



Original Article

A “Handy” tool for hypertension prediction: Dermatoglyphics

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ABSTRACT

Background: Fingerprints studied by dermatoglyphics are unique for a given individual. It depends on the genetic makeup of an individual. Hypertension, a harbinger of many complications, is determined by genetic and environmental factors. In this observational study, we tried to find an association of palmar dermatoglyphic parameters and hypertension.

Method: Two hundred fifty known hypertensives as cases and 250 normotensives as controls were enrolled after considering inclusion and exclusion criteria. Dermatoglyphic patterns on tips of fingers obtained by digital imaging were noted in both the groups, and “atd” angle was calculated using “screen protractor” software. Collected data were statistically analyzed to find any association between dermatoglyphic qualitative and dermatoglyphic quantitative patterns and hypertension.

Result: Mean “atd” angle was higher in cases than in controls. Comparison of dermatoglyphic patterns in both the groups in various ways—both hands together, the right hand and left hand separately, similar fingers on right and left hand together, and similar fingers separately—was performed which revealed that at every level, whorls were more frequent in cases than in controls and that distribution of dermatoglyphic patterns were statistically significant in cases than in controls.

Conclusion: Fingerprint patterns can be reliably used to identify individuals likely at risk for hypertension, and accordingly, preventive measures can be targeted. This subject area demands a need for further research and analysis with large sample size to allow dermatoglyphics to evolve into a cost-effective and handy tool for identifying individuals at risk of hypertension.

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1. Introduction

Palmistry, an art of reading palm and fingerprints as a predictor of future, has evolved scientifically as well. In the past 150 years, with scientific interpretation of palmistry, it has developed eventually into the field of dermatoglyphics, derived from Greek, derma meaning skin and glyphic meaning carvings. The word “dermatoglyphics” was coined by Professor Harold Cummins, and it refers to the analysis of epidermal ridge patterns of skin on volar aspect of fingers, palms, toes, and soles.^{1,2} The epidermal patterns in any individual start to develop during sixth and seventh weeks of

intrauterine life and are fully formed by the end of the second trimester.³

Galton (1892) was among the first to use certain fingerprint ridgeline patterns or minutiae to study individuality of fingerprints. Genetic and environmental factors influence fingerprints. Dermatoglyphics are helpful and aid in many ways including identification of single-gene disorders.^{4,5} The fact that they are unique for every single person further strengthens the point that genetic characteristics of an individual will be shown by his/her fingerprint. Hypertension, commonly known as raised blood pressure, also termed as “silent killer of mankind” is influenced by genetic and environmental factors and can be detected with the aid of dermatoglyphics at an early stage.⁶

Prevalence of hypertension has been on a steady rise over the last 50 years, more noticeably in urban than in rural areas. Hypertension is a major health problem in India. Prevalence of hypertension is 59.9 and 69.9 per 1000 in males and females, respectively.⁷ A decrease by 2 mmHg of blood pressure in

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hypertensive individuals shows a mortality rate diminution by 3%, showing the importance of evaluation and control. Studies under the same umbrella have shown that genetic factors play a major role in the pathogenesis of essential hypertension.⁸ By analyzing dermatoglyphics of normotensive individuals at an early age, we can try to identify particular patterns strongly associated with development of hypertension and thereby modify other risk factors at an earlier stage in these susceptible individuals. This can form a basis for primary prevention and control of hypertension.

2. Aim of the study

The aim was to analyze various dermatoglyphic parameters in patients with hypertension and ascertain association between specific dermatoglyphic patterns and hypertension.

3. Materials and methods

After obtaining institutional ethical committee clearance, our cross-sectional study proceeded with subjects selected by convenient sampling method who were aged between 25 and 50 years of age, attending tertiary health care center in Southern India for routine health checkup conducted on behalf of their working institution. Nature of this observational study conducted between August 2014 and August 2016 was explained to subjects, and informed consent was obtained from all subjects. Subjects were enrolled after thorough clinical examinations, and detailed history was collected. Blood pressure was measured using a mercury sphygmomanometer on the right hand in sitting position three times at 5-min intervals to confirm blood pressure values and ensure controls are normotensive. Average of the three readings each taken at 5-min intervals was considered as the final reading.

