Original Article

Study of fingerprint patterns to evaluate the role of dermatoglyphics in early detection of bronchial asthma

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Abstract

Background: Dermatoglyphics and bronchial asthma (BA) are both influenced by genetic factors. Hence, we assessed the diagnostic potential of correlation between fingerprint pattern and BA. **Materials and Methods:** The study was carried out in out-patient Department of Pulmonary Medicine of All India Institute of Medical Sciences Bhopal. It included 36 patients of BA and 50 nonasthmatic individuals as controls. The following parameters were studied and analyzed: (a) Whorls, (b) arches, (c) radial loops, (d) ulnar loops, (e) the absolute finger ridge count (AFRC), (f) total finger ridge count (TFRC). **Results:** A significant decrease in the mean value of the arches and increase in the mean value of the ulnar loops were observed in BA patients compared to the control group. The mean values of TFRC, AFRC, and whorls were similar in both groups. **Conclusion:** Evaluation of dermatoglyphic patterns may be useful in identifying patients prone to developing BA.

Key words: Bronchial asthma, dermatoglyphics, fingerprints

INTRODUCTION

The study of the epidermal ridge patterns of the skin of the fingers, palms, toes, and soles is known as "dermatoglyphics."[1,2] The dermatoglyphic science is based on two major facts; first, the ridges are slightly different for different fingers and no two persons, not even monozygotic twins, show exactly similar fingerprint patterns, and second, the ridges are permanent throughout life and they survive superficial injuries and also environmental changes after the 21st week intra-uterine life. Fingerprint patterns of dermal ridges can be classified into three major groups[2] [Figure 1]:

(1) Arches,
(2) Loops, and
(3) whorls.

The arches are the simplest and least frequent pattern, which pass across the finger with slight bow distally. They may be subclassified as "plain" when the ridges rise slightly over the middle of the finger or "tented" when the ridges rise to a point. The loop pattern has a triradius and a core. A triradius is a point at which three groups of ridges coming from three directions meet at angles of about 120°. The core is essentially a ridge that

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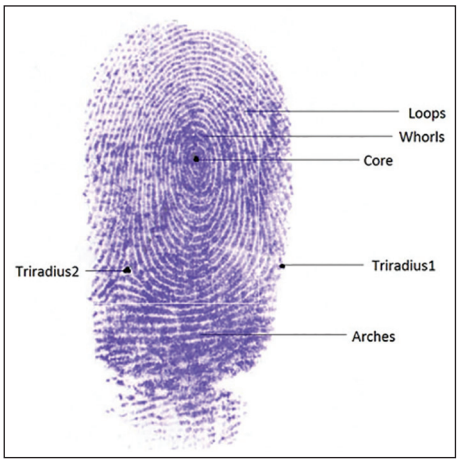

Figure 1: Fingerprint patterns of dermal ridges

is surrounded by fields of ridges, which turn back on themselves at 180°. Loops can be either radial or ulnar. A finger possesses a radial loop if its triradius is on the side of the little finger for the hand in question, and the loop opens toward the thumb. A finger has an ulnar loop if its triradius is on the side of the thumb for that hand, and the loop opens toward the little finger. The whorls are the patterns so constructed that the characteristic ridge courses follow circuits around the core. The shape of the pattern area may be either circular or elliptical. This pattern has two triradii with the ridges forming various patterns inside.

Traditionally, the ridge count is defined as the number of ridges that intersect or touch the line drawn from the easily recognized triradius (where three ridges meet) to the center of the pattern.[3] A simple loop characterized by a single triradius, whorls have two triradii yielding two counts, while simple arches have no true triradii, resulting in a zero count. When the ridge count is used as a measure of a maximum pattern size on fingers, only the largest count from each finger is scored, and their sum is defined as the total finger ridge count (TFRC). Alternatively, the sum of all possible counts on all 10 fingers can be calculated yielding an absolute finger ridge count (AFRC), a measure of the total pattern size. TFRC and AFRC are highly heritable,[3] and the ridge patterns are genetically determined.[4,5] The ridge patterns are of considerable clinical interest because they are affected by certain abnormalities of early development including genetic disorders. Simian lines have been noted on rudimentary palms of infants whose limb development was affected by thalidomide teratogen. Abnormal dermatoglyphic patterns are also observed in several nonchromosomal genetic disorders and other diseases whose etiology may be influenced directly or indirectly, by genetic inheritance.[5,6]

Bronchial asthma (BA) is a syndrome characterized by airflow obstruction that varies both spontaneously and with a specific treatment.[7] Common symptoms include wheezing, coughing, chest tightness, and shortness of breath. Asthma is thought to be caused by a combination of genetic and environmental factors. Its diagnosis is usually based on the pattern of symptoms, response to therapy over time, and spirometry. Asthma has increased dramatically in prevalence and is now recognized as a major cause of disability, medical expense, and preventable death. BA occurs at all ages but predominantly in early life. About one-half of cases develop before age 10, and another third occur before age 40. BA is influenced by genetic factors.[8] Considering the genetic association of both dermatoglyphic patterns and BA, we assessed if there is any correlation between these two. Only a few studies have shown links between fingerprint pattern and BA,[4,7-9] which are of help in predicting the occurrence of BA among relatives of patients suffering from the disease. Hence, this study was designed to assess the correlation between fingerprint pattern and BA.

