British Journal of Medicine & Medical Research
12(11): 1-8, 2016, Article no.BJMMR.22786
ISSN: 2231-0614, NLM ID: 101570965

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Palmar Dermatoglyphic Patterns in Bronchial Asthma between Afro-Trinidadian and Indo-Trinidadian: A Comparative Study

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Authors' contributions

This work was carried out in collaboration between all authors. Author SRR designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors NB and TRR managed the literature searches, analyses of the study performed and managed the experimental process. Author BS performed the statistical analysis. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2016/22786
Editor(s):
(1) S. U. Fuhong, ICU Laboratory, Erasme Hospital, Free University Brussels, Brussels, Belgium.
Reviewers:
(1) Hassan Ali Abd Elwahed, Suez Canal University, Egypt.
(2) Alphus D. Wilson, Southern Hardwoods Laboratory, USA.
Complete Peer review History: http://sciencedomain.org/review-history/12634

Short Research Article

Received 27th October 2015
Accepted 30th November 2015
Published 11th December 2015

ABSTRACT

Background: Dermatoglyphics, the ridged skin covering our palms and sole, are not only found on human beings. All primates have ridged skin, and it can also be found on the paws of certain mammals and on the tails of some monkey species. Palmar creases develop during the 2nd and 3rd month of intrauterine life and are not influenced by movement of hand in utero. They are of considerable clinical interest because they are affected by certain abnormalities of early development including genetic disorders.
Aim: The present study is carried out to correlate the dermatoglyphic patterns in patients of bronchial asthma.

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Methods: Dermatoglyphic prints were obtained from both hands of 100 patients of bronchial asthma among Afro-Trinidadian and Indo-Trinidadian. Hundred normal healthy individuals, without family history of bronchial asthma, were selected as control group. The qualitative parameters like whorls, loops and arches were studied in the above mentioned study groups.
Results: Presence of whorls loops and arches showed significant difference, $p<0.01$in III and IV digits in Afro-Trinidadian group and only in III digit in Indo-Trinidadian group when compared to the controls. The intergroup comparisons also showed significant changes in the percentage of all the finger print patterns in the II & III digit in Afro-Trinidadian bronchial asthma patient when compared with Indo-Trinidadian bronchial asthma patients.
Conclusion: Presence of whorls, loops and arches on both the III digit can be used as one of the diagnostic criterion for patients with bronchial asthma.

Keywords: Dermatoglyphic; bronchial asthma; finger prints.

1. INTRODUCTION

Dermatoglyphics is the study of surface markings of the skin, especially of the palmar and plantar regions. The study of dermatoglyphics was pioneered many years ago by Galton [1] and it is a simple yet complicated tool in the study of genetic disorders. The study of pattern traceries of fine ridges on the fingers, the palm and the sole has been a useful tool for personal identification and determination of paternity for quite some time.

Palmar creases develop during the 2nd and 3rd month of intrauterine life and are not influenced by movement of hand in utero [2]. They are of considerable clinical interest because they are affected by certain abnormalities of early development including genetic disorders [3]. Simian lines have been noted on rudimentary palms of infants whose limb development is affected by thalidomide teratogen. Abnormal dermatoglyphic patterns have been observed in several non-chromosomal genetic disorders and other diseases whose etiology may be influenced directly or indirectly, by genetic inheritance [4,5]. A significant link has been established by pioneer workers between ridge pattern in congenital heart diseases [6], diabetes [7], pulmonary tuberculosis [8], leprosy [9,10] and bronchial asthma [11-13]. However, the data from available studies do not give conclusive evidence. Problems and limitations of other studies include a lack of comparison between different ethnic groups, small sample sizes, incomplete diagnoses, limited parameters in the studies, poorly matched control group, statistical problems and methodological flaws. In order to overcome all these problems more information need to be acquired.

Therefore, the present work was undertaken to do a systematic study of dermatoglyphics pattern in patients with bronchial asthma in persons of African and East Indian descent in Trinidad. Examination of genetic markers may be of value in identifying some of the patients at risk of these disorders. These parameters may help in early identification and may serve as biological markers for the conditions being studied.

2. MATERIALS AND METHODS

The present study is a case control study. The sample comprised patients from the Eric Williams Medical Sciences Complex, Mt. Hope, and from the San Fernando Hospital. Diagnostic criteria for labeling bronchial asthma, is based on medical history, family history, physical examination, and laboratory studies like spirometry, and allergy tests, and chest X-ray. Airway obstruction is measured objectively with pulmonary function tests. Spirometry measures the forced expiratory volume in one second (FEV_1), the forced vital capacity (FVC) [14-16].

Inclusion criteria:

- Subject is diagnosed with bronchial asthma
- Airflow obstruction is at least partially reversible, demonstrated by spirometry at any time.
- Age≥ 18 years.
- Subject has signed the informed consent form.

