DISASSOCIABLE COGNITIVE IMPAIRMENTS IN PROBLEM DRINKERS

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Abstract — Patients in a treatment programme for severe alcohol dependence were tested on a battery of tests designed to examine organizational and visuo-spatial abilities. Analysis using a case-study approach indicated independent organizational and visuo-spatial impairments. An understanding of aetiological factors underlying these cognitive deficits and implications for treatment are discussed.

INTRODUCTION

Reviewers generally agree that patients seeking treatment for alcohol-related problems suffer cognitive deficits. These deficits have included impairments in abstracting ability, visuo-spatial processing, and memory (Parsons et al., 1987; Beatty et al., 1996; Parsons, 1996). Fox (1992) suggested that abstracting and visuo-spatial impairments were theoretically independent processes and should therefore be dissociable in this group. Previous studies examining the long-term effects of severe alcohol dependence have typically employed standardized neuropsychological tests within group studies, rather than a cognitive neuropsychological approach. The existence of dissociable impairments could explain the relatively low proportion of patients who are impaired on tests which show statistically significant group differences. Estimates of the proportion of individuals demonstrating impairment on these tests varies between 30 and 75% (Tarter and Edwards, 1986; Parsons, 1989). Explanations for the low clinical significance of particular tests include the nature and sensitivity of the tests used and the likely role of mediating factors, such as genetic predisposition, thiamine deficiency, and liver dysfunction, in the development of cognitive impairment.

The present study was designed to identify dissociations between visuo-spatial and organizational impairments in severely dependent drinkers using a case-study approach. Performance on tasks which independently assess organizational and visuo-spatial abilities was examined. It was predicted that patients would show impaired performance on traditional neuropsychological tests, but that this impairment could be attributable to visuo-spatial deficits in some patients and organizational deficits in others.

MATERIALS AND METHODS

Subjects

Treatment group. Twelve patients attending a residential programme for alcohol-related problems were assessed between 2 and 3 months after admission. Patients were excluded from the study if they exhibited overt neurological signs of Wernicke–Korsakoff syndrome, had a history of epileptic seizures (excluding withdrawal-related seizures), regularly used any other drugs, or if English was not their native language. Data from two of these subjects were selected for the present report as their cognitive profiles demonstrated the dissociations of interest. Neither patient differed significantly from the control group on age, years of education or estimated pre-morbid intellectual ability. Patient 1 was a 45-year-old right-handed male. He completed 9 years of education and a correspondence course in agriculture. He started drinking regularly at 15 years of age and reportedly consumed 270 g of ethanol daily, prior to admission for treatment. His first and only treatment admission was at age 45 years. He stated that he had been abstinent for 12 weeks prior to the assessment. His score of 45 on the Michigan Alcoholism Screening Test (MAST) exceeds the cut-off score of 5, recommended for screening purposes (Selzer, 1987) and indicated that he had experienced severe problems associated with alcohol use. Patient 2 was a 45-year-old right-handed male, who completed 9 years of education and courses in rigging and scaffolding. Patient 2 commenced regular drinking at 15 years of age and reportedly consumed 260 g of ethanol daily, prior to the present admission. He reported seven admissions to detoxification centres between the ages of 41 and 45 years of age. He was admitted 8 weeks prior to the assessment and stated that he had been abstinent over this period. His MAST score of 41 indicated that he also had experienced severe problems associated with alcohol use.

Control group. Thirty males from the community were recruited as a control sample. Exclusion criteria for the control group were the same as for the treatment group, except that they were also excluded if they had ever sought treatment for drug- or alcohol-related problems or if their score on the MAST exceeded 5. The age range of the control sample was between 23 and 58 years and years of education ranged from 9 to 18.

Cognitive tests

Subjects completed a battery of cognitive and electrophysiological recording tasks as part of a larger project. Variables analysed included the Block Design subtest of the WAIS-R, Mental Rotation (subjects presented with two cartoon figures...
and had to state whether the man in each picture held a glass in the same or different hands), Rey Auditory Verbal Learning Test (RAVLT — difference in performance between trial 1 and trial 5) and Verbal Memory (lists of nine-item word lists presented sequentially on a Digital VT220 monitor with free recall at the end of each list). Subjects completed 10 lists with no specified learning strategy (natural strategy — NS), 10 lists following instructions to use rote learning strategies (RS), and 10 lists following instructions to use elaborative learning strategies (ES), where they were instructed to link the items in the list by forming an integrated story or picture.

