ACTA Vol. 6, No. 2, 2008, 140-148
NEUROPSYCHOLOGICA

SOCIAL INTELLIGENCE MONITORING IN PATIENTS WITH ORBITOFRONTAL CORTEX INJURY

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Key words: *inappropriate self-disclosure, behavior control, intimate information, self-awareness*

SUMMARY

Background. *The orbitofrontal cortex is responsible for self-awareness, behavior control, the ability to adapt one's actions to the current situation and social rules, and comprehending another person's state of mind. It can thus be assumed to be crucial for social intelligence monitoring. The aim ofresearch present study was to examine inappropriate and unaware disclosure of intimate information, which may appear after injury of the orbitofrontal cortex. Such disorders are most striking during conversations with unfamiliar persons.*

Material and methods. *10 patients with an orbitofrontal cortex injury and 10 controls were asked 9 questions by a person seen by them for the first time. During this process they were filmed. Then the subjects assessed their own answers on film and described the emotions they had experienced during the conversation. In addition, a questionnaire about personal principles concerning contacts with strangers was used.*

Results. *Patients with orbitofrontal injury turned out to be less accurate in assessing how open they had been in their conversations with a stranger. Moreover, they spoke of some matters in a more open way than controls, and disclosed more information which people usually do not give out to strangers. They also more frequently transgressed their personal principles concerning talking to strangers.*

Conclusions. *One of the possible consequences of damage to the orbitofrontal part of the frontal lobes is a disorder of social intelligence monitoring. In our research this manifested itself in inappropriate and unaware self-disclosure while answering an unknown interlocutor's questions.*

Furthermore, such disclosure was contrary to declared principles, but did not cause embarrassment. These data provide support for views concerning the integrating, supervising and adjusting role of the orbitofrontal cortex.

INTRODUCTION

Despite the fact that researchers have described many features and symptoms in persons with damage to the orbitofrontal cortex, we still do not know enough about these persons' social interactions and the abilities they may lack in this area. For instance, it would be both interesting and useful to examine in orbitofrontal-damaged patients their ability to adjust their verbal expression to the specific characteristics of the situation and interlocutor, which is a part of social intelligence. The ability to assess one's level and manner of self-expression adequately, which is part of self-monitoring, is also worth examining.

Social intelligence is the ability to understand other people and know how to deal with them wisely (Thorndike 1920, cited by Goleman 1995). According to Sternberg (1999), this kind of intelligence enables us to perceive and identify efficiently signals of interpersonal relations and other people's mental state. Taking into account other opinions (Cantor & Kihlstrom 1987, cited by Sternberg 1999, Jaworowska & Matczak 2001, Śmieja 2005), we may add that social intelligence means planning suitably and flexibly one's interpersonal actions. In order to monitor this ability, self-awareness and the ability to control one's own behavior are essential (Goldberg 2001). In order to organize and assess our own or others' behavior, and also to assess adequately the current situation, we often refer to rules and norms that we know and accept. The role of emotions is also considerable in behavior regulation, but sometimes underestimated. For instance, embarrassment signals the infringement of an accepted norm, especially social, of which the subject is aware (Lewis 1992, cited by Doliński 2000). Moreover, it very important for social intelligence and its monitoring to have a theory of mind, which means an "ability to form an internal representation of a different person's mind" (Goldberg 2001:110); this is what makes it possible to respect the interlocutor's needs, expectations, and intentions.

