DOI: 10.7860/JCDR/2012/4734.2368

Original Article

Anatomy Section

Study of the Fingertip Pattern as a Tool for the Identification of the Dermatoglyphic Trait in Bronchial Asthma

SANDEEP V. PAKHALE, BHARAT S. BOROLE, MEGHA A. DOSHI, VIJAY P. MORE

ABSTRACT

Introduction: Bronchial Asthma is one of the most extensively studied respiratory diseases and its genetic basis is well established. Dermatoglyphic traits are formed under genetic control early in development but may be affected by environmental factors during first trimester of pregnancy. These patterns may represent the genetic makeup of an individual and therefore his/her predisposition to certain diseases. Patterns of dermatoglyphics have been studied in various congenital disorders like Down's syndrome, Klinefelter's syndrome and also in chronic diseases like Hypertension, Diabetes Mellitus etc. Epidermal ridge patterns of finger tips in bronchial asthma patients were studied to find out fingertip pattern as Dermatoglyphic features in patients of Bronchial Asthma; it's comparison and association if exists between normal and bronchial asthma patients and also to find use of fingertip pattern in early childhood as non-invasive anatomical marker for bronchial asthma in adulthood.

Methods: The study was conducted on clinically diagnosed all bronchial asthma patients attending OPD of Dr Ulhas Patil Medical College, Jalgaon. Matched controls were selected without any respiratory problem or any symptoms related to asthma from medical students, staff members and paramedical staff of hospital after taking the informed consent and permission from the institutional ethical committee. Data collection and fingertip prints were taken by ink and rolling finger method. Prints taken were analysed and tabulated; data was analysed by using statistical tests.

Results: Study shows that decrease in number of arches, increase in AFRC in patients as compared with controls. Also there were increased ulnar loops in male patients and increased Whorls and radial loops in female patients.

Conclusion: The fingerprints can represent a non-invasive anatomical marker of bronchial asthma risk and facilitate early detection and effective management which is vital for selecting appropriate agents for treating infections.

Key Words: Dermatoglyphics, Bronchial Asthma.

INTRODUCTION

In India, since ancient times till today, the ridges on the palms and fingers have been studied for prophecy and fortune telling. With the emergence of civilization, this interest was replaced by a methodical and a scientific study on these patterns. The fingerprints have been also used as an identification feature by law enforcing authorities, anthropologists and geneticists.

The study of the epidermal ridge patterns of the skin of the fingers, palms, toes, and soles is known as 'Dermatoglyphics' [1]. Harold Cummins coined the term 'Dermatoglyphics' in 1926 (Greek derma-skin, Greek Glyphein- to carve) [1,2]. The dermatoglyphic science is based upon 2 major facts; firstly, the ridges are slightly different for the fingers and no 2 persons, not even uniovular twins, show exactly similar finger print patterns and secondly, the ridges are permanent throughout life and they survive superficial injuries and also environmental changes after the 21st week of the intra-uterine life. The dermal ridge differentiation takes place early in the foetal development. The resulting ridge patterns are genetically determined and are influenced by environmental factors. The patterns which are once established never change throughout life. The specific dermatoglyphic traits were claimed to be inherited as dominant, incompletely dominant recessive, single gene or polygenic with complete or incomplete penetrance and as a variable expression of genes.

Dermatoglyphics has been studied in certain clinical disorders which are associated with chromosomal and developmental defects like mongolism, Turner's syndrome, cardiovascular disease, Diabetes mellitus, schizophrenia and ischaemic heart disease. The dermatoglyphic analysis has many advantages as a diagnostic tool [3].

Bronchial asthma is one of the most extensively studied respiratory diseases and its genetic basis has been well established. The dermatoglyphic traits are formed under genetic control, early in the development, but they may be affected by environmental factors during the first trimester of pregnancy. They however do not change significantly thereafter, thus maintaining a stability which is not greatly affected by age. These patterns may represent the genetic make up of an individual and therefore his/her predisposition to certain diseases. The patterns of dermatoglyphics have been studied in various congenital disorders like Down's syndrome and Kleinfelter's syndrome and also in chronic diseases like hypertension, Diabetes mellitus, etc. The prints can thus represent a non-invasive anatomical marker of the bronchial asthma risk and they can thus facilitate an early detection and treatment of the diseases.

