Introduction

It is now recognized that heavy and prolonged alcohol intake can lead to a deterioration of mental functions which, although not clinically apparent, can be identified by psychological testing (Tarter, 1975; Ron, 1977). The factors responsible for this, and the precise effects on mental functions, are still in dispute. A long history of heavy drinking (Jones and Parsons, 1971) and a short period of abstinence before testing (Clarke and Haughton, 1975) appear to increase the chances that psychological deficits will be found. Parker and Noble (1977) have even claimed that cognitive impairment can be detected in heavy social drinkers.

Three areas of psychological deficit have been emphasized: loss of abstract attitude (Kleinkecht and Goldstein, 1972; Page and Linden, 1974), impairment of frontal lobe functions (Tarter, 1975; Ron, 1977), and deficient ability to perceive and remember complex non-verbal material (Jones and Parsons, 1972; Clarke and Haughton, 1975). Impairment of frontal lobe functions has received most attention because pathological findings (Courville, 1955) are consistent with this and because loss of the abstract attitude can be attributed to damage in the same area of the brain. The defective perception and memory of non-verbal material has been relatively neglected in formulations of the topic. The aim of the present study is to compare the performance of a group of alcoholics with that of controls on tests of abstract attitude, frontal lobe functions and non-verbal memory, in order to identify the relative contributions of each of these deficits.

Patients and Methods

Forty alcoholics and 40 controls were selected. Each group contained 30 men and 10 women. The age range was 40 to 60 years, and the mean age and verbal intelligence (Mill Hill Vocabulary) of the groups were not significantly different (see Table). The alcoholics were all under psychiatric care for alcohol dependence at the time of testing, and none had a clinical diagnosis of Korsakov's syndrome or alcoholic dementia. Thirty-one were consecutive inpatients in one hospital, whose ages were within the specified range and who had been abstinent for more than four weeks since admission; the remaining 9 were out-patients, for whom the same period of abstinence could be confidently accepted.

There are several ways in which the severity of alcoholism can be evaluated. For the present purpose this needs to be quantified, and the measure chosen was an estimate of total lifetime alcohol consumption (Smith et al, 1973; Parker and Noble, 1977). In this way the alcoholics
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Comparisons of means of test result scores in alcoholics and controls

<table>
<thead>
<tr>
<th></th>
<th>All subjects</th>
<th>Males</th>
<th>Females</th>
<th>Male alcoholics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number in group</td>
<td>40</td>
<td>40</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Age in years</td>
<td>50</td>
<td>49</td>
<td>50</td>
<td>49</td>
</tr>
<tr>
<td>Intelligence (Mill Hill Vocabulary)</td>
<td>99</td>
<td>98</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>Verbal memory % score</td>
<td>75.5</td>
<td>77.0</td>
<td>73.0</td>
<td>78.5</td>
</tr>
<tr>
<td>Picture memory % score</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patterns:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hit</td>
<td>68.4*</td>
<td>77.6</td>
<td>64.8*</td>
<td>76.8</td>
</tr>
<tr>
<td>False positive</td>
<td>20.4</td>
<td>15.2</td>
<td>19.6*</td>
<td>13.2</td>
</tr>
<tr>
<td>Total correct</td>
<td>48.0**</td>
<td>62.4</td>
<td>45.2**</td>
<td>63.6</td>
</tr>
<tr>
<td>Object pictures:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hit</td>
<td>85.6*</td>
<td>92.4</td>
<td>84.4</td>
<td>91.6</td>
</tr>
<tr>
<td>False positive</td>
<td>4.0</td>
<td>1.6</td>
<td>4.4</td>
<td>1.6</td>
</tr>
<tr>
<td>Total correct</td>
<td>81.6*</td>
<td>90.8</td>
<td>80.0*</td>
<td>90.0</td>
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<tr>
<td>Abstract attitude</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Similarities % score</td>
<td>44.6</td>
<td>48.0</td>
<td>43.0</td>
<td>50.0</td>
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<tr>
<td>Proverbs % score</td>
<td>58.5</td>
<td>60.0</td>
<td>57.5</td>
<td>61.2</td>
</tr>
<tr>
<td>Verbal fluency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animals/minute</td>
<td>15.1</td>
<td>17.2</td>
<td>15.1</td>
<td>17.4</td>
</tr>
<tr>
<td>'S' words/minute</td>
<td>10.2*</td>
<td>14.1</td>
<td>9.9*</td>
<td>14.4</td>
</tr>
</tbody>
</table>

P (t-test) < 0.05*; P < 0.01**. Comparisons between means of adjacent columns.

were allocated to two equal groups—'heavy' and 'moderate' drinkers. As all the women fell into the group with the lower consumption only male alcoholics were considered in the eventual comparison of heavy and moderate drinkers. The cut-off point between these groups was a lifetime consumption of about 1,200 litres of pure alcohol (equivalent, for example, to moderate social drinking for 20 years, followed by the consumption of a bottle of whisky a day for eight years). Controls were obtained from two sources: 21 were patients in a neurological ward without brain disease; 19 were psychiatric out-patients attending for personality disorder or neurosis; none gave a history of excessive alcohol intake. The selection of such abnormal controls can be criticized, but it was impracticable to find 40 healthy volunteers who could be matched for age and intelligence. All subjects were informed that the author was investigating 'concentration and memory in people with their condition', and were invited to participate.

