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Comparative Dermatoglyphic Study of Patients with Bipolar Affective Disorder type I and Healthy Controls

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The aim of this study was to compare the fingerprint patterns and finger ridge count in patients with bipolar I disorder (BPI) and healthy controls. The study included 61 BPI patients and 100 mentally healthy subjects. Rolled palmprints were obtained using an ink method and were read with light (6D) magnification. We found an increased incidence of loops and reduced finger ridge count in male BPI patients, and an increased finger ridge count and higher incidence of whorls in female BPI patients in comparison with their same-sex controls. For both genders we observed increased fluctuating asymmetry in the fingerprint images. Within the context of neurodevelopmental hypothesis of mental disorders dermatoglyphic traits may become reliable biological markers of the timing of prenatal damage and the pathogenetic mechanisms behind it.

Key words: dermatoglyphics, bipolar I disorder, fingerprint patterns, finger ridge count, fluctuating asymmetry.

Introduction

In contrast to schizophrenia, studies on dermatoglyphics in bipolar I disorder (BPI) are insufficient and dermatoglyphic traits have rarely been examined [17, 19]. Schizophrenia and bipolar affective disorder are similar in some epidemiological and pathophysiological characteristics, suggesting that the causes for both disorders can be found in the perinatal or early postnatal period, which is one of the basic principles of neurodevelopmental hypothesis of mental illness. Several neuroimaging dissimilarities between the two disorders have been observed together with the clinical characteristics, which are probably due to differences in the affected hemisphere and a specific brain area, as well as to the predisposing genes of the individual [7, 17, 19]. Subtle dermatoglyphic alterations have been found in patients with severe bipolar disorder suggesting connection between early prenatal insults and later onset of the disease [4, 10].

The importance of dermatoglyphics as biological markers of abnormal neurodevelopment is associated with the common ectodermal origin of the brain and dermal patterns and the strictly defined periods of embryonic formation of papillary ridges that defines them as potential chronomarkers in determining the time of exposure

to prenatal insults. This applies primarily to the degree of fluctuating asymmetry, which is a random deviation from symmetry typical for the individuals, and is a sign of ontogenetic stability in different organisms, including humans [8, 9].

The formation of papillary ridges takes place during the III-V months of embryogenesis and the main differentiation of ridge patterns ends at the end of the IV month of prenatal development. Ridge patterns appear first on the pads of the fingers, and later on the palms and then on the soles [14]. The critical period in differentiation is the III month, which is before the appearance of fingers on the limb germ. Harmful agents of different origin may interfere during the formation of the ridges and disrupt their normal development.

The aim of this study was to compare the fingerprint patterns and finger ridge count in patients with bipolar I disorder (BPI) and healthy controls in order to find evidence suggestive of prenatal factors in the etiology of the disease.

Material and Methods

Subjects

The study included 61 BPI patients (24 males, 37 females) with a mean age of 38.15±14.81 years, consecutively admitted to the Clinic of Psychiatry in Plovdiv and the District Psychiatry Dispensary in Plovdiv. All patients met DSM-IV criteria for a diagnosis of bipolar I disorder (1) on the basis of case records review, a semi-structured interview based on a checklist of DSM-IV items and information obtained from relatives to enhance the validity of the diagnosis. Potential subjects were excluded if they had a history of drug or alcohol abuse, an identifiable neurological disorder, any signs of mental retardation or a somatic disorder with neurological components. Potential patients were excluded if there were evidences of pathological conditions known to be associated with variation of dermatoglyphic characters, e.g., psoriasis, congenital abnormalities such as polydactylia and spina bifida, congenital heart disorders, diabetes mellitus, certain diseases with abnormal caryotype, etc.

The normal comparison group comprised 100 mentally healthy subjects (47 males and 53 females) with a mean age of 39.65 ± 10.68 years. Normality was defined as the absence of a major axis I or axis II disorder according to DSM-IV. Normal controls satisfied exclusion criteria similar to those applied to patients. In addition, to separate the two groups better, potential controls were excluded if they had a first-degree relative with a history of a psychotic disorder, major affective disorder or suicide.