Much little is known as far as the dermatoglyphics in 'bronchial asthma' is concerned. These days, dermatoglyphics as a genetic marker, is attracting the attention of many workers [4].

The genetic factors are clearly operational in case of atopy and asthma. Linkages have been found between the similar chromosomal sites for both atopy and asthma. The asthma phenotypes are

polygenetic and they require the expression of multiple genes [5].

The pre-ponderance of the whorl in most of the digits and the presence of the whorl pattern on both the thumbs was a constant feature in all the asthma patients, irrespective of their family history [6]. A higher frequency of whorls was observed in first digit of the bronchial asthma patients in comparison to that in the controls. In all the digits, the frequency of the arches was reduced in the bronchial asthma patients as compared to that in the controls [7].

The fingertip pattern configurations are the ridge patterns on the distal phalanges of the fingertip, which are grouped into: arches, loops and whorls [8]. The three basic dermatoglyphic landmarks which are found on the fingertip patterns are:

The triradius: The triradius is formed by the confluence of three ridge systems.

The core: The core is the approximate centre of the pattern.

The radiants: The radiants are the ridges that start from the triradius and enclose the pattern area.

The finger ridge count: It is done to indicate the pattern size. The ridges are counted along a straight line which connects the triradial point to the point of the core. In the whorls, where there are 2 triradii, the larger one is taken into count. A Total Finger Ridge Count (TFRC) represents the sum of the ridge counts of all the 10 fingers. To some extent, the ridge count may reflect the pattern type [9]. The Absolute Finger Ridge Count (AFRC) represents the sum of the ridge counts of all the ten fingers and it includes both the ridge count values of the whorl pattern.

MATERIALS AND METHODS

The study was conducted on all the clinically diagnosed bronchial asthma patients who attended the OPD during the study period, at Dr. Ulhas Patil Medical College and hospital. Matched controls were selected from among the medical students, staff members and the paramedical staff of the hospital (those who did not have any respiratory problem or any symptoms which were related to asthma), after taking their informed consent and after getting permission from the institutional review board and the ethical committee of Dr Ulhas Patil Medical College, Jalgaon. The data collection and the fingertip prints of 200 patients and 200 controls were taken, as it has been given below.

The proformas were filled after the clinically diagnosed patients and the controls were selected. The procedure which was used for taking the prints was the ink and rolling finger method [3]. The instruments were cleaned before and after taking the prints. The subjects were convinced about the procedures and the idea behind taking the prints and his or her informed consent was taken. The subject was asked to relax and to co-operate to achieve the required movement of the finger. The fingers were cleaned with soap, water and spirit to remove oily dirt, sweat and other dirt. Ink was applied to the tips of the fingers and then the tips were pressed and rolled against paper. The hands were cleaned after taking the prints.

The work protocol was submitted to the ethical committee for approval and the necessary permission was taken. A written consent was taken from all the individuals. No individual developed any complication like allergy to the ink during or after the procedure. The dermatoglyphic patterns were read on the digits. The following patterns were studied and analyzed in the present study: fingertip patterns: whorls, arches, total loops, radial loops, ulnar loops, the Absolute Finger Ridge Count (AFRC) and the Total Finger Ridge Count (TFRC).

The data which was collected on the study variables was of both types i.e., quantitative and qualitative. The sample size was more than 30 and therefore, the comparison of each study variable in the patients and the controls was done by applying the 'z' test. For the quantitative data, the 'z' test for the standard error of the difference between two means was used and for the qualitative data, the 'z' test for the standard error of the difference between 2 proportions was used. The difference was said to be significant if the 'p' value was less than 0.05.

RESULT

The quantitative data, qualitative data and the indices were calculated from the fingerprints of 400 individuals 200 patients, (100 males and 100 females) 200 controls, (100 males and 100 females). They were tabulated, compared and analyzed statistically. Since dermatoglyphic differences have been reported in males and females, the observations were recorded and tabulated separately. All the parameters were compared and analyzed in a single group, since the ridges or the patterns which are once formed, remain the same throughout life [10].

