ELSEVIER

Psychiatry Research 59 (1995) 97–107

PSYCHIATRY RESEARCH

Deficits in short-term memory in adult survivors of childhood abuse

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Received 6 March 1995; revision received 31 July 1995; accepted 8 August 1995

Abstract

Exposure to stress has been associated with alterations in memory function, and we have previously shown deficits in short-term verbal memory in patients with a history of exposure to the stress of combat and the diagnosis of posttraumatic stress disorder (PTSD). Few studies of any kind have focused on adult survivors of childhood physical and sexual abuse. The purpose of this study was to investigate short-term memory function in adult survivors of childhood abuse. Adult survivors of severe childhood physical and sexual abuse ($n = 21$), as defined by specific criteria derived from the Early Trauma Inventory (ETI), who were presenting for psychiatric treatment were compared with healthy subjects ($n = 20$) matched for several variables including age, alcohol abuse, and years of education. All subjects were assessed with the Wechsler Memory Scale (WMS) Logical (verbal memory) and Figural (visual memory) components, the Verbal and Visual Selective Reminding Tests (SRT), and the Wechsler Adult Intelligence Scale-Revised (WAIS-R). Adult survivors of childhood abuse had significantly lower scores on the WMS Logical component for immediate and delayed recall in comparison to normal subjects, with no difference in visual memory, as measured by the WMS or the SRT, or IQ, as measured by the WAIS-R. Deficits in verbal memory, as measured by the WMS, were associated with the severity of abuse, as measured by a composite score on the ETI. Our findings suggest that childhood physical and sexual abuse is associated with long-term deficits in verbal short-term memory. These findings of specific deficits in verbal (and not visual) memory, with no change in IQ, are similar to the pattern of deficits that we have previously found in patients with combat-related PTSD.

Keywords: Physical abuse; Sexual abuse; Memory; Intelligence; Trauma; Posttraumatic stress disorder; Neuropsychology

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SSDI 0165-1781(95)02800-C

1. Introduction

Childhood physical and sexual abuse is a problem of enormous magnitude. Rates of sexual abuse have been estimated from community samples to be from 11% to 62% in women (Russell, 1983; Finkelhor and Hotaling, 1984; Kercher and McShane, 1984; Wyatt, 1985) and from 3% to 39% in men (Finkelhor and Hotaling, 1984; Kercher and McShane, 1984). Childhood abuse has been associated with a range of adverse psychiatric outcomes, including depression (Briere et al., 1988; Swett et al., 1990), anxiety (Briere et al., 1988; Swett et al., 1990), dissociation (Putnam et al., 1986; Chu and Dill, 1990; Ross et al., 1991), posttraumatic stress disorder (PTSD) (Greenwald and Leitenberg, 1990), borderline personality disorder (Herman et al., 1989; Ogata et al., 1990), alcohol and substance abuse (Ladwig and Anderson, 1989; Brown and Anderson, 1991), and other psychiatric disorders (Green, 1978; Herman, 1981; Carmen et al., 1984; Bryer et al., 1987; Bulik et al., 1989; Hall et al., 1989; Palmer et al., 1990). In spite of this, few studies have examined the long-term consequences of exposure to childhood abuse.

Considerable evidence supports a relationship between stress and alterations in memory (reviewed in Charney et al., 1993; Bremner et al., 1995a). Studies in animals suggest that exposure to stress results in deficits in short-term memory (Drugan et al., 1984). High levels of glucocorticoids released during stress have been shown to cause damage to neurons in the hippocampus (Sapolsky et al., 1988, 1990; Uno et al., 1989), a brain structure that plays an important role in learning and memory (Squire and Zola-Morgan, 1991). Neurotransmitters and neuropeptides released during stress also have the potential to result in an overconsolidation of memory traces, which may explain the existence of intrusive memories in patients with PTSD (Pitman, 1989; Pitman et al., 1993; Bremner et al., 1995a). Studies of war veterans suggest an association between the extreme stress of combat and alterations in memory function, including the forgetting of names or other pieces of important personal information. Five percent of soldiers in a major campaign in World War II had no memory for events which had just occurred immediately after they had participated as combatants (Torrie, 1944). Other studies in combat veterans and prisoners of war from World War II and the Vietnam war have documented amnesia and other disturbances of memory (Archibald and Tuddenham, 1965; Thygesen et al., 1970; Eitinger, 1980; Goldstein et al., 1987; Bremner et al., 1992, 1993b). Empirical studies of short-term memory have shown deficits in short-term memory, as measured by the Logical component of the Wechsler Memory Scale, in prisoners of war in comparison to combat veterans without a history of containment during the Korean war (Sutker et al., 1988, 1991). We have previously reported deficits in short-term verbal memory, as measured by the Logical component of the Wechsler Memory Scale and the Verbal Selective Reminding Test, with no change in IQ, in Vietnam combat veterans with posttraumatic stress disorder (PTSD) in comparison to control subjects (Bremner et al., 1993a). We have also found a decrease in volume of the right hippocampus in Vietnam combat veterans with PTSD in comparison to matched control subjects. Deficits in verbal short-term memory, as measured by the Wechsler Memory Scale, were associated with decreased right hippocampal volume in these patients (Bremner et al., 1995b). Other studies in Vietnam combat veterans have shown deficits in new learning and memory using different neuropsychological tests than the Wechsler Memory Scale (Uddo et al., 1993; Yehuda et al., 1995). Studies in children have shown a relationship between markers of abuse and deficits in the arithmetic subscale of the IQ test (Lewis et al., 1979).

