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Original Research Article

A comparative study of dermatoglyphic markers in schizophrenia patients and normal controls

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ABSTRACT

Background: Schizophrenia is a complex mental illness with multiple etiological factors. Prenatal insult to the developing foetus has been implicated as a major risk factor for the genesis of schizophrenia, according to the neuro-developmental model. As the brain and skin are ectodermal derivatives, insult to developing brain is reflected in several dermatoglyphic markers.
Methods: Total finger ridge count (TFRC), Total A-B ridge count (TABRC) and ATD Angle of 100 patients diagnosed with schizophrenia were compared with 100 age and sex matched healthy controls.
Results: Statistically significant differences were observed in the values recorded and compared between healthy controls and schizophrenia patients.
Conclusions: This study shows the correlation between abnormalities in dermatoglyphic patterns and development of schizophrenia.

Keywords: ATD Angle, Dermatoglyphics, Schizophrenia, TABRC, TFRC

INTRODUCTION

Dermatoglyphics is the scientific study of fingerprints. The term was coined by Cummins and Midlo.[1] In humans, dermatoglyphics gives insight into a critical period of embryogenesis, from 4 weeks to 20 weeks, when the architecture of the major organ systems is developing. Dermatoglyphics, determined by polygenic inheritance, is a useful tool in finding out an association of morphological and genetic characters.

The malformations of dermatoglyphic characteristics can result from a number of physiological insults that can occur during foetal development, including exposure to environmental toxins, viral infections, or genetic mutations. The second trimester of foetal development is particularly implicated as a period of potential vulnerability as this trimester is the critical period for both foetal brain and epidermal ridge development.[2] Thus, dermatoglyphics provide an attractive set of potential markers, as their development is localized to that period during which the maturing foetal brain may be at highest risk for the later development of schizophrenia.

Ridges appear on the surface ectoderm of fingers and palm during the first and second trimester of gestation.[3] During this same period there is significant and critical growth and development of the neuroectodermal derivative, the brain.

Skin and brain develop from ectoderm and cells migrate to the cerebral cortex in second trimester. It is probable that an insult causing damage to one of these systems would damage the other, and there is now evidence relating aspects of the dermatoglyphic profiles of the hands to schizophrenia.[4,5] The rationale for studying dermatoglyphic features is derived from the fact that during their ontogeny, massive neural cell migration

occurs in the brain, which is a neuroectodermal derivative. Once formed, the dermatoglyphic patterns remain unchanged. Therefore, unlike other potential markers such as cerebral ventricle dimensions, the time window associated with the experience of risk is relatively narrow and certain to occur within the period of foetal development.

Thus, dermatoglyphic alterations in schizophrenia are markers of disrupted early development and contribute support to the neuro-developmental model of schizophrenia.[6,7] It states that the interaction of genetic and environmental factors influences the way in which nerve cells are laid down, differentiated and re-modelled. An insult, whether genetic, environmental or both, occurred during early mid-gestation.[8,9]

The possible explanation for the occurrence of insult to the developing brain during fetal life and manifestation of schizophrenia most commonly in adolescence is that, some maturational processes occur throughout adolescence that modulate psychosis.

It is known that the human brain reaches approximately adult size during the early school years, and that this growth seems to be affected by the increase of grey matter volume as opposed to white matter volume. It is also known that the fine tuning of neuronal connections and the selective reduction of cerebral structures occurs during early cerebral maturation. A genetic alteration in some maturational mechanisms, such as "cortical pruning", expressed during adolescence can explain the delay between initial lesion and onset of illness.

The study of dermatoglyphics may be useful in trying to understand how developmental insults interact with genetic vulnerability in the case of schizophrenia.

METHODS

The material for the study consisted of finger and palm prints of out-patients attending psychiatry out-patient department of The Government Chengelpet Medical College, Chengelpet, Tamil Nadu, India. 100 patients diagnosed with schizophrenia were randomly chosen for the study.

The age group of the patients ranged from 18 to 60 years and both sexes were included. Age and sex matched healthy controls were taken from community after screening with General Well Being Schedule (GWBS). 100 controls were chosen. Participants of the study were informed about the procedure in detail and their consent was obtained for the study.

Finger and palm prints of both hands were obtained by the following standardized method. The patient was asked to thoroughly wash his hands with soap and water before taking the print. This ensures removal of dirt and grease which would affect the quality of the print to be taken. Then the hand was dried with a towel. A thin layer of ink was applied to the clean dry hands and it was spread uniformly over the palm and all the fingers using an ink roller. This ensures uniform spreading of ink. An A4 paper was placed over the a smooth surfaced cylinder. The wrist was placed at the bottom edge of the paper and rolled gently over the paper which was kept over the cylinder.

The dorsum of hand was gently pressed over the paper to ensure that the entire palm print was recorded properly. The recording was completed in the same manner till the finger tips were reached. The prints of finger tips were again taken separately at the bottom of the same paper. The finger prints were numbered as Roman Numerals I to V, starting from the thumb. The recordings were taken from both hands. The ink was then removed from the hands with soap and water. After the finger and palm prints were obtained by the above method, they were analyzed.

RESULTS

Total finger ridge count (TFRC), Total a-b Ridge Count (TABRC) and ATD angle measurement was carried out in both the hands of 100 cases and 100 controls. All the parameters were recorded separately for right and left hands and were compared between corresponding hands of cases and controls. Chi-square test was used for group comparisons. Independent t-test was performed to compare the mean scores between schizophrenia patients and controls. All the analyses were carried out using SPSS software version 16.0.