Social intelligence monitoring is a compound brain function located by neuropsychologists in the orbitofrontal part of the brain for several reasons. Firstly, the orbitofrontal cortex is the part of the central nervous system that is the most involved in inner mechanisms of self-control. This function is based on self-awareness, the ability to assess one's own behavior, and the ability to identify and analyze the exterior situation (Herzyk 2000). The orbitofrontal part of the brain is also responsible for defining the emotional valence of current stimuli (Damasio 2003). Moreover, this area enables a person to adjust her behavior to specific features of the current situation, noticed at present or concluded from past experiences, and also to detect and cor-

rect mistakes (Kaczmarek 1986, Steuden 1998, Herzyk 2000). Later, it formulates representations of alternative behaviors or positions, and enables one to anticipate future occurrences (Maruszewski 1970, Kaczmarek 1986). Then, this area allows an individual, while acting, to take into consideration obligatory social principles and rules, for example relating to conversations with strangers, and also a chosen action plan (Maruszewski 1970, Kaczmarek 1986). Many authors (Walsh 1987, Herzyk 2000) describe impairment of emotions and drive control, associated with reduced self-criticism, in patients with damage to the orbitofrontal area. Moreover, the loss of restraint in speech, which is a possible consequence of such an injury, may have a negative influence on one's social relations (Herzyk 2000, Goldberg 2001). What is more, thanks to the orbitofrontal cortex we are able to formulate a theory of mind, while traumatic injury impairs this ability considerably (Goldberg 2001, Havet-Thomassin et al. 2006).

MATERIAL AND METHODS

In our research we examined two groups of 10 persons each. Written informed consent was obtained from each participant. The experimental group consisted of patients with lateral or bilateral injury to the orbitofrontal part of the frontal lobes, caused by head trauma, ischemic stroke, or multiple sclerosis. These participants were selected from a population of patients hospitalized in neurology departments and rehabilitation clinics in Lublin and Cracow, Poland. The control group consisted of persons without known brain pathology. The two groups were matched for age, gender, level of education, profession, and residential status (urban or rural). In order to exclude from our investigation persons with dementia, we screened all our subjects with the Mini Mental State Examination (Folstein et al. 1975). Additionally, we excluded persons with depression, psychosis, aphasia, epilepsy, or alcohol addiction. All medical data were gathered from hospital documentation.

Our research procedure was based on the experiment conducted by Pachalska and co-workers (described by Pachalska, 2007), who kindly provided the list of questions and two questionnaires. An additional questionnaire concerning personal principles was created by the authors of the present study. The person speaking with the participants was introduced at the beginning of the session only by first name and occupation, and had never been seen by them before. What is more, during each conversation the interlocutor deliberately avoided expressing her own feelings or thoughts, and did not ask supplementary questions.

The list of questions included nine general questions, mostly open (for example: "What are your favorite memories? Why?"). This allowed us to learn how much intimate information our participants were inclined to disclose to a stranger. The whole conversation was recorded on video camera. Afterwards, the patients and the controls filled in a questionnaire relating to

the conversation, assessing the degree to which their answers had revealed intimate information (for instance, "I talked to the person conducting the conversation as frankly as if I were talking to my friend.") and their appropriateness (for instance, "I disclosed information that usually isn't given to a stranger."). Then all subjects were asked to report, using a five-point scale, the emotions they had experienced during the conversation, including amusement, anxiety, embarrassment, indignation or disgust. The same questionnaire was filled in again by each subject after watching the video recording of the conversation (for purposes of confidentiality the films were erased after this viewing). In the last questionnaire the participants declared their personal principles concerning conversations with strangers about 21 topics, such as family life, embarrassing experiences, personal faults, etc.

The measure of social intelligence monitoring is the mean positive difference between two evaluations of the participants' answers: one made by competent judges, and one made by the participants themselves. Each of three competent judges assessed the answers in writing, not knowing whether the person speaking had a central nervous system injury or not, with the same questionnaire relating to the conversation as the subjects. As a social intelligence factor we took the mean evaluation of the competent judges' evaluation of the answers. The differences between the experimental and the control group as regards these variables were analyzed with the t-Student test. For purposes of comparison we split the population at the median age into younger and older participants. In order to compare participants as regards to their level of education, we joined subjects with elementary and vocational education in a worse-educated group and those with secondary and higher education in a better-educated group. For purposes of comparison with regard to profession we included persons with a college education in the "white collar" group and others in the "blue collar" group. The measure of accordance between verbal behavior and personal principles are positive differences between the amount of disclosed information and the amount of information designated as appropriate in the questionnaire relating to personal principles as regards each topic. In order to test whether the participants displayed a lack of verbal restraint in quantitative terms, we analyzed the differences between the numbers of words spoken by all subjects during the conversation based on the list of questions.