In addition to obtaining the subjects' Mill Hill Vocabulary score, six tests were carried out. Two measured abstract attitude: the similarities subtest of the Wechsler Adult Intelligence Scale, and proverb interpretation (answers to each of the ten common proverbs were marked out of 2). Two assessed frontal lobe functions through verbal fluency: number of animals named in one minute, and number of words beginning with 'S' produced in one minute. A yes-no picture-recognition test was
designed to study picture memory. Subjects viewed 50 pictures on cards, each for three seconds; these items were then shuffled with 50 new pictures (fillers) and the whole set re-presented, with the request that subjects should report whether they had been shown any picture earlier. Half the items and fillers were patterns (e.g. photographs of histological specimens) and half were of simple objects (e.g. elephant). The test was scored by calculating hit rate on items, false positive rate on fillers and subtracting the latter from the former to give a total correct score. The final test, as a contrast to non-verbal memory, was a verbal learning task: a modified version of the paired-associate learning subtest of the Wechsler Memory Scale (easy and hard pairs were replaced by moderately easy pairs, and the ten pairs were presented twice instead of three times, giving a maximum score of 20). Statistical analysis of the results was by means of a t-test on each psychological score between each of the four pairs of subject groups—all alcoholics/controls, male alcoholics/controls, female alcoholics/controls, and male heavy/moderate drinkers.

**Results**

Significant differences between alcoholics and controls were confined to the picture memory task and one of the verbal fluency tests (production of words beginning with the letter 'S'). The level of significance was greatest on the total correct score for patterns between the entire groups and between the male groups. 'Heavy' drinkers were significantly worse than 'moderate' drinkers on the same tests. Verbal learning, the two measures of abstract attitude, and the other verbal fluency test (production of animal names in a minute) did not differentiate the groups.

**Discussion**

Recognition memory for pictures, particularly patterns, was deficient in the alcoholics. This confirms the findings of several authors who included some measure of non-verbal perception or memory in their test battery (Boeke, 1970; Brewer and Perrett, 1971; Clarke and Haughton, 1975). Performance was worse in those with a greater lifetime consumption of alcohol. This supports the opinions of Jones and Parsons (1971) and Smith et al (1973). Parker and Noble (1977), however, found that the amount drunk in an average sitting correlated better with psychological deficit than did lifetime consumption, but their sample consisted of social drinkers and their conclusions may not generalize to alcohol-dependent subjects. The ability to interpret proverbs or appreciate similarities between items was not significantly impaired. If one assumes that these tests adequately reflect the abstract attitude, then this finding is in conflict with the reports of most authors who have investigated the topic. Jones and Parsons (1972) are an exception. They found that the abstract attitude was only impaired if the test involved non-verbal skills, and argued that visuo-perceptual deficits might be responsible for findings which had been attributed by other authors to impaired abstracting ability. This formulation receives support in the present study. The only test on which alcoholics performed poorly, which did not rely on visuo-perceptual or visual memory skills, required subjects to produce words beginning with a specified letter in limited time. This is regarded as a valid test of frontal lobe functions (Perret, 1974; McFie, 1975) and according to Perret is a better measure than the listing of animal names.

It would appear, therefore, that in the present sample of alcoholics picture memory and frontal lobe functions were each deficient, whilst abstracting ability and verbal learning remained intact. Jones and Parsons (1972), who reached a similar conclusion, discussed the implications of the co-existence of these two areas of deficit. They considered whether the impairment of non-verbal skills could be attributed to frontal lobe deficit, and mentioned deficient eye scanning movements and failure to inhibit temporally and spatially integrated behaviour as possible primary defects. It is, however, generally recognized that non-verbal memory relies on an intact right temporal lobe, and it is therefore unlikely, on the basis of the present results, that the brain damage responsible for psychological deterioration in alcoholics is situated solely within the frontal lobes.
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It is more plausible to assume one of two hypotheses to account for the prominence of these two areas of psychological deficit. Either the tests which revealed the deficits are particularly sensitive to brain damage and therefore the apparent prominence of frontal and right temporal damage merely reflects the failure to use tests sensitive to damage in other areas of the brain; or, these two areas of the brain are particularly susceptible to the effects of prolonged alcohol intake. In support of the former hypothesis is the finding in the present study that alcoholics were poorer than controls on other tests, for example verbal memory, although this did not reach statistical significance. It could be argued that a verbal learning test and a picture recognition memory task are not comparable in such sensitivity and that the significant disassociation which emerged should be attributed to this. The development of alcoholic dementia (Horvath, 1975), where global intellectual deterioration occurs, also suggests that other psychological functions and other areas of the brain are not immune from the effects of alcohol. In support of the second hypothesis is the finding (Cutting, in press) that alcoholics resemble patients who have had a right temporal lobectomy, more than they do left lobectomy patients or dementes, in the pattern of their memory impairment. Resolution of these issues would have important clinical implications for the management of alcoholism.

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References


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