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RESEARCH ARTICLE

Palmar dermatoglyphics patterns in diabetes mellitus and diabetic with hypertension patients in Gangtok region

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Abstract

Background: Considerable progress has been made in understanding of the associations between dermatoglyphics and various medical disorders, as a result of which dermatoglyphics analysis has been established as a useful diagnostic and research tool in medicine, providing important insights into the inheritance and embryologic development of many clinical disorders.

Materials and Methods: The present study was carried out to evaluate characteristic dermatoglyphic features in subjects with diabetes mellitus and diabetes mellitus with hypertension in Gangtok, Sikkim. Palmar dermatoglyphic analysis on 210 subjects was carried out. Dermatoglyphics prints were taken by 'Ink method' described by Cummins and Mildo. Further, statistical analysis was done to find the variations in the dermatoglyphics features in all groups.

Result: The a-b ridge counts were higher in all the patients and statistically significant in diabetic females, in right hands of male and left hand of females of diabetic with hypertension. The atd angles were decreased in both hands of male and female both diabetic and diabetic with hypertensive patients than controls.

Conclusion: Dermatoglyphic investigation is absolutely cost effective and requires no hospitalization and it can help in predicting the phenotype of possible future illness. It can be used as a screening tool for early identification of at-risk individuals and prevent the further complications.

INTRODUCTION

Dermatoglyphics is the study of specific patterns of epidermal ridges in the palms and soles. The term dermatoglyphics was coined by Cummins and Mildo (1926)[1] and was derived from Greek words 'derma' means skin and 'glyphics' means carvings.[2] Each dermatoglyphic configuration is unique and stable marker of identity. They are genetically determined and influenced by physical, topographical and environmental factors. No two persons, not even uniovular twins, show exactly similar dermatoglyphic features. This fact has been known for the purpose of personal identification.[3] Dermatoglyphics features are inherited by polygenic system with individual gene contributing a small additive effect, has been reflected in number of diseases which have a strong hereditary basis.[4,5] Diabetes mellitus has a strong hereditary background. As there is increased risk of diabetes in persons with

family history because of genetic factors, the study of co-relation between dermatoglyphics and diabetes mellitus can help in early identification of people with the genetic predisposition to develop diabetes mellitus.

Recently, the number of patients with diabetes and hypertension has strikingly increased in most countries. The prevalence of hypertension in patients with type-II diabetes is known to be 1.5-3 times higher than in age- matched non-diabetic population. The presence of hypertension in patients with diabetes markedly enhances development of macrovascular and microvascular disease in these individuals. Diabetic individuals with coexisting hypertension have a much greater prevalence of stroke and transient ischemic episodes than do normotensive diabetics. Overall, the risk of cardiovascular death in diabetic patients is nearly doubled in the presence of hypertension. Both hypertension and diabetes mellitus are major independent risk factors for accelerated atherosclerosis and ischemic heart disease.[6]

The present study was carried to determine the relationship between dermatoglyphic patterns and type-II diabetes mellitus and diabetic with hypertension patients. If any significant correlation exists in dermatoglyphics patterns then, patients prone to diabetes are informed and warned to avoid certain trigger factors. The earliest prediction and diagnosis of patients with diabetes mellitus will definitely improve the result of treatment and prevent further complications.

Materials and methods:

The present study is an observational, descriptive and hospital based case-control study. The study was carried out in Department of Anatomy, Sikkim manipal institute of medical sciences, Gangtok, Sikkim.

A total 210 subjects were used for the study; 70 subjects having diabetes (32 males and 38 females), 70 subjects having diabetes with hypertension (32 males and 38 females) and 70 normal healthy individuals (32 males and 38 females) as control were used. All were clinically diagnosed and confirmed by investigations as diabetic and diabetic with hypertensive patients without any other special genetic disease that could affect their dermatoglyphic patterns of age group between 21-80 years. Patients attending out-door and in-door patients in medicine department from SMIMS, Gangtok, Sikkim were included in the present study.

For control group, subjects with no family history of diabetes mellitus, normal blood sugar levels and without any other major illnesses were selected for the present study. Controls were matched for gender, lifestyle and economic status as that of patients (case group). Equal number of males and females were selected in cases and controls to avoid the bias of sex in result. The ethical clearance was obtained from the institutional ethics committee prior to this study and informed consent was informed from the participants.

Materials used: Duplicating ink, white paper, Ink pad, magnifying hand lens, Needle with a sharp point- for ridge counting, cotton puffs, scale, pencil pen, protractor- to measure 'atd' angle.

