

Negative schizophrenic symptoms and the frontal lobe syndrome: one and the same?

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Abstract The negative symptoms of schizophrenia have been considered to be a psychiatric form of the frontal lobe syndrome. However, no studies have compared these two disorders at the clinical level. In this study, 12 negative symptom schizophrenic patients and 11 patients with behavioural variant frontotemporal dementia (bv-FTD) were rated for negative symptoms and for occurrence of frontal lobe behaviours in everyday life. They were also rated for speech disorder and were given a series of executive tests. Both patient groups showed positive ratings on negative symptoms and frontal lobe behaviours in daily life; however, the schizophrenic patients had higher

negative symptom scores and the bv-FTD patients had higher carer ratings on frontal behaviours in daily life. Both groups were impaired on the executive tests, but the bv-FTD patients showed significantly greater impairment on verbal fluency and a test requiring inhibition of prepotent responses. A minority of the bv-FTD patients unexpectedly showed speech abnormalities typically associated with schizophrenia. The findings indicate that the negative syndrome in schizophrenia and the frontal lobe syndrome resemble each other clinically in important respects. Some of the differences may be attributable to the additional presence of disinhibition in the frontal lobe syndrome.

Keywords Schizophrenia · Frontal lobe syndrome · Frontotemporal dementia · Cognition

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Introduction

Although schizophrenia is widely considered to be caused by a biological disturbance of brain function, how this might translate into the symptoms of the disorder is poorly understood. One of the most enduring proposals has been that negative symptoms are a manifestation of impaired frontal lobe function. Thus, noting the emotional dullness, impaired judgment, poor initiative, decreased concern for personal hygiene and social withdrawal seen in schizophrenia, Weinberger [44] stated: 'These symptoms are phenomenologically similar to many of the characteristics of patients with disease of the frontal lobe, especially of the dorsolateral convexity.' Liddle [25] drew the same comparison and further argued that negative symptoms were associated with poor performance on neuropsychological tests sensitive to frontal lobe function. Explanations of negative symptoms wholly or partly in terms of frontal lobe

dysfunction also feature in several other integrative accounts of schizophrenia [14, 23, 35, 46].

The ‘frontal lobe’ hypothesis of negative symptoms has mainly been investigated from the neuropsychological point of view. Such studies have often, although not always, found significant correlations between negative symptom scores and impairment on a range of executive tests [11], and the association is supported by meta-analysis [10]. There has also been some investigation of the relationship between negative symptoms and hypofrontality on functional imaging, although this has been more limited and the studies not had very consistent findings (for reviews see [24, 30]). However, the relationship has received hardly any attention from the clinical point of view, i.e. whether and to what extent symptoms like avolition, poverty of speech and flattening of affect in schizophrenia resemble changes seen the frontal lobe syndrome.

On intuitive grounds, lack of volition in schizophrenia seems to be similar to the apathy of the frontal lobe syndrome. The same might also apply to schizophrenic poverty of speech and the frontal lobe symptom of speech adynamism. At the same time, the speech abnormalities recorded in both disorders go beyond reduced speech: the ‘alogia’ syndrome in schizophrenia also includes poverty of content of speech [5, 36], and besides adynamism, patients with the frontal lobe syndrome have been reported to show perseveration and make irrelevant remarks [1, 34]. Whether flattening of affect in schizophrenia is similar or different to the emotional changes seen in the frontal lobe syndrome is hard to decide. Terms used to describe the emotional changes in the latter disorder include indifference, blandness and lack of concern, but these are often accompanied by statements about brashness, tactlessness and lack of appreciation of the consequences of behaviour [7, 32], features which do not have clear counterparts in negative symptoms.

Patients with the frontal lobe syndrome are uncommon and, since they are usually the result of brain trauma, they often show changes due to damage in other areas as well. However, a more accessible and homogeneous group exists in the frontotemporal dementias, of which the frontal or behavioural variant (bv-FTD) accounts for about half of all cases [18]. bv-FTD is characterized by behavioural and personality changes, which include apathy, emotional blunting and loss of empathy, disinhibition and aberrant social conduct. These are accompanied by reduced speech and poor insight into the condition. The patients also show dysexecutive problems in day-to-day life and impairment on standard tests of executive function [18, 19]. Neuroimaging and pathological studies suggest that the site of the pathology is mainly the mesial and orbitofrontal cortices, followed by the dorsolateral cortex [9, 37, 38].

