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Original Research Article

Palmar Dermatoglyphic Patterns in Pulmonary Tuberculosis between Afro-Trinidadian and Indo-Trinidadian: A Comparative Study

Suresh R Rao[1*], Nelleen Baboolal[2**], Bidyadhar Sa[3*], T. Ramesh Rao[1*]

[1]Dept of Preclinical Sciences, [2]Dept of Clinical Medical Sciences, [3]Centre for Medical Sciences Education,
[*]Faculty of Medical Sciences, the University of the West Indies, St. Augustine Trinidad & Tobago.
[**]The University of the West Indies, St. Augustine Trinidad & Tobago.

Corresponding Author: Suresh R Rao

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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 variousdermatoglyphic features in patients of pulmonary tuberculosis, to compare dermatoglyphic features in normal and patients of pulmonary tuberculosis.
Methods: Dermatoglyphic prints were obtained from both hands of 100 patients of pulmonary tuberculosis among Afro-Trinidadian and Indo-Trinidadian. Hundred normal healthy individuals, without family history of pulmonary tuberculosis, were selected as control group. The qualitative parameters like whorls, loops and arches were studied in the above mentioned study groups.
Results: Presence of significant increase ($p<0.01$) in the number of whorls in I, II and III digits and significant decrease ($p<0.01$) in number of arches in III and IV digits were found in Afro-Trinidadian group when compared with control group. A significant increase in number of whorls at the level of $p<0.01$ was found only in III and IV digits in Indo-Trinidadian group when compared with the control group. The intergroup comparisons also showed significant increase in number of whorls only in IV digit of Afro-Trinidadian pulmonary tuberculosis patients when compared with Indo-Trinidadian pulmonary tuberculosis patients.
Conclusion: From this study we conclude that dermatoglyphics is a simple, nonexpensive diagnostic aid for conditions pulmonary tuberculosis. Presence of increase in number of whorls and arches can be used as one of the diagnostic criterion for patients with pulmonary tuberculosis.

Key Words: Dermatoglyphic, Pulmonary Tuberculosis, Finger prints.

INTRODUCTION

Pulmonary tuberculosis remains a vast public health problem. It is one of the oldest known diseases to affect humans caused by Mycobacterium tuberculosis. Tuberculosis typically attacks the lungs, but can also affect other parts of the body. It is spread through the air when people who have an active TB infection cough, sneeze, or otherwise transmit respiratory fluids through the air. [1] One-third of the world's population is thought to have been infected with *M. tuberculosis*, [2] and new infections occur in about 1% of the

population each year. [3] In 2007, an estimated 13.7 million chronic cases were active globally, [4] while in 2013, an estimated 9 million new cases occurred. In 2013 there were between 1.3 and 1.5 million associated deaths, [5,6] most of which occurred in developing countries. [7] More people in the developing world contract tuberculosis because of a poor immune system, largely due to high rates of HIV infection and the corresponding development of AIDS. [8]

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 [9] 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. [10] They are of considerable clinical interest because they are affected by certain abnormalities of early development including genetic disorders. [11] 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. [12,13] A significant link has been established by pioneer workers between ridge pattern in congenital heart diseases, [14] diabetes, [15] pulmonary tuberculosis, [16] leprosy [17,18] and bronchial asthma. [19-21] 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 pulmonary tuberculosis 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.

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 Coura Hospital. Diagnostic criteria for labeling pulmonary tuberculosis, is based on detail medical history, family history, physical examination, chest X-ray and confirmed by the sputum culture and skin test.

Inclusion criteria:

- Age≥ 18 years.
- Subject has signed the informed consent form.
- Diagnosis of pulmonary tuberculosis is based on the finding of acid fast-bacilli on microscopic examination under the oil immersion objective of expectorated three sputum specimens stained with Ziehl-Neelsen basic fuschin dyes, showing two or more typical bacilli.
- At least two initial sputum smears positive for acid fast bacilli or one acid fast bacilli positive smear and one positive culture.

Exclusion criteria:

- Subject has not signed the informed consent form.
- Patients with deformed fingers and palms, infections and injuries like

burns of fingers and palms, scars of burns of fingers and palms of both hands will be excluded from the study.

- At least three negative smears.

About 50 patients in each ethnic group are matched with 50 healthy controls that were having no family history of the above mentioned clinical conditions or any other inheritable disease. This healthy control is 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 patient is 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' [22] 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 print of both hands is 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, [9] classified them in: whorls, loops and arches.

