PAPERS AND ORIGINALS

Sleep Epilepsy: Its Pattern and Prognosis

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Summary

In a series of 645 patients with epilepsy only 38 had attacks exclusively during sleep. A further 111 had attacks while waking and sleeping. The total number of patients whose epilepsy started with sleep attacks and who later developed attacks when waking increased with each successive year. The prognosis of sleep epilepsy is important in relation to the granting of driving licences.

Introduction

The recent revision of the regulations concerning driving and epilepsy (*Statutory Instrument*, 1971) allows people with epilepsy to drive in certain circumstances.

2. . . an applicant for a licence suffering from epilepsy shall satisfy the conditions that—

- (a) he shall have been free from any epileptic attack whilst awake for at least three years from the date the licence is to have effect.
- (b) in the case of an applicant who has had such attacks whilst asleep during that period, he shall have been subject to such attacks whilst asleep but not whilst awake since before the beginning of that period.
- (c) the driving of a vehicle by him in pursuance of the licence is not likely to be a source of danger to the public.

The regulations assume that a person who has experienced only sleep seizures for three years is unlikely to develop waking attacks. The difficulty in applying the regulations is increased by the fact that many sleep seizures go unrecognized or unreported. Unfortunately there is no definite evidence about the prognosis of sleep seizures nor is there any proof that they are affected by medication though this has been suggested (Janz 1962; Gastaut and Broughton, 1972). We investigated patients with sleep epilepsy to determine clinical characteristics and prognosis.

Patients and Methods

A six-year retrospective survey was made of all the National Health Service patients in the Westminster Hospital Group who had been diagnosed as having epilepsy and who had had an E.E.G. Everyone who had had one or more seizures was included. The features considered to diagnose sleep epilepsy included: a witnessed tonic or clonic attack, either focal or generalized; adult nocturnal enuresis, which was sporadic and without known precipitant; waking with a bitten tongue; and waking with a disordered bed or postictal phenomena, such as a characteristic headache, in a patient known to have prior or night seizures. One patient was witnessed to have grimacing with repetitive speech while asleep, the usual manifestation of his waking temporal lobe attacks.

The patients were divided into one of four categories; (a) those who had attacks when awake or drowsy but never when asleep, (b) those who had attacks mostly when awake or drowsy and some when asleep, (c) those who had attacks mainly when asleep and some when awake or drowsy, and (d) those who had attacks only when asleep. "Waking" was used to describe the state of full consciousness. "Drowsy" was used to describe the transitional state between full consciousness and full sleep.

The pattern on the E.E.G. was classified as being normal, or showing non-specific abnormalities without spikes or sharp waves, or showing focal or other localized abnormalities with or without spikes and sharp waves, or showing generalized paroxysmal spikes, sharp wave discharges, or both. If a series of records had been taken the E.E.G. was classified by the most abnormal or paroxysmal tracing. The tracings were usually made when patients were awake but if E.E.G.s had been performed when they were asleep these were also considered.

Results

Out of 5,199 patients who had had electroencephalography in the Westminster Hospital Group during the period of the survey 952 were thought to have had epilepsy. The notes of 792 of these were available for study and contained satisfactory clinical information. Out of these 792 patients there was insufficient evidence to justify a definite diagnosis of epilepsy in 108. A further 39 had only petit mal absences or

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akinetic seizures, which occur only when awake. This left 645 patients with one or more motor seizures.

A total of 38 of our patients had only sleep epilepsy without any attacks while awake or drowsy. Only one patient with sleeping attacks only had them during the day time; this was a 10-year-old child. All the other patients' attacks occurred in nocturnal sleep. There was no difference between the sex ratio or age at onset between the groups with waking, sleeping, or both types of seizures (table I). There seemed to be a lower incidence of associated petit mal triad and temporal lobe attacks in patients with entirely sleep epilepsy than in those with some or entirely waking attacks. The E.E.G. findings in the patients in the various groups are summarized in table II. Though 48 children had febrile convulsions, mainly with normal E.E.G.s, the distribution of attacks was comparable with the other groups.

TABLE I—Pattern of Attacks in 645 Patients with Motor Epilepsy

	No. of Patients	Mean Age (+ S.D.) at Onset of Attacks	Sex Ratio (M:F)	No. with Associated Psycho-motor Epilepsy	No. with Associated Petit Mal
All waking	496	19 ± 22	242:254	30	35
Some sleeping	77	17 ± 20	44:33	3	6
Mostly sleeping	34	20 ± 17	19:15	4	1
All sleeping	38	22 ± 20	21:17	1	1

TABLE II—E.E.G. Findings in 645 Patients with Motor Seizures according to Pattern of Attacks

		Pattern of Attacks			
		All Waking	Some Sleeping	Mostly Sleeping	All Sleeping
Normal (including medication activity)	..	91	19	7	13
Non-specific abnormalities	..	83	10	2	8
Local and focal abnormalities	..	128	24	13	10
Generalized paroxysmal discharges	..	194	24	12	7

The notes of all those who had had only sleep attacks during the first six months of their epilepsy were considered in further detail. Patients who had had daytime attacks during childhood (usually febrile convulsions) but whose attacks had then ceased and who had later developed nocturnal epilepsy were also considered (table III). Records of 76 such patients provided sufficient detail for the chronological pattern of their epilepsy to be recorded accurately.

TABLE III—Chronological Pattern of Epilepsy in 76 Patients with Sleep Epilepsy

Year of Follow-up	No. Followed till End of Year	No. in whom Waking Epilepsy Began during Year	No. in whom Sleep Epilepsy Ceased during Year who never had Waking Epilepsy	No. in whom Sleep Epilepsy Continued after End of Year who never had Waking Epilepsy	No. in whom Sleep Epilepsy Continued, Waking Epilepsy having Begun in Previous Years
1	76	4	6	66	0
2	61	9	8	43	1
3	44	3	1	34	6
4	39	2	3	26	8
5	33	1	0	23	9
6	27	1	0	19	7
7	22	1	1	16	4
8	19	0	0	15	4
9	17	1	0	12	4
10	16	0	1	10	5
11	13	1	0	8	4
12 and 13	13	0	2	6	5
14 and 15	9	0	1	6	4
Total	—	23	23	—	—

One year after an initial night attack 66 patients continued to have sleep attacks, six stopped having night attacks, and four started to experience waking attacks. In the