RESULTS

There were no statistically significant differences between the experimental and control groups regarding the general level of social intelligence monitoring during the conversation with the stranger, there being no positive difference between the competent judges' mean assessment of the participants' answers and the mean of the participants' assessment of their own performance. However, the patients with orbitofrontal injury had significantly worse

results in respect to the ability defined in the fourth statement of the questionnaire concerning the conversation ("Most people would disclose as much as I did during the conversation.") ($Z = -2.275$; $p = 0.023$). Figure 1 presents the mean evaluations of answers made by the competent judges and by these patients themselves.

The women and men in this study did not differ significantly as regards social intelligence monitoring. The exception was a positive difference be-

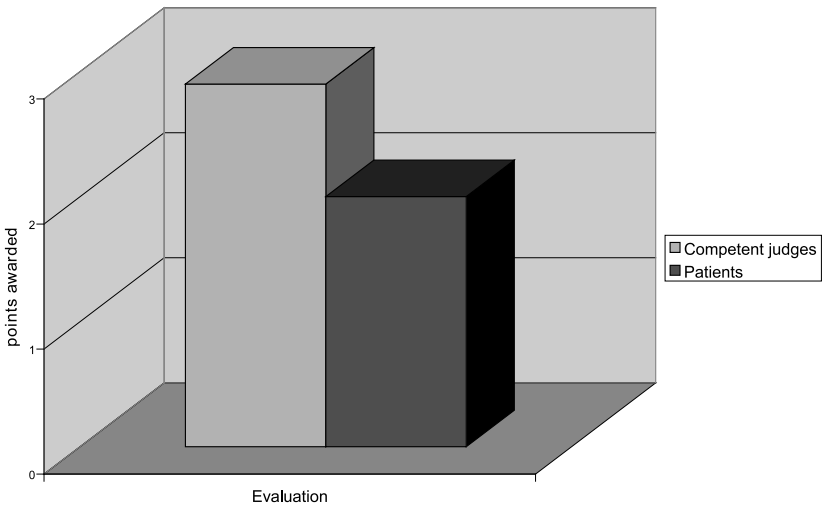

Fig. 1. Mean evaluations by competent judges and patients regarding the latter's answers to the questionnaire statement, "Most people would disclose as much as I did during this conversation."

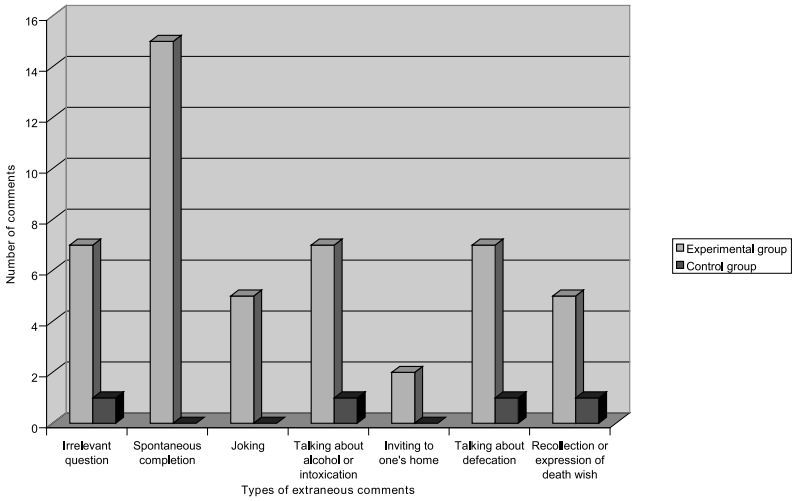

Fig. 2. Summary of positive differences between groups in the degree of disclosure of intimate information in the respective categories

tween the competent judges' mean assessment and the participants' mean assessment in the seventh statement of the questionnaire ("I shared information with the person conducting the interview that I would not disclose to a stranger"), which was significant in the case of the women ($Z = -2.874$; $p = 0.004$). Age and educational level did not significantly influence the participants' social intelligence monitoring. The patients in the "blue collar" group were less accurate in the assessment of how typical their answers were for conversations with strangers than the "white collar" workers ($Z = -3.731$; $p = 0.000$). Additionally, the ability to restrain one's verbal expression in the presence of an unknown interlocutor was lower in the blue collar group ($Z = -6.395$; $p = 0.000$).

