SIDE-BIAS IN ALCOHOL AND HEROIN ADDICTS

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(Received 5 January 2000; in revised form 13 March 2000; accepted 27 March 2000)

Abstract — Alcoholics, heroin addicts and normal controls were asked for their degree of preference for the two lateral (left, right) sides during their performance of unilateral activities involving one of the four paired organs, hand, foot, eye and ear. Side-bias was assessed by a questionnaire, with 22 items for hand preference, and five items each for foot, eye and ear preference. Group difference was assessed with a mixed-factorial design (Group \( \times \) Side) for each form of side-bias. Unlike heroin addicts and normal controls, alcoholics exhibited a significant reduction in right side-bias for all four measures, which suggests an anomalous pattern of lateralization.

INTRODUCTION

By side-bias, we mean the bias reflected in the differential use of paired organs (such as hand, foot, eye or ear) as a function of preference, performance, or attentional/intentional factors (Mandal et al., 2000). The behaviour is more commonly associated with the expression of handedness, especially left or atypical (anomalous) handedness, that has been extensively studied in relation to developmental dyslexia, autism, immune deficiency, and psychopathology of certain kinds (see the review by Coren and Halpern, 1991). Though inconsistent, findings in general revealed an association between left/atypical handedness and these behavioural aberrations. The search for such relationships began with the theoretical postulations (about 200) proposed by Geschwind and Galaburda (1985). In their ‘cerebral lateralization’ thesis, these authors also envisaged an increased incidence of non-right handedness in psychoactive drug abusers. Although some early studies revealed increased incidence of non-right handedness amongst alcoholics using either preference or performance measures (Nasrallah et al., 1983; London, 1986; Bird and Novotny, 1991; McNamara et al., 1994; Cocchi, 1997; Leutin et al., 1999), the proposition was little tested utilizing side-bias measures of all forms, hand, foot, eye and ear.

The present study made an attempt to examine the different forms of side-bias in addition to handedness in drug addicts of certain kinds, with a specific aim to assess their pattern of functional lateralization. Side-bias is considered to be an indicator of functional cerebral lateralization. Although investigators make a distinction between limb (hand, foot) and sense organ (eye, ear) lateralizations, these indices (especially handedness) in essence are taken up as the relatively stable indicators of behavioural asymmetry akin to cerebral lateralization. It was postulated in the present study that drug addicts would exhibit atypical (anomalous) side-bias in comparison to normal controls. The confirmation of the hypothesis would allow us to investigate the possible association between side-bias and drug addiction. Geschwind and Galaburda (1985) envisaged the association between non-right handedness and addiction proneness behaviour as a function of maturational defect at the pre-natal level of the individual.

SUBJECTS AND METHODS

Samples

Thirty alcoholics (mean age ± SD: 32.8 ± 5.50 years; mean years of education 12.4), 30 heroin addicts (mean age 29.1 ± 4.60 years; mean years of education 12.8) and 30 normal controls without a history of drug addiction (mean age 32.6 ± 4.90 years; mean years of education 13.6) participated in the study. Groups did not differ significantly in age or education (\( P > 0.05 \)). The average length of drug abuse for the addict group ranged between 4 and 7 years (mean 5.2 years). Subjects were all males and had a middle-class socio-economic status.

Addicts receiving out-patient hospital treatment during the ages 15–45 years were invited to participate in the study. Patients with hand tremor or with known organic pathology were excluded. Addicts older than 45 years were excluded, to avoid any confounding effect of age on the pattern of handedness. It has been observed that the incidence of left handedness decreases with the increase in age, in particular at an upper level (Coren and Halpern, 1991).

Procedure

Side-bias questionnaires (Mandal et al., 1992a,b) were used to assess the degree of preference for all four measures: hand (22 items: writing, eating, throwing a ball, lifting a bucketful of water, using a spoon to stir, keying a lock, using scissors, painting, threading a needle, combing, brooming, winding a clock, screwing a nut, hammering a nail, opening a tap, switching the light, lighting a matchstick, toothbrushing, sorting cards, using a knife, using a racket for games, unscrewing a jar), foot (five items: kicking a ball, foot extended to get into a bus, foot on which body weight rested in standing posture, stepping over an obstacle, foot extended in long jump), eye (five items: looking through a telescope, snapping a photograph, gunshooting, looking through a keyhole, preferred eye to wink), ear (five items: listening on the telephone when both hands are free, hearing a pocket radio, matching musical tone, sensing tick movement in wrist watch, listening to a low voice). Subjects were asked to indicate their preference for an activity in the questionnaire on a 5-point rating scale (1 = never, 2 = rarely, 3 = occasionally, 4 = frequently, 5 = always) for both sides, left and right, separately and independently in each instance.

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RESULTS

Table 1 shows the mean (SD) preference of each group for four forms of side-bias, separately, because the preferential continuity for different forms of side-bias has not yet been established (Bryden, 1982).

**Handedness**

A 3 (Groups: alcoholic, heroin addict, normal control) x 2 (Side: left, right) factorial design with repeated measures in the Side factor was carried out with preference score as the dependent measure. The main effect of Group was non-significant. The main effect of Side was significant \( F(1,87) = 60.6, P < 0.001 \), suggesting that hand bias was significantly more for the right (mean 4.19) relative to the left (mean 2.37) side. Although the interaction of Group x Side was not significant, post-hoc analysis by simple effect ANOVA revealed that alcoholics did not exhibit a significant difference between right (mean 3.95) and left (mean 2.80) preferences \((P > 0.01)\). Heroin addicts (right: mean 4.29; left: mean 2.22) and normal controls (right: mean 4.34; left: mean 2.08, \(P < 0.01\)) exhibited a clear rightward bias.