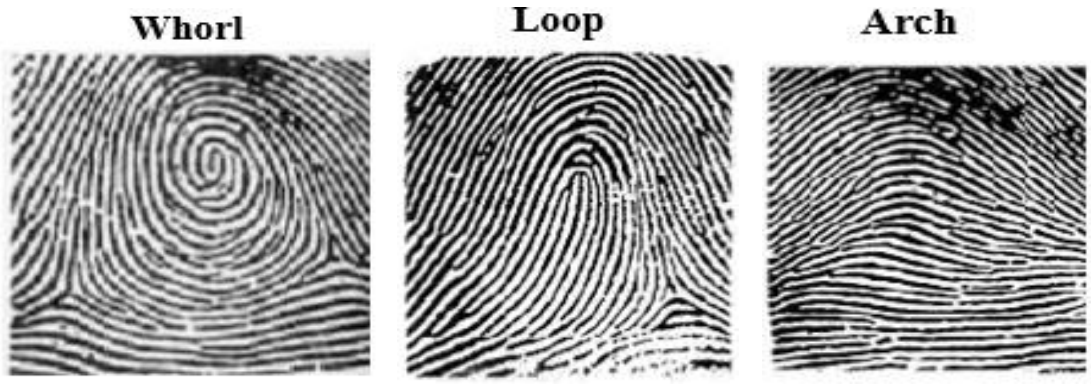

Fig: 1. Dermatoglyphic digital patterns of ridges

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.

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.

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.

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.

RESULTS

Table 1: Comparison of finger print patterns in Afro-Trinidadian pulmonary tuberculosis patients & controls (N1=100 & N2=100).

Digit I				
	Whorl	**Loop**	**Arch**	**Total**
Control	25	46	29	100
Tuberculosis	54	33	13	100
Chi-square test=18.880; P > 0.01 (Sig.)				
Digit II				
	Whorl	Loop	Arch	Total
Control	51	40	9	100
Tuberculosis	56	35	9	100
Chi-square test=0.567; P > 0.05 (Not Sig.)				
Digit III				
	Whorl	Loop	Arch	Total
Control	42	33	25	100
Tuberculosis	52	42	6	100
Chi-square test=13.789; P < 0.01 (Sig.)				
Digit IV				
	Whorl	Loop	Arch	Total
Control	31	41	28	100
Tuberculosis	56	39	5	100
Chi-square test=23.264; P < 0.01 (Sig.)				
Digit V				
	Whorl	Loop	Arch	Total
Control	39	54	7	100
Tuberculosis	53	42	5	100
Chi-square test=3.964; P > 0.05 (Not Sig.)				

The results of different finger print pattern studied in Afro-Trinidadian tuberculosis patients group showed significant increase in number of whorls at the level of p<0.01, were found in I, III and IV digits when compared with the control group. There was also significant decrease in the arch's in III and IV digits when compared to the control group. However there was a decreased in loop pattern in the study group, but it was not at any significant level (Table 1).

Table 2: Comparison of finger print patterns in Indo-Trinidadian pulmonary tuberculosis patients & controls (N1=100 & N2=100).

Digit I				
	Whorl	**Loop**	**Arch**	**Total**
Control	53	34	13	100
Tuberculosis	50	41	9	100
Chi-square test=1.468; P > 0.05 (Not Sig.)				
Digit II				
	Whorl	**Loop**	**Arch**	**Total**
Control	42	51	7	100
Tuberculosis	55	39	6	100
Chi-square test=3.419; P > 0.05 (Not Sig.)				
Digit III				
	Whorl	**Loop**	**Arch**	**Total**
Control	35	50	15	100
Tuberculosis	54	37	9	100
Chi-square test=7.499; P > 0.05 (Sig.)				
Digit IV				
	Whorl	**Loop**	**Arch**	**Total**
Control	32	58	10	100
Tuberculosis	55	23	12	100
Digit V				
	Whorl	**Loop**	**Arch**	**Total**
Control	30	61	9	100
Tuberculosis	46	48	6	100
Chi-square test=5.519; P > 0.05 (Not Sig.)				

Table 3: Intergroup comparison of finger print patterns in Afro-Trinidadian and Indo-Trinidadian control group (N1=100 & N2=100).

Digit I				
	Whorl	**Loop**	**Arch**	**Total**
Control (Group I)	25	46	29	100
Control (Group II)	53	34	13	100
Chi-square test=17.947; P > 0.01 (Sig.)				
Digit II				
	Whorl	**Loop**	**Arch**	**Total**
Control (Group I)	51	40	9	100
Control (Group II)	42	51	7	100
Chi-square test=2.451; P > 0.05 (Not Sig.)				
Digit III				
	Whorl	**Loop**	**Arch**	**Total**
Control (Group I)	42	33	25	100
Control (Group II)	35	50	15	100
Chi-square test=6.618; P > 0.05 (Sig.)				
Digit IV				
	Whorl	**Loop**	**Arch**	**Total**
Control (Group I)	31	41	28	100
Control (Group II)	32	58	10	100
Chi-square test=11.461; P > 0.01 (Sig.)				
Digit V				
	Whorl	**Loop**	**Arch**	**Total**
Control (Group I)	39	54	7	100
Control (Group II)	30	61	9	100
Chi-square test=1.85; P > 0.05 (Not Sig.)				