Exclusion criteria:

- Subject is diagnosed with any of the following asthma differential diagnosis:
    a. Obstructions involving large airways: foreign body in trachea or bronchus, vocal cord dysfunction, vasucular rings of laryngeal webs; laryngo tracheomalacia, tracheal stenosis or

bronchostenosis enlarge lymph nodes or tumor.

b. Obstructions involving small airways: viral bronchiolitis or obliterative bronchiolitis, cystic fibrosis, brohchopulmonary dysplasia.
c. Other causes: recurrent cough not due to asthma, chronic obstructive pulmonary disease, congestive heart failure, pulmonary embolism.

- Subject has not signed the informed consent form.

The present study is carried out for a period of eleven months, from September 2014 and it was completed in July 2015.

About 50 patients in each ethnic group is matched with 50 healthy controls that were having no family history of the above mentioned clinical conditions or any other inheritable disease. These healthy controls are selected from the Faculty of Medical Sciences, Mount Hope. First and second year M.B.B.S. students is used.

An “ink & paper” method will be used. The patients are identified by a code so that the classification of fingerprint patterns is done in a single blind fashion. The hands are washed with soap and water, and the humidity is removed with the help of Ether, which also removes the greasy material. Instead of classical ‘CUMMINS’ [17] ink method the stamp pad smeared with black ink is used for making finger prints. It has been proven to be an easier and better method. The thumb is placed with ulnar edge downward and rolled toward body and other digits were placed with radial edge downward and rolled away from body. The finger prints of both hands are taken. After that these prints will be studied for the pattern types, whorl, loops and arches with help of a hand lens and dissection microscope.

Ethical approval was obtained from the Ethics Committee of the Faculty of Medical Sciences. Consent forms signed from the patients and controls were obtained prior to participating in the study.

Description of various Dermatoglyphic digital patterns of ridges [Fig. 1].

The epidermal ridges form definite local design on the terminal segments of digit and various other sites on the palm. Galton [1], classified them in: whorls, loops and arches.

2.1 Whorl

These 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. Whorls have two triradi and may have various shapes like whorl spiral, whorl double loop and whorl symmetrical. Sometimes whorls are single cored but mostly they are double cored.

1. Symmetrical whorls are composed of concentric ridges around a single centre (Whorls concentric)
2. Whorl with a single centre and spirally arranged ridges are twining either in clockwise or anticlockwise direction (Whorl spiral).
3. Double loop type whorls with two cores.

2.2 Loop

It is simple in contrast to the whorl. It possesses only one triradii. Twist site of ridges is called head of the loop. From the opposite extremity of the pattern, the ridges flow to the margin of digits. If the loop opens to the ulnar side, it is an ulnar loop and if to the radial margin, it is called a radial loop.

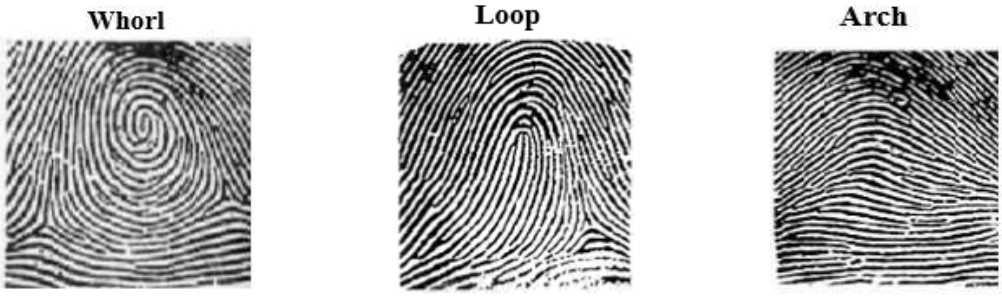

Fig. 1. Dermatoglyphic digital patterns of ridges

2.3 Arch

The plain arch is composed of ridges which pass across the finger with slight bow distally. There is no triradii. The pattern of ridges in tented arch is almost similar but there is abrupt elevation of the transversely coursing ridges, forming the "tent" which gives the name to the pattern as Tented Arch.

2.4 Statistical Analysis

Data obtained from patients and controls were subjected to statistical tests: Chi-square test of independence was used. The p value was tested against both .05 and .01 level of significance.

3. RESULTS

3.1 Afro-Trinidadian

There was no significant difference in the entire three finger print pattern in I and II digit when compared with control group. However, significant difference in the entire finger print pattern at p<0.01 level was noted in III and IV digit in the Afro-Trinidadian bronchial asthma patients when compared with same control group (Table 1a).