The aim of this study was to compare the negative schizophrenic syndrome with the frontal lobe syndrome as

manifested in an aetiologically homogeneous group, i.e. patients with bv-FTD. We compared these two groups symptomatically and also in terms of the impairments they showed in daily life. Additionally, we examined similarities and differences in their profiles of impairment on executive tests.

Method

Subjects

Schizophrenic patients

The sample consisted of 12 patients with chronic schizophrenia under the care of a rehabilitation service. They all met DSM-IV criteria for schizophrenia and were selected on the basis they showed an overall negative symptoms score of at least 2 (mild) out of a maximum of 5 on the Schedule for the Assessment of Negative Symptoms (SANS) [3]. Eight patients had ratings of 3 (moderate negative symptoms), two scored 2 (mild) and two scored 4 (moderately severe). Presence of positive or disorganization symptoms were not a reason for exclusion, although we did not include patients who showed marked thought disorder or preoccupying delusions and hallucinations to an extent which made interview difficult. None of the patients had a history of head injury, central nervous system disease or a history of alcohol abuse. One patient had abused heroin for a period of 4 years; however, this occurred after he had developed schizophrenia and he had not used this or other drugs for 18 months prior to taking part in the study. All patients were taking clozapine with the exception of one who was on depot pipothiazine. They were all in stable clinical condition and outside any recent relapse at the time of testing.

bv-FTD patients

The 11 patients in the sample were ascertained through the Early Onset Dementia Clinic at Addenbrookes Hospital, Cambridge. All met the international consensus criteria for bv-FTD [32] with a caregiver confirming the history of progressive decline in social cognition and personality change without psychotic features. None of the patients had a history of drug or alcohol abuse.

Both groups of patients were selected to be free of obvious evidence of generalized cognitive impairment. This was defined as a score above the cut-off for mild dementia of 23 on the Mini-Mental State Examination (MMSE) [13].

All patients gave written informed consent to participate. The study was approved by the local research ethics committee.

Procedure

The patients were interviewed over two or more sessions. One session consisted of a clinical interview where they were questioned about negative symptoms. During this interview, they were also engaged in conversation designed to elicit abnormalities in speech. Amongst other things they were asked the questions, ‘Are you a religious person?’ and ‘Could you tell me why some people believe in God?’ They also had to describe two pictures, The ‘Cookie Theft’ picture from the Boston Diagnostic Assessment of Aphasia [15] and Card 11 from the Minnesota Test for the Differential Diagnosis of Aphasia [39]. The interviews were video-recorded. During the remaining session or sessions, the subjects underwent neuropsychological testing.

Carers of both groups of patients completed two questionnaires about frontal lobe behaviours in daily life. For the bv-FTD patients, these were spouses in all cases. For the schizophrenic patients, they were mainly staff in the hostels where they lived, nurses or community support workers who knew them well. However, two schizophrenic patients had partners who were interviewed.

Measures

Clinical

Negative symptoms were rated from the video recordings using the SANS [4]. We excluded ratings on the subscale ‘attentional impairment’ on the grounds that these would likely reflect cognitive impairment rather than negative symptoms. Speech disorder was rated using the version of the Thought Language and Communication (TLC) scale in the Comprehensive Assessment of Symptoms and History [2]. This includes items related to fluent disorganization of speech (derailment, tangentiality, incoherence, illogicality, circumstantiality, pressure of speech, distractibility, and clanging). There are also two items relating to alogia (poverty of speech and poverty of content of speech).

If patients scored 2 (mild) or greater on any of the TLC items, transcripts were made of the interviews. These transcripts were edited to remove diagnosis-identifying information and were then examined under blind conditions by a panel of four clinicians (two general adult psychiatrists, one old age psychiatrist and one neuropsychiatrist) who were otherwise uninvolved in the study. They were asked to identify which group the patient belonged to on the basis of their speech.

