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A prospective psychological study of patients with undiagnosed episodes of disturbed consciousness

L.D. Blumhardt, D. Barnes, S.J. Howell and E. Ghadiali

Department of Neurological Science, Faculty of Medicine, c/o Walton Hospital, Rice Lane, Liverpool L9 1AE, UK

Correspondence to: L.D. Blumhardt, Division of Neurology, Faculty of Medicine, University Hospital, Queen's Medical Centre, Nottingham NG7 2UH, UK

We have carried out a prospective psychological and clinical study of neurological out-patients with episodes of disturbed consciousness that were mostly unexplained after clinical assessments and prolonged follow up. When compared with matched healthy subjects, both the undiagnosed patients and a control group with chronic epilepsy, had evidence of abnormal personality and psychological disturbance. However, in the undiagnosed patients there were significant differences between two subgroups defined by the results of clinical follow up. Patients whose symptoms resolved spontaneously were psychologically indistinguishable from healthy control subjects, whereas patients whose unexplained symptoms continued, with or without empirical treatment trials, had highly abnormal personality profiles. Although the basic psychological tests we used cannot reliably separate individual patients with epilepsy from those with non-epilepsy, they do have some predictive value with respect to the prognosis of unexplained symptoms. Further detailed prospective studies may help to establish the relationship between psychological disorder and unexplained symptoms and perhaps reduce the need for repeated, expensive investigations.

Keywords: Ambulatory monitoring – EEG – Epilepsy – Personality disorder – Psychological tests – Undiagnosed attacks

INTRODUCTION

Patients with episodic disturbances of consciousness are a common problem in routine neurology clinics. While most are easily diagnosed after a full clinical history and examination, there is a significant minority where doubt may remain, even after repeated neurological investigations and "therapeutic trials" of anti-epileptic medication (AED). Definitive diagnoses are difficult to achieve in these patients, often because symptoms are non-specific, eye witnesses are lacking, or attacks are too infrequent to study with video-telemetry.

Ambulatory monitoring of the EEG and ECG (AEEG/ECG), which increases the chances of recording infrequent symptoms, should be a useful diagnostic aid in this situation. However, the prevalence of epilepsy or significant cardiac arrhythmias in patients who have been neurologically-screened appears to be low, with most AEEG studies reporting negative findings in the majority of cases even when typical symptoms have been recorded (Woods and Ives, 1977; Cull, 1985; Blumhardt, 1986). While cardiac arrhythmias can be excluded with some confidence by a normal recording during symptoms, the practical difficulties of interpreting negative EEG records [e.g. the limited spatial resolution, the occurrence of "AEEG-negative" seizures in patients with definite epilepsy (Ives and Woods, 1980; Blumhardt, 1986) and the lack of behavioural observations], still leaves room for diagnostic uncertainty.

It has previously been suggested from studies of patients with "pseudoseizures" simulating tonic-clonic seizures, that psychological tests could help to distinguish between epilepsy and non-epilepsy (Wilkus *et al.*, 1984). There have been few psychological investigations of patients with less dramatic attacks in which the non-specific symptomotology overlaps with complex partial seizures or syncope (Luther *et al.*, 1982; Vanderzant *et al.*, 1986). We suspected from the frequent spontaneous resolution of attacks after negative investigations (Blumhardt, 1986), that psychological factors might be an important factor in many of these cases.

In the present study we have applied a battery of routine psychological tests to a sequential sample of undiagnosed patients with negative clinical and laboratory assessments in whom epilepsy (and not pseudoseizures) had been suspected, but remained unconfirmed. The patients underwent clinical follow-up in an attempt to determine the diagnostic outcome. The psychological data obtained at study entry was then re-examined according to the outcome of follow up. The results were compared with data

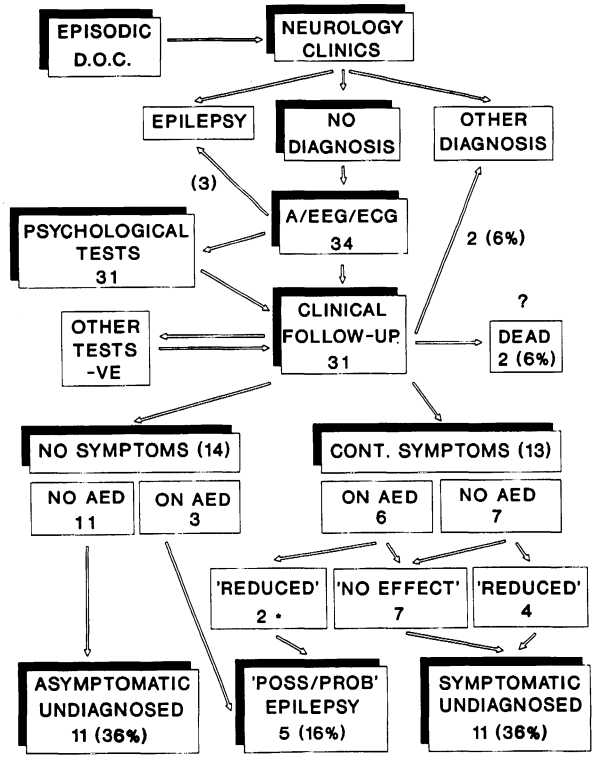

FIG. 1. Flow diagram of sequence of investigations in undiagnosed patients and outcome of clinical follow up. See text for more details. D.O.C, symptoms of disturbances of consciousness; AED, anti-epileptic medication; cont., continuing; "Reduced" and "no effect" refer to results of AED medication; ? implies uncertainty over relationship of deaths to original symptoms.

from a healthy control group and from patients with epilepsy.