3.2 Indo-Trinidadian

In Indo-Trinidadian group, only III digit showed significant difference at p<0.01 level in all the finger print patterns in bronchial asthma patients compared to control group. In other digits that are I, II, IV & V digits did not find any significant changes in any finger print patterns bronchial asthma patients compared with the control group (Table 1b).

3.3 Inter Group Comparisons

In intergroup comparisons between both Afro-Trinidadian and Indo-Trinidadian control groups did not show any significant changes in any of the finger print patterns studied. However, there was a significant increase in the percentage of all the finger print patterns in the II & III digit in Afro-Trinidadian bronchial asthma patient when compared with Indo-Trinidadian bronchial asthma patients (Tables 2a, 2b).

Table 1a. Comparison of finger print patterns in Afro-Trinidadian bronchial asthma patients & controls (N1=100 & N2=100)

Digit I				
	Whorl	**Loop**	**Arch**	**%**
Control	45	46	9	100
Bronchial Asthma	40	51	9	100
Chi-square test=0.552	P > 0.05 (P value=5.991; Not Sig.)			
Digit II				
	Whorl	**Loop**	**Arch**	**%**
Control	51	40	9	100
Bronchial Asthma	53	33	14	100
Chi-square test=1.797	P > 0.05 (P value=5.991; Not Sig.)			
Digit III				
	Whorl	**Loop**	**Arch**	**%**
Control	42	53	5	100
Bronchial Asthma	52	29	19	100
Chi-square test=16.255	P < 0.01 (P value=9.210; Sig.)			
Digit IV				
	Whorl	**Loop**	**Arch**	**%**
Control	31	61	8	100
Bronchial Asthma	72	22	6	100
Chi-square test=34.931	P < 0.01 (P value=9.210; Sig.)			
Digit V				
	Whorl	**Loop**	**Arch**	**%**
Control	39	54	7	100
Bronchial Asthma	52	46	11	100
Chi-square test=3.004	P > 0.05 (P value=5.991; Not Sig.)			

Table 1b. Comparison of finger print patterns in Indo-Trinidadian bronchial asthma patients & controls (N1=100 & N2=100)

Digit I				
	Whorl	**Loop**	**Arch**	**%**
Control	53	34	13	100
Bronchial Asthma	50	41	9	100
Chi-square test=1.468	P > 0.05 (P value=5.991; Not Sig.)			
Digit II				
	Whorl	**Loop**	**Arch**	**%**
Control	42	51	7	100
Bronchial Asthma	31	56	13	100
Chi-square test=3.691	P > 0.05 (P value=5.991; Not Sig.)			
Digit III				
	Whorl	**Loop**	**Arch**	**%**
Control	55	40	5	100
Bronchial Asthma	40	47	13	100
Chi-square test=6.487	P < 0.05 (P value=5.991; Sig.)			
Digit IV				
	Whorl	**Loop**	**Arch**	**%**
Control	32	58	10	100
Bronchial Asthma	31	63	6	100
Chi-square test=1.222	P > 0.05 (P value=5.991; Not Sig.)			
Digit V				
	Whorl	**Loop**	**Arch**	**%**
Control	30	61	9	100
Bronchial Asthma	39	48	13	100
Chi-square test=3.452	P > 0.05 (P value=5.991; Not Sig.)			

Table 2a. Intergroup ccomparison of finger print patterns in Afro-Trinidadian and Indo-Trinidadian control group (N1=100 & N2=100)

Digit I				
	Whorl	**Loop**	**Arch**	**%**
Control (Afro-Trinidadian)	45	46	9	100
Control (Indo-Trinidadian)	53	34	13	100
Chi-square test=3.18	P > 0.05 (P value=5.991; Not Sig.)			
Digit II				
	Whorl	**Loop**	**Arch**	**%**
Control (Afro-Trinidadian)	51	40	9	100
Control (Indo-Trinidadian)	42	51	7	100
Chi-square test=2.451	P > 0.05 (P value=5.991; Not Sig.)			
Digit III				
	Whorl	**Loop**	**Arch**	**%**
Control (Afro-Trinidadian)	42	53	5	100
Control (Indo-Trinidadian)	55	40	5	100
Chi-square test=3.559	P > 0.05 (P value=5.991; Not Sig.)			
Digit IV				
	Whorl	**Loop**	**Arch**	**%**
Control (Afro-Trinidadian)	31	61	8	100
Control (Indo-Trinidadian)	32	58	10	100
Chi-square test=0.314	P > 0.05 (P value=5.991; Not Sig.)			
Digit V				
	Whorl	**Loop**	**Arch**	**%**
Control (Afro-Trinidadian)	39	54	7	100
Control (Indo-Trinidadian)	30	61	9	100
Chi-square test=1.85	P > 0.05 (P value=5.991; Not Sig.)			