According to the Joint National Committee (JNC 7), those with systolic blood pressure >140 mmHg and/or diastolic blood pressure >89 mmHg were considered hypertensives.⁹ A total of 250 hypertensive patients aged between 25 and 50 years were included as cases, and 250 normotensive patients older than 50 years were included as controls, based on the inclusion and exclusion criteria. Hypertensives with or without treatment but with any deformities of fingers and palm or infected hand or with deep burns of fingers and palms leading to scars were excluded from our study.

The digital data scanner Canoscan lide110 flatbed scanner was used for taking finger and palm prints and images of both hands. After cleaning the subject's hands with soap and water, the subject would place both hands on the scanner screen, and a digital image of hands was obtained. A separate image was obtained for two thumbs. Images scanned were stored for analysis. There are specific patterns of epidermal ridges on the fingertip—loop (ridges start on

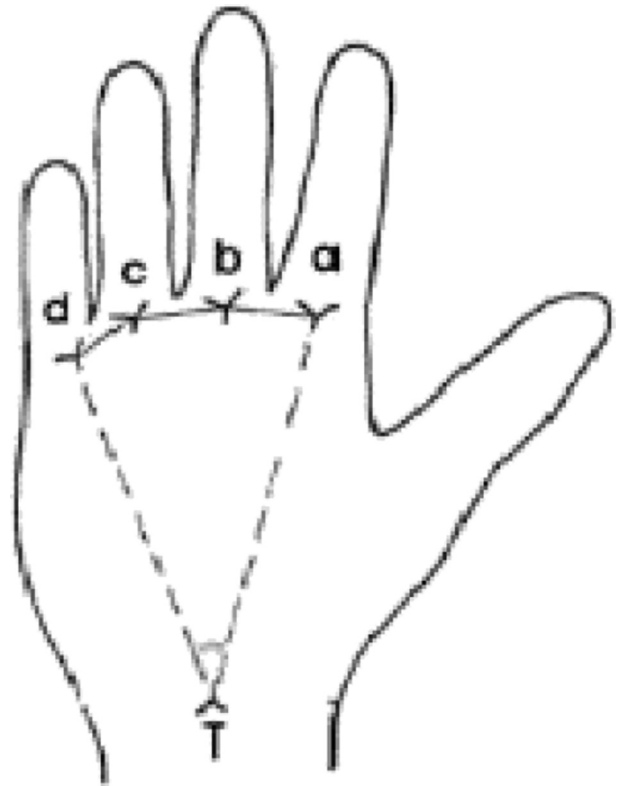


Fig. 2. “atd” angle.

one side, rise toward center, and return back to the side they started from; ulnar loop has the open end toward the ulnar side, and radial loop has the open end toward the radial side), whorls (ridges are circular), arches (ridges enter from one side, make a rise in the center, and exit through the opposite side) (Fig. 1), and composite (both loop and whorl together). Patterns were read under direct visualization.

“atd” triangle also termed as “palm angle” is formed by joining three triradii in palm. Triradii “a” is at the base of the index finger, triradii “d” is at the base of the little finger, and “t” is the axial triradius situated further below. So, “atd” angle is formed at “t” triradius. “atd” angle was calculated using “screen protractor” software (Fig. 2). Finally, all data thus collected were statistically analyzed. Chi-square test was used to analyze the fingerprint pattern, whereas Student *t* test was used for determining the “atd” angle.