**Procedure**

The experimental procedure was described to subjects and informed consent obtained. They were tested individually over two sessions approximately 1 week apart. During the first session, demographic and drinking-history data were collected and the cognitive tasks completed. During the second session, subjects participated in an experiment examining event-related potential indices of memory processes, although these data will not be reported here.

**RESULTS**

Patient scores were normalized based on the control group’s performance and the appropriate z-scores are reported. A clinically significant impairment in performance was determined when the patient’s performance fell 1.5 SD below the control group’s level of performance. Normalized scores on cognitive tests are summarized in Fig. 1.

Patient 1 performed poorly on Block Design (scaled score = 7). The average scaled score on this test is 10, with a standard error of measurement of 0.98 (Wechsler, 1981). Performance on tasks designed to tap organizational abilities fell within normal limits; however, his performance on visuo-spatial tasks was significantly impaired. His reaction times (RTs) during the Mental Rotation task were significantly slower than controls (7035 ms). Furthermore, his RTs were only slower than controls when rotation of the figures was required, with no significant slowing when rotation was not required (z = 0.09, P = 0.64). This pattern of results suggests that Patient 1 had a selective impairment in visuo-spatial abilities even though his organizational/planning abilities with verbal tasks were intact.

Patient 2 was significantly impaired on Block Design (scaled score = 6). His performance on other tasks suggested that the deficit observed on Block Design was related to an organizational impairment rather than a visuo-spatial impairment. His performance over trials on the RAVLT was significantly poorer than the control subjects and verbal memory was impaired when instructed to use organizational learning strategies. There was no evidence for an impairment in visuo-spatial abilities which indicates a selective impairment on tasks requiring organization and integration of information, independent of visuo-spatial abilities. The differential pattern of deficits in the two patients was unchanged after adjusting for age and education.

**DISCUSSION**

The pattern of results across these two patients indicates a double dissociation between organizational and visuo-spatial abilities and provides support for the hypothesis that these two types of impairment may be independently observed in problem drinkers. Patient 1 was impaired on Block Design and the Mental Rotation task, but showed no trace of impairment on the organizational memory tasks. Therefore, his basic impairment is in visuo-spatial ability, not organizational skills. Patient 2 was also impaired on Block Design. However, in contrast to Patient 1, he showed no trace of impairment on the
Mental Rotation task, but was impaired on organizational verbal memory tasks. Therefore, his basic impairment is in organizational skills, not visuo-spatial ability. The differences observed in these two patients do not appear to be related to the patients’ pattern or style of drinking, age or level of education.

These results highlight the need for detailed evaluation of cognitive status during treatment. It has been suggested that cognitive deficits influence treatment effectiveness and are amenable to cognitive rehabilitation (Allen et al., 1997). Furthermore, it has been argued that complex, higher order psychological variables, such as cognitive appraisal and coping strategies, account for much of the variance in relapse rate (Miller et al., 1996).

One mediating factor proposed to influence the relationship between drinking history and cognitive impairment is family history of alcohol-related problems. The reported incidence of problem drinkers was higher for Patient 1 (three of six siblings, father, grandfather, one of four aunts) than for Patient 2 (one out of three siblings). Therefore, it is possible that the dissociations may reflect a genetic vulnerability to the development of visuo-spatial impairments following excessive alcohol consumption. Family history of alcohol-related problems has been linked to visuo-spatial impairments in a number of studies, whereas no association has been reported for frontal lobe functioning (Adams et al., 1998).

A second mediating factor proposed is liver dysfunction, although neither patient reported overt liver damage. Arria et al. (1991) reported that many of the visuo-spatial deficits experienced by severely dependent problem drinkers may be due to underlying liver disease, rather than to the direct effects of alcohol on performance. Walton and Bowden (1997) recently reported no relationship between neuropsychological test performance and liver function tests, although visuo-spatial ability was not independently assessed in their study.

An implication of the results of this study is that a detailed evaluation of cognitive functioning prior to treatment could provide information on the most appropriate treatment programme for a particular individual. Furthermore, examination of the pattern of performance could provide further insights into the role of other mediating factors in the development of cognitive impairment.

REFERENCES