The purpose of this study was to compare memory function in adult survivors of childhood physical and sexual abuse with that in healthy matched controls. Based on our previous findings in Vietnam combat veterans with PTSD, we hypothesized that adult survivors of abuse would have deficits in verbal (but not visual) memory, with no change in IQ, in comparison to matched controls.

2. Methods

2.1. Subjects

The patient group consisted of 21 adult survivors of childhood physical and sexual abuse. Pa-

tients were recruited from the inpatient and outpatient treatment units of the West Haven VA Medical Center over a 12-month period. A long period of recruitment was necessary to identify patients with a severe history of abuse, based on the criteria outlined below. All new admissions to these units were briefly screened for a history of abuse, and referrals were made for the study, following which a more complete evaluation was performed to determine eligibility. All but one of the patients who were identified in this manner, who met inclusion criteria for the study, and who were eligible for study entry consented to participate. Patients were included if they had a history of severe childhood physical and/or sexual abuse, as determined by the Early Trauma Inventory (ETI), and an Axis I psychiatric disorder on the basis of a semistructured interview, the Schedule for Affective Disorders and Schizophrenia-Lifetime version (SADS-L; Endicott and Spitzer, 1978). Patients were excluded if they had a history of exposure to combat trauma, a diagnosis of schizophrenia or current alcohol or substance abuse based on the SADS-L, a history of traumatic brain injury or neurological disorder, current use of benzodiazepine medication, or a history of loss of consciousness for >10 min. Some of the patients were being treated with antidepressant medication at the time of the study.

The comparison group ($n = 20$) comprised physically healthy men and women of nonprofessional occupations who were matched with the patients for age, sex, race, handedness, height, weight, years of education, years of parental education, and years of alcohol abuse. Subjects with a history of traumatic brain injury, meningitis, neurological disorder, current alcohol abuse by *DSM-III-R* criteria (American Psychiatric Association, 1987), physical illness, psychiatric disorder, or history of loss of consciousness for >10 min were excluded from the study.

There were no differences between patients and comparison subjects in any of the demographic variables that were measured in this study. Patients were similar to controls in age (patients: mean = 39.7, SD = 7.1; controls: mean = 36.7, SD = 10.0; $t = 1.1$, $df = 39$, $P = 0.28$), race (patients: 18/21 [86%] white, 1/21 [5%] black, 2/21 [10%] Hispanic; controls: 14/20 [70%] white, 4/20 [20%] black, 1/20 [5%] Hispanic, 1/20 [5%] other; $\chi^2 = 3.61$, $df = 3$; $P = 0.31$), sex (patients: 15/21 [71%] males and 6/21 [29%] females; controls: 16/20 [80%] males and 4/20 [20%] females ($\chi^2 = 0.41$, $df = 1$, $P = 0.52$), handedness (patients: 18/21 [86%] right-handed and 3/21 [14%] non-right-handed; controls: 19/20 [95%] right-handed and 1/20 [5%] non-right-handed; $\chi^2 = 1.34$; $df = 1$; $P = 0.50$), years of education (patients: mean = 13.5, SD = 2.1; controls: mean = 14.0, SD = 3.0; $t = 0.59$, $df = 39$, $P = 0.55$), and years of alcohol abuse (patients: mean = 10.9, SD = 9.4; controls: mean = 6.6, SD = 10.2; $t = 1.39$, $df = 39$, $P = 0.17$).