Carer ratings

The patients’ carers completed 2 questionnaires rating frontal lobe behaviours in daily life, the Dysexecutive

Questionnaire (DEX) from the Behavioural Assessment of the Dysexecutive Syndrome (BADS) [45] and the Frontal Systems Behavior Scale (FrSBE) [16]. Both scales assess functioning over the preceding month. Scores on the FrSBE are additionally divided into three subscales, apathy, disinhibition and executive dysfunction—the last category includes positive responses to statements such as ‘Repeats certain actions or gets stuck on certain ideas’, ‘Mixes up a sequence, gets confused when doing several things in a row’.

Neuropsychological tests

In addition to the MMSE, the patients’ overall cognitive function was assessed using the more detailed Addenbrooke’s Cognitive Examination, Revised (ACE-R) [31]. This consists of a series of tests which cover 5 subdomains of cognitive function: orientation/attention, memory, verbal fluency, language and visuospatial function. Both groups were also given a battery of executive tests, consisting of the following.

Hayling Sentence Completion Test [8]: This tests ability to suppress prepotent responses. The subject is read 15 sentences from which the last word is omitted and is required to supply a word which does not make sense for completing the sentence. The test measures both time to respond and errors. Because slowness of responding is a well-documented finding in schizophrenia, only errors were scored.

Brixton Spatial Anticipation Test [8]: This is a test of rule attainment conceptually similar to the Wisconsin Card Sorting Test. The subject is presented with many pages showing a rectangular array of ten circles, one of which is coloured blue. The coloured circle moves around the array according to various patterns that change without warning. He/she has to work out the pattern and predict the next position of the target.

Cognitive Estimates Test [41]: This requires the subject to make ‘educated guesses’ about questions he/she would be unlikely to know the precise answer to, such as, ‘How fast do racehorses gallop?’ and ‘What is the age of oldest person alive in Britain today?’.

Verbal Fluency: Subjects were asked to generate as many words as possible in 1 min in a semantic category (animals) and in a phonological category (beginning with letter P).

Letter-number sequencing [43]: This is a working memory task requiring short-term recall and manipulation of information. Strings of letters and numbers of increasing length are read out to the subject, who has to organize them into the numbers in ascending order, followed by the letters in alphabetical order.

The Hotel Test [27]: This is an ‘ecologically valid’ task designed to evaluate executive function in real life situations, under conditions where multiple demands are made.

Table 1 Demographics and cognitive status scores in schizophrenic and bv-FTD patients [mean (range; standard deviation)]

	Schizophrenia (<i>N</i> = 12)	bv-FTD (<i>N</i> = 11)	<i>P</i> -value
Age	54 (34–68; 10.33)	62.55 (52–71; 8.22)	0.04
Gender (M/F)	11/1	10/1	
Years of education	12.83 (9–18; 2.69)	12.82 (10–16; 2.23)	0.99
MMSE	28.42 (27–30; 1.51)	28.45 (27–30; 1.29)	0.95
ACE-R	85.33 (78–97; 6.67)	82.82 (74–94; 7.11)	0.63

Participants are required to carry out 5 hotel-related tasks, e.g. sorting coins, proofreading a brochure, making up guests' bills. It is explained that they cannot complete any of the tasks in the 15-min test period, but that they should instead try to devote some time to each of them. They also have to remember to press a button at two pre-designated times that represent opening and closing the hotel garage doors. They have access to a clock, which they can consult briefly. Performance is measured in 3 ways, number of tasks attempted, deviation from optimal time on each task, and opening and closing the garage doors.

Results

Demographic data are shown in Table 1. The bv-FTD patients were significantly older than the schizophrenic patients, but otherwise the groups were well matched. Both groups performed similarly on the MMSE and the ACE-R.

Negative symptoms

SANS summary scores (sum of global ratings on affective flattening, alogia, avolition-apathy and anhedonia-asociality) were 10.17 (SD 3.13) for the schizophrenic patients and 6.82 (SD 4.16) for the bv-FTD patients. This difference was significant ($t = 2.16$, $P = 0.04$).

The pattern of scores on the subscales of the SANS are shown in Fig. 1, which shows the global ratings (range 0–5) on each of the four subscales of affecting flattening, alogia, avolition-apathy, and anhedonia-asociality. It can be seen that while the schizophrenic patients' scores were higher across all subscales, the pattern was similar in the two groups. Differences were significant for avolition-apathy ($t = 2.76$, $P = 0.02$), were at trend level for affective flattening ($t = 1.83$, $P = 0.09$) and anhedonia-asociality ($t = 1.82$, $P = 0.08$), and were insignificant for alogia (Mann–Whitney $U = 61.00$, $P = 0.74$; a non-parametric test was used here because of the large number of zeros).