We have tested the following hypotheses: (i) a high prevalence of pre-existing psychological abnormalities might be predicted in patients whose non-specific episodes of altered consciousness remained undiagnosed after neurological screening, AEEG monitoring and prolonged neurological follow-up; (ii) the patterns of psychological abnormality in such patients might be expected to differ from those found in patients with epilepsy, and (iii) there may be psychological differences in undiagnosed patients whose symptoms either resolved, or continued after negative investigations.

METHODS

Psychological tests were given to 88 individuals classified into three groups: (i) 31 patients with recurrent unexplained episodes of disturbed consciousness; (ii) 27 patients with a firm clinical diagnosis of epilepsy on treatment with AED; and (iii) 31 healthy control subjects. The three groups were matched as closely as possible for age and sex. All groups were followed up after monitoring. The patients gave informed consent and the study was ethically approved.

Undiagnosed patient group ($n = 31$)

The patients included were from a sequential series, initially of 34 cases, referred for AEEG/ECG from routine neurological outpatient clinics in a regional unit where they were attending for their first diagnostic assessment of recurrent, unexplained, disturbances of consciousness (Fig. 1). A minority had been investigated by physicians or cardiologists prior to neurological referral. All were clinically assessed by two or more staff neurologists. The criteria for inclusion were recurrent attacks for which no diagnosis had been made after a clinical history, examination, routine 16-channel laboratory EEG (with photic stimulation and hyperventilation) and a 12-lead ECG. Where indicated, these tests had been repeated. In some cases, additional investigations (including CT scanning, Holter monitoring, cardiological assessments and special biochemical tests) had been performed as indicated by the history and examination. Video-telemetry was carried out in some patients, but was inconclusive due to the infrequency of attacks.

Three of the 34 patients (9%) with unexplained attacks were diagnosed by prolonged AEEG/ECG recordings in which unequivocal EEG seizure activity coincided with symptoms; they were excluded from further study (Fig. 1). The remaining 31 cases (20 females and 11 males), all with negative AEEG/ECG recordings, had a mean age of 41 years (F, 38 years; M, 45 years) (range 17-72 years). Eighteen of the 31 (58%) had non-specific symptomatic attacks in which loss of consciousness with a fall to the ground occurred without evidence of a seizure, cardiac arrhythmia or other factors which may have provoked syncope. The remaining 13 (42%) described non-specific episodes of altered awareness with no fall, in which partial awareness of the surroundings was maintained. Eye witness accounts obtained in 18 patients (58%), were inconclusive. Symptoms had been present for an average of 3.1 years (range 2 months - 18 years). Fourteen patients could estimate their total number of attacks (average 7; range 2 - 25). Seventeen were unable to provide an estimate due to the irregular occurrence of symptoms which varied from 10/day to periods of freedom of several months.

At the time of referral for monitoring, the differential diagnosis invariably included epilepsy (mostly complex partial seizures, CPS), which had not been ruled out in any case and was thought to be the most likely possibility in 23 patients (77%). The symptoms often suggested more than one diagnosis. Other possibilities mentioned in the differential diagnosis, but thought to be less likely, included; in 15 patients (50%), some form of syncope (including possible cardiac arrhythmias in 5); in 13 patients (42%), a possible non-epileptic cause (e.g. anxiety or panic attacks,

hyperventilation syndrome) or depressive symptoms (in three, 10%), atypical migraine in two, and in three, possible hypoglycaemia (10%). These alternative diagnoses had been excluded as far as possible by appropriate tests (e.g. ECG monitoring, fasting glucose or psychiatric examinations). In five patients a trial of AED prior to monitoring was inconclusive. No undiagnosed patient was on AED during monitoring or psychological testing.

Epilepsy control group ($n = 27$)

A group of 118 patients with partially controlled epilepsy was randomly selected from the same routine neurology clinics as the undiagnosed patients. Thirty-two cases were matched for age and sex with the other two groups. These patients were diagnosed and confirmed independently by two neurologists on clinical grounds, with or without additional routine EEG evidence. Although partially controlled on AED, they were continuing to have seizures.

Twenty-seven of the 32 completed all the psychological tests. There were 19 females and eight males with a mean age of 37.2 years. The duration of the epilepsy averaged 12 years (6 months - 61 years). The epilepsy was mainly idiopathic with or without a past history of febrile seizures (25/27). In one case the seizures were considered secondary to trauma and in another to meningitis. The seizure type was CPS alone in 10 patients (37%), CPS with a history of past or continuing tonic clonic seizures in 12 patients (44%), and tonic clonic seizures alone, in five patients (19%).

Healthy control subjects ($n = 31$)

Volunteers who were either friends or relatives of hospital staff or husbands or wives of patients, with no history of episodic disturbances of consciousness, were matched approximately for age, sex and educational characteristics with the undiagnosed cases. There were 20 females and 11 males with a mean age of 37.3 years.