Procedure:

Dermatoglyphics prints were taken by the 'Ink Method' described by Cummins and Mildo (1961).[7] Patients were informed about the procedure in detail and written informed consent was taken from the patients. Subjects were asked to wash their hands with soap water and dried with a soft cotton cloth, so as to remove any oil or dirt. Black duplicating ink was smeared on their hands uniformly and taking care that hollow of the palm and flexor creases of the wrist was uniformly inked. The hands of the patient were then placed on the bond paper from proximal to distal end. The palm was gently pressed between intermetacarpal grooves at the root of fingers and on the dorsal side corresponding to the thenar and hypothenar regions. The palm was then lifted from the paper in reverse order, from distal to proximal end. Then, palm were cleaned, washed and dried with a hand towel. The same procedure was adopted for controls. The printed sheet was coded with name, age, sex and for case group (diabetic, diabetic with hypertension) and control group. The prints were then subjected to dermatoglyphic analysis with the help of magnifying hand lens and ridge counting was done with the help of a sharp needle. The quantitative analysis was included atd, dat, adt angles and a-b ridge counts.

Advantages of this method:

- Simple technique
- Low cost
- Clarity of prints
- Being less time consuming
- Non-invasive
- No additional equipment is required
- No laboratory facilities are needed
- No two people have exactly the same fingerprints, not even twins.

Statistical analysis: The data obtained was analyzed statistically using SPSS (statistical programme for social sciences, version 18.0) computer software package. Descriptive statistics analysis of variance two way were applied and p-value <0.05 was consider as significant.

a-b ridge count: the number of ridges intersected by a line drawn between the 'a' triradius (at the base of index finger) and 'b' triradius (at the base of middle finger) of the palm in each hand. The count excludes the ridges forming the triradii.[8] (figure-1)

'atd' angle: the atd angle is an indication of the degree of distal displacement of axial triradius. This angle is formed by lines drawn from the digital triradius 'a' to axial triradius 't' and to digital triradius 'd'. The symbol 't' is reserved for axial triradii found in the proximal region of the palm, near the wrist crease. A triradius situated near the centre of the palm is term 't''. An extremely distally placed triradius (distal to proximal transverse crease) is termed as 't"'. The most important one is that the atd angle tends to decrease with age because the palm grows more in length than in breadth. This problem can be partially overcome by introducing the age correction. The size of atd angle is affected by the amount of spreading of fingers when the patterns are printed. The pressure exerted while the palm is printed also can affect the atd angle.[8] (Figure-1)

RESULTS:

The present study analyzed the palmar pattern of 210 subjects which includes 70 diabetic patients, 70 diabetic with hypertension patients and 70 control subjects.

Comparison of diabetic group with control group:

In the present study, the mean values of atd and dat angles in both hands of diabetic patients were lower than control whereas mean values of adt angles were higher than control on both right and left sides. Significant difference was found in the right hands of diabetic group. (Table-1, figure -2)

In the both hands (right and left) of male and female, the mean values of atd angle and dat angle of diabetic group were lower than control while the mean values of adt angle were higher than control. No significant difference was found. (Table-2, Figure-2)

The mean values of a-b ridge count in both hands were higher in diabetics male and female except in the left hands of male and highly significant difference was found in both hands of female. (Table-4, Figure-2)

Comparison of diabetic with hypertensive patients with control group:

In the right hands, mean values of atd angle were lower than control group and significant difference was found whereas mean values of dat and adt angles were higher than control group and significant difference was found in adt angle. (Table-1, Figure-3)

In the left hands, mean values of atd angle and dat angle were lower than control group and significant difference was found whereas mean values of adt angles were higher than control group and significant difference was found in adt angle. (Table-1, Figure-3)

In the right hands of both male and female, the mean values of atd angle were lower than control whereas mean values of dat and adt angles were higher than control. There was no significant difference found. (Table-3, Figure-3)

In the left hands of both male and female, the mean values of atd angle and dat angle were lower than control whereas mean values of adt angle were higher than control. There was significant difference found in left hands of females. (Table-3, Figure-3)

The mean values of right and left side a-b ridge count were higher in diabetic with hypertensive than controls and significant difference was found in right hands of male and left hands of females. (Table-4, Figure-3)