Carer ratings of frontal failures in daily life

In contrast to the findings with the SANS, scores were higher in the bv-FTD patients than in the schizophrenic

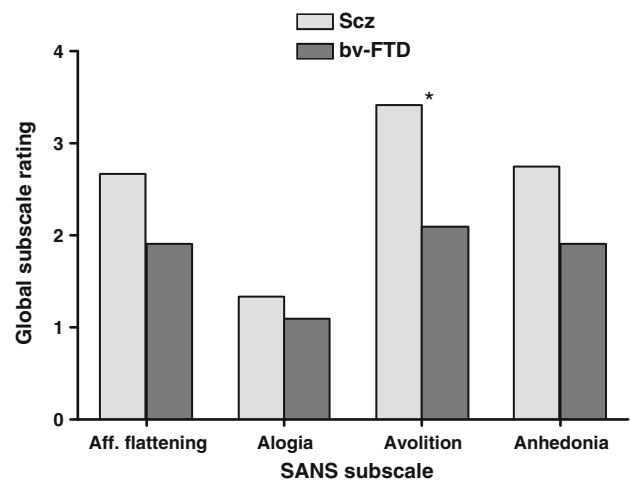


Fig. 1 SANS subscale scores in the schizophrenic and bv-FTD patients (* $P < 0.05$)

patients on both the DEX (35.45 (SD 20.14) vs. 20.33 (SD 10.59), $t = -2.29$, $P = 0.04$) and on the FrSBE (69.17 (SD 16.45) versus 94.91 (SD 27.81), $t = -2.67$, $P = 0.008$).

The pattern of carer-rated impairment on the FrSBE subscales of apathy, disinhibition and executive dysfunction is shown in Fig. 2. It can be seen that the bv-FTD group scored significantly higher than the schizophrenic group on disinhibition ($t = -3.49$, $P = 0.004$) and executive dysfunction ($t = -2.83$, $P = 0.01$), but that the levels of apathy were similar ($t = -0.81$, $P = 0.43$).

Speech

Numbers of patients who scored 2 (mild) or more on any of the items on the TLC are shown in Table 2. Three bv-FTD patients and four schizophrenic patients showed poverty of speech. Three of the bv-FTD patients were also rated as showing poverty of content of speech (two mild and one moderately severe). One bv-FTD patient showed pressure of speech (mild) and one showed circumstantiality (mild). There were no significant differences between the groups in the frequency of any of the TLC items. Some examples of speech abnormalities recorded in the bv-FTD patients are shown in the Appendix.

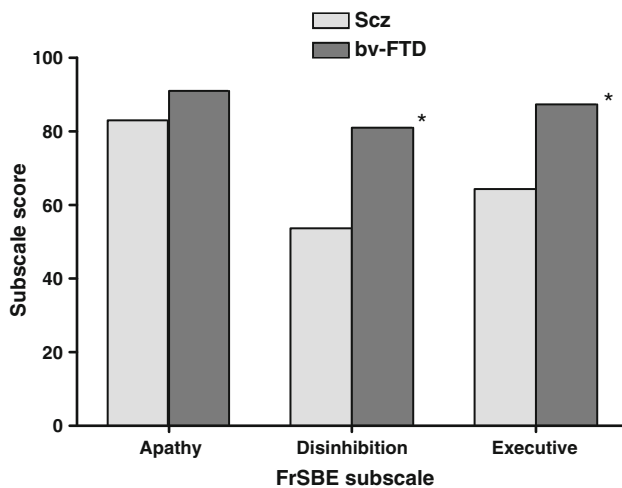


Fig. 2 FrSBE subscale scores in the schizophrenic and bv-FTD patients (* $P < 0.05$)

Table 2 TLC abnormalities rated as present (based on score of ≥ 2) in the schizophrenic and bv-FTD patients

	Schizophrenic patients ($N = 12$)	bv-FTD patients ($N = 11$)	P -value
Derailment	2	0	0.48
Tangentiality	0	0	–
Incoherence	0	0	–
Illogicality	1	0	1.00
Circumstantiality	2	1	1.00
Pressure of speech	4	1	0.32
Distractible speech	0	0	–
Clanging	0	0	–
Poverty of speech	4	3	1.00
Poverty of content of speech	3	3	1.00

There were 11 interviews (5 bv-FTD patients and 6 schizophrenic patients) where the patients scored 2 or greater on any of the TLC items. The clinicians examining the transcripts of speech of these 12 interviews under blind conditions correctly identified 6/11, 6/11, 5/11 and 5/11, respectively, and so none were significantly above chance.