**Footedness**

Identical analysis with foot preference as the dependent measure yielded a non-significant main effect of Group, but a significant effect of Side. Foot bias was significantly more for the right (mean 4.07) as compared to the left (mean 2.61) side. The interaction of Group x Side was significant \( F(2,87) = 6.78, P < 0.002 \). Simple effect ANOVA of the interaction revealed that, whereas normal controls (right: mean 4.30; left: mean 2.43, \(P < 0.01\)) and heroin addicts (right: mean 4.40; left: mean 2.25, \(P < 0.01\)) exhibited a clear rightward bias, alcoholics did not exhibit side-bias (right: mean 3.52; left: mean 3.16, \(P > 0.01\)).

**Eyedness**

Unlike limb laterality, mixed factorial ANOVA with eye preference as the dependent measure yielded a significant main effect of Group \( F(2,87) = 17.30, P < 0.001 \). Normal controls (mean 3.67) had overall higher preference score followed by heroin addicts (mean 3.47) and alcoholics (mean 3.26). Eye bias was significantly more for the right (mean 4.12) than the left (mean 2.81) side \( F(1,87) = 33.4, P < 0.001 \). Post-hoc (simple effect ANOVA) analysis of the non-significant interaction of Group x Side indicated a clear rightward bias for normal controls (right: mean 4.340 left: mean 3.00, \(P < 0.01\)) and heroin addicts (right: mean 4.40; left: mean 2.53, \(P < 0.01\)). Alcoholics (right: mean 3.61; left: mean 2.90, \(P > 0.01\)) did not exhibit any such bias \((P > 0.01)\).

**Earedness**

Ear preference did not reveal a group difference; the main effect of Side was, however, significant indicating a rightward bias (right: mean 4.24; left: mean 2.72) \( F(1,87) = 88.9, P < 0.001 \). The interaction of Group x Side was significant \( F(2,87) = 28.45, P < 0.001 \). As in other forms of side-bias, alcoholics exhibited atypical ear preference (right: mean 3.26, left: mean 3.45, \(P > 0.01\)). Heroin addicts (right: mean 4.80; left: mean 2.27, \(P < 0.01\)) and normal controls (right: mean 4.67, left: mean 2.45, \(P < 0.01\)) exhibited bias for the right side.

**DISCUSSION**

The present findings suggest a reduced lateralization (non-right handedness) in alcoholics, but not in heroin addicts, in comparison with normal controls. Heroin addicts and normal controls exhibited a clear rightward bias for all forms of side-bias, namely hand, foot, eye and ear.

Earlier findings on this issue documented a reduction of normal pattern of right handedness in alcoholics (Nasrallah et al., 1983; London, 1986). McNamara et al. (1994) documented an increased prevalence of left handedness and learning disabilities in alcoholics. Earlier, Chyatte and Smith (1981) obtained a similar finding for alcoholics and speculated on the poor outcome of treatment for left-handed as compared to right-handed alcoholics (Smith and Chyatte, 1983). These observations substantiate the prevalence of non-right handedness in alcoholics. In the present study, an identical pattern of observation was made for other forms of side-bias, such as footedness, eyedness, and earedness, in alcoholics. The associations amongst these behavioural measures in terms of preference were not found strong enough in normal subjects. In fact, preferential bias for long limbs (hand, foot) relative to sense organs (eye, ear) was observed as more consistent (Mandal et al., 1992a). Interestingly, atypical (away from normal pattern of bias) side-bias has been found in this study to be a consistent feature across paired organs in alcoholics. This trend was reflected by a significant reduction in their rightward preference from other groups for all these forms of bias, thus supporting the notion of reduced pattern of lateralization in these subjects.

Because few explanations have been put forward as to why alcoholics exhibit such a pattern, it may be premature to draw conclusions. One may speculate that alcohol affects the dominant (left) hemisphere more adversely in comparison to the non-dominant (right) hemisphere which, in turn, affects the natural pattern of bias for the contralateral side. A second explanation entails a component of maturational/genetic defect (e.g., Geschwind and Galaburda, 1985). The view suggests that anomalous dominance (as a function of developmental delay, neuroimmune disorder, early cerebral insult, or genetic aberrations) may predispose individuals to alcoholism. Since side-bias is determined long before alcohol abuse begins, the latter explanation seems more suited to the present finding.

<table>
<thead>
<tr>
<th>Group</th>
<th>Hand</th>
<th>Foot</th>
<th>Eye</th>
<th>Ear</th>
</tr>
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<tr>
<td></td>
<td>Left</td>
<td>Right</td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
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<td>3.00</td>
<td>3.26</td>
<td>3.02</td>
<td>3.45</td>
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<td>(1.00)</td>
<td>(1.05)</td>
<td>(1.00)</td>
<td>(1.05)</td>
</tr>
<tr>
<td>Heroin addicts</td>
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<td>2.40</td>
<td>2.53</td>
<td>2.40</td>
</tr>
<tr>
<td>(n = 30)</td>
<td>(1.00)</td>
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<td>3.00</td>
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<tr>
<td>(n = 30)</td>
<td>(1.00)</td>
<td>(1.02)</td>
<td>(1.00)</td>
<td>(1.03)</td>
</tr>
</tbody>
</table>

*a = never, 5 = always. Values are means (SD).*
Given such speculation, it may be interesting to observe in a future study the functional laterization pattern in those who are at risk due to family history of developing alcoholism.

REFERENCES