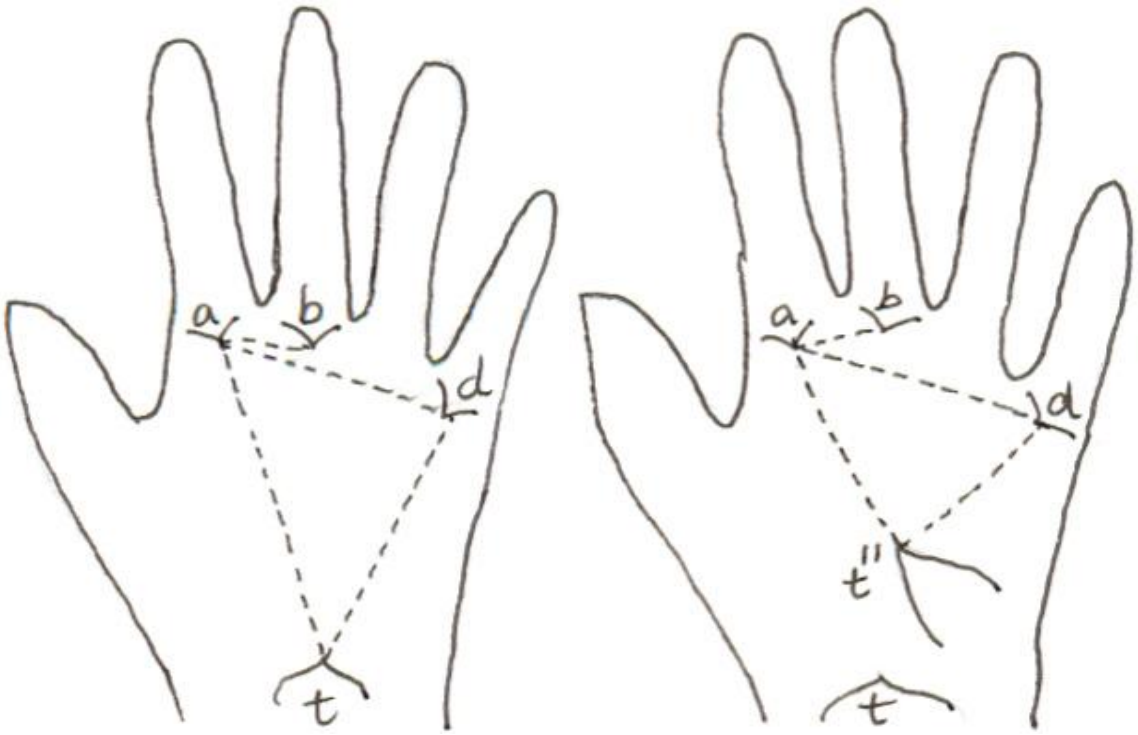

Figure 1: showing method of a-b ridge count and atd, dat and adt angles and a-b ridge count.

Figure : 2 Dermatoglyphics pattern of right hand of Diabetic group patient showing 'atd' angle, ' dat' angle and 'adt' angle and a-b ridge count .

Figure:3 Dermatoglyphics pattern of right hand of Diabetic with hypertension group patient showing 'atd' angle, 'dat' angle and 'adt' angle and a-b ridge count.