Patients were evaluated with the SADS-L for comorbid psychiatric diagnoses. SADS-L data were not available for three patients. All patients in the study met criteria for current PTSD related to their early trauma. Many patients also had diagnoses of affective disorders. Five out of 18 (28%) patients evaluated with the SADS-L met criteria for current and 16/18 (89%) for lifetime major depression. In addition, 1/18 (6%) patients met criteria for current and 2/18 (11%) for lifetime dysthymia, while none met criteria for either current or lifetime bipolar disorder or bipolar disorder not otherwise specified. There were a number of patients with comorbid anxiety disorder diagnoses. Seven out of 18 (39%) met criteria for current and lifetime panic disorder with agoraphobia, and 2/18 (11%) for current and 5/18 (28%) for lifetime panic disorder without agoraphobia, 2/18 (11%) had a history of current and lifetime diagnoses of agoraphobia without a history of panic disorder, 3/18 (17%) current and 4/18 (22%) lifetime social phobia, 2/18 (11%) current and 3/18 (17%) lifetime generalized anxiety disorder, 1/25 (4%) current and lifetime simple phobia, and none with current or lifetime obsessive-compulsive disorder. No patients had current or lifetime diagnoses of schizophrenia. Other diagnoses included current bulimia in one patient (6%) and lifetime bulimia in two patients (11%), and current anorexia in no patients and lifetime anorexia in one patient (6%). No patients had current or lifetime psychosis not otherwise

specified, somatization disorder, somatic pain disorder, undifferentiated somatization disorder, or hypochondriasis.

Consistent with previous reports, comorbid lifetime diagnoses for alcohol and substance abuse disorders were increased in our group of early trauma patients. Fourteen out of 18 patients (78%) met criteria for alcohol dependence and 1/18 (6%) for alcohol abuse, 3/18 (17%) for sedative/hypnotic/anxiolytic dependence and 1/18 (6%) for abuse, 9/18 (50%) for cannabis dependence and 2/18 (11%) for cannabis abuse, 7/18 (39%) for stimulant dependence and 2/18 (11%) for stimulant abuse, 5/18 (28%) for opiate dependence and none for opiate abuse, 10/18 (56%) for cocaine dependence and none for cocaine abuse, 1/18 (6%) for hallucinogen/PCP dependence and 2/18 (11%) for abuse, and 4/18 (22%) for polydrug dependence and none for abuse.

2.2. Assessment of childhood abuse

Research in the area of childhood abuse has been limited by the lack of a comprehensive instrument with demonstrated reliability and validity (Briere and Runtz, 1988). The current study used the Early Trauma Inventory (ETI), which was developed as part of a parallel project for the assessment of childhood physical, sexual, and emotional abuse. The ETI was developed by a multidisciplinary team including one of the authors of the current study (Kriegler et al., 1993) in collaboration with colleagues from the National Center for PTSD, based on clinical experience, a review of available existing instruments, and a survey of the clinical literature on childhood abuse (Finkelhor, 1979, 1986; Lewis et al., 1979; Herman, 1981; Herman et al., 1986; Russell, 1986; Briere and Runtz, 1987; Wyatt, 1885). The ETI assesses the frequency of abuse experiences at different developmental periods/academic epochs (preschool, elementary school/junior high school, and high school), the age of the individual when the abuse began and when it stopped, the perpetrator(s) of the abuse, the emotional impact of the abuse on the individual immediately after the event and across the life span, and the effect of the abuse on social and occupational functioning as assessed with a 7-point dual-valenced (positive and negative impact) bipolar rating. In cases where individuals reported abuse that occurred from before age 4, and indicated that they believed it had occurred since birth, abuse was scored as having occurred since birth. Immediate and long-term sequelae for the events, such as medical health seeking and change in custody status, are assessed at the conclusion of the interview. Interrater reliability and validity studies of the ETI are currently being performed and will be reported in a future publication. The ETI was administered by a clinical psychiatrist trained in the use of the ETI by one of the authors of the instrument. The clinical psychiatrist was unaware of the information obtained from neuropsychological testing. Asessments of abuse in this study were based on self-report.