All patients and control subjects were of Bulgarian origin in order to avoid the potential confounding effects of racial and ethnic variation in the expression of dermatoglyphics. Individuals were excluded if their parental or grandparental ethnic group was other than Bulgarian.

The study was approved by the local Ethics Committee at St. George University Hospital. All subjects gave written informed consent to participate.

Assessment of dermatoglyphic patterns

A set of dermatoglyphic configurations with low racial instability and high diagnostic value was examined [5, 6]. Rolled palmprints were obtained using an ink method and

were read with light magnification (6D). Fingerprinting was carried out in a passive manner, using a rotary cone sample divider method. For a greater reliability the scoring of the palmprints was done separately by two persons according to the rules in Memorandum on dermatoglyphic nomenclature [13].

Finger ridge patterns were analyzed in accordance with the methods given by Cummins, Midlo [2]. Dermatoglyphic patterns are classified as arches, loops and whorls according to the number of deltas [3].

Several quantitative variables were measured: the sum of each individual finger ridge count, the finger ridge count of each hand and the total ridge count (TFRC), the sum of the ridge counts for all 10 fingers. Ridge count was calculated from the number of ridges that intersected or touched the line of Galton, which connects the triradius with the core of the pattern. Ridge count of whorl patterns was analyzed by using the higher of the two counts.

Fluctuating asymmetry is defined as small random deviations from perfect symmetry in bilateral traits. It is commonly used as an index of developmental stability: i.e. the ability of an organism to neutralize harmful insults during the prenatal period [11, 18].

Statistical analysis

The data were analyzed with SPSS 17.0. (Statistical Package for the Social Sciences 17.0), using descriptive statistics, nonparametric analysis: c^2- test, Fisher's Exact Test, parametric analysis: Student's t–test.

The level of statistical significance was set at $P < 0.05$.

Results and Discussion

The distribution of the main types of fingerprint images in patients with BPI and controls is presented in **Table 1**. BPI patients showed increased incidence of loops, followed by whorls and arches. BPI males had a higher incidence of loops, and BPI females showed a higher incidence of whorls compared with their same-sex controls, the latter difference falling just short of statistical significance.

Table 1. Comparison of mean number of fingerprint patterns in BPI patients and healthy controls distributed by gender.

	Males						**Females**					
	Controls (n=47)		Bipolar I disorder (n=24)		Statistical significance		Controls (n=53)		Bipolar I disorder (n=37)		Statistical significance	
	Mean	SD	Mean	SD	t	p	Mean	SD	Mean	SD	t	p
Arches	0,36	1,09	0,58	1,55	-0,697	0,488	0,57	1,29	0,32	0,67	1,157	0,251
Loops	5,66	2,78	5,96	3,04	-0,414	0,680	6,91	2,31	6,16	2,68	1,404	0,164
Whorls	3,89	2,85	3,46	3,31	0,577	0,566	2,53	2,36	3,51	2,91	-1,769	0,080

The results of our study showed lower finger ridge count in BPI males compared with controls of the same gender, for the right and the left hand, as well as for both hands (**Table 2**). In BPI female patients finger ridge count was increased for the right and the left hand as well as for both hands.

Table 2. Finger ridge count in BPI patients and healthy controls distributed by gender.