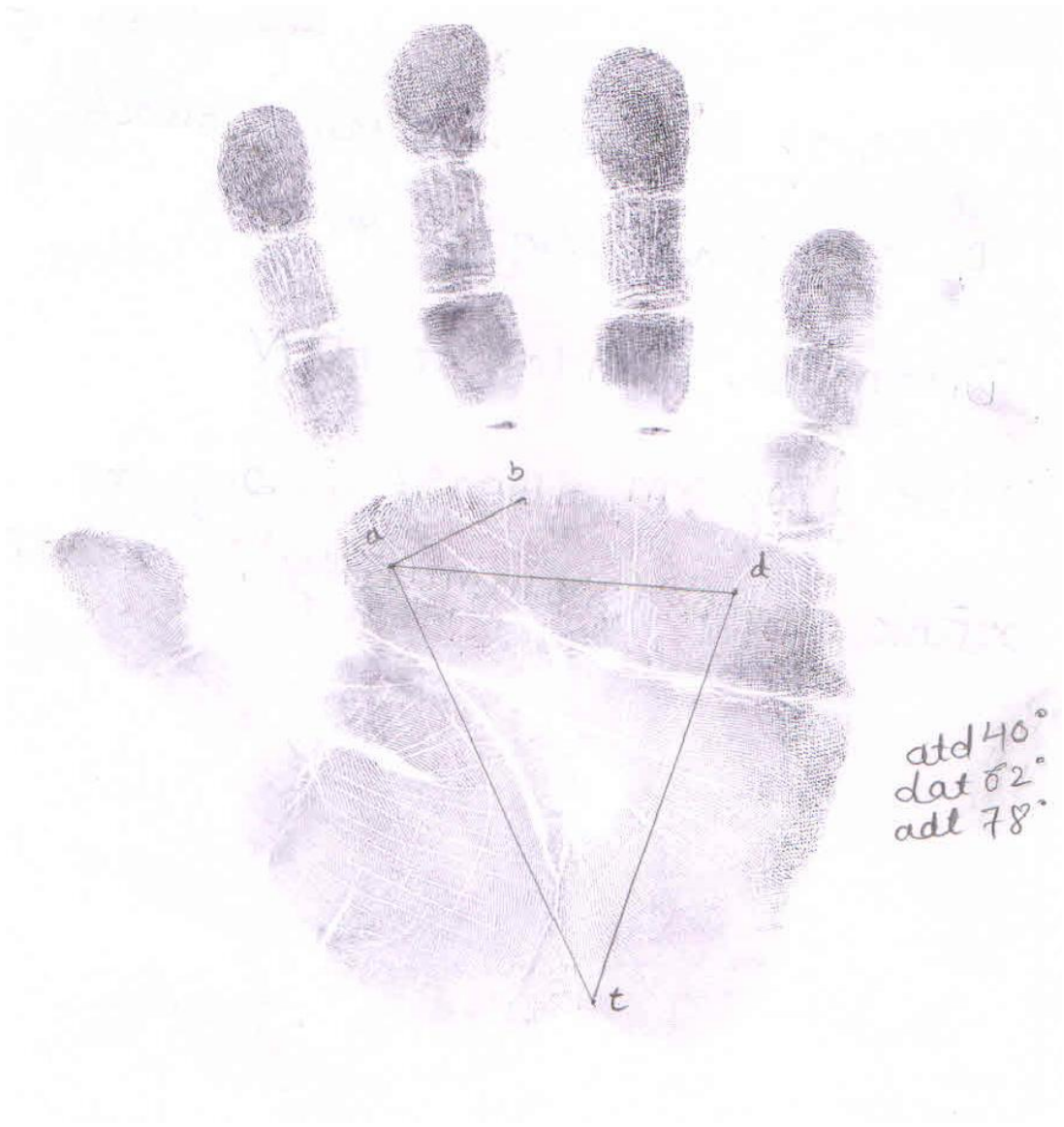

Table: 1 Comparison of atd, dat and adt angles in the both hands of diabetic with hypertensive and control groups.

Parameter	Group	Diabetic		Diabetic with hypertension	
		Right Hand (Mean±SD)	Left Hand (Mean±SD)	Right Hand (Mean±SD)	Left Hand (Mean±SD)
'atd' angle	Case	43.27±7.60	43.41±6.10	42.52±6.06	43.55±7.32
	Control	45.28±7.40	45.17±6.96	45.28±7.40	45.17±6.96
	p-value	0.106	0.089	0.016	0.135
'dat' angle	Case	57.57±4.14	57.90±5.01	58.41±4.41	58.08±6.66
	Control	58.22±5.34	58.34±4.84	58.22±5.34	58.34±4.84
	p-value	0.406	0.555	0.818	0.811

	Case	**78.84±7.20**	**78.60±5.90**	**79.07±6.45**	**78.52±6.17**
'adt' angle	**Control**	**76.51±7.48**	**76.48±6.62**	**76.51±7.48**	**76.48±6.62**
	p-value	**0.034**	**0.053**	**0.022**	**0.026**

Table: 2 Comparison of atd, dat and adt angles in the both hands of male and female diabetic patients with control groups.

Parameter	**Group**	**Male**		**Female**	
		Right Hand (Mean±SD)	**Left Hand (Mean±SD)**	**Right Hand (Mean±SD)**	**Left Hand (Mean±SD)**
	Diabetic	**42.65±8.20**	**42.06±4.90**	**43.78±7.13**	**44.55±6.80**
'atd' angle	**Control**	**45.09±5.90**	**44.84±8.10**	**45.44±8.54**	**45.44±5.93**
	p-value	**0.162**	**0.082**	**0.355**	**0.861**
	Diabetic	**58.87±4.54**	**59.43±3.64**	**56.47±3.46**	**56.60±5.65**
'dat' angle	**Control**	**60.03±4.47**	**59.62±4.77**	**56.71±5.59**	**57.26±4.70**
	p-value	**0.354**	**0.861**	**0.818**	**0.537**
	Diabetic	**78.09±8.09**	**78.50±5.63**	**79.47±6.39**	**78.68±6.20**
'adt' angle	**Control**	**74.93±6.92**	**75.53±7.45**	**77.84±7.76**	**77.28±5.82**
	p-value	**0.054**	**0.073**	**0.277**	**0.347**

Table: 3 Comparison of atd, dat and adt angles in the both hands of male and female diabetic with hypertensive patients with control groups.