Although considerable variation exists with regard to the definition of childhood abuse (Kinsey et al., 1953; Finkelhor and Hotaling, 1984; Wyatt, 1985; Briere and Runtz, 1988), there are no empirical bases to justify the use of specific criteria. One approach is to identify subjects with a history of very severe abuse, for whom there is no question from their report that they have been exposed to childhood abuse. We have developed specific criteria for severe abuse based on the ETI interview to identify subjects with severe abuse. Severe abuse was defined as a history of exposure to physical abuse (being hit with an object, burned, or locked in a closet, or suffering penetrative sexual abuse) that had occurred once a month or more for at least a year and that had extremely negative effects on the individual when the event occurred as well as on current emotional, social, or occupational functioning.

Histories of abuse were obtained in this study by self-report. It might be argued that patients do not accurately report their abuse. One should consider, however, other methods of validating the history of abuse. Obtaining history from family and friends has its own problems, as these individuals may have been involved in the abuse or be in active denial that abuse could have occurred. Limiting study to individuals for whom there are court records of abuse would represent a biased sample, as our clinical impression is that the majority of abused individuals do not enter the legal system. One might also argue that deficits in

memory in these patients could result in deficient memory for episodes of abuse. These memory deficits, however, involve short-term new learning (not recall of long-term storage). We hypothesize that memory deficits are the result of abuse exposure; therefore, there would be no reason to expect that memory for the abuse itself would be impaired. It is also our clinical impression that memory traces for these events are often very strong (in circumstances where amnesia does not exist).

Patients in this study, as would be expected from the selection criteria, had experienced high levels of physical and sexual abuse. All of the patients experienced some form of physical and emotional abuse, while 19/21 (90%) experienced some form of sexual abuse. As can be seen in Table 1, patients endorsed experiencing a wide range of abuse experiences in the different abuse domains (physical, emotional, and sexual abuse). Abuse experiences in the different domains were related to each other; that is, there were significant correlations between severity of physical and emotional abuse ($r = 0.50$, $df = 20$, $P < 0.05$), sexual and emotional abuse ($r = 0.47$, $df = 20$, $P < 0.05$), and physical and sexual abuse ($r = 0.60$, $df = 20$, $P = 0.004$). These abuse experiences had a very negative effect on the patients' current lives. For example, 16/21 (76%) of patients reported that physical abuse had an extremely negative effect on them emotionally, 14/21 (68%) an extremely negative effect on work performance, and 16/21 (76%) on family life at the current time. Onset of the abuse occurred from infancy for physical abuse in 16/21 (76%) patients, emotional abuse in 16/21 (76%), and sexual abuse in 3/21 (14%) (or 6/21 [29%] before the age of 5 years). Fourteen out of 21 (68%) patients reported that the primary perpetrator of their physical abuse was a male primary caretaker (e.g., father), 6/21 (29%) a female primary caretaker (e.g., mother), and 1/21 (5%) a female child family member. For emotional abuse, 12/21 (57%) reported that the primary perpetrator was a male primary caretaker and 9/21 (43%) a female primary caretaker; for sexual abuse, 3/21 (14%) reported that the primary perpetrator was a male primary caretaker, 1/21 (5%) a female primary caretaker, 2/21 (10%) a male known adult family member, 1/21 (5%) a male child family member, 9/21 (43%) a known adult male, 3/21 (14%) a known adult female, and 2/21 (10%) did not experience sexual abuse.

Table 1
Frequency of exposure to traumatic events as assessed by the early trauma inventory (ETI)

Abuse	*N*	Percent (%)
Physical abuse		
Spanked with a hand	19/21	91
Slapped in the face	18/21	86
Burned with hot water/cigarette	8/21	38
Punched or kicked	16/21	76
Hit with objects	20/21	95
Choked	15/21	71
Pushed or shoved	17/21	81
Tied up/locked in closet	9/21	43
Sexual abuse		
Exposed to inappropriate comments about sex/body parts	16/21	76
Exposed to someone flashing	17/21	81
Someone watched you dressing	8/21	38
Forced/coerced to watch sexual acts	13/21	62
Touched in private parts — made you uncomfortable	17/21	81
Someone rubbed their genitals against you	14/21	67
Forced/coerced to touch another person's private parts	14/21	67
Had genital sex against your will	5/21	24
Had oral sex on someone against your will	11/21	52
Someone performed oral sex on you against your will	8/21	38
Someone had anal sex on you against your will	8/21	38
Emotional abuse		
Often put down or ridiculed	19/21	91
Often ignored/made to feel you didn't count	18/21	86
Often told you were no good	18/21	86
Often shouted at or yelled at	21/21	100
Most of the time treated in cold or uncaring way	19/21	91
Parents controlled your life	19/21	91
Parents fail to understand your needs	21/21	100
Parents expected you to act older	14/21	67