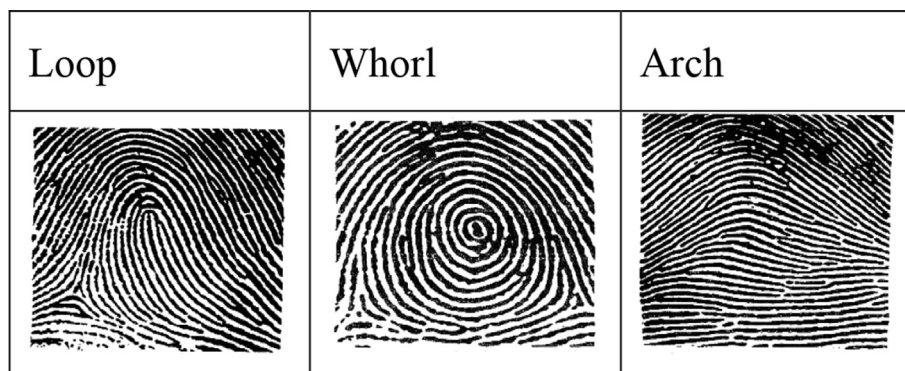
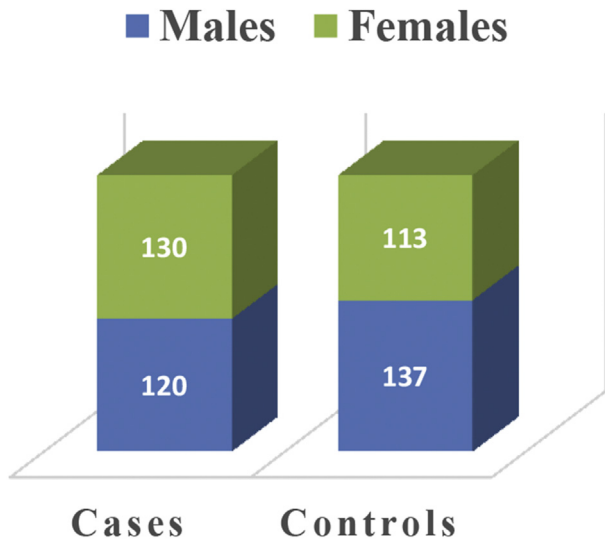


Fig. 1. Finger print patterns.



Graph I. Demographic details of study subjects.

4. Results

Our observational study involved comparison of palmar dermatoglyphic parameters between cases and controls. Parameters were analyzed quantitatively—*atd* angle—and qualitatively—radial loop, ulnar loop, arch, whorl, and composite.

As shown in Graph I, of total 250 cases, 120 (48%) were males, and 130 (52%) were females. Of total 250 controls, 137 (54.8%) were males, and 113 (45.2%) were females.

According to Graph II, we found that mean “*atd*” angle was higher in cases than in controls, and there was a statistically significant association of mean “*atd*” angle in cases compared with controls. We also found the right and left mean “*atd*” angle was higher in cases than controls with strong statistically significant association of right mean “*atd*” angle in cases than in controls.

By analyzing qualitative parameters in the study group, distribution of the dermatoglyphic patterns was statistically significant in cases when compared with controls.

According to Table 1, the radial loop was more frequent in cases, whereas the ulnar loop was more commonly found in normotensive controls.

According to Table 2, analysis of qualitative parameters in each hand of cases and controls showed that the distribution of dermatoglyphic parameters was statistically significant.

Table 1 Dermatoglyphic pattern distribution in cases and controls*.

Fingerprint pattern	Cases		Controls	
	Frequency	Percentage	Frequency	Percentage
Radial loop	254	10.2	190	7.6
Ulnar loop	961	38.4	1494	59.8
Arch	135	5.4	178	7.1
Whorl	1144	45.8	632	25.3
Composite	6	0.2	6	0.2

**p*: 0.001—highly significant.

Table 2 Comparison of dermatoglyphic qualitative parameters in each hand in cases and controls.

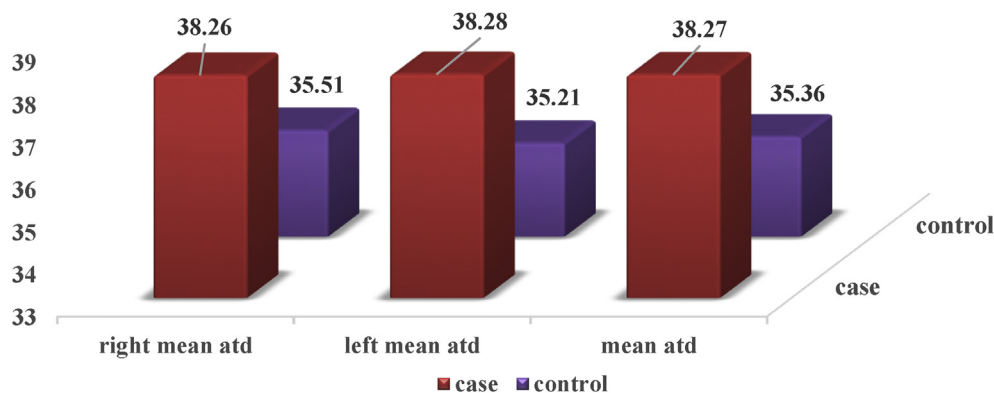
Hand	Value	<i>p</i> value	Significance
Right	136.17	0.001	Highly significant
Left	144.07	0.001	Highly significant

As shown in Table 3, comparing qualitative parameters in each finger of both cases and controls for distribution of dermatoglyphic patterns showed statistically significant association.