Parameter	**Group**	**Male**		**Female**	
		Right Hand (Mean±SD)	**Left Hand (Mean±SD)**	**Right Hand (Mean±SD)**	**Left Hand (Mean±SD)**
	DM+HTN	**42.59±5.94**	**43.93±8.79**	**42.47±6.25**	**43.23±5.91**
'atd' angle	**Control**	**45.09±5.90**	**44.84±8.10**	**45.44±8.54**	**45.44±5.93**
	p-value	**0.073**	**0.620**	**0.094**	**0.088**
	DM+HTN	**60.18±3.55**	**59.59±7.32**	**56.92±4.56**	**56.81±5.86**
'dat' angle	**Control**	**60.03±4.47**	**59.62±4.77**	**56.71±5.59**	**57.26±4.70**
	p-value	**0.886**	**0.986**	**0.860**	**0.741**
	DM+HTN	**77.25±6.38**	**76.21±6.21**	**80.60±6.15**	**80.47±5.43**
'adt' angle	**Control**	**74.93±6.92**	**75.53±7.45**	**77.84±7.76**	**77.28±5.82**
	p-value	**0.119**	**0.651**	**0.096**	**0.004**

Table: 4 Comparison of a-b ridge counts of both hands of diabetic, diabetic with hypertensive (DM+HTN) and control groups.

Parameters	**Rt. a-b ridge count**		**Lt. a-b ridge count**	
	Male (Mean± SD)	**Female (Mean± SD)**	**Male (Mean± SD)**	**Female (Mean± SD)**
Diabetic	**23.71±8.05**	**24.28±7.71**	**23.15±6.82**	**23.81±8.51**
Control	**21.40±5.78**	**20.47±5.14**	**24.09±6.40**	**20.34±5.05**
p-value	**0.131**	**0.003**	**0.434**	**0.004**
DM+HTN	**24.15±6.89**	**21.36±4.99**	**24.75±6.62**	**22.31±4.71**

Control	**21.40±5.78**	**20.47±5.14**	**24.09±6.40**	**20.34±5.05**
p-value	**0.043**	**0.401**	**0.654**	**0.049**

DISCUSSION

The genetic association of the diabetes mellitus is well known fact and it is universally accepted. India is referred as the 'diabetes capital of the world' as it leads the world with largest number of diabetic subjects. Several authors have studied the dermatoglyphic patterns in type-II diabetes mellitus and their findings are matching with observations of the present study. Cummins reported that in mongloids dermatoglyphics of fingertip and palm present number of characters which are different from those of racially comparable normal controls. [9]

In the present study, mean values of a-b ridge count was found higher in diabetic than control and highly significant in case of females. This was similar to the findings of Ziegler, GS Oladipo and MB Ogunnowo whereas Ana Tarca, PK Dam found decrease a-b ridge count in diabetic patients. [10,11,12,13]

In the present study, mean 'atd angle was narrow in both hands of diabetics as compared to control group both in male and female. Similar findings were reported in the study conducted by Mandasescu et al while opposite to the findings of Ravindranath et al and Mukesh mittal et al. MK Sharma et al. The 'dat' angle decreased in diabetic patients while 'adt' angle increased in diabetic patients than control.[14,15,16,17]

In diabetic with hypertensives patients, mean values of a-b ridge count were higher than controls and values of 'atd' angle and 'dat' angle were decreased while value of 'adt' increased in diabetic with hypertensive patients than control. There was no previous literature found on the diabetic with hypertensive patients pattern study, hence our present findings could not be compared.

Thus, with the available data and statistical analysis, dermatoglyphic patterns may be used as a reliable indicator for scientific screening of population prone to diabetes mellitus.

CONCLUSION

Dermatoglyphic investigation is very cost effective and requires no hospitalization. In clinical medicine, the importance of dermatoglyphics is that it can help in predicting the phenotype of a possible future illness. The most disturbing trend is the shift in age of onset of diabetes to a younger age in the recent years. This could have long lasting adverse effects on nation's health and economy. Early identification of at-risk individuals using simple screening tools like dermatoglyphics which is user friendly; economically viable would greatly help in preventing or postponing the onset of diabetes and thus reducing the burden on the community and the nation as a whole.

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