Our analysis of social intelligence suggests that the patients with damage to the orbitofrontal cortex and the persons without brain pathology differed significantly at three points. First of all, the patients with orbitofrontal injury talked to the unknown interlocutor about their attitude towards reputation more openly ($Z = -2.256$; $p = 0.024$). Secondly, they disclosed significantly more information which people usually do not give out when speaking to an unknown interlocutor about embarrassing experiences ($Z = -2.361$; $p = 0.018$) and unrealized desires ($Z = -2.357$; $p = 0.018$). Thirdly, asked about embarrassing experiences, they depreciated themselves more often, by presenting situations caused by themselves (for instance: soiling the hospital corridor with one's own feces), whereas the controls usually recalled others' actions. As for the length of the subjects' answers, there was no significant difference between the groups, in general as well as within separate topics.

Analyzing the level of social intelligence in conversations with strangers, we should also take into consideration the frequency of inappropriate infor-

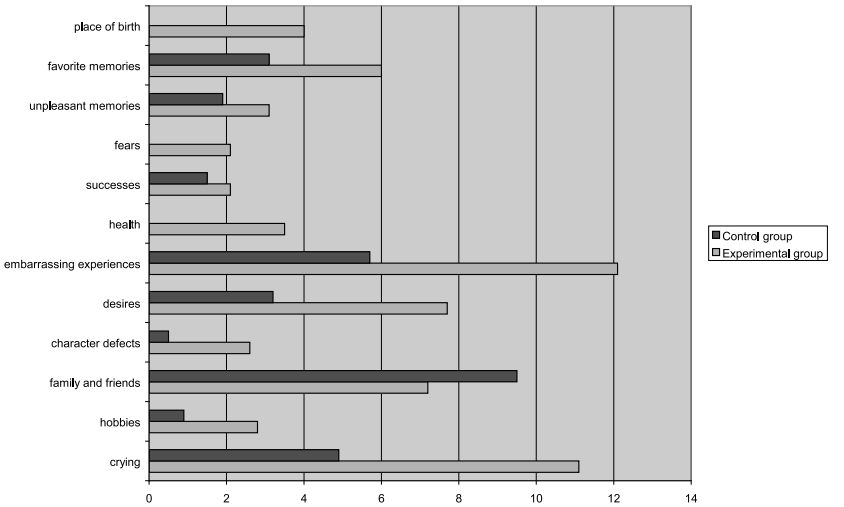

Fig. 3. Forms of extraneous comments used while answering questions in the experimental and control groups

mation disclosed by the subjects spontaneously. Such forms of expression appeared much more often in the persons with orbitofrontal cortex injury (Figure 2).

The comparisons concerning personal principles relating to conversations with strangers showed no significant differences between the experimental and the control group (all $p > 0.05$). The exception was the subject "favorite memories," about which the persons without brain pathology declared in the questionnaire a readiness to disclose more information ($t = -3.693$; $p = 0.010$). In regard to observing personal principles, the patients with orbitofrontal area damage exceeded their own boundaries more often during the conversation, which is presented in Figure 3.

Moreover, the degree to which the espoused principles were exceeded differed significantly in the experimental and control groups ($t = 2.084$; $p = 0.048$).

The extent of embarrassment felt after answering the questions asked by a stranger did not differ significantly in both groups (identical averages). The extent of embarrassment after watching the video recording of one's own conversation were similar in the experimental and the control group as well, since no increase in this emotion appeared.