MATERIALS AND METHODS

Study design

Phase-I Diagnostic Study.

Study settings

Out-patient Department (OPD) of Pulmonary Medicine of All India Institute of Medical Sciences Bhopal, India. All suspected patients of BA were subjected to pulmonary function test, and BA was confirmed on a predefined criterion. The present study was conducted on two groups that is, Group A including 36 patients of BA and Group B including 50 healthy controls. Following approval from Institutional Ethical Committee, informed consent was taken from all patients prior to study. The objectives of the study were explained to all participants. They were asked to relax and co-operate to achieve the required movement of the fingers. Their fingers were cleaned with soap, water, and spirit to remove any oily dirt and sweat. Nontoxic Kores Ink was applied to the tips of the fingers, and then the tips were pressed and rolled against the white glossy paper. The fingers were cleaned after taking the prints. The fingerprints from both hands of Group A and Group B were obtained for present study. The thumb was placed with the ulnar edge downward and rolled toward the body, and other digits were placed with the radial edge downward and rolled away from the body. The prints were analyzed with the help of the hand lens. The following parameters were studied and analyzed:

a. Whorls
b. Arches

c. Radial loops
d. Ulnar loops
e. AFRC
f. TFRC.

These parameters were compared with the previous study values to confirm if there is any correlation between control and study group. The data were also analyzed for any abnormal new pattern particular to the study group.

Study participants, inclusion and exclusion criterion

The study was planned to be conducted on the clinically diagnosed BA patients attending the OPD. Patients of all age groups were selected. Nonasthmatic participants were considered as controls and selected from among the OPD visitors and residents around health facility (those not having any respiratory problem or any symptoms related to asthma).

Statistical methods

Data were analyzed with Epi Info Software (Epi Info™ 7.1.5, CDC Atlanta, USA). Data were summarized with descriptive measures like mean, median and standard deviation.

Mann-Whitney U test was used to test difference between fingerprint patterns among two groups. A p-value less than 0.05 was considered as statistically significant.

RESULTS

Fingerprints of 86 individuals (36 patients and 50 controls) were analyzed, and indices were calculated [Table 1 and Figure 1]. A highly significant decrease in the mean value of the arches was observed in BA patients compared to the control group. The mean value of the ulnar loops in the BA patients was significantly more than that in the control group.

While the mean values of the radial loops, whorls, TFRC, and AFRC were similar in both groups.

Table 1: Fingerprints patterns among study subjects

Variable	*n*	Mean	SD	Median	Mann-Whitney U-test *P*
Ulnar loops					
Patients	36	181.583	139.6406	208	0.042
Controls	50	122.400	123.6871	140	
Radial loops					
Patients	36	49.389	79.2072	0	0.118
Controls	50	84.180	103.8267	0	
Arches					
Patients	36	58.111	47.1864	44	<0.001
Controls	50	102.080	42.0194	91	
Whorls					
Patients	36	66.889	65.2480	54	0.105
Controls	50	49.060	53.2964	32	
TFRC					
Patients	36	152.920	72.8106	134	0.759
Controls	50	138.917	42.0954	131	
AFRC					
Patients	36	185.028	83.6498	159	0.377
Controls	50	168.840	80.0779	145	

SD: Standard deviation, TFRC: Total finger ridge count, AFRC: Absolute finger ridge count

DISCUSSION

The present study was aimed to evaluate whether the dermatoglyphic parameters have any diagnostic significance in BA patients. Indeed, the number of arches was lower, and the ulnar loop was significantly higher among BA patients compared to control group. A qualitative and quantitative analysis on dermatoglyphic patterns in patients with BA was previously reported.[10] In this study, similar to our observation, significantly higher number of ulnar loops and lower number of arches were observed in the BA group compared to that of the control group. Additionally, significantly higher TFRC with no changes in AFRC was also reported.[10] However, we did not observe any differences in radial loops, whorls, TFRC, and AFRC as previously reported.[3,4,9,10] The low number of patients in our study may have resulted in such differences in addition to the contribution from variation in patient demographics. Higher values for a-b angle and less TFRC counts are also reported in BA patients;[8] however, we did not observe such differences in our study.

CONCLUSION

From the present study, we conclude that the decreased number of arches, increased number of ulnar loops in association with some respiratory ailments can be used as the early diagnostic criteria for BA. Nevertheless, due to small sample size in our study, more elaborated studies are required to further validate our observations.

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Conflicts of interest

There are no conflicts of interest.

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