Executive test performance

For these analyses we used age as a covariate, as this variable can influence cognitive test performance. The findings are shown in Table 3. Overall executive test performance was initially compared between the groups by means of a MANCOVA. This revealed a significant difference (Hotelling's $T = 2.65$, $P = 0.02$). Follow-up ANCOVAs revealed that the groups did not differ significantly on 5 of the 7 tests. The two exceptions were the

Hayling Test and one of the two verbal fluency tests, category fluency; in both cases the bv-FTD patients performed more poorly than the schizophrenic patients.

Table 3 also shows the numbers of patients failing each of the tests, i.e. the numbers falling below normal 5th percentile cut-offs based on existing normative data, either published or from the authors' own unpublished data (verbal fluency for words beginning with the letter P could not be included due to lack of normative data for this test). It can be seen that in both groups' test failures were uncommon on some tests, notably the Cognitive Estimates Test and verbal fluency. Failures were most frequent on the Hotel Test in both groups.

Discussion

Kleist [22] was the first to propose that what psychiatrists were later to call negative symptoms were essentially the same phenomenon as the apathy and emotional indifference seen in the frontal lobe syndrome. Several decades later, in the first functional imaging study of schizophrenia, Ingvar and Franzen [21] again suggested that symptoms like reduced spontaneous movement and speech, emotional indifference and 'autism' in schizophrenia were a consequence of the hypofrontality they found. Currently, the 'frontal lobe' hypothesis of negative symptoms has the support of influential contemporary authors, such as Weinberger [44], Liddle [25] and Frith [14]. It has been heavily investigated neuropsychologically [11, 29] and to some extent from the standpoint of functional imaging [24]. However, the present study is, to our knowledge, the first to explore the similarities between the two disorders at the clinical level.

The bv-FTD patients in the study rated positive on a widely used scale for negative symptoms, although their scores were lower than those for the schizophrenic patients. Significantly, they scored not only on symptoms like avolition-apathy and alogia, which have obvious counterparts in frontal lobe apathy and reduced speech, but also on affective flattening, where their scores ranged up to 4 (moderately severe). As noted in the introduction, descriptions of emotional changes in the frontal lobe literature have been scanty and their similarity or otherwise to the affective flattening of schizophrenia is difficult to evaluate. However, there are more descriptions in the bv-FTD literature, where authors have spoken of blandness, emotional blunting, loss of empathy and a virtually complete lack of emotional display [33]; patients have been described as 'flat' or 'robotic', showing little warmth and often seeming indifferent to the feelings of others [18]. This study strengthens the case that the affective changes seen in schizophrenia and the frontal lobe syndrome are

Table 3 Performance of the schizophrenic and bv-FTD patients on executive tests [Mean (standard deviation)]

Test	Schizophrenia (<i>N</i> = 12)	No. of test failures	bv-FTD (<i>N</i> = 11)	No. of test failures	<i>P</i> -value
Verbal fluency (letter <i>P</i>)	12.50 (4.95)	–	9.18 (4.79)	–	0.19
Verbal fluency (animals)	18.50 (11.17)	3	11.09 (7.67)	7	0.02
Cognitive estimates test	5.67 (3.14)	0	6.27 (4.60)	1	0.96
Hayling test ^a	6.00 (0.739)	0	3.82 (2.93)	6	0.04
Brixton test ^a	4.25 (2.56)	5	4.36 (3.04)	3	0.39
Letter-number sequencing	7.42 (2.72)	6	8.09 (2.39)	2	0.41
Hotel test ^b					
Tasks attempted	3.67 (1.371)	7	3.45 (1.36)	8	1.00
Doors	4.42 (3.37)	–	4.64 (3.59)	–	0.62
Deviation from optimal time (s)	679.42 (360.48)	–	780.91 (321.70)	–	0.69

^a Scores are raw scores for all tests except the Hayling and Brixton which are scaled scores

^b All cut-offs are 5th percentile, except for the Hotel Test (tasks attempted) where none of a group of normal subjects scored less than the maximum of 5 tasks attempted

more similar than has perhaps been previously thought, although there may be differences in degree.