DISCUSSION

The results presented above show that patients with orbitofrontal cortex injury have a significantly lower level of social intelligence monitoring than healthy persons as regards assessing whether the information they have disclosed is typical of conversations with unknown persons. This implies that dysfunction of the orbitofrontal part of the frontal lobes may impair insight into one's own verbal behavior, and the ability to assess it adequately (Herzyk 2000, Goldberg 2001). Moreover, according to Kaczmarek (1986), this brain area also functions to construct the general plan of a statement and verify its implementation. A lower than average level of social intelligence monitoring in contacts with strangers could be also a result of impairment of the ability to restrain one's action according to accepted social rules, including those governing contacts with strangers (Maruszewski 1970, Kaczmarek 1986).

The ability to monitor one's social behavior appears not to depend on such demographic characteristics as age and level of education. Moreover, the women and men we examined did not differ in respect to this capability. The notable exception here was women talking to a stranger of the same sex: they gave out more information usually reserved for close persons than they realized. Because of the examiner's gender, we were not able to verify such a tendency in the men; however, it is possible that people feel more comfortable and familiar with an unknown representative of the same sex. Moreover, the blue collar workers had less ability to monitor their social intelligence than the white collar workers and students. Two factors were included here: less accurate assessment of whether or not their answers were typical of conver-

sations with strangers, and less capability to restrain one's verbal behavior due to not knowing the interlocutor. This deficit may result from rarer interpersonal contacts in the case of mechanics, farmers, factory workers, and so on, which entail less proficiency in assessing social situations and a frustration of the need for affiliation.

Our research results suggest that persons with orbitofrontal cortex injury have a lower level of social intelligence during conversations with unknown people than persons without brain pathology in several aspects. To be precise, they may talk more openly about their attitude towards reputation, depreciate themselves more often while telling about embarrassing experiences, and disclose more information which people usually do not give to strangers about their embarrassing experiences and unrealized desires. Moreover, they have a tendency to give spontaneously to a stranger information that was not requested, or in which the interlocutor is probably not interested. These pieces of information are often inappropriate, since they concern negative intimate experiences, and may indicate excessive shortening of social distance.

The symptoms discussed above may be regarded as a consequence of impairment of the capacity to adjust oneself to the current situation or interlocutor, and to manage one's action according to social principles and rules. We may also conclude that some of our subjects with orbitofrontal cortex injury manifest a deficit of theory of mind (Kaczmarek 1986, Herzyk 2000, Goldberg 2001). It is important to note that a tendency to excessive self-disclosure to people seen for the first time probably does not result from or correlate with the lack of verbal restraint in quantitative terms. Our research implies that such prolixity (hyperverbality) is a very rare symptom of orbitofrontal injury.

The impairment of social intelligence monitoring in patients with damage to the orbitofrontal area is connected with violation of personal principles, particularly while talking about one's intimate experiences. These persons' principles themselves are similar to those declared by healthy person. This observation is consistent with the view of Herzyk (2000), who pointed out a dissociation between the knowledge possessed by people with orbitofrontal injuries and their ability to make use of it. It is likewise significant that our patients with such lesions did not feel embarrassed, either during the conversation or after watching the video recording, although they had exceeded their personal principles and disclosed some intimate information to the stranger. This may result from impairment of self-criticism, which prevents the person from realizing that she has violated norms and principles, and also from a disorder in determining the emotional valence of the situation (Kaczmarek 1986, Damasio 2003).

CONCLUSIONS

Lesions in the orbitofrontal area of the brain may result in a disorder of social intelligence monitoring, which manifests itself clearly during conversations with unknown persons. This is connected with an impairment in social intelligence, violation of personal principles, and lack of justified embarrassment. These symptoms should be explained to patients and their families, due to the danger and difficulties they may cause. Later, self-monitoring should be included as a regular aspect of both neuropsychological diagnosis and therapy.

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Received: 5 May 2008
Accepted: 28 July 2008