SHORT REPORT

Disturbances of affective prosody in patients with schizophrenia; a cross sectional study

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Abstract

The objective was to determine whether disturbances of affective prosody constitute part of the symptomatology of schizophrenia. Affective prosody is defined here as a neuropsychological function that encompasses all non-verbal aspects of language that are necessary for recognising and conveying emotions in communication. Twenty six schizophrenic outpatients and twenty four normal controls underwent a standardised prosody test, assessing four different aspects of affective prosody: spontaneous prosody, prosodic recognition, prosodic repetition, and facial affect recognition.

Patients scored significantly worse than controls on three of the four subtests: spontaneous prosody, prosodic recognition, and prosodic repetition. There were no significant differences on a subtest for facial affect recognition. Differences in educational level between patients and controls could not account for these differences.

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Non-verbal aspects of language play an important part in communication. These aspects, which encompass such elements as pitch, rhythm, rate, stress, volume, and intonation, are collectively regarded as a distinct neuropsychological function, called "prosody". Prosody is commonly divided into affective and non-affective prosody. Affective prosody is necessary for establishing emotional "rapport" and for recognising and conveying emotions in communication. Research suggests that this function is highly lateralised to the right hemisphere, at least in right handed persons. Non-affective prosody mainly serves a function in removing syntactic ambiguities and in clarifying the general interactive character of a sentence—that is, whether the sentence is a question, an order, or a neutral statement. Non-affective, or linguistic, prosody does not seem to be lateralised to one of the cerebral hemispheres.[1–6]

Disturbances in prosody have long been recognised as a symptom in various neurological disorders. More recently, psychiatry has gained an interest in prosody now that several studies and case reports suggest that disturbances in prosody, or aprosodia, may also constitute part of the symptomatology of psychiatric disorders, including schizophrenia.[7–9]

The aim of the present study is to evaluate the presence and severity of prosodic deficits in patients with schizophrenia.

Patients and methods

Twenty six right handed schizophrenic patients and twenty four right handed normal controls were examined for disturbances of prosody. Patients were recruited from the outpatient department of a large psychiatric hospital. They all met the DSM-IV criteria for schizophrenia; patients with schizoaffective disorder were excluded.[10] Other grounds for exclusion were concomitant neurological diseases, mental retardation, and speech and hearing disorders. Normal controls were recruited from staff from the clinic with domestic, administrative, and academic backgrounds. The same exclusion criteria applied, but controls also had to be free of psychiatric diseases and without any psychotropic medication. The study was approved of by the hospital ethics committee, and both patients and controls had to give their informed consent before participation.

Demographic data on sex, age, and education were collected. For patients, the psychiatric history and current medication were registered. Positive and negative symptoms were assessed using the "positive and negative syndrome scale" (PANSS).[11]

Both patients and controls underwent a standardised prosody test, consisting of four subtests. This test follows the general guidelines of Ross and is an adapted version of the recently proposed validated test by Haskins *et al*.[2 6 12]

The first subtest assessed "spontaneous prosody". This was done by tape recording several minutes of spontaneous conversation with the subject as well as a story, read by the subject, that contained several prosodic elements. These recordings were rated seperately by a speech therapist who was unaware of the status of the subject. The scale used to score spontaneous prosody was the "prosody abnormality score"

Table 1 Sociodemographic variables and characteristics of patients and controls, with standard deviations (SD) in parentheses

	Patients	Controls	p Value
Sex:			
Male	7	12	0.093
Female	19	12	
Age (y)	41.2 (11.7)	39.3 (9.7)	0.0545
Years of education	11.7 (2.3)	15.8 (2.3)	<0.0001
Years since diagnosis	18 (9.3)		
Haloperidol eq (mg)	6.1 (4.7)		
Diazepam eq (mg)	6.0 (11.0)		
PANSS total score	60 (15)		
PANSS positive score	13 (5)		
PANSS negative score	16 (5)		
PANSS composite score	−3 (6)		

p Values for the calculated test statistic are mentioned.
eq = Equivalents; PANSS=positive and negative syndrome scale.

by Scott and Caird, which scores seven prosodic items: speech volume, pitch, tone, intonation, vocal quality, and rate and rhythm of speech. Each item is rated 0 when normal or 1 when abnormal.[13] To obtain one score only for spontaneous prosody, while maintaining comparability with the original rating scale, the two scores were added and then divided by two.