Psychological tests

All subjects and patients had the following tests: the Eysenck Personality Questionnaire (EPQ), Beck Depression Inventory (BDI), Zung Anxiety Scale and a shortened form of the Minnesota Multiphasic Personality Inventory (MMPI) which utilised the hypochondriasis, hysteria and depression scales. These tests were selected as they are well-known tests in general clinical use for detecting psychological disturbance and because they have been reported to be abnormal in previous studies of patients with non-epileptic attacks ("pseudoseizures") (Wilkus *et al.*, 1984).

The psychological testing, which took between 1 and 2 h, was supervised by a neurologist (DB) who had no knowledge of the diagnostic classification of subjects. The testing was performed after AEEG/ECG monitoring, but before the results were known to the patients.

Ambulatory monitoring technique

All subjects were monitored as out-patients using four channel cassette recorders (Oxford Medilog 4-24) and the same technique that has been described in detail elsewhere (Blumhardt and Oozeer, 1983; Blumhardt, 1986). One channel was used for ECG (modified lead II), one for time/event identification and two channels for EEG (T3-P3, T4-P4). If symptomatic attacks were infrequent (less than once weekly) monitoring was carried out for 24 h. Where symptoms occurred at least weekly, recordings were timed and continued as long as possible in order to increase the possibility of capturing an attack. Recordings were first analysed by a neurologist "blinded" to the clinical classification of the subject. Re-analysis of the ictal recordings carried out by a second "unblinded" observer, gave identical results.

Statistical analysis

The distribution of the data showed no significant deviations from normality on the Shapiro-Wilk test. To compare means we used an unpaired two-tailed Student's t-test with 95% confidence limits unless there were significant differences in the variance between groups (Fisher's variance ratio) when the non-parametric Mann-Whitney U-test (two-tailed) with correction for ties was used. To avoid possible effects of chance, the significance level was set at $p < 0.01$.

RESULTS

Ambulatory monitoring

In the undiagnosed patients, monitoring was carried out for an average of 50 h per patient (range 24-312 h), during which a total of 82 symptomatic events were reported by 17 patients; 14 remained asymptomatic. The recorded events were considered "typical" of the symptoms under investigation in 14 of the 17 patients. Eight of the 14 patients thought that events during the monitoring were "less severe versions" of their usual attacks and four described apparently unrelated symptoms which differed from their initial presenting complaints.

There were no diagnostic cerebral or cardiac dysrhythmias at the time of the recorded symptoms, although the AEEG traces were often partially obscured by muscle and movement artefacts. Three patients had mild gradual accelerations of heart rate at the time of their symptoms which were not considered significant. The ictal recording in one subject suggested features of an otherwise unsuspected "pseudoseizure" (intermittent bursts of muscle and movement artefact with a gradually accelerating sinus tachycardia).

In the interictal AEEG recordings, five patients had possible asymptomatic "abnormalities" comprising unilateral asymmetric slow wave activity ($n = 3$) or small

TABLE I. Mean scores (S.D.) for psychological tests in patients and control groups

Test	Undiagnosed patients ($n=31$)	vs.	Healthy controls ($n=31$)	vs.	Epilepsy controls ($n=27$)
MMPI					
Hysteria	62.1 (18.4)	**	48.5 (11.2)	**	55.2 (10.6)
Hypochondriasis	66.5 (15.4)	**	54.5 (10.9)	*	61.8 (14.3)
Depression	60.0 (21.8)	**	46.2 (13.7)	**	58.7 (16.4)
Zung Anxiety	38.0 (9.7)	*	32.9 (9.1)		33.9 (9.8)
Beck Depression	10.8 (9.1)		7.9 (6.3)		9.6 (7.5)
EPQ					
Neuroticism	13.9 (5.9)		10.6 (5.6)		11.9 (5.1)
Extroversion	12.6 (5.5)		13.5 (5.9)		11.3 (4.8)
Psychoticism	2.8 (2.2)		3.0 (4.1)		3.7 (4.1)
Lie	11.0 (4.4)	*	8.7 (3.9)		10.7 (3.9)

* $p<0.05$; ** $p<0.01$ refer to differences between columns. Differences between patients with epilepsy and patients with undiagnosed symptoms were not significant.

sharp waves ($n = 2$). These features were considered only equivocal and no significant epileptic abnormalities were recorded. Four of the 31 patients (13%) had asymptomatic cardiac arrhythmias of doubtful significance. There were two cases of sinus node irregularity (sinus pauses of less than one second or exaggerated sinus arrhythmia), one of first degree heart block and one case with frequent ventricular extrasystoles. None of these cases had symptoms or signs of clinical cardiac disease and the arrhythmias were considered to be unrelated to the primary complaints.

The 27 patients with epilepsy were monitored for an average of 46 h (range 24-216 h). Typical attacks were recorded in 11 cases, nine of which (82%) were associated with unequivocal EEG seizure activity. In one patient recordings of 11 typical episodes revealed no EEG or ECG abnormalities. Multiple recordings of typical attacks in one other case showed only prominent muscle and movement artefacts, with no definite EEG seizure activity.

