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BRIEF COMMUNICATION

Lateral preference in post-traumatic stress disorder

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ABSTRACT

Background. We assessed lateral preference in 80 male patients with combat-related post-traumatic stress disorder (PTSD) and in 100 healthy age-matched male controls.

Methods. Hand, foot, eye and ear preferences were examined, using the Edinburgh Handedness Inventory-Modified and the Coren Inventory of Lateral Preference.

Results. Mixed lateral preference was noted in significantly more PTSD patients than controls (65 *v.* 43%, $P < 0{\cdot}005$).

Conclusions. These results indicate a possible hemispheric imbalance (less lateralization) in PTSD patients, with the right hemisphere playing a more active role in perceptual and cognitive processing and in the regulation of biological responses in these patients. This imbalance may be relevant to the pathophysiology of PTSD.

INTRODUCTION

Various clinical psychiatric conditions have been associated with an abnormal distribution of lateral preference. A high proportion of left handedness and mixed handedness has been reported in schizophrenic patients (Green *et al.* 1989) and increased mixed handedness in schizoaffective patients (Taylor & Amir, 1995). Left handedness has been linked to antisocial, histrionic and explosive personality traits (Standage, 1983; Grace, 1987), alexithymia (Rodenhauser *et al.* 1986), and emotional instability (Orme, 1970). Poor lateralization of handedness has also been related to 'general maladjustment' (Palmer, 1963). On the basis of these findings several authors have proposed that psychopathology may be traced to asymmetrical cerebral dysfunction and that lateral preference implies a cerebral lateral organization (Geschwind & Galaburda, 1985; Taylor & Amir, 1995).

Laterality has been studied in post-traumatic stress disorder (PTSD) mainly in the context of alexithymia (Zeitlin *et al.* 1989; Henry, 1993), but also in studies suggesting interhemispheric communication deficit (Shalev *et al.* 1988; Zeitlin *et al.* 1989; Henry, 1993) and right hemisphere over-control (Watson *et al.* 1988; Schiffer *et al.* 1995). Watson *et al.* (1988) described a neurophysiological model, introduced by Chemtob and Hamada, which is based on the hemispheric lateralization of cognition and affect. They emphasized the role of the right (non-dominant) hemisphere and of asymmetrical hemispheric function in PTSD, and suggest that 'less lateralized individuals are more prone to experience maladaptive levels of anxiety'.

The aim of the present study was to determine whether lateral preference (hand, foot, eye and ear) may be associated with PTSD.

METHOD

The study population consisted of 80 male combat veterans of mean ($\pm$S.D.) age 33·2 $\pm$ 6·2 years with a diagnosis of chronic PTSD who

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were randomly drawn from a population of about 800 combat-related PTSD patients who volunteered to participate in the study (non-help-seeking patients). All patients were diagnosed for the first time at the Mental Health Services of the Israel Defense Forces during the period 1987 to 1992, according to DSM-III-R criteria using the revised PTSD inventory – Hebrew version (Solomon *et al.* 1993). The 80 PTSD participants were re-evaluated in 1993–4 and the diagnosis was confirmed according to DSM-III-R criteria. None had evidence (as ascertained by detailed clinical interview) of past or current neurological disorders, including epilepsy, brain tumours, head trauma and cerebrovascular accident. The duration of PTSD ranged from 4 to 15 years. Psychiatric co-morbidity was obtained by a structured interview using the Schedule for Affective Disorders and Schizophrenia – Lifetime Version (SADS-6) (Spitzer & Endicott, 1979). The co-morbidity of this PTSD group was described by us in details elsewhere (Spivak *et al.* 1997). Briefly, 25 of the PTSD patients had at least one additional psychopathology, as follows: major depressive disorder ($N = 4$), bipolar affective disorder ($N = 2$), generalized anxiety disorder ($N = 8$), agoraphobia ($N = 4$), panic disorder ($N = 1$), obsessive–compulsive disorder ($N = 4$), alcoholism ($N = 2$), drug dependence ($N = 3$). One hundred healthy veterans, age-matched males (age $36 \pm 9{\cdot}0$ years) without signs of any mental or neurological disorder served as controls. All the control subjects had been in combat, but none had signs or symptoms of PTSD. Exposure to combat was confirmed by interview in both PTSD patients and controls.

All subjects gave informed consent to participate in the study after the procedure was fully explained to them.

Lateral preference was assessed, as follows, by two observer-based questionnaires.

Edinburgh Handedness Inventory – Modified (Oldfield, 1971)

This questionnaire includes 10 questions about right- and left-hand preference. Each reply receives one point: $+1$ for right hand or -1 for left hand. Right preference is defined by a score of $+10$ and left preference by a score of -10; other results indicate mixed preference.

Coren Inventory of Lateral Preference (Coren *et al.* 1979)

This inventory checks hand (4 questions), foot (3 questions), eye (3 questions) and ear (3 questions) preference. Each reply is rated $+1$ for right preference, -1 for left preference or 0 for no preference. Right preference is defined as a score of $+4$ for hand and $+3$ for leg, eye and ear and left preference by a score of -4 for hand and -3 for leg, eye and ear; other results indicate mixed preference.

The collected data were analysed by Fisher's exact test and Student's t test as appropriate.

RESULTS

Overall, the PTSD patients had a significantly higher rate on mean score of mixed preference and a significantly lower rate of right preference than the control group in both Edinburgh and Coren questionnaires (Table 1).