Conversely, the patients with schizophrenia showed frontal lobe problems in daily life. It is important to note that the positive ratings here were not just due to the patients showing the behavioural accompaniments of poor executive function, such as poor planning and perseveration, which might be expected to be present, given that schizophrenia is associated with a prominent neuropsychological deficit in executive function. They also rated positive on the FrSBE subscales for apathy (to the same extent as the bv-FTD patients) and disinhibition (to a lesser degree).

On these grounds, the negative schizophrenic and the frontal lobe syndromes resemble each other. There is also a difference, however, in that the negative symptom schizophrenic patients scored more highly than the bv-FTD patients on clinician-rated apathy, affective flattening and poverty of speech, whereas the frontal lobe patients were rated by their carers as having more frontal behavioural problems in daily life. One possible explanation for this difference might be that the bv-FTD patients had more opportunity to score on frontal lobe behaviours in daily life because the frontal lobe syndrome encompasses two sub-syndromes, its so-called apathetic and disinhibited forms [7], with most patients showing a combination of both. The patients with schizophrenia, on the other hand, were selected for showing negative symptoms, and so they would in effect be preselected to score only on apathetic frontal behaviours and not on disinhibited ones. This, however, is at most only a partial explanation since, while it can account for the bv-FTD patients' higher ratings on the carer scales for frontal failures in daily life, it does not explain the schizophrenic patients' higher ratings than the bv-FTD patients on negative symptoms.

Another possibility is that there is a genuine dissociation between the two disorders, presumably reflecting the different nature of their underlying pathologies. For example, patients with bv-FTD have a degenerative brain process which causes progressive loss of brain substance in the prefrontal cortex, whereas in schizophrenia brain structural changes are subtle—there is only a 2% reduction in whole brain volume and a 5% reduction in the frontal lobes [47]—and are considered to be non-progressive (for a review see [30]) or at most only progressive to a small extent [20]. Changes in frontal function in schizophrenia might also be plausibly related to neurochemical dysfunction rather than actual structural damage in this area. However, in the absence of firm knowledge about the nature of brain pathology in schizophrenia, any such explanations have to be regarded as speculative.

We found that schizophrenic patients with negative symptoms and patients with bv-FTD showed, for the most part, a similar neuropsychological profile. Notably, this similarity extended to the finding that in both groups the highest failure rates were on the Hotel test. The Hotel test is one of a number of ecologically valid tests of executive function which were developed in response to the observation that some patients with obvious clinical evidence of the frontal lobe syndrome perform normally on conventional 'frontal' tests [12, 40]. For example Shallice and Burgess [40] found that three patients with the frontal lobe syndrome due to traumatic brain damage performed well on a wide range of conventional executive tests, but they all showed obvious difficulties with two novel tasks where they had to organize their behaviour and set priorities in the face of competing demands. From our findings, it appears that patients with schizophrenia share this increased sensitivity to ecologically valid executive tests.

Nevertheless, the bv-FTD patients did perform more poorly than the schizophrenic patients on two tests. One of these, the Hayling test, requires inhibition of prepotent responses. Failures on this task are known to be prominent even in mild frontotemporal dementia [19, 26]. The bv-FTD patients' markedly higher failure rate on this test (6 vs. 0) might be related to the presence of a greater degree of disinhibition than in the schizophrenic patients, as discussed above. However, the bv-FTD patients also performed more poorly than the schizophrenic patients on one of the two verbal fluency tests (naming animals over a minute). While impaired verbal fluency is a consistent finding in FTD [18], there is also ample evidence that it is impaired in schizophrenia [17]. Therefore, why we found differences between these two patient groups is unclear.