The ETI was also used to develop an index of severity of abuse exposure so that the relationship between severity of childhood abuse and memory function could be examined. Childhood abuse severity indexes were developed for each of the subscales of the ETI (physical, emotional, and sexual) by multiplying the total number of items endorsed as having occurred times the total number of years during which the event occurred, times the frequency with which the event occurred when it was occurring most frequently (based on an integer from 1 to 6, with 6 being the most frequent, definitions available upon request). The three subscales were also summed to give a total abuse severity index.

2.3. Assessment of alcohol abuse

The Addiction Severity Index (ASI) interview was used to assess lifetime alcohol abuse. The ASI evaluates the total number of years of alcohol abuse over the individual's lifetime (i.e., drinking to the point of intoxication, three or more drinks per day, on a regular basis, three or more days in a week) (McClellan et al., 1985). Early trauma patients with a history of alcohol abuse were matched on a case-by-case basis with controls with a history of alcohol abuse on the basis of the ASI interview.

2.4. Neuropsychological testing of memory and intelligence

All subjects were administered a battery of neuropsychological tests as described below. (1) Four subtests of the Wechsler Adult Intelligence Scale (WAIS-R) were administered, including Arithmetic, Vocabulary, Picture Arrangement, and Block Design, to estimate an intellectual level for each subject. (2) Two subtests of the Wechsler Memory Scale (WMS) were administered according to the Russell revision (Russell, 1975). The subtests include Logical Memory, the free recall of two story narratives, which is felt to represent a test of verbal memory, and Figural Memory, which is felt to represent visual memory, involving the reproduction of designs following a 10-s presentation. For both the WMS subtests, immediate and delayed reproduction were tested, and a percent retention score was computed (delayed recall/immediate recall × 100). (3) The Verbal Selective Reminding Test (VeSRT; Buschke and Fuld, 1974; Hannay and Levin, 1985) is a measure of verbal learning in which a list of 12 words is presented for immediate recall. On subsequent trials, only the words not recalled on the prior trial are presented. The task is complete after two consecutive perfect recall trials or 12 presentations. (4) The Visual Selective Reminding Procedure (ViSRT; Buschke and Fuld, 1974; Hannay and Levin, 1985) is a task modeled on the verbal selective reminding in which 12 designs are presented one at a time for 3 s each, followed by an opportunity for the subject to draw all from memory. Each design that is not accurately reproduced on a given trial is shown again until perfect recall is attained or 12 trials are reached. Five indices of learning and memory are obtained from each of the selective reminding tasks: Total Recall, Long-term Retrieval, Long-term Storage, List Learning (Consistent Long-term Retrieval), and Delayed Recall.

2.5. Data analysis

A series of t tests were performed between patients and controls for each of the subcomponents of the WMS, SRT, and WAIS-R. Two-tailed nonpaired tests of significance were used throughout. Pearson's product-moment correlations were performed between scores on neuropsychological testing and abuse severity scores. The Bonferroni correction was applied to adjust for multiple comparisons. Significance was defined as $P < 0.05$.

3. Results

Adult survivors of abuse had deficits in verbal short-term recall, as measured by decreased scores on the Logical component of the WMS for immediate recall and delayed recall, but not percent retention. Adult survivors of abuse also had deficits in verbal recall, as measured by the VeSRT (Table 2). After adjustment for multiple comparison with the Bonferroni correction, only the WMS Logical immediate and delayed recall tests differed significantly between patients and controls ($P < 0.003$). Adult survivors of abuse did not have

Table 2
Wechsler Memory Scale (WMS) and Selective Reminding Test (SRT) scores in early trauma patients and normal subjects