FINGERTIP PATTERNS

[Table/Fig-1] shows the significant decrease in the mean value of the arches in male patients than in the controls. The mean value of the ulnar loops in the male patients was significantly less than that in the controls. There was no significant difference between the mean values of the total loops, radial loops and the whorls in the male patients and the controls.

[Table/Fig-2] shows the significant decrease in the mean values of the arches and the total loops, especially that in the radial loops in the female patients than in the controls. The whorls were found to be significantly increased in the female patients.

[Table/Fig-3 and 4] show the increase in the mean value of the TFRC in the male as well as the female patients than in the controls, which was statistically not significant. The AFRC values in the male and the female patients were found to be significantly increased.

DISCUSSION

Bronchial Asthma: Asthma is a Greek word, which means 'panting'. It is a condition which is marked by recurrent attacks of paroxysmal dyspnoea with wheezing due to the spasmodic contraction of the bronchi. The causative factors for bronchial asthma are many. Out of these, atopy, which is IgE mediated, is the common cause. Heredity is also one of the causes. Asthma is often associated with allergic conditions such as allergic rhinitis and atopic dermatitis. The attacks may be seasonal or perennial [11].

Atopy and asthma are a diverse group of related conditions, which are similarly disparate in their origins. Despite this, the genetic factors are clearly operational. Linkages have been found between the similar chromosomal sites for both atopy and asthma [5]. The evidence for the genetic linkage of the high total serum IgE levels and atopy has been observed on chromosomes 5q, 11q and 12q in a number of populations which are scattered throughout the world [11].

Dermatoglyphics: Harold Cummins and Midlow coined the term

Patterns	Male Patients		Male Controls		'Z' Value	Statistical Significance
	Total Value	Proportion ± S.D	Total Value	Proportion ± S.D		
Arches	48	0.048 ± 0.006	124	0.124 ± 0.010	-6.06	Significant
Total Loops	573	0.573 ± 0.015	531	0.531 ± 0.015	1.89	Not significant
Ulnar Loops	555	0.555 ± 0.015	501	0.501 ± 0.016	2.42	Significant
Radial Loops	18	0.018 ± 0.004	30	0.030 ± 0.005	-1.75	Not Significant
Whorls	379	0.379 ± 0.015	345	0.345 ± 0.015	1.58	Not Significant

[Table/Fig-1]: Comparison of fingertip patterns in Male Patients and Controls

Patterns	Female Patients		Female Controls		'Z' Value	Statistical Significance
	Total Value	Proportion ± S.D	Total Value	Proportion ± S.D		
Arches	62	0.062 ± 0.008	108	0.108 ± 0.009	-3.69	Significant
Total Loops	553	0.553 ± 0.016	606	0.606 ± 0.015	-2.40	Significant
Ulnar Loops	528	0.528 ± 0.016	541	0.541 ± 0.015	-0.58	Not Significant
Radial Loops	25	0.025 ± 0.005	65	0.065 ± 0.008	-4.31	Significant
Whorls	385	0.385 ± 0.015	286	0.286 ±0.014	4.69	Significant

[Table/Fig-2]: Comparison of fingertip patterns in Female Patients and Controls.

Count	Male Patients	Male Controls	'Z' Value	Statistical Significance
	Mean ± S.D.			
TFRC	141.15 ± 43.47	119.42 ± 46.97	0.53	Not Significant
AFRC	188.15 ± 81.36	163.11 ± 85.32	2.1239	Significant

[Table/Fig-3]: Comparison of finger ridge counts in Male Patients and Controls

Count	Female Patients	Female Controls	'Z' Value	Statistical Significance
	Mean ± S.D.			
TFRC	132.78 ± 49.00	120.02 ± 46.02	1.898	Not Significant
AFRC	176.4 ± 80.83	153.14 ± 73.46	2.1296	Significant

[Table/Fig-4]: Comparison of finger ridge counts in Female Patients and Controls

'dermatoglyphics' in 1926 [2]. The 'dermatoglyphics' word is derived from the Greek words 'dermatos', which means skin, and 'glyphein', which means to carve. Thus, dermatoglyphics can be defined as a study of the patterns of the ridges of the skin of the fingers, palms, toes, and the soles.

Antenatal factors may be involved in the pathogenesis of a disease, which may become apparent later in life; this would be suggested if a relationship between a prenatal event such as a dermal ridge formation and this disease could be established. Thus, dermal ridges have many notable characteristics which make them important, not only for the personal identification of a person, but also in medical science.