Secondly, "prosodic comprehension" was tested. Subjects had to interpret the affect states of 25 prerecorded statements with neutral content that were read in five different affect states (happy, angry, sad, bored, and surprised) by an expressively gifted stage actor. The score is formed by the number of correctly interpreted statements.

Thirdly "prosodic repetition" was assessed. Subjects had to repeat 10 prerecorded affect laden statements in the same affective voice. This was recorded on tape and scored blindly by the speech therapist. A point was given for every statement of which she would correctly recognise the intended affect.

Finally, "facial affect recognition" was evaluated. Subjects were asked to describe the affect on 10 photographs of emotionally expressive faces, chosen from a standardised set.[14] The score is formed by the number of correctly interpreted photographs.

The hypothesis tested was that there would be no significant differences in scores on each of the four subtests for aprosodia between schizophrenic patients and controls. A significance level of p=0.05 is used, unless otherwise stated. All calculations were performed using the SPSS/PC+ software package.

Results

Twenty six patients (19 male and seven female) and twenty four normal controls (12 male and 12 female) participated in the study. Table 1 shows the sociodemographic variables and patient characteristics. The differences in age and sex distribution were not significant. There was, however, a significant diference in the number of years of formal education between patients and controls.

The scores on the different subtests were checked for normality by the normal plot and the Shapiro-Wilks test. Whereas scores for controls showed a normal distrubution, the scores for patients were clearly skewed. There were no outliers, neither within tests, nor across tests. For counts, taking the square root rather than log transformation is advised to deal with skewed distributions. However, as only one distribution was skewed, we decided to use the non parametric Mann-Whitney *U* test for the analysis.

Table 2 Median scores on the four prosodic subtests for patients and controls, including p values for the Mann-Whitney U test

	Patients	Controls	p Value
Spontaneous prosody	0.75 (1.00)	0.0 (0.0)	0.0002
Prosodic comprehension	18.5 (4.0)	21.0 (3.0)	<0.0001
Prosodic repetition	5.0 (4.25)	9.0 (2.0)	<0.0001
Facial affect recognition	9.0 (1.25)	10.0 (1.0)	0.273

Values in parentheses are interquartile ranges.

Table 2 shows the scores on the four subtests. Patients scored significantly worse on spontaneous prosody, prosodic comprehension, and prosodic repetition. The differences on the test for spontaneous prosody were almost accounted for by different scores on only two of the seven items of the PAS scale: intonation and vocal quality. Although patients tended to perform worse on the subtest for facial affect recognition, the difference is not significant.

It could be argued that differences in prosodic performance on the first three subtests could be attributed to the significant difference in educational level. Also the differences in sex and age distribution approached significance. Aware of the fact that the assumption of normality is not strictly met, we performed an analysis of variance (ANOVA) with educational level, sex, and age as covariates to eliminate this possibility. The difference in scores for spontaneous prosody became less significant, and scores for prosodic recognition and prosodic repetition remained highly significant. The values of the test statistic *F* and the corresponding levels of significance for spontaneous prosody, prosodic recognition and prosodic repetition were F=3.86, p=0.055; F=10.98 p=0.002; and F=10.30, p=0.002 respectively. Moreover, analysis of a subpopulation of eight schizophrenic patients that could be exactly matched for educational level with eight controls,, still showed the same significant differences for these three subtests using the non-parametric Wilcoxon matched pairs signed rank sum test

Discussion

Prosodic performance of 26 moderately severe schizophrenic outpatients was assessed using a standardised test. As no reference values existed for this test, their scores were compared with those of 24 staff from the outpatient department. Both groups did not differ significantly in age and sex distribution, but the number of years of education was significantly different. Analysis of variance with education as covariate and analysis of a subpopulation, matched exactly for educational level, showed that differences in performance were not accounted for by this difference in education.