	Early trauma patients (n = 21)		Normal subjects (n = 20)		t	P
	Mean	SD	Mean	SD		
WMS Logical Memory						
Immediate recall	13.6	3.3	20.8	6.5	3.71	0.0007*
Delayed recall	10.5	5.6	17.8	6.1	3.98	0.0003*
Retention (%)	75.0	24.1	84.7	11.9	1.58	0.12
WMS Figural Memory						
Immediate recall	10.2	2.9	10.9	3.4	0.66	0.51
Delayed recall	10.1	3.2	9.3	4.2	0.73	0.47
Retention (%)	96.4	6.9	82.9	20.8	2.96	0.007
Verbal SRT						
Recall	102.6	19.1	115.6	14.4	2.47	0.019
Long-term storage	92.4	18.5	111.5	16.6	2.64	0.013
Long-term retrieval	83.8	29.1	101.5	21.6	2.21	0.033
Continuous long-term retrieval	58.7	32.5	83.8	32.4	2.48	0.018
Delayed recall	8.0	3.5	10.0	2.2	2.24	0.03
Visual SRT						
Recall	126.3	16.6	126.3	30.7	0.004	0.99
Long-term storage	124.4	21.4	125.1	30.8	0.08	0.93
Long-term retrieval	121.1	23.4	123.9	30.9	0.32	0.75
Continuous long-term retrieval	111.5	30.2	120.4	31.5	0.92	0.36
Delayed recall	11.3	1.0	11.1	2.7	0.44	0.66

*$P < 0.05$ after Bonferroni correction for multiple comparisons (df = 39 for all comparisons).

deficits in visual short-term memory as measured by the WMS figural component or the ViSRT. In fact, there appeared to be a tendency (which was not significant after correction for multiple comparisons) for the patients to have higher scores on the WMS visual memory task than did the controls (Table 2).

There were no significant IQ differences between adult survivors of severe childhood physical and sexual abuse and controls. Specifically, there were no differences in WAIS-R scores between PTSD patients (n = 21) and controls (n = 20) for verbal IQ (patients: mean = 101.0, SD = 17.5; controls: mean = 103.0, SD = 17.6; t = 0.34, df = 39, P = 0.73), performance IQ (patients: mean = 100.5, SD = 18.4; controls: mean = 107.8, SD = 19.5; t = 1.21, df = 39, P = 0.23), or full scale IQ (patients: mean = 101.0, SD = 16.5; controls: mean = 106.7, SD = 19.1; t = 1.01, df = 39, P = 0.32). Although there were no statistically significant differences, there was a tendency for the abused patients to have slightly lower IQ. The magnitude of difference was not nearly so large as for memory. We elected not to compare memory scores between the two groups with covariation for IQ, because deficits in memory could cause slight decreases in IQ (i.e., memory function likely contributes to some of the variance in IQ).

Severity of abuse was related to deficits in verbal short-term memory in the PTSD patient group. Overall severity of abuse, as measured by the summed abuse severity score (sum of physical, sexual, and emotional abuse severity scores, calculated from the ETI as described above), was significantly correlated with deficits in short-term verbal recall, as measured by the WMS Logical immediate recall subcomponent (r = −0.46, df = 20, P = 0.035). In addition, severity of sexual abuse

when considered alone was correlated with deficits in verbal short-term memory, as measured by the WMS Logical immediate recall subcomponent ($r = -0.48$, $df = 20$, $P = 0.026$). Although there were no statistically significant differences in IQ between early trauma patients and comparison subjects, it is of interest to note that there were some relationships between IQ and abuse in this study. Overall severity of abuse, as measured by the summed abuse severity score, was associated with decreased performance IQ ($r = -0.45$, $df = 20$, $P = 0.039$) and full-scale IQ ($r = -0.44$, $df = 20$, $P = 0.045$). Severity of physical abuse was associated with decreased performance IQ ($r = -0.50$, $df = 20$, $P = 0.022$).

4. Discussion

Adult survivors of childhood physical and sexual abuse had deficits in verbal short-term recall, as measured by the WMS Logical component, as well as immediate and delayed recall, with no difference in IQ in comparison to matched control subjects. There were no differences in visual memory between adult survivors of childhood abuse and control subjects. Overall severity of abuse was related to degree of memory impairment in the early trauma patients.

Stress at different stages of development appears to have similar effects on verbal short-term memory. In our previously reported group of patients with combat-related PTSD, exposure to trauma in most patients occurred at about the age of 20, while in the current group of survivors of childhood abuse, traumatic exposure often occurred as early as before the age of 5 years. There is a similar pattern of specific deficits in verbal memory, with no significant change in IQ, in both adult survivors of abuse and patients with combat-related PTSD. The left hippocampus is felt to be involved in verbal memory to a relatively greater degree than the right, while the right hippocampus is involved in visual memory to a greater degree. Thus, left hippocampal dysfunction might explain our findings.