The epidermal ridges which are once formed, remain unchanged, except for their dimensions. This means that they are stable. Realizing the need for objective, means to study genetics Many workers have been studying the quantitative and the qualitative features of the epidermal ridges, such as ridge counting, the 'atd' angles, the fingertip patterns, etc. Dermatoglyphics is not only a division of anatomy, but it also provides a common platform for various works in many disciplines like genetics, anthropology and other biological investigations.

The inheritance of dermatoglyphics: The epidermal ridge patterns are under a genetic influence. Galton (1892) [8] and Wilder (1904) [12] were the first to study the heredity of the epidermal ridge patterns; many genetic studies have confirmed this.

The dermatoglyphic features are confirmed by using a polygenic system,with only an additive contribution by the individual genes. A genetic theory which was put forth by Herman M. Slatis et al., says that the basic fingerprint pattern sequence which is present in all is the ulnar loops and that various genes cause deviations from this pattern sequence. Thus, other patterns are formed.

Each ridge of the palm and the sole has an underlying ridge of connective tissue which is known as the primary dermal ridge. Each primary ridge is divided into secondary dermal ridges due to the downward projection of the epidermis, which is called as 'rete pegs', because it appears like a peg in the sections.

The epidermis presents surface markings like tension lines, flexion creases (skin joints) and papillary ridges. These papillary ridges show particular arrangements which are classified as loops, whorls, arches, etc. [13].

Dermatoglyphics in Asthma: In the recent past, much work was done in finding out an association between the morphological and the genetic characters in a number of diseases, with the help of certain investigations. Dermatoglyphics is determined by the polygenic inheritance and it is one of such tools which are frequently used in scientific studies. Many workers have demonstrated that dermatoglyphics is an important aid in the diagnosis of and for understanding the genetics of many diseases.

In the present study, many dermatoglyphic parameters were studied and they were found to be statistically significant. Since

atopic asthma is a genetically transmitted disease, it was thought that there would be some correlation between asthma and dermatoglyphics, which would be of statistical significance in the patients as compared to the controls. The present study was undertaken to find out the correlation between dermatoglyphics and bronchial asthma. The dermatoglyphic pattern in bronchial asthma was studied under the following headings:

Fingertip patterns: Arches, loops – radial and ulnar, whorls, AFRC and TFRC.

After analyzing the data, we can conclude that there was a decrease in the number of arches in the patients, as compared to that in the controls, both in males as well as in females. There was also an increase in the AFRC in the patients as compared to that in the controls, in males as well as in females. The increased ulnar loops and the AFRC with decreased arches and some respiratory ailments in males can be used as the early diagnostic criteria for bronchial asthma. Similarly, the increased whorls and the AFRC with decreased arches, the total loops, especially the radial loops and some respiratory ailments in females can be used as the early diagnostic criteria for bronchial asthma.

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AUTHOR(S):

1. Dr. Sandeep V. Pakhale
2. Dr. Bharat S. Borole
3. Dr. Megha A. Doshi
4. Mr. Vijay P. More

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Anatomy, Dr. Ulhas Patil Medical College and Hospital, Jalgaon (KH), Maharashtra, India.
2. Assistant Professor, Department of Pathology, Dr. Ulhas Patil Medical College and Hospital, Jalgaon (KH), Maharashtra, India.
3. Professor and Head, Department of Anatomy, Krishna Institute of Medical Sciences University, Karad, Dist-Satara, Maharashtra, India.
4. Assistant Professor, Department of Community Medicine, Dr. Ulhas Patil Medical College and Hospital, Jalgaon (KH), Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sandeep V. Pakhale
Associate Professor
Department of Anatomy
Dr. Ulhas Patil Medical College and Hospital
Jalgaon(Kh), Maharashtra, India.
Phone: +917798847711
E-mail:- sandeeppakhale@yahoo.co.in

FINANCIAL OR OTHER COMPETING INTERESTS:

None.

Date of Submission: **Jun 20, 2012**
Date of Peer Review: **Jul 16, 2012**
Date of Acceptance: **Jul 31, 2012**
Date of Publishing: **Oct 10, 2012**