Reduced speech to the point of mutism is a well-recognized feature of the frontal lobe syndrome, and so it is not surprising that 3/11 of the bv-FTD patients in our study were rated as showing poverty of speech. More unexpectedly, they also displayed a range of speech and language deficits typically associated with schizophrenia. Three were rated as showing poverty of content of speech, and this was marked in one of them. One also scored on circumstantiality and one on pressure of speech. There are very few references to fluent speech abnormalities in the literature on patients with frontal lobe lesions, although two authors [1, 34] have alluded to digressions, vagueness and rambling, and 'free association of ideas'. One of Blumer and Benson's [7] frontal lobe patients also replied to questions in a way which they interpreted as suggesting an inability to maintain specific meanings. Finally, stilted speech, pedantry, word approximations and even nonsensicality have been recorded as consequences of frontal lobotomy in nonpsychotic patients (for a review see [29]). Our study thus adds to a very small literature which suggests that there is some degree of fluent disorganization of speech in patients with the frontal lobe syndrome.

Our findings here also provide support for the frontal/executive theory of formal thought disorder in schizophrenia. As proposed by McGrath [28] and others (for a review see [29]), this argues that at least part of what makes schizophrenic speech difficult to follow is a frontal-type failure to plan and edit speech, as well as a failure to monitor speech for errors while it is being produced. This theory predicts that poor performance on executive tests will be associated with presence of the disorganization syndrome in schizophrenic patients, or with formal thought disorder scores, a prediction which has received a considerable amount of experimental support [6, 10, 42]. It also predicts that patients with the frontal lobe syndrome will show not just reduced speech, but also fluent speech abnormalities indistinguishable from those seen in schizophrenia; our study appears to have documented this for the first time.

Some limitations of this study need to be acknowledged. One of these is that the clinical evaluations were not made under blind conditions. In fact, the original study design called for videos of the patients to be rated blind to diagnosis. In practice, however, it proved impossible to do this, mainly because the bv-FTD patients' age and social circumstances provided obvious clues to their diagnosis. Another limitation is that the sample sizes were small. This reflects the fact that neurological patients showing the frontal lobe syndrome are uncommon and difficult to find in relatively pure form. Against this, the study has the strength of aetiological homogeneity in the frontal sample used. The patients included in the present study fulfilled current criteria for bv-FTD, which meant that they exhibited a quite pure form of this variant of frontotemporal dementia. They presented with insidiously progressive changes in personality and social cognition accompanied by apathy, disinhibition, stereotypic patterns of behaviour, mental rigidity, alterations in eating habits, reduced empathy and poor insight [18]. Patients with language variants of frontotemporal dementia, i.e. semantic dementia and progressive nonfluent aphasia [18], show striking impairments in language, and these were not present in our subjects. Frontotemporal dementia in general is also usually easy to distinguish from Alzheimer's disease, where there is severe amnesia accompanied by more variable deficits in attention, language and visuospatial function, and in which social cognition tends to be relatively preserved.

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Conflict of interest None.

Appendix: Examples of speech abnormalities in patients with bv-FTD

Poverty of content of speech

Interviewer: are you a religious person?

Patient: No, apart from being able to look out my window and see the church over there, I'm not too keen. I used to be more keen when I lived in [place] and I used to be [involved in church activity] and looking after things that way, all right. Again I was finding ways to waste my time I suppose. It worked reasonably well and I used to quite enjoy it, yeah.

Interviewer: I wonder if you could tell me why some people believe in god?

Patient: The answer is probably, no I can't. (Laughs). Although, I'm not sure that's the answer you expected or not, so, I don't really know why they're coming as closely as that, but that's what used to happen and I mean when I lived at [place] which as you say you went through on your way here this morning, I don't really know why I got involved. I quite like [church activity] and doing the right thing as far as the church is concerned, alright. So, I'm not sure if that's the right thing to say, but it's the truth as far as I was concerned.

Circumstantiality

How's your appetite?

Appetite is fine, I must admit, I had some lovely chocolate just now; and as I often do say, eating things does make a difference to your brain at times and drinking things as well. I pleased to say I don't eat very much chocolate, that chocolate you gave me, first chocolate I've had in a very long time. I quite enjoy eating fruit, like plums, I like eating apples and I have grapes and that sort of thing. And usually when out in town, I enjoy drinking soup and some fresh bread. Well, I have chips now and again but I don't have too much on that side, otherwise food wise not bad at all.

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