These findings add to the growing literature in support of a relationship between stress and alterations in memory. A number of preclinical studies suggest that stress is associated with deficits in memory. For example, animals exposed to the stress of electric footshock develop deficits in short-term memory as manifested by deficits in maze escape behaviors (Drugan et al., 1984). High levels of glucocorticoids associated with stress result in damage to neurons of the hippocampus (Sapolsky et al., 1988, 1990; Uno et al., 1989), a brain structure that plays an important role in learning and memory, with associated deficits in memory (Luine et al., 1994). Stress also appears to result in overconsolidation of memory, which may be related to neurotransmitters and neuropeptides released during stress that facilitate the laying down of memory traces (Pitman, 1989; Pitman et al., 1993; Bremner et al., 1995a).

There was a relationship between overall level of abuse exposure measured with the ETI and deficits in short-term verbal memory in the patients in this study. The relationship suggests that deficits in short-term memory are clinically meaningful and relate to exposure to the stressor of abuse itself instead of to other factors such as psychiatric patient status. In addition, the current findings are a partial validation of the ability of the ETI to measure abuse-related phenomena. Early trauma patients also showed a relationship between IQ and level of trauma exposure, where lower IQ was associated with increased levels of abuse. This relationship between trauma exposure and IQ was not seen in our combat-related PTSD sample. Previous studies in children with a history of severe abuse have found a relationship between the arithmetic subscale of the IQ test and markers of abuse (Lewis et al., 1979). Trauma at early stages of development may have an effect on IQ that is not seen in patients exposed to traumatic stress at later periods of development. Alternatively, since IQ is remarkably stable throughout the lifetime, and appears to have a heritable component, one might consider that families in which there is lower IQ may be associated with situations of abuse. Therefore, low IQ may be a risk factor, rather than an outcome, for exposure to abuse. Although our patients did not have significantly lower IQ scores than comparison subjects, it can be seen from the data that with a much larger number of subjects, it might be possible to demonstrate lower IQ in the patients in comparison to the normal subjects.

One might argue that our findings of deficits in

verbal memory in patients with early trauma-related PTSD are attributable to an impairment in concentration. Decreased concentration is a symptom of PTSD. However, emerging findings from other groups using the continuous performance test (CPT) in the evaluation of concentration in PTSD patients have revealed no difference between patients and controls in concentration. In addition, a general concentration impairment would not be expected to result in a specific deficit in verbal memory function, but rather a general effect on both visual and verbal memory.

Findings of deficits in short-term verbal memory have implications for the clinical treatment of individuals with a history of severe childhood abuse. These patients may have difficulties with learning that impair academic performance (P. Saigh, personal communication, February 1, 1995). There is a tendency to direct patients who are disabled by psychiatric disorders toward rehabilitation programs. These programs often involve a return to the university to learn new job skills. Patients with a history of severe abuse may have deficits in new learning and memory that make academic goals difficult to attain. Rehabilitation that involves, for example, training in job skills that do not require a large amount of memorization may be indicated. In addition, early treatment interventions may prevent the long-term impairments in memory function, and hence academic performance, that appear to be associated with exposure to high levels of stress as occurs with childhood abuse (Saigh, 1989). Studies such as the current one that demonstrate long-term impairment in academic performance, which appears to be associated with childhood abuse, underscore the magnitude of childhood abuse as a major public health problem.

Acknowledgments

The authors thank Valinda Ouelette, R.N., for assistance in administration of testing and Beverly Horner for assistance in research administration and data management. This project was supported by a Veterans Administration Research Fellowship in Biological Psychiatry and a Veterans Administration Career Development Award to Dr. Bremner, as well as the National Center for PTSD Grant. The authors also thank Dudley Blake, Ph.D. (formerly of the VA Medical Center site of the National Center for PTSD in Menlo Park, Calif., and now in Boise, Idaho), and Paula Schnurr, Ph.D. (White River Junction site of the National Center for PTSD), for useful discussions, as well as their contribution and those of other individuals to the Early Trauma Inventory (ETI) project, which involved the collaboration of investigators from the four sites of the National Center for PTSD (White River Junction, Vt.; West Haven, Conn.; Boston, Mass.; Menlo Park, Calif.). We also thank Carolyn Mazure, Ph.D., for expert collaboration in instrument development methodology in the ETI project.

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