The interictal recordings contained epileptic features (spikes or spike and wave) in eight patients and in three (neither of the ictal AEEG-negative cases) this was the sole abnormality. Six of the nine patients with recorded seizures had abnormal interictal recordings. Five of this group had asymptomatic interictal cardiac irregularities (two with paroxysmal supraventricular tachycardia and three with varying degrees of atrio-ventricular block or "sick sinus syndrome").

All healthy controls were monitored for 48 h and no abnormalities were detected.

Psychological tests

The undiagnosed patients overall had higher mean scores for most tests than either the healthy subjects or the patients with epilepsy (Table I). The mean scores for the group with epilepsy tended to be intermediate between the undiagnosed patients and the healthy controls.

When the undiagnosed patients were compared with healthy controls, there were significant differences on the MMPI scales for hypochondriasis, hysteria and depression (Table I). The elevated scores resembled the pattern known as the "conversion V" profile (Wilkus *et al.*, 1984) (higher scores for hypochondriasis and hysteria and lower, but still elevated scores for depression) (Fig. 2a). The Beck, Zung and EPQ tests all showed the same trends (higher in the undiagnosed patients), but did not reach significance against either the epilepsy patients or the healthy subjects.

When the patients with epilepsy were compared with the healthy subjects, the former had higher mean scores for all tests with significant elevations for their MMPI depression and hysteria scales (Table I).

Patients in the undiagnosed group who reported symptoms during monitoring ($n = 17$) were compared with those with no symptoms ($n = 14$). There were no significant differences between these subgroups in the estimated number of attacks, the pattterns of symptom occurrence, or their frequency prior to monitoring. Similarly, the psychological tests did not discriminate between the two. A similar analysis of the epilepsy controls according to attacks recorded or not recorded also failed to reveal any significant psychological differences.

Clinical follow-up

All 31 of the undiagnosed patients were followed up for an average of 52 months (range 14-77 months). The results are summarised in Table II. Two patients had died of malignancies, apparently unrelated to their initial attacks. In a further two cases, diagnoses had been made (drug-induced syncope complicating anti-depressive therapy and hypoglycaemia) and treated apparently successfully. These four cases who, in retrospect, all had normal psychological scores, were removed from further analysis.

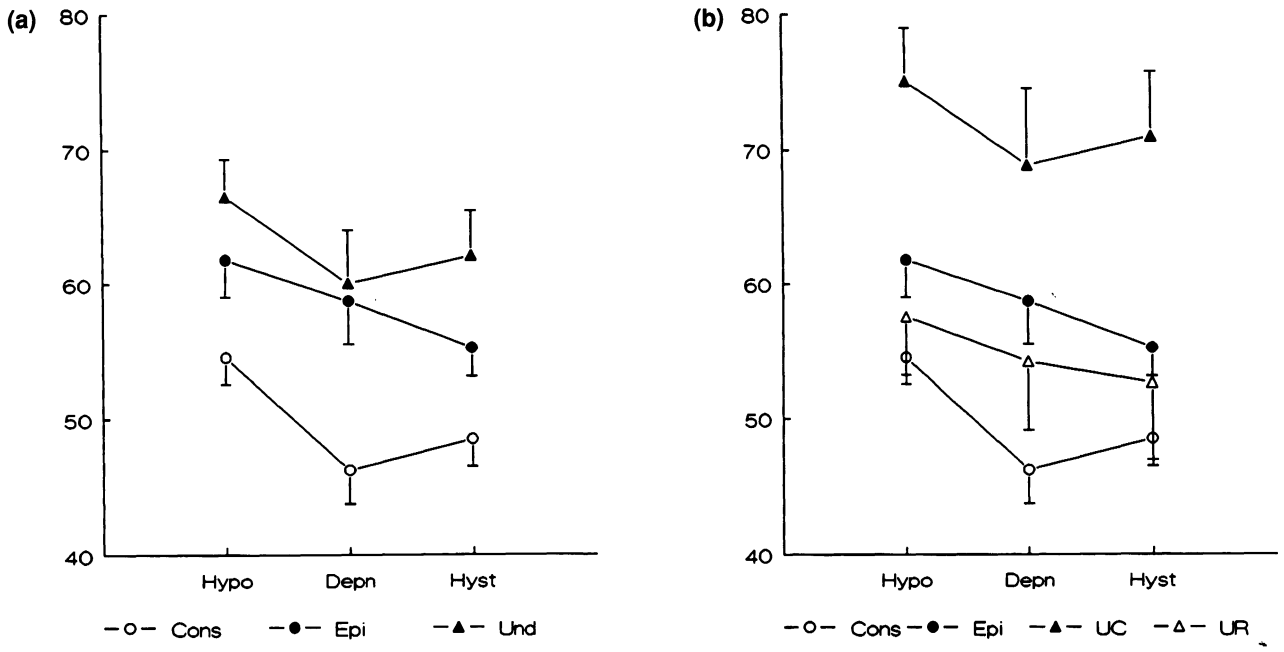

FIG. 2. (a) Group mean Minnesota Multiphasic Personality Inventory (MMPI) scale scores for hypochondriasis (hypo), depression (depn) and hysteria (hyst) in healthy controls (Cons), epilepsy controls (Epi) and patients with undiagnosed attacks (Und). Note the elevated scores in both the epilepsy controls and undiagnosed patients compared with healthy controls and the "conversion V" pattern in the undiagnosed patients. Vertical bars show standard error. (b) Group mean MMPI scale scores for undiagnosed patients by outcome of clinical follow-up. Patients whose attacks resolved spontaneously without treatment (UR) have lower scores than epilepsy controls (Epi) and do not differ significantly from healthy control subjects (Cons). Patients who have continuing unexplained attacks (UC) have markedly higher scores for hypochondriasis and hysteria and show "conversion V" pattern.