	Males				**Females**			
	Controls (n=47)		Bipolar I disorder (n=24)		Controls (n=53)		Bipolar I disorder (n=37)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Right hand	74,43	22,43	69,50	28,13	67,36	24,50	70,76	20,87
Left hand	69,42	24,41	67,61	27,31	66,33	23,77	67,39	24,96
Total	142,68	46,05	136,17	54,88	133,88	47,61	137,42	44,56

Figure 1 shows the level of matching in fingerprint patterns between BPI patients and healthy subjects. The results showed a high degree of discordance in the second fingers, followed by the first, fourth, third and fifth fingers, which determined increased fluctuating asymmetry in the homologous structures between patients and controls. The high level of fluctuating asymmetry is considered a sign of impaired neurodevelopment occurring during the formation of papillary ridges, which is during the 3rd to 5th month of gestation. The main differentiation of the papillary ridges ends at the end of the 4th month of prenatal development, but the ridges do not rise above the skin surface before the 18th week of gestation. It is obvious that deviations from the normal configuration of the papillary ridges can result from genetic or exogenous factors acting during the period of embryogenesis. Harmful agents of different origin may interfere during the formation of the ridges and disrupt their normal formation which might be combined not only with development of psychiatric disorders later in life, but also with other diseases like chromosomal aberrations and visual impairment [16]. In the scientific research of Tornjova-Randelova S. et al. [16] the authors applied a new approach to the examination of dermatoglyphic patterns according to the topical innervation of the volar surface of the fingers and palms and established deviations in the dermatoglyphic traits affecting structures of visual apparatus in children of both ectodermal and mesodermal origin.

However, our study has several limitations. Larger sample size is probably necessary to find statistical significant differences between the groups when comparing the fingerprint patterns. Further research and statistical analysis is indispensable for evaluation of the specific differences in dermatoglyphic patterns comparing both subject groups in order to contribute to the differentiation between health and disease.

Conclusions

Our findings are suggestive of prenatally acting exogenous factors that affect the normal morphogenesis of ectodermal derivatives. The common ectodermal origin of dermal ridges and nervous system renders the observed dermatoglyphic traits relevant to the body of morphological, histological and brain-imaging research in support of the neurodevelopmental hypothesis of bipolar disorder [12, 15].

Within the context of this hypothesis dermatoglyphic traits may become reliable biological markers of the timing of prenatal damage and its underlying pathogenetic mechanisms.

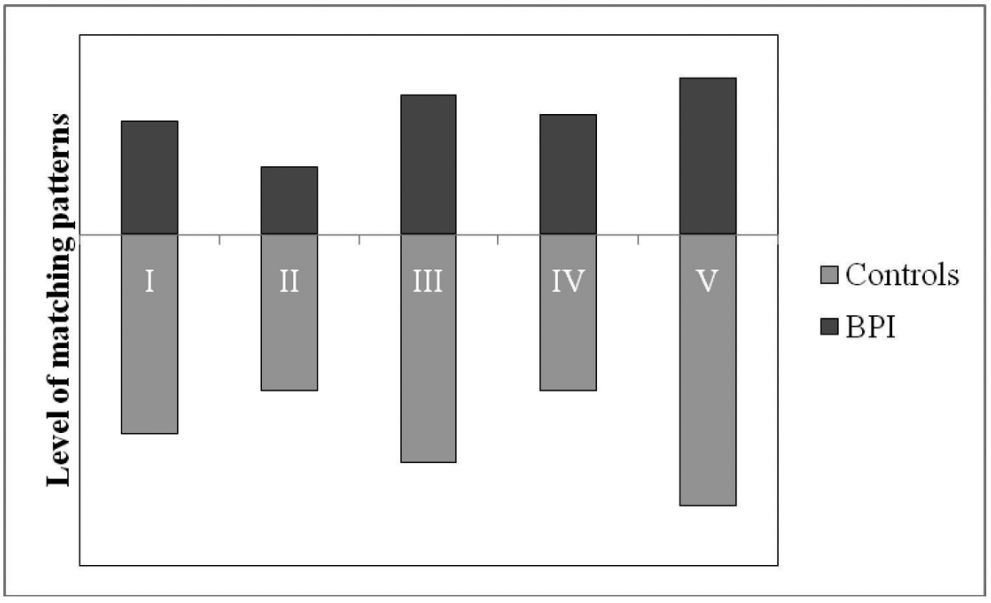

Fig. 1. Fluctuating asymmetry in fingerprint patterns in BPI patients and healthy controls.

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