The Indo-Trinidadian tuberculosis patients group showed a significant increase in number of whorls at the level of p<0.01 only in III and IV digits, when compared with the control group. In other digits there was a decrease in number of

all the studied finger print patterns but it was not at any significant level with that of the control group (Table 2).

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 number of whorl pattern only in digit IV in Afro-Trinidadian tuberculosis patient group when compared with Indo-Trinidadian tuberculosis patients (Table 3 &4).

Table 4: Intergroup comparison of finger print patterns in Afro-Trinidadian and Indo-Trinidadian pulmonary tuberculosis group (N1=100 & N2=100).

Digit I				
	Whorl	**Loop**	**Arch**	**Total**
Tuberculosis (Group I)	54	33	13	100
Tuberculosis (Group II)	50	41	9	100
Chi-square test=1.746; P > 0.05 (Not Sig.)				
Digit II				
	Whorl	**Loop**	**Arch**	**Total**
Tuberculosis (Group I)	56	35	9	100
Tuberculosis (Group II)	55	39	6	100
Chi-square test= 0.825; P > 0.05 (Not Sig.)				
Digit III				
	Whorl	**Loop**	**Arch**	**Total**
Tuberculosis (Group I)	52	42	6	100
Tuberculosis (Group II)	54	37	9	100
Chi-square test=0.954; P > 0.05 (Not Sig.)				
Digit IV				
	Whorl	**Loop**	**Arch**	**Total**
Tuberculosis (Group I)	56	39	5	100
Tuberculosis (Group II)	55	23	12	100
Chi-square test=6.512; P < 0.05 (Sig.)				
Digit V				
	Whorl	**Loop**	**Arch**	**Total**
Tuberculosis (Group I)	53	42	5	100
Tuberculosis (Group II)	46	48	6	100
Chi-square test=0.986; P > 0.05 (Not Sig.)				

DISCUSSION

Pulmonary tuberculosis is one of the important causes for mortality and morbidity in the developing countries. Pulmonary tuberculosis is influenced by genetic factors; it has been linked to Mannose Binding Protein Gene. [23] Significant association has been found between IL - 1 Gene clusters and host susceptibility to tuberculosis. [24] The dermatoglyphic patterns are also genetically determined, which may have a correlation that could be of help in predicting the occurrence of pulmonary tuberculosis. Dermatoglyphics can play an important role in diagnosis of pulmonary tuberculosis. Even though, various diagnostic tools are available for diagnosing pulmonary tuberculosis, dermatoglyphics is a simple, inexpensive and non-invasive procedure which may be used as a reliable indicator for screening pulmonary tuberculosis. Recently the dermatoglyphic patterns have proved to be of diagnostic value in certain clinical disorders associated with chromosomal and developmental defects like mongolism, Turner's syndrome, cardiovascular disease, diabetes and schizophrenia. [25-28] However the studies on correlation between dermatoglyphics patterns in pulmonary tuberculosis patients are very few. Sangita S Babu et al [29] studied the whorl pattern significantly predominant with decrease in loop pattern. Analysis of Geetha V et al [30] has found 60.6% of whorl patterns, 36.4% loops and 3% arches in tuberculosis patients. Sindhu LS [31] and Nechaeva OB et al, [32] found significant differences in distribution of various subtypes in index fingers of both hand and little finger of right hand. In our present study we also found that increase in the whorl patterns and decrease in the arches of both ethnic groups. However, in the intergroup comparison of our studies showed Afro-Trinidadian group increase in whorl patterns was more predominant. On contrary, Danborno et al [33] work on the hause ethnic group of Nigeria in terms of their percentage frequencies of digital pattern found ulnar loop being the highest (48.38%), followed by whorls (29.74%). Studies conducted on Nigerians residing in Lagos by Abue AD et al [34] and Osunwoke EA et al [35] on Okrika and Ikwerre ethnic groups of Nigeria, also found that predominant in ulnar loop (79.5%), Whorls (42.4%), arch's (12.4%) and radial loops (9.3%). Even though, there is only significant increase in whorls and decrease in arches finger print patterns of only I, 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 pulmonary tuberculosis and it is possible to certain extent to predict an individual's chance of acquiring pulmonary tuberculosis 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.

CONCLUSION

The dermatoglyphic pattern seen in pulmonary tuberculosis patients in our study establishes the fact that there is a correlation between palmar pattern and incidence of pulmonary tuberculosis. It is possible to certain extent to predict occurrence of pulmonary tuberculosis from certain dermatoglyphic parameters. Implementation of our findings in the screening test for pulmonary tuberculosis has to be evaluated by further elaborate studies between the studied ethnic groups.

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