In 14 of the remaining 27 patients (52%) the symptoms which had provoked the neurological referral ceased during follow up, often soon after monitoring. Resolution of symptoms occurred spontaneously, without treatment in 11 of these 14 patients. Epilepsy was considered "possible" in the other three patients, as despite a lack of any further clinical diagnostic information, the symptoms resolved with the empirical introduction of AED.

Attacks continued in 13 cases (42%). Additional follow up information (a cerebral glioma in one and an eye witness account suggestive of CPS in the other) allowed a clinical diagnosis of probable epilepsy in two cases, both apparently partially improved by AED. Episodic symptoms were occurring less frequently in six cases (two on AED and four untreated, apart from one on an anxiolytic) and increased or unchanged in seven (four on AED and three untreated) (i.e. unexplained attacks continued without apparent modification by AED in 11 patients). Of nine patients who had been treated with AED, attacks had ceased in three, were less frequent in two and either continued unchanged or increased in four. The patients on AED treatment included four of the five cases with interictal AEEG "abnormalities". The effects of treating these four patients is not clear, as attacks continue with apparently reduced frequency in three cases and with no change in one.

Despite repeated attempts at diagnosis in the 11 patients with continuing apparently unmodified attacks, including regular outpatient review, further EEG monitoring, sleep studies and videotelemetry where appropriate, no diagnosis was established. This can be attributed mainly to the low frequency of attacks which rendered in-patient observation or video-telemetry ineffective.

All the epilepsy control patients have been regularly followed up in neurology clinics (mean follow-up 53 months, range 17-69 months) and in only one case has the diagnosis been altered. This patient, with multiple AEEG-equivocal attacks, has since been suspected on clinical grounds of having both epileptic and "non-epileptic" attacks. No healthy control subject had developed any relevant symptoms in a mean follow up of 58 months.

Analysis of psychological tests by follow-up outcome

After excluding the two cases in whom another definitive diagnosis had been reached (Fig. 1 and Table II) and those in whom a diagnosis of probable epilepsy was suggested either by complete resolution ($n = 3$) or partial improvement ($n = 2$) in symptoms on AED, or on additional circumstantial clinical evidence ($n = 2$) (Fig. 1), we carried out an analysis of the baseline psychological tests, comparing the 11 undiagnosed patients in whom attacks had

TABLE II. Results of neurological follow-up of undiagnosed patients and epilepsy controls

Group	Clinical follow-up	*n*
Undiagnosed cases AEEG negative/Eq. ($n=31$)	Asymptomatic, no AED	11 (36%)
	Asymptomatic on AED	3 (10%)
	Asymptomatic—other diag.**	2 (6%)
	Symptoms continue, no AED	7 (23%)
	Symptoms continue on AED*	6 (19%)
	Dead (neoplasia)	2 (6%)
Clinical epilepsy ($n=27$)		
No sympt. seizures ($n=16$)	Epilepsy	16
Sympt. seizures ($n=11$)		
AEEG seizure ($n=9$)	Epilepsy	9
AEEG negative/Eq. ($n=2$)	Epilepsy	1
	Epilepsy + pseudoseizures	1

* Includes two cases with probable epilepsy (see text); ** see text for diagnostic details.
Eq. = equivocal AEEG due to ictal-associated artefacts; diag. = diagnosis.

TABLE III. Mean scores (S.D.) of psychological tests according to outcome of clinical follow-up

Test	Symptoms resolved ($n=11$)		Symptoms continue ($n=11$)
MMPI			
Hysteria	52.6 (18.9)	*	71.0 (15.0)
Hypochondriasis	57.6 (14.3)	**	75.1 (12.3)
Depression	54.2 (16.8)		68.8 (17.9)
Zung Anxiety	36.2 (9.0)		40.3 (8.3)
Beck Depression	9.9 (10.0)		12.6 (9.4)
EPQ			
Neuroticism	13.8 (7.6)		13.6 (5.0)
Extroversion	12.9 (4.8)		11.9 (5.4)
Psychoticism	2.4 (2.0)		1.9 (0.7)
Lie	9.7 (4.0)		12.8 (5.5)

* $p<0.05$; ** $p<0.01$.

spontaneously resolved after monitoring with the 11 in whom undiagnosed symptoms continued at follow-up.

The patients who continued to have undiagnosed attacks had evidence of more psychological disturbance than those in whom the symptoms resolved without treatment (Table III). They had a "conversion V" profile on the MMPI (Fig. 2b) similar to that of the overall group, but with significantly higher scores (Table III). Their mean scores for hysteria differed markedly from both healthy controls ($p<0.00001$) and from patients with epilepsy ($p<0.003$) (Fig. 2b). There were similar significant differences for hypochondriasis (vs. healthy controls, $p<0.00001$ and vs. epilepsy controls, $p<0.02$). They were significantly more depressed than the healthy subjects ($p<0.001$), but not the epilepsy controls. They also had higher levels of anxiety than the patients with epilepsy ($p<0.05$). Although there were significant differences between the mean values for the subgroups defined according to the outcome of follow up, the ranges of the scores for individuals showed considerable overlap (Figs 2a, b).