Table 2b. Intergroup ccomparison of finger print patterns in Afro-Trinidadian and Indo-Trinidadian bronchial asthma group (N1=100 & N2=100)

Digit I				
	Whorl	**Loop**	**Arch**	**%**
Bronchial Asthma (Indo-Trinidadian)	50	41	9	100
Bronchial Asthma (Afro-Trinidadian)	40	51	9	100
Chi-square test=2.198	P > 0.05 (P value=5.991; Not Sig.)			
Digit II				
	Whorl	**Loop**	**Arch**	**%**
Bronchial Asthma (Indo-Trinidadian)	31	56	13	100
Bronchial Asthma (Afro-Trinidadian)	53	33	14	100
Chi-square test= 11.743	P < 0.01 (P value=9.210; Sig.)			
Digit III				
	Whorl	**Loop**	**Arch**	**%**
Bronchial Asthma (Indo-Trinidadian)	40	47	13	100
Bronchial Asthma (Afro-Trinidadian)	52	29	19	100
Chi-square test=6.953	P > 0.05 (P value=5.991; Not Sig.)			
Digit IV				
	Whorl	**Loop**	**Arch**	**%**
Bronchial Asthma (Indo-Trinidadian)	31	63	6	100
Bronchial Asthma (Afro-Trinidadian)	72	22	6	100
Chi-square test=36.097	P < 0.01 (P value=9.210; Sig.)			
Digit V				
	Whorl	**Loop**	**Arch**	**%**
Bronchial Asthma (Indo-Trinidadian)	39	48	13	100
Bronchial Asthma (Afro-Trinidadian)	52	46	11	100
Chi-square test=1.682	P > 0.05 (P value=5.991; Not Sig.)			

4. DISCUSSION

Bronchial asthma is one of the most common chronic diseases globally. Dermatoglyphics can play an important role in diagnosis of bronchial asthma. Even though, various diagnostic tools are available for diagnosing bronchial asthma, dermatoglyphics is a simple, inexpensive and non-invasive procedure which may be used as a reliable indicator for screening bronchial asthma. Bronchial asthma is influenced by genetic factors and the dermatoglyphic patterns are also genetically determined, which may have a correlation that could be of help in predicting the occurrence of bronchial asthma. Xue et al. [18] suggest that ADAM33 polymorphisms are correlated with asthma and may be the underlying genetic basis of the association between asthma and palm dermatoglyphic patterns. However the studies on correlation between dermatoglyphics patterns in bronchial asthma patients are few [19-23]. Recently the dermatoglyphic patterns have proved to be of diagnostic value in certain clinical disorders associated with chromosal and developmental defects like mongolism, Turner's syndrome, cardiovascular disease, diabetes and schizophrenia [24-27].

The dermal ridge patterns are formed very early in the embryonic period of life; because of that they remain unchanged during a person's life and is affected by certain abnormalities of early development (3). The present study was conducted to find out the correlation between dermatoglyphic changes in finger tips in patients with bronchial asthma. The different patterns of controls were compared with that of Afro-Trinidadian and Indo-Trinidadian patients of bronchial asthma. Results from our studies showed that whorls, loops and arches only in III and IV digits were significantly increased when compared with controls. Similar results were obtained in the studies conducted by Sreenivasulu et al. [28] with only one ethnic group. Ozkaragoz [12] also found that 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. Gupta et al. [11] found that a higher frequency of whorls was observed in first digit of the bronchial asthma patients in comparison to controls. Cummins and Midlow [29] found that in all the digits, the frequency of the arches was reduced in the bronchial asthma patients as compared to that in the controls. On contrary Sahana et

al. [30], found significant increase in the number of ulnar loops and significant decrease in the number of arches in the bronchial asthma group when compared to the control group. Eventhough, there is only significant increase in the all finger print patterns of only III and IV digits the presents results provide further data and indicate that there are some genetic factors which are involved in the causation of bronchial asthma and it is possible to certain extent to predict an individual's chance of acquiring bronchial asthma from the finger print pattern. As far as we are aware, there is no published report comparable to the present study on selected two ethnic groups. However, the relevance of our findings needs to be evaluated by further studies.

5. CONCLUSION

In the present study whorls, loops and arches showed significant changes only in the III and IV digits in both Afro-Trinidadian and Indo-Trinidadian asthmatic patients. These observations can provide additional support and may help in the early diagnosis of bronchial asthma. After extensive studies this parameter can be included as part of the clinical picture of bronchial asthma.

ACKNOWLEDGEMENTS

We are grateful to the Eric Williams Medical Sciences Complex, Mt. Hope and San Fernando General Hospital, Trinidad and The University of the West Indies, St. Augustine Campus, Trinidad, West Indies for providing the facilities and support that made it possible for us to undertake this research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/12634