Mixed Handedness and the Schizophrenic Spectrum

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ABSTRACT

Background: In the recent years, there has been growing interest in the relation between handedness and schizophrenia. Special emphasis on mixed handedness and a shift away from either a pure right or a pure left handedness as a possible indicator of a neurodevelopmental change that may contribute to the schizophrenic process has been proposed. Schizotypal traits, considered on the schizophrenic spectrum, have also been associated with similar findings. **Objective:** We aimed to identify the prevalence of the type of handedness in patients with schizophrenia, with special emphasis on mixed handedness and to explore any correlation between schizotypal traits and mixed handedness in normal healthy controls. **Subjects and methods:** Forty two patients with schizophrenia and sixty three normal healthy controls participated in this study. Briggs Handedness questionnaire was used to identify patterns of handedness found in both patients and controls. The Scale for the Assessment of Schizotypal personality (SPQ) was applied to the controls to assess presence of schizotypal traits. **Results:** No significant differences in the hand preferences were identified either between patients with schizophrenia and controls. Also there were no significant differences in the results of the SPQ among the three subgroups of controls (RH, LH and MH). **Conclusion:** This study failed to demonstrate increase prevalence of mixed handedness in schizophrenic patients. Similar studies with a larger number of participants utilizing a combination of observational methods and multiple items questionnaires are recommended.

Key word: Schizophrenia, Mixed handedness, Egypt.

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INTRODUCTION

The role of handedness in the evolution of the schizophrenic process has been investigated thoroughly yielding conflicting results. A comprehensive review of the literature concerned with atypical handedness in schizophrenia found that there was a shift in the distribution away from right handedness[1]. The association between handedness and schizophrenia was also addressed reporting a leftward or atypical shift in the handedness distribution[2]. This shift was further examined to determine the nature of the leftward shift and they found that it was due to an increase mixed handedness compared with normal or controls. This finding was further replicated by Ortuno et al. who observed a significant relationship between mixed handedness and schizophrenia in male patients[3]. However a metanalysis conducted evaluating over than 40 studies on various handedness subtypes concluded

that the leftward shift in handedness distribution is not entirely because of an increase in mixed handedness alone but it is due to an increase in exclusive left handedness[4].

Different hypotheses explained different subtypes of atypical handedness (PLH, MH, AH) in schizophrenia, with particular attention to MH. The term mixed handedness is used when there is a firm preference for different hands for different actions[5].

Satz and Green, viewed that it refers to subjects who are less lateralized (ambidexters). They added that P.L.H. refers to a subset of natural right–handers who because of early brain injury to the left hemisphere suffer from a transient hypofunction of the right hand which in turn causes a shift to preference for the left hand[2].

The term ambiguous handedness was suggested for changes of hand between trials to the same task[6]. This is a subgroup of mixed handedness that has no consistent directional asymmetry on a given task[2].

Some hypothesis addressed some aspect pertaining to the left hemisphere, e.g.: left hemispheric lag[7], left hemispheric vulnerability[8] and left hemispheric specialization[9].

Other hypotheses attributed schizophrenia to diffuse or multifocal neuron-developmental changes such as directional disorientation of the pyramidal cells of the hippocampus[10] or abnormal cell migration in the prefrontal and temporal regions[11].

Many studies indicated loss of asymmetry[12-14]. There is also a single dimension of asymmetry that accounts for the right frontal to left occipital preponderance (the cerebral torque) but that this is expressed to different degrees in different individuals and that in those predisposed to psychosis the expression is less than in the population as a whole[15].

Satz and Green, tried to explain why a neuordevelopmental abnormality that is most likely diffuse or multifocal may yield a shift in handedness that is unidirectional. They hypothesized that early bilateral or multifocal brain insult would be necessary and sufficient to alter the left hemisphere's control over cognitive (language) and contralateral motor (handedness) functions leading to a less complete and more variable form of MH[2].

A structural versus functional pathology has been proposed raising the possibility of a reversibility of this variation in MH. In addition a study concluded that an active syndrome of schizophrenia reflects a left over right hemispheric imbalance which is functional in nature and can therefore change with symptom remission[16].

There is still a debate concerning the genetic influence of schizophrenia on handedness and mixed handedness was attributed to both genetic and environmental factors[17].