The patients whose symptoms resolved spontaneously showed no significant differences from either the healthy subjects or the epilepsy controls on any test (Fig. 2b). The presence of one or more suspected behavioural or psychological factor in the symptomotology of 13 patients (e.g. anxiety, depression or hyperventilation) did not predict either the outcome of follow up, or the psychological test results.

DISCUSSION

We have studied a selected group of undiagnosed patients with non-specific symptoms of disturbed consciousness in which epilepsy, although considered a possibility, could not be confirmed by neurological assessment or investigation. As both the epilepsy controls and undiagnosed patients showed evidence of psychological abnormality, the main interest of our results depends heavily on the accuracy of our techniques to *reliably* distinguish epilepsy from non-epilepsy—a notoriously difficult area. In this study, we have attempted to use two methods of diagnostic validation, AEEG/ECG recordings and prolonged clinical follow up.

Many would regard the "gold standard" for the diagnosis of epilepsy as seizure recording by video-telemetry. Whereas such a sophisticated method is appropriate for a tertiary centre, for example, for selected difficult cases with suspected "pseudoseizures", it is clearly not appropriate for the majority of undiagnosed patients with possible epilepsy seen in routine out-patient clinics. The limitations relate to the costs and the logistics of attempting to monitor large numbers of in-patients with infrequent attacks for long periods. All attempts to use videotelemetry in the present study were unsuccessful due to the failure to capture symptomatic attacks. Even with the prolonged recordings provided by AEEG methods in similar groups of undiagnosed patients, it has proved difficult to capture attacks in the majority. Capture rates of between 14% and 33% (Graf *et al.*, 1982; Blumhardt, 1986) are likely unless patients with high attack frequencies are selected (Woods and Ives, 1977).

AEEG/ECG is a useful "first look" method which allows long periods of monitoring in the patient's usual environment. Despite the obvious limitations, the only comparative studies of seizures recorded simultaneously

by AEEG and video-telemetry have reported reasonable correlations with only a slight loss of sensitivity for *ictal* seizure activity (Ebersole and Leroy, 1983; Ebersole and Bridgers, 1985). In the rare "blinded" comparative studies of seizures recorded by both AEEG and cable telemetry, the agreement between the systems has been as high as 96% and 97% (Ebersole and Leroy, 1983; Jerrett, 1985). The relatively poor spatial resolution of AEEG, while inadequate for interictal epileptic abnormality localisation, is less of a limitation when it comes to *ictal* EEG events, as special electrode montages can improve the yield (Leroy and Ebersole, 1983). Nevertheless, the possibility of "false-negative" AEEG recordings of epileptic seizures must always be considered.

In patients with a clinically unequivocal diagnosis of a generalised or focal seizure disorder, ictal AEEG recordings have been confirmatory in 79% to 91% of recorded attacks (Ives and Woods, 1980; Oxley and Roberts, 1985; Blumhardt *et al.*, 1986). This suggests that negative or equivocal AEEG traces could be expected in between 9% and 21% of seizures (the comparable rate for the epilepsy controls in the present study was 18%). Possible explanations for the latter include coexistent non-epileptic seizures and the failure of seizure activity, particularly simple partial seizures or temporal lobe auras (Ives and Woods, 1980), to propagate to scalp electrodes. An additional difficult problem, particularly with the limited spatial resolution of AEEG montages, is the orbito-frontal seizure. However, no such diagnosis has been suspected during the prolonged clinical follow up of our AEEG-negative group.

Less information is available about "false-negative" recordings in undiagnosed patients, but a previous study suggested that a diagnosis of epilepsy will eventually be made at follow-up in approximately 8% of patients with initially negative ictal AEEG recordings (Blumhardt, 1986). Extrapolating these results to the present study, one might expect that one or two of the 31 undiagnosed patients may have epilepsy. At the time of this report, clinical evidence has suggested "probable seizures" in two cases. However, the "false-negative" AEEG rate could be as high as 5/31 (16%) if the apparent resolution of attacks after the introduction of AED in three cases is also accepted.

Although a high proportion of cases remain unexplained after AEEG, we have established a clear relationship between *positive* ictal AEEG results and diagnostic certainty; seizure activity was confirmed in nine of 11 (82%) control patients with clinically-diagnosed epilepsy and in only three of the 34 (9%) initially undiagnosed patients (odds ratio 34, 95% C.I. 5-590). This suggests that the low proportion of positive findings in undiagnosed neurological patients [an epileptic basis for unexplained symptomatic events has been demonstrated in 8%-33% of cases and cardiac arrhythmias in 6%-17% (Woods and Ives, 1977; Graf *et al.*, 1982; Blumhardt, 1986)], is due largely to the populations sampled, rather than limitations of the AEEG techniques. If there had been a significant number of "false negative" recordings, more "missed" cases of epilepsy might have been revealed by the follow up study.