However, that the results have been influenced by non-specific effects such as attention, motivation, or medication cannot be ruled out.

Spontaneous prosodic performance of schizophrenic patients was significantly worse than that of the control group. This finding is consistently mentioned in several previous studies. Unfortunately, most of these did not use objective measures to score spontaneous prosody.[7–9] An exception is the study by Haskins *et al*,[12] who found a similar result, using the "emotional blunting scale" of Abrams and Taylor.[12 15] In our opinion the prosody abnormality score is to be preferred to the emotional blunting scale, as the second does not contain any explicitly verbal score items. However, the prosody abnormality score, which was originally developed to measure prosody in parkinsonian patients, is far from ideal, as almost all of the variation in scores is explained by just two of the seven items: intonation and vocal quality; other items can be ignored without much loss of information. An adaptation of the prosody abnormality score could make it a more useful tool to assess prosody in schizophrenic patients.

The significant difference in prosodic comprehension between patients and controls is consistent with the findings of studies by Murphy and Cutting[9] and Haskins *et al*,[12] and is also described in two of the eight schizophrenic patients in the case report by Fricchione *et al*.[8] The same case report describes a deficit in prosodic repetition in four patients. Haskins *et al* report a non-significant trend, suggesting that controls performed better than patients on the subtest for prosodic repetition.[12] In our study the difference was clearly significant. This discrepancy might be explained by the fact that in our test all stimuli were presented in semantically congruent sentences, whereas Haskins *et al* present half of the stimuli in semantically neutral sentences. This increases the difficulty of this subtest.

The finding of a deficit in facial affect recognition, described by earlier studies, could not be replicated.[16 17] This is in line with the findings of case histories described by Fricchione and the study by Haskins *et al*.[8 12]

The prosodic deficits found in this and previous studies have several implications for our views on schizophrenia. In general, knowledge of neuropsychological deficits unites psychological and biological viewpoints and are therefore of great importance for our understanding of the nature and consquences of psychiatric disorders. From the psychological point of view, knowledge of aprosodia can provide us with a framework from which to understand some of the communicational difficulties that patients have. This is a first prerequisite for the development of treatment strategies that aim to improve this handicap or help patients to cope with it.

From the biological point of view it may help us to further develop hypotheses about functional brain lateralisation and interhemispheric communication. In neurological disorders, affective prosody is the consequence of structural brain damage of the right (or non-dominant) hemisphere.[1–6] Based on clinical evidence, Ross distinguishes various aprosodic syndromes, which he locates in the right posterior frontal, parietal and superior temporal regions.[2 6] On the basis of similarity of symptoms with these neurological patients, at least a functional deficit of these regions can be hypothesised. This would challenge the current hypothesis of structural or functional alterations of predominantly the left hemisphere.[18–21] In another publication, Ross *et al*[22] hypothesises that integration of affective and propositional language components between hemispheres takes place via the corpus callosum. This theory is supported by the finding that disturbances in both affective and linguistic prosody can occur after surgical transection of the corpus callosum.[23 24] If prosodic deficits can indeed be explained by callosal damage or dysfunction, this would support the hypothesis that callosal abnormalities may play an aetiological part in schizophrenic pathology.[21 25 26] Functional neuroimaging studies might disclose further evidence in support of these hypotheses.

Conclusions

Disturbances of affective prosody do indeed constitute part of the symptomatology of schizophrenia. On a standardised test, patients scored significantly worse than normal controls on spontaneous prosody, prosodic comprehension, and prosodic repetition. Earlier findings of a reduced facial affect recognition could not be replicated. These differences in performance could not be explained by differences in educational level. Although results of this study suggest that disturbances in affective prosody constitute part of the symptomatology of schizophrenia, we are aware that this does not mean that they are specific for, or confined to, this disorder. Further studies in other psychiatric patient populations are necessary. This future research could focus on the neuroanatomical and neurophysiological background of prosodic deficits in schizophrenia, but also on the functional consequences for patients with these deficits.

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