When only hand dominance was checked (Edinburgh questionnaire), the PTSD patients revealed a significantly lower rate of right-hand dominance ($P < 0{\cdot}01$) and a significantly higher rate of mixed dominance ($P < 0{\cdot}01$) than controls (Table 1). Results evaluated separately for hand, foot, eye and ear (Coren questionnaire) showed a significantly higher mixed preference and a significantly lower right preference for the hand and for the foot in the PTSD group as compared to controls (Fisher's exact test, $P < 0{\cdot}005$ for both).

Within the group of PTSD, significantly more subjects had mixed preference than right preference ($P < 0{\cdot}005$) (Table 1). No such significance was observed within the control group.

Table 1. *Lateral preference in PTSD patients and normal controls*

		Questionnaire					
		Edinburgh			Coren		
		Right	Left	Mixed	Right	Left	Mixed
PTSD patients ($N = 80$)	N	56*	6	18*	24**	4	52**[a]
	(%)	(70)	(7·5)	(22·5)	(30)	(5)	(65)
Controls ($N = 100$)	N	86	6	8	52	5	43
	(%)	(86)	(6)	(8)	(52)	(5)	(43)

Fisher's exact test: * $P < 0{\cdot}01$ *v.* Controls; ** $P < 0{\cdot}005$ *v.* Controls; [a] $P < 0{\cdot}005$ *v.* Rt. (within the PTSD patients).

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DISCUSSION

Findings of previous studies indicate the possible alteration in hemispheric function of PTSD patients. Zeitlin *et al*. (1989) found the evidence of the interhemispheric communication deficit in PTSD patients with alexithymia evaluated with finger localization test. However, PTSD subjects without alexithymia did not differ from control subjects in interhemispheric transfer ability. It was suggested that the deficit in interhemispheric transfer is not an indicator of PTSD but, rather, of alexithymia (Zeitlin *et al*. 1989).

Shalev *et al*. (1988) using audiological evaluation found evidence for hemispheric disconnection in a subgroup of PTSD patients. However, the evidence for interhemispheric dysfunction was not demonstrated in most of the evaluated PTSD patients.

The main finding of our study is that significantly more PTSD patients have a mixed lateral preference compared to normal controls, and within the PTSD patients, more subjects exhibited mixed preference than right preference. When hand, foot, eye and ear preference were considered together, a mixed preference was noted for 65% of the study group. Mixed preference in PTSD patients may indicate poor lateralization of cerebral hemispheric function. The normally non-dominant right hemisphere may become relatively more active and thereby exert a greater influence on behaviour and on the expression of the psychopathological symptoms.

It is widely accepted that the right hemisphere plays a major role in the subjective experience and the external expression of emotion. It is also of predominant importance in the analysis of external space, orientation in this space and in attention systems essential to survival (Geschwind & Galaburda, 1985). Otto *et al*. (1987) have suggested that the right hemisphere is specialized for processing negative and aversive emotional stimuli: 'This processing involves two components: right hemisphere activation by negative affective stimuli, and, once activated, the processing of subsequent stimuli with a negative emotional tone.' Thus, right hemisphere activation has been related to catastrophic and depressive reactions (Gainotti, 1972; Flor-Henry, 1979). Films shown exclusively to the right hemisphere were judged as more unpleasant and horrific (Diamond *et al*. 1976), and warning stimuli projected to the right hemisphere were associated with a shorter reaction time (Heilman & Van den Abell, 1979), reflecting a higher level of arousal of the right hemisphere compared with the left (Otto *et al*. 1987).

These data indicate that the activation of the right hemisphere by a stressful traumatic environmental stimuli may contribute to the individual's experience of stressful events as catastrophic. Furthermore, the changes in perception and cognition associated with right hemisphere activation may contribute to the tendency to recall negative memories, thoughts and visual images (Otto *et al*. 1987) that are of a central clinical importance in PTSD (Horowitz, 1986).

Two recent studies in this area with regard to PTSD have shown evidence of right hemisphere over-control in post-traumatic patients.

Schiffer *et al*. (1995) using auditory-evoked potential methods found that subjects with a history of childhood trauma had a significant left dominant asymmetry during the neutral memory, which markedly shifted to the right during the unpleasant memory. Along the same lines, Rauch *et al*. (1996), using a symptom-provocation positron emission tomographic (PET) study of PTSD patients, observed, for the traumatic conditions, increases in normalized blood flow in the right-sided limbic, paralimbic and visual areas. It was concluded that the PTSD emotional state may be mediated by the right limbic–paralimbic systems, and that the visual component of PTSD re-experiencing phenomena may be related to the activation of right visual cortex.

It is possible, therefore, that individuals with mixed lateral preference have alteration in normal hemispheric balance, with the right hemisphere playing a more active role in perceptual and cognitive processing and in the regulation of neurobiological responses. This relative increase in right hemisphere activity makes affected individuals more vulnerable to the development of PTSD symptoms following exposure to stressful environmental stimuli. It is of note that our work included non-help-seeking patients who, nevertheless, did not refuse to participate in the study (10% of the 800 PTSD

patients who were approached); thus, there is a possibility of a selection bias towards a less severe PTSD population.

Further studies employing brain imaging techniques as well as psychophysiological diagnostic tests to investigate hemispheric function and organization in PTSD patients, with various degrees of severity, are needed. Such an integrative approach may identify the brain structures implicated in PTSD neuropathology.

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