A possible criticism of our study is that we have investigated patients characterised by a *symptom* (i.e. disturbed consciousness) rather than patients in firm diagnostic categories. However, we included a control group with a firm diagnosis of epilepsy partly for this reason and our clinical follow up was designed to categorise patients by *final diagnosis*. It should be clear for the reasons given above, that as for other studies of similar groups of patients (Blumhardt, 1986) a low prevalence of definitive diagnoses (7% in this study) is to be expected in a population that has been neurologically screened. The reason for testing the hypothesis that psychological factors could play an important role in such patients was precisely *because* previous studies had shown such a low incidence of epilepsy in apparently similar groups. Even if the findings of an *apparent* abolition or reduction of symptoms after AED are accepted as reasonable evidence of "probable epilepsy" (17%), neurological investigations have failed to provide a diagnosis in the majority. After more than four years of follow up, the major outcome categories are a group whose unexplained attacks disappeared without treatment (36%) and a group whose undiagnosed attacks continued with or without treatment (36%). Obviously, further diagnostic information is unlikely to come to light in patients whose symptoms rapidly resolve after negative tests, particularly as such patients often fail to reattend clinic. Similarly, when attacks become infrequent, expensive in-patient video-telemetry studies are both difficult to justify and often unsuccessful.

The results of the present study suggest that many patients attending neurology clinics with non-specific episodic disturbances of consciousness, will demonstrate a high degree of disturbance on a variety of psychological tests when compared with healthy controls. Against our predictions, the patients in whom follow up revealed a rapid resolution of symptomatic attacks after monitoring were, as a group, psychologically indistinguishable from both healthy subjects and from patients with epilepsy. The abnormal profile shown by the group overall (Fig. 2a) was largely due to the subgroup of patients who continue to have unexplained symptoms (Fig. 2b). The psychological abnormalities we found in the latter group are almost identical to those previously reported in patients with video-telemetry confirmed pseudoseizures (Wilkus *et al.*, 1984), although this diagnosis had not been a diagnostic consideration for any of our cases when they first attended the neurology clinics, or even during follow up.

The failure to suspect a non-epileptic basis for the

attacks in our patients may be related to the lack of a motor component in most cases. Blinded studies of neurologists attempting to distinguish epileptic from non-epileptic seizures on video recordings have shown a correlation with the presence of motor activity. An accuracy of about 90% has been reported in attacks with motor activity, but for epileptic seizures or pseudoseizures without motor activity, the comparable figures were 67% and 59%, respectively (King *et al.*, 1982). The prevalence of non-epileptic episodes which stimulate partial seizures is uncertain. In a study from a special epilepsy unit, only one of 37 (3%) pseudoseizures was thought to resemble CPS (Luther *et al.*, 1982). By contrast, Riley (1979) considered "CPS-like" non-epileptic events to be more common than attacks resembling tonic-clonic seizures and noted their frequent omission from neuropsychological studies. Gulick and colleagues (1982) found that 30% of patients with pseudoseizures have episodes of decreased responsiveness or complex behaviour resembling automatisms, while 11% seemed to have episodic impaired responsiveness with no motor or automatic behaviour. They concluded there was a broad spectrum of stereotyped clinical phenomena in patients with pseudoseizures which may superficially simulate any of the major types of epileptic seizures. The neurologists in the present study were understandably concerned about the possibility of missing partial seizures and seemed reluctant to consider the possibility of "CPS-like" non-epileptic attacks.

Previously reports of psychological testing have been mainly limited to patients with grand mal-like pseudoseizures and conclusions have varied. A history of psychiatric or affective disorder, "morbid anxiety" and abnormalities on the General Health Questionnaire, were reported to be more prevalent in these patients than in matched patients with epilepsy (Roy, 1979). Evidence of "borderline personality organisation" and abnormal psychological profiles ("conversion V") have been described using the MMPI (Stewart *et al.*, 1982). Some investigations have shown a higher prevalence of hysteria compared with general medical populations (Finlayson and Lucas, 1979) whereas others have been unable to demonstrate any evidence of abnormal personality, conversion reaction or psychiatric manifestations (Liske and Forster, 1964).

From our study, the "conversion V" phenomenon is clearly not limited to patients with attacks mimicking generalised seizures, but would appear to be a finding associated with a broad spectrum of non-epileptic symptomotology. While we believe that the attacks in these patients are an expression of their psychological disturbances, we cannot exclude the possibility that other unidentified factors might account for both the symptoms *and* the abnormal personality profiles. Furthermore, although we cannot rule out the possibility that other diagnoses may eventually come to light in some of the patients whose symptoms resolved spontaneously, we may conclude from the current data that patients with non-epileptic symptoms who have normal psychological profiles are reassured by their negative investigations, while those with abnormal profiles are at risk of continuing unresolved symptoms.

We found significant psychological abnormalities in our epilepsy control group. Abnormalities of the MMPI, particularly depression and personality disorders have been widely reported in patients with epilepsy. In some series depression is the most common psychiatric diagnosis associated with epilepsy, occurring in up to 31%, while personality disorders may be present in as many as 20% (Betts, 1981). Our epilepsy control group being hospital-based would be clearly subject to the bias common to any series of patients with chronic illness and likely to over-represent those with psychological problems (Pond *et al.*, 1960). This data clearly complicates clinical applications in this area. (For details of the psychological abnormalities associated with epilepsy, which are beyond the scope of the present study see the review by Betts, 1981).