TFRC

The mean TFRC is significantly lower in schizophrenia patients when compared with controls with P value <0.0001 (Table 1).

FRC in right and left hands of cases and controls

The mean finger ridge count in both right and left hands were significantly lower (P<0.0001) in schizophrenia patients than controls (Table 2).

TABRC

The mean TABRC is significantly lower in schizophrenia patients when compared with controls with P value <0.0001 (Table 3).

ABRC in right and left hands of cases and controls

The mean ABRC is significantly lower in schizophrenia patients when compared with controls with P value <0.0001 in both hands (Table 4).

Table 1: Test of significance for TFRC in cases and controls (n=100).

	Group	Mean	Std. deviation	Std. error mean	Confidence interval		P Value
					Upper	Lower	
TFRC	Case	110.45	5.739	0.574	109.31	111.59	0.000
	Control	143.55	5.907	0.591	142.38	144.78	(P<0.0001)

Table 2: Test of significance for FRC in right and left hands of cases and controls (n=100).

	Hand	Group	Mean	Std. deviation	Std. error mean	P Value
FRC	Right	Cases	55.2600	2.91849	0.29185	0.000 (P<0.0001)
		Controls	71.7900	2.94836	0.29484	
	Left	Cases	55.1900	2.86284	0.28628	0.000 (P<0.0001)
		Controls	71.7600	3.00209	0.30021	

Table 3: Test of significance for TABRC in cases and controls (n=100).

	Group	Mean	Std. deviation	Std. error mean	Confidence interval		P Value
					Upper	Lower	
TABRC	Case	77.74	7.595	0.760	76.23	79.25	0.000
	Control	81.95	5.240	0. 524	80.91	82.99	(P<0.0001)

Table 4: Test of significance for ABRC in right and left hands of cases and controls (n=100).

	Hand	Group	Mean	Std. deviation	Std. error mean	P Value
ABRC	Right	Cases	38.8700	3.82088	0.38209	0.000 (P<0.0001)
		Controls	40.9800	2.65520	0.26552	
	Left	Cases	38.8700	3.80763	0.38076	0.000 (P<0.0001)
		Controls	40.9500	2.65290	0.26529	

Table 5: Test of significance for ATD angle in cases and controls (n=100).

	Group	Mean	Std. deviation	Std. error mean	Confidence interval		P Value
					Upper	Lower	
ATD angle	Case	43.97	2.840	0.284	43.37	44.57	0.000
	Control	39.83	2.432	0.243	39.29	40.37	(P<0.0001)

Table 6: Test of significance for ATD angle in right and left hands of cases and controls (n=100).

	Hand	Group	Mean	Std. deviation	Std. error mean	P Value
ATD angle	Right	Cases	43.9700	3.00993	0.30099	0.000 (P<0.0001)
		Controls	39.8300	2.74158	0.27416	
	Left	Cases	43.9600	3.00814	0.30081	0.000 (P<0.0001)
		Controls	39.8300	2.74158	0.27416	

ATD angle

The mean ATD angle is significantly higher in schizophrenia patients when compared with controls with P value <0.0001 Table 5.

ATD angle in right and left hands of cases and controls

The mean ATD angle is significantly higher in both hands, in schizophrenia patients when compared with controls with P value <0.0001 Table 6.

DISCUSSION

Total finger ridge count (TFRC)

TFRC appears to be under relatively strong genetic control, and little influenced by environmental events.[10] The most commonly used measure in dermatoglyphic studies is TFRC.[11]

In the present study, TFRC is significantly reduced in schizophrenia patients when compared to controls, with a

mean of 110.45 in cases and 143.55 in controls and P value <0.0001. Several other studies also recorded a significantly low TFRC in schizophrenia patients when compared with healthy controls.[12-17]

Right and left FRC of cases and controls

Comparison of the right and left hands of cases and controls also showed similar significant reduction in finger ridge count in the present study. This is in accordance with studies by Divakaran A et al and Paez F et al.[12,15]

Total A-B ridge count (TABRC)

Rose et al have suggested that the a-b ridge count is sensitive to environmental stress because the area of the palm in which the a-b ridge count is situated, the second inter digital region, begins to develop earlier than the fingers.[18] However, ridge formation progresses more slowly on the palms than the fingers, and ridge differentiation proceeds in a distal radial to proximal ulnar direction. Thus, the ridges in the second inter digital region may develop over a longer period, exposing that area for a longer period to potential environmental insults.

In the present study, the total a-b ridge count is significantly reduced in cases when compared to controls with a mean of 77.74 in cases and 81.95 in controls and a P value of < 0.0001. This observation matched with many studies.[19-22]

ATD angle

Penrose observed that the ATD angle is even more sensitive to environmental effects than the a-b ridge count.[11]

In the present study when the ATD angles were compared between cases and controls, statistically significant result was obtained. The ATD angle in schizophrenia patients was significantly larger with a mean of 43.97 and that of controls was smaller with a mean of 39.83 and P value was <0.0001. Similar results were reported in two studies.[23,24]

There were a few limitations to present study. The study sample was small consisting of 100 cases and controls each. Further this being a pilot study we did not go in to the illness characteristics of the study population and correlation.

CONCLUSION

As per present study, the TFRC, TABRC and ATD angle can be used as reliable markers to predict the development of schizophrenia in an individual. Further study in a large population cohort shall add more validity to the study findings.

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