5. Discussion

On studying dermatoglyphic patterns in hypertensive cases and comparing the same with those of normotensive controls, authors of this study found that the mean “*atd*” angle was higher in cases than in controls. This might also indicate a higher value of mean “*atd*” angle in an individual (38.2; Graph II), with a higher likelihood of developing hypertension in future. This study also shows right and left mean “*atd*” angles (38.2; Graph II) were significantly higher in cases than in controls, thereby suggesting a higher possibility of having a raised blood pressure in an individual if the right and/or left “*atd*” angle is more. Our findings corroborate with those of similar studies conducted elsewhere, one in Malawian population and another in inhabitants of West Bengal, India.^{10,11}

Comparing dermatoglyphic qualitative patterns in cases versus controls by considering (Table 1) both hands together and separately, as in the right hand of cases versus the right hand of controls and likewise, authors noted that whorls were more frequent in cases, thus suggesting that the presence of whorls may be associated with an increased probability of having raised blood pressure. Similarly, comparing individual fingers on the right and left hand in cases versus similar fingers on the right and left hand in controls,



Graph II. “atd” angle in cases vs controls.

Table 3
Comparison of dermatoglyphic parameters in each finger of cases and controls.

Finger	Value	p value	Significance
Right thumb	48.07	0.001	Highly significant
Right index	13.69	0.001	Highly significant
Right middle	24.35	0.001	Highly significant
Right ring	46.96	0.001	Highly significant
Right little	25.11	0.001	Highly significant
Left thumb	23.03	0.001	Highly significant
Left index	23.49	0.001	Highly significant
Left middle	26.58	0.001	Highly significant
Left ring	47.51	0.001	Highly significant
Left little	41.69	0.001	Highly significant

the study shows that the chance of being afflicted with hypertension is more with the presence of radial loops. These observations suggest that hereditary or environmental factors, acting in early gestation, may play a role in genesis of disease conditions. Epidermal ridge patterns are formed at the end of the embryonic period under genetic control and do not change thereafter. They, therefore, give an indication of stability or otherwise of development at an early stage. This suggests that hereditary or environmental factors, acting in early gestation, may play a role in genesis of certain disease conditions.^{4,6}

In our study, we observed an increased association with whorls in hypertensive patients and a significant association with ulnar loops in normotensive patients. Our findings are validated by similar outcomes of another study conducted in western Maharashtra, India, with a low frequency of ulnar loops in hypertensives.¹² Our findings stand in line with those of another work conducted on Iranian population in which 40 known hypertensives were compared with 20 normotensives without hypertension history for two generations in their family.¹³

In our study, we noticed a higher frequency of whorls in all the fingers of hypertensives. A study in Nigeria also found higher frequency of whorls in most of the fingers of the right and left hand in hypertensives.¹⁴ Our observations regarding atd angle and fingerprint pattern were similar to those by Kulkarni DU and Herekar NG (2005) who found lesser number of fingertip ulnar loops, higher number of whorls, and also a greater mean atd angle in hypertensives.¹⁵

We, however, did not study the total finger ridge count and a–b ridge count, another two quantitative parameters which may be considered while conducting a large sample size study. Without considering gender-wise composition of the study sample in terms of numbers of males and females, authors find it difficult to establish the impact of sexual dimorphism on results of the present study. Considering similar studies carried out in this field, it can be said that this is a unique and first-of-its-kind study conducted in

South India. Such study needs further research to ascertain relation to hereditary and in utero environmental factors.

6. Conclusion

The results obtained in this study shows that there exists a definite association between palmar dermatoglyphics and blood pressure. The subject demands a need for further research and analysis with a much larger sample size so as to allow dermatoglyphics to evolve into a cost-effective, specific, and handy tool for predicting individuals at risk, so that targeted preventive measures can be undertaken to prevent the occurrence of hypertension in those at risk.

Conflict of interest

The author's declare that there is no conflict of interest.

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