Could these psychological tests have any clinical utility? Although Wilkus and colleagues (1984) suggested that the MMPI could help to distinguish epilepsy from non-epilepsy, other investigators (Vanderzant *et al.*, 1986) have been unable to confirm this. Similarly, we found a considerable overlap in the scores in our patient groups. Nevertheless, the use of the two most abnormal MMPI parameters allows some potentially useful separation of patients with continuing undiagnosed and presumed non-epileptic attacks from those with epilepsy (Fig. 3a). Using an arbitrary two S.D. limit, 50% of the undiagnosed group were identified at the expense of 16% of the epilepsy controls. The same parameter allows some prediction of outcome in the undiagnosed patients (Fig. 3b). Two S.D. limits for both scores would accurately predict 50% of those who continue to have unexplained attacks, at the expense of 18% whose symptoms spontaneously resolve. Such findings could be used to reduce the need for repeated tests unless there were other indications for re-investigation. While further exploration of psychological tests in larger trial samples could improve discrimination, the high prevalence of personality disorders among patients with epilepsy is likely to prevent a more accurate definition.

In conclusion, there is a significant minority of patients with episodes of disturbed consciousness who prove difficult to diagnose. They may undergo repeated consultations, hospital admissions and lengthy and expensive investigations including video-telemetry, cardiological and endocrinological studies, often to no avail. On the other hand, episodic abnormal behaviour patterns may be

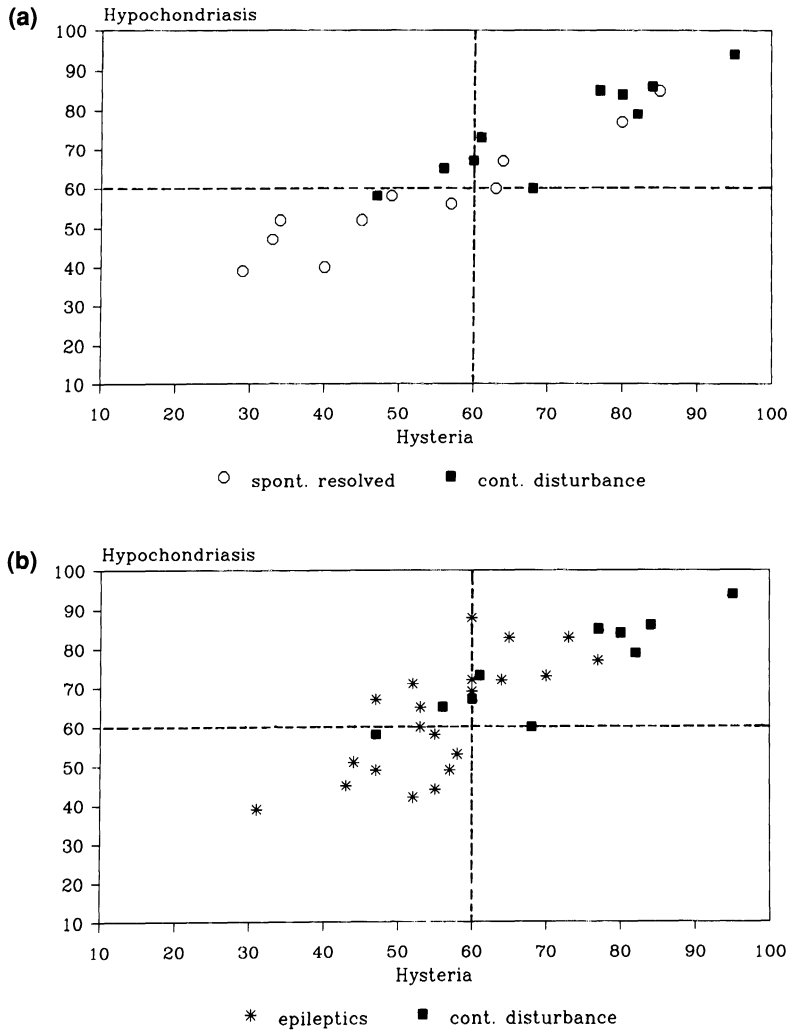

FIG. 3. (a) Plot of individual scale scores (MMPI) for hypochondriasis and hysteria in undiagnosed patients whose attacks spontaneously (spont.) resolved and in patients with continuing (cont.) unexplained attacks at follow-up. NB in both Figures some patients had identical scores. Dashed lines show 1 S.D. limits. (b) Individual scale scores (MMPI) for hypochondriasis and hysteria in patients with epilepsy and patients with unexplained attacks continuing (cont.) at follow-up.

mistaken for partial epilepsy in some patients. Failure to obtain a clear history or eye witness account of motor activity or other key features characteristic of seizures, is likely to produce diagnostic confusion. A normal psychological profile in a patient with non-specific symptoms and negative out-patient investigations, could be helpful in deciding whether to proceed to more intensive and repeated studies, particularly if symptoms continue and remain undiagnosed. On the other hand, a highly abnormal personality profile associated with continuing unexplained symptoms and negative initial investigations, including ambulatory monitoring, suggests that psychological or psychiatric investigations and therapy might be a more rewarding (and economical) tactical decision.

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