Neurological soft signs was investigated in 30 monozygotic twins' pairs, 13 pairs discordant for schizophrenia schizoaffective disorders and 17 health comparison twins' pairs and concluded that the occurrence of neurological soft signs and their lateralization to the left body are genetically transmitted[18].

Chromosome p12–q11 was linked to a quantitative measure of handedness and they have also found linkage of schizophrenia, schizoaffective disorder to this same chromosomal region in two

separate studies[19]. More recently, the association between handedness and a haplotype upstream of the gene LRRTM1 was described[20].

In a comparison of the findings of the the largest linkage studies published so far, including schizophrenic and schizoaffective psychosis, together with findings from a study of bipolar illness of comparable size showed no reliable linkage[15, 21-23].

SUBJECTS AND METHODS

Forty two patients with schizophrenia entered the study. This number represents all male inpatients in a private psychiatric hospital willing to participate from the period of July 2008 to September 2008. Patients met the criteria of schizophrenia according to the Diagnostic and statistical manual of mental disorders(DSM-IV)[24]. Exclusion criteria included illiteracy, dual diagnosis and patients not giving consent.

The Kasr Al Ainy Semistructured clinical interview was administered to all patients in the beginning to confirm diagnosis, assess present state. Sixty three normal healthy controls matched for age and gender and assessed for presence of family history of psychiatric illness were selected.

The following tools were used:

Handedness questionnaire[25]: This tool is adapted from Annett hand preference questionnaire. It represents a 5–point scale measuring strength of laterality for the twelve items of the Annett's questionnaire. It was applied to both patients and controls groups.

The Scale for the Assessment of Schizotypal personality (SPQ) (26): A self-report scale modeled on DSM-III-R criteria for schizotypal personality disorder and containing subscales for all nine schizotypal traits. It was applied to the controls only. Both tools were translated by the author and back translated by another M.D. certified psychiatrist.

RESULTS

The total number of patients was 42 male patients, with mean age (25.3$\pm$5.1), 77% (n= 32) were of average education (up to high school) and 23% (n=10) were highly educated 93% (n=39) of the sample were single, 5% (n=2) were divorced and 2% (n=1) were married.

The total number of controls was 63 all of them were males with mean age 22.7 ($\pm$ 4.3). 82% (n=52) were highly educated (university degree) and 18% (n=11) were of average education (up to high school). 76% (n=48) were single, 14% (n=9) were engaged and 9% (n = 6) were married.

The hand preferences of the patients were as follow: 85.7 (n=36) was right handed and 14% (n=6) were mixed handed. There was no left handedness among the patients groups. 77.8% (n=49) of the controls group were right handed, 15.9 (n=10) were mixed handed and 6.3 (n=7) were left handed. There were no significant differences between both groups regarding the prevalence of different hand preferences (table 1).

Also no significant differences were found in the scores of the 9 different subitems of the SPQ among the 3 groups of the controls (right handed, left handed and mixed handed) using the Anova test (table 2)

Table 1: Prevalence of right, left and mixed hand preferences in patients & controls.

	Patients		Controls		X^2 /P
	N	%	N	%	
Right handed	36	85.7%	49	77.8	0.261 0.6092
Left handed	0	0 %	7	6.3%	0.01 0.91
Mixed handed	6	14.3%	10	15.9%	1.374 0.362

Table 2: Results differences of S.P.Q. scale among the 3 subgroups of controls (right handed, left handed and mixed handed) using the Anova test.

SPQ subscale	F	Sig.
Ideas of reference	0.206	0.814
Social anxiety	0.936	0.398
Odd Beliefs/Magical thinking	1.058	0.354
Unusual perceptual experiences	0.128	0.880
Eccentric/Odd behavior and appearance	2.668	0.078
No close friends	0.319	0.728
Odd Speech	1.236	0.298
Constricted Affect	1.652	0.200
Suspiciousness/ paranoid ideation	0.757	0.474
Total SPQ score	1.005	0.372

The Mann-Whitney test was further used to compare the scores of the S.P.Q. among the mixed handers and the right handers as well as the left hander's of the controls group, again no significant differences were found (table 3 and 4)

Table 3: Differences of scores of S.P.Q. scale between right handed & mixed handed groups of controls using Mann-Whitney test

SPQ	**Mann-Whitney U**	**Asymp. Sig. (2talied)**
Ideas of reference	238.000	0.886
Social anxiety	170.000	0.124
Odd Beliefs/ Magical thinking	181.000	0.181
Unusual perceptual experiences	235.500	0.844
Eccentric/Odd behavior & appearance	157.500	0.058
No close friends	216.000	0.552
Odd Speech	203.000	0.391
Constricted Affect	184.000	0.213
Suspiciousness/ paranoid ideation	190.000	0.267
Total SPQ score	174.500	0.154

Table 4: Differences of S.P.Q. scale scores between left handed & mixed handed groups of the controls using Mann-Whitney test

SPQ	**Mann-Whitney U**	**Asymp. Sig. (2talied)**
Ideas of reference	327.000	0.703
Social anxiety	185.000	0.691
Odd Beliefs / Magical thinking	128.000	0.032
Unusual perceptual experiences	145.000	0.271
Eccentric/Odd behavior and appearance	227.000	0.254
No close friends	195.000	0.471
Odd Speech	139.000	0.313
Constricted Affect	217.000	0.163
Suspiciousness/ paranoid ideation	114.000	0.076
Total SPQ score	187.000	0.115

DISCUSSION

While it was hypothesized that there is a higher prevalence of mixed handedness in

patients with schizophrenia, no significant differences between patients and normal controls were found[3, 27]. In normal controls, the level of mixed handedness was 14% and 11.6% respectively[1,28]. In contrast, there was a difference in findings of the distribution of mixed handedness to be 25%[27].

Using observation rather than self-report method indicated an increase in mixed-handedness in schizophrenia[1, 28] and when compared to the present study, both of these studies found higher rates of mixed-handedness among patients (39% and 36% respectively). A similar high percentage (37.8%) of mixed handedness in patients with schizophrenia were found when using a multiple items questionnaire and a significant difference was found between patients and controls only when mixed handedness was qualitatively subdivided into weak, moderate and strong[3].

Studies investigating handedness in schizophrenia used different methodological procedures. These methods varied from simple observational, whereby the individuals were observed during a writing task, passing by self reports and finally multiple–item questionnaires. This variation in method of establishing handedness, may yield confusing results because many of the individuals reporting left handedness by simple procedures proved to be mixed handed when investigated by multiple–item questionnaires[2].

In addition, although high retest reliability is found in normal subjects, this may not be true for patients with schizophrenia[27].

Accordingly, 19.4% of patients with schizophrenia used a different hand for the same item on retesting compared to only 3.8% of controls, (ambiguous–handedness)[1].

In addition, using a questionnaire method, control subjects tend to overestimate non-preferred hand use, whereas patients with schizophrenia tend to underestimate non-preferred hand use. This may explain the absence of left handedness in the patients group in contrast to 6.3% (n=7) of the control group[27].

In keeping with the hypothesis that schizophrenia is a lateralized brain disorder where the clear task assignment to each hemisphere is not preserved, this study attempted to search for a correlation between the schizotypal traits, a finding on the schizophrenia spectrum and mixed handedness in normal controls.

In a search for a correlation between handedness and the prescense of schizotypal traits it was found that healthy individuals with mixed handedness showed higher scores on different cognitive perceptual subscales of the S.P.Q. (e.g. suspiciousness, eccentric behavior and unusual perceptual experiences)[29-31]. No such correlation was found in this study. This may be attributed to methodological procedures previously mentioned and/or the limited number of participants.

Another dimension that may have contributed to the negative findings is the possibility of presence of subtypes of schizophrenia not encountered in this study. Those subtypes have been alluded to by some studies, showing an increase prevalence of persistent auditory hallucinations in left handed schizophrenic patients[32].

In addition, schizophrenics with mixed handedness performed worse than right handed patients on rhythm and memory

items of the Luria Nebraska Battery[33]. Also the non-right handed patients suffer less from tardive dyskinesia[34-35] and mixed handedness may be associated with a more chronic course[29].

For future studies, a larger number of participants assessed by a combination of observational methods to quantify the level of ambiguous handedness as well as multiple items questionnaire that qualitatively differentiates the degree of mixed handedness taking into consideration test-retest reliability are recommended. This should take in consideration the possibility of different subtypes of patients with schizophrenia.

ABBREVIATIONS: AH: ambiguous handedness, MH: mixed handedness, PLH. Pathological left handedness, SPQ: schizotypal personality questionnaire, RT: right handedness, LT: left handedness

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