value
	Total ridge count	Mean ridge count	Total ridge count	Mean ridge count		
Thumb	7050	14.1	9750	19.5	–2.08893	0.01831
Index	5050	10.1	6750	13.5		
Middle	4100	8.2	6100	12.2		
Ring	4300	8.6	8200	16.4		
Little	4000	8	7100	14.2		
		9.78		15.16		

Table 4 Mean and standard deviation of right hand

	Mean	SD	*t*	*P* value
Diseased group	9.8	2.54	–3.13	0.014
Control group	15.16	2.86		

Table 5 Ridge count in left hand

Digit	Diseased group		Control group		*z* score	*P* value
	Total ridge count	Mean ridge count	Total ridge count	Mean ridge count		
Thumb	6300	12.6	10250	20.5	–1.88004	0.03005
Index	4400	8.8	7100	14.2		
Middle	5650	11.3	5300	10.6		
Ring	6250	12.5	7050	14.1		
Little	4700	9.4	8000	16		
		10.92		15.08		

Table 6 Mean and standard deviation of left hand

	Mean	SD	*t*	*P* value
Diseased group	10.92	1.75	–2.32	0.049
Control group	15.08	3.61		

Table 7 Counting whorl pattern in all fingers of diseased and control groups

Number of whorls/10 fingers	Diseased group	Control group
0	50	129
1	81	91
2	63	82
3	37	68
4	29	30
5	10	33
6	100	27
7	41	20
8	29	19
9	22	1
10	18	0
Total	500	500

Table 8 Frequency of whorls between diseased and control group

	Diseased group [*n* (%)]	Control group [*n* (%)]
>6 whorls	270 (54)	433 (86.6)
6 or more whorls	230 (46)	67 (13.4)
Total	500	500

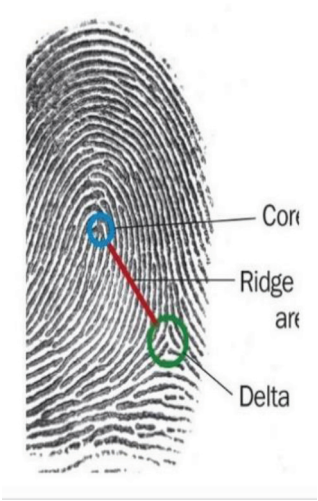
compared with the same number in the control group (13.4%) (Table 8).

Discussion

Breast cancer is one of the most important diseases that affect women all over the world. In our study, we examined the fingerprints of all fingers regarding the specific patterns and ridge count. We found that there was a significant statistical difference regarding print pattern issue between the two groups, where the whorl pattern significantly dominates in the diseased group whereas the radial loop and arch patterns significantly dominate in the control group, and these records are similar in both hands. Chintamani *et al.* [15] had the same dominance regarding the arch pattern like ours, but regarding the loop pattern, their results were opposite to ours, being significantly dominated in the diseased, whereas there was no significant difference in whorl pattern. Moreover, in a study done by Abilasha *et al.* [16], the authors found the same dominance regarding the patterns and its distribution in the study groups in the left hand.

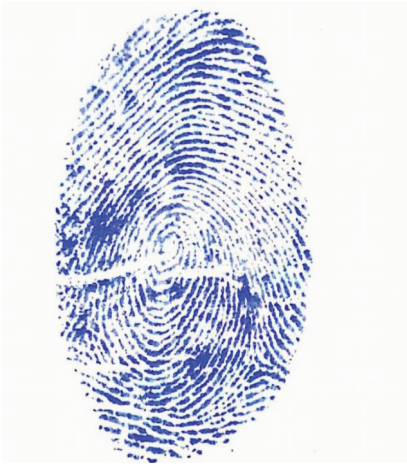
Regarding the ridge count, in our study, both the count for each individual finger and the mean for all fingers in each hand showed statistically significant increase in favor of the control group. Typically, the same results were recorded by Chintamani *et al.* [15], for both individual fingers, and the mean for each hand (12.4 for cases vs. 19.6 for controls). Raizada *et al.* [17] did

Figure 1



Ridge Count from core to delta point (Hawthorne, 2009) [21].

Figure 2



Whorl pattern.

Figure 3

Radial loop pattern.

Figure 4

Ulnar loop pattern.

Figure 5

Arch pattern.

Figure 6

Composite/compound pattern.

prove that decreasing ridge counts is more accompanied by increased risk of developing breast cancer when compared with increasing ridge counts. They found more cancer cases with total ridge counts below 50; however, if the count increased above 126, the control group dominated.

The whorl pattern was found to be the commonest pattern among the diseased group in comparison with the control one. This is similar to Murray *et al.* [18] and Madhavi *et al.* [19], but in contrary with the pattern among patients with breast cancer in Indian populations, and also in contrary with Raizada *et al.* [17], who found that the arch pattern is the commonest among Indian population.In the current study, we observe that the presence of six whorls or more was found in breast cancer population when counting the total number of whorls in all fingers; this is similar to Chintamani *et al.* [15] and Sakineh *et al.* (2006) [20,21].

Conclusion

Fingerprint patterns and ridge counts are easy, simple, noninvasive, cheap, and applicable methods for screening high-risk groups of breast cancer.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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