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NARROW AND BROAD DEFINITION OF MIXED-HANDEDNESS IN MALE PSYCHIATRIC PATIENTS[1]

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Summary.—Differences in assessment and classification procedures of many mixed-handedness studies have made comparison of findings difficult. In the present study, "narrow" and "broad" definitions of mixed-handedness were investigated using the Annett Handedness Questionnaire in patients with schizophrenia ($n=68$), panic disorder ($n=62$), borderline personality disorder ($n=35$), heroin addiction ($n=54$), and mental retardation ($n=33$) in comparison with 944 controls. According to the "narrow" definition of mixed-handedness, an excess of mixed-handedness was observed in patients with borderline personality disorder and mental retardation. An excess of nonmixed-handedness was found in patients with panic disorder. According to the "broad" definition of mixed-handedness, an excess of mixed-handedness was observed in patients with mental retardation, in the total sample of psychiatric patients ($n=252$), and in the schizophrenic patients. Thus, we can conclude that different mixed-handedness definitions can be associated with different results. Furthermore, we suggest that the neurotic part of the present psychopathology spectrum tends to be related to an excess of normal or nonmixed-handedness, and the psychotic as well as the organic portion is associated with an excess of mixed-handedness, regardless of the definition of mixed-handedness used.

There is evidence from many sources of an anomaly in hemispheric lateralization process among different psychiatric populations. An excess of mixed-handedness has been reported in a variety of neurodevelopmental disorders: dyslexia (Richardson, 1994), mental retardation (Pipe, 1988), and autism (Cornish & McManus, 1996). In addition, many studies have shown an elevated incidence of nonright-handedness among substance abusers and alcoholics (Narsallah, Keelor, & McCalley-Whitters, 1983; Coren, 1992), as well as delinquents (Feehan, Stanton, McGee, Silva, & Moffitt, 1990). The relation between nonright-handedness and depression has been the subject of many studies, but whether there is a positive relation between them remains unresolved. Flor-Henry (1986), reviewed several findings which point to an elevated incidence of nonright-handedness in bipolar depression, but normal or excessive right-handedness was noted in other studies of depressives (Clementz, Iacono, & Beiser, 1994). On the subject of handedness and anxiety, an almost equal number of studies have shown increased nonright-

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handedness of anxious individuals (Strom, Dean, Wenck, & Ibe, 1987) as have shown normal handedness or excessive dextrality in such persons (French & Richards, 1990).

Reversal of normal structural asymmetries has been found in the brains of schizophrenic patients in the occipital (Luchins, Polin, & Wyatt, 1980) and temporal regions (Crow, Colter, Frith, Johnston, & Owens, 1989). Increased fluctuating asymmetry of dermatoglyphic traits (Markow & Wandler, 1986) and asymmetry of dopamine type 2 receptor density (Reynolds, Czudec, Broweij, & Seeman, 1987) have also been reported. Narsallah, Keelor, and Van Schroeder (1981) reported an increase in both left- and mixed-handedness among patients with schizophrenia. Also, an excess in both ambidexterity (Nelson, Satz, Green, & Cicchetti, 1993; Cannon, Byrne, Cassidy, Larkin, Horgan, Sheppard, & O'Callaghan, 1995; Malesu, Cannon, Jones, McKenzie, Gilvarry, Rifkin, Toone, & Murray, 1996) and ambiguous-handedness (Green, Satz, Smith, & Nelson, 1989) has been noted, but compared with controls, pure left-handedness in schizophrenia has not been reported. It is possible that an increased proportion of "mixed-handed" rather than pure left-handed individuals accounts for the observed sinistral shift in the handedness of schizophrenics. Mixed-handedness has also been more common in schizotypal personality disorder (Kim, Raine, Triphon, & Green, 1992; Richardson, 1994) and in psychometrically defined psychosis-prone individuals (Chapman & Chapman, 1987) than in the general population.

However, differences in assessment and classification procedures have confounded interpretations of these results. Factors influencing the measurement of handedness include sex, age, whether the report is by self or observed, whether the tasks are performed with one or two hands, the diversity of methods of scoring responses in the list of tasks, as well as environmental factors, such as a left-handed child being trained to write right-handed. Inconsistent criteria for mixed-handedness and the failure to account for those individuals who are best described as mixed-handed has rendered difficult comparison of different studies (Green, *et al.*, 1989; Orr, Cannon, Gilvarry, Jones, & Murray, 1999). In this paper, using the narrow and broad definitions of mixed-handedness, we examined whether more psychiatric patients are mixed-handed than controls. Furthermore, we examined these types of mixed-handedness in different psychiatric diagnoses representing the whole spectrum of psychopathology.

Method

Subjects

The patients were drawn from the psychiatric department of the Tripolis Army Hospital. All patients were male conscripts, admitted consecutively during the first eight months of 2000, and they all had signed informed con-

sent. In all, 252 patients were interviewed with the Structured Clinical Interview for the DSM-III–R, Axis I and II (Spitzer, Williams, Gibbon, & First, 1990). The investigation included 68 patients with schizophrenia, 62 with panic disorder, 35 with borderline personality disorder, 54 with heroin addiction, and 33 with mental retardation, on all of whom full handedness data were available. The age distribution, as well as the average age of onset of all diagnostic groups are shown in Table 1. All schizophrenic patients were under antipsychotic therapy, 13 (21%) and 18 (29%) of the patients with panic disorder had a comorbidity with depression or agoraphobia, and 41 (76%) of the patients with heroin addiction also showed multiple drug use. Mental retardation patients had an IQ range from 51 to 65, according to their psychiatric histories.

TABLE 1
AGE DISTRIBUTION IN DIAGNOSTIC GROUPS

Group	*n*	Age, yr.		Age of Onset, yr.	
		M	*SD*	*M*	*SD*
Controls	944	21.3	2.9		
All Patients	252	22.2	3.3		
Schizophrenia	68	22.5	3.3	18.1	2.3
Panic Disorder	62	23.7	4.0	20.3	1.8
Borderline Disorder	35	23.5	3.2		
Heroin Addiction	54	21.0	1.5	16.3	2.5
Mental Retardation	33	19.7	1.1		

Nine hundred forty-four individuals consented to participate as a control group. They were male recruits following the basic training in the army. It should be noted that all controls had been found healthy because all recruits are screened for mental and somatic diseases, and those with symptoms were excluded before any survey began. Both patients and controls were matched for age and socioeconomic status.

Assessment

All patients and controls were administered the Annett Hand Preference Questionnaire (Annett, 1985), which assesses hand preference according to the stated and demonstrated preference for 12 discrete actions: six primary actions (writing, throwing a ball, hammering a nail, brushing teeth, striking match, holding a racquet) and six secondary actions (sweeping, shoveling, unscrewing a jar lid, dealing cards, threading a needle, holding scissors). Subjects stated and demonstrated "right," "left," or "either" to each action. Based on the response pattern, a subject is assigned to one of eight classes (Annett, 1970, 1985). According to the "narrow" definition, mixed-handedness was defined as Annett Classes 5 and 6 only (Orr, *et al.*,

1999), and according to the "broad" definition of mixed-handedness(McMeekan & Lishman, 1975), we included all subjects who were not totally right- or left-handed (Annett Classes 2 to 7). Pure right- or left-handedness were defined as Groups 1 and 8, respectively, for some analyses.

Frequencies were analyzed with Mantel-Haenszel odds ratio and 2×2 chi-squared analysis using Fisher's two-tailed probability tests, in the Statistical Package for the Social Sciences (SPSS) for Windows.

Results

The proportion of subjects with "narrow" definition mixed-handedness (Annett Classes 5 and 6) in the five patient groups and the control group is reported in Table 2. There was a significant excess of mixed-handedness among the mental retardation patients (Odds Ratio: 2.79; 95% CI: 1.2–6.3, $p = .01$) and the borderline personality patients (Odds Ratio: 2.58; 95% CI: 1.1–5.8, $p = .02$) when compared with the control group. In contrast, patients with panic disorder showed a significant excess of nonmixed-handedness (Odds Ratio: 0.14; 95% CI: 0.02–1.04, $p = .02$) when compared with the control group.

TABLE 2
Odds Ratios of "Narrow" Definition Mixed-handedness* in Patients Compared With Controls

Group	*n*	Mixed-handed		Odds Ratio	95% CI	*p*
		n	%			
Controls	944	97	10.3			
All Patients	252	33	13.1	1.32	0.86–2.01	ns
Schizophrenia	68	10	14.7	1.51	0.75–3.04	ns
Panic Disorder	62	1	1.6	0.14	0.02–1.04	.03
Borderline Disorder	35	8	22.9	2.59	1.14–5.85	.02
Heroin Addiction	54	6	11.1	1.09	0.46–2.62	ns
Mental Retardation	33	8	24.2	2.79	1.23–6.37	.01

*Annett Classes 5 and 6.

Table 3 shows the proportion of subjects classified in the "broad" definition of mixed-handedness (Annett Classes 2 to 7) in the same psychiatric and control groups, as previously examined. The research also showed a significant excess of mixed-handedness in mental retardation patients (Odds Ratio: 2.86; 95% CI: 1.3–5.8, $p = .003$) when compared with the control group. According to this type of definition, the "all patients" group showed a significant excess of mixed-handedness (Odds Ratio: 1.95; 95% CI: 1.1–2.0) when compared with the controls. In addition, the schizophrenic patients also showed a significant excess of mixed-handedness (Odds Ratio: 1.95; 95% CI: 1.2–3.2, $p = .007$). They also showed a decreased incidence of pure

right-handedness in comparison with the controls (45.5% vs 58.5%), and none of them was purely left-handed (0.0% vs 5.8%). Finally, patients with heroin addiction showed no excess in pure right- or pure left-handedness or in mixed-handedness regardless of the definition used.

TABLE 3
ODDS RATIOS OF "BROAD" DEFINITION MIXED-HANDEDNESS* IN PATIENTS COMPARED WITH CONTROLS

Group	*n*	Mixed-handed		Odds Ratio	95% CI	*p*
		n	%			
Controls	944	37				
All Patients	252	123	48.8	1.56	1.18–2.07	.002
Schizophrenia	68	37	54.4	1.95	1.19–3.21	.007
Panic Disorder	62	25	40.3	1.11	0.66–1.87	ns
Borderline Disorder	35	18	51.4	1.73	0.88–3.41	ns
Heroin Addiction	54	22	40.7	1.13	0.64–1.97	ns
Mental Retardation	33	21	63.6	2.87	1.39–5.89	.003

*Annett Classes 2 to 7.

DISCUSSION

The main limitations of this study is the small sample and the lack of a female comparison group. The findings confirm some previous reports of an increased prevalence of mixed-handedness (ambidexterity) in different psychiatric populations. Orr, *et al.* (1999) found an excess of mixed-handedness in a schizophrenic group using the narrow definition, but Malesu, *et al.* (1996) did not find such an excess when they used the broad definition of mixed-handedness. The present study showed an excess of mixed-handedness in schizophrenic patients using the broad definition. Differences in sample sizes, diagnostic criteria, and assessment of handedness may account for these discrepancies. The present study examined only male patients, and the excess of mixed-handedness in the Orr, *et al.* (1999) study was accounted for by the striking proportion of mixed-handers among the female schizophrenic patients as compared to the control group. In addition, it appears that, using a questionnaire, control subjects tend to overestimate nonpreferred hand use, whereas patients with schizophrenia tend to underestimate nonpreferred hand use (Malesu, *et al.*, 1996). The situation is further complicated by the issue of retest reliability of handedness tests. Although the Annett Hand Preference Questionnaire has high retest reliability in normal subjects (McMeekan & Lishman, 1975), this may not be true for patients with schizophrenia. Green, *et al.* (1989) found that 19.4% of schizophrenic patients used a different hand for the same item on retesting but only 3.8% of controls did so. This phenomenon is referred to as "ambiguous-handedness." Moreover, the use of a different scale, as for example, the Edinburg

Handedness Inventory (Oldfield, 1971) may produce different classifications in the same study populations as well (Peters, 1995).

According to both Annett's narrow and broad definition of mixed-handedness, an excess of mixed-handedness was found in mental retardation patients. It should be noted that they also had an excess of pure left-handedness in comparison with controls (16.7% vs 5.8%). This finding agrees with previous findings for mental retardation patients as well as for patients with neurodevelopmental disorders like dyslexia and autism (Pipe, 1988; Richardson, 1994).

This is possibly the first study examining hand-preference in patients with borderline personality disorder. Previous studies showed that mixed-handedness is more common in schizotypal personality disorder (Kim, *et al.*, 1992; Richardson, 1994) and in psychosis-prone individuals (Chapman & Chapman, 1987). In the present study, borderline personality disordered patients, who are thought to share some common features with psychotic patients, showed an excess of mixed-handedness according to the narrow definition of mixed-handedness which did not coincide with the findings based on the broad definition of mixed-handedness.

Patients with heroin addiction, who are usually anxious and depressive, showed normal handedness. The neurotic group in this study, who suffered from panic disorder, showed an excess of nonmixed-handedness, without having any significant excess of pure right- or left-handedness when compared with controls (58.0% vs 58.5% and 2.7% vs 5.8%, respectively). Similar findings of normal handedness or excessive dextrality were reported by French and Richards (1990) among anxious individuals.

Finally, after close examination and comparison of the hand preference of subjects with different psychiatric diagnoses, we can suggest that those belonging to the neurotic part of the psychiatric disorders spectrum may tend to show an excess of nonmixed-handedness or normal handedness. The psychotic and the organic part of this spectrum may tend to show an excess of mixed-handedness, which is in accordance with the neurodevelopmental hypothesis of these disorders (Murray, O'Callaghan, Castle, & Lewis, 1992; Crow, Done, & Sacker, 1996; Yeo, Gangestad, Edgar, & Thoma, 1999). It is thought, therefore, that more data are needed on lateralization within psychiatric disorders when mixed-handedness is examined separately for each group of patients as well as quantifying ambiguous-handedness (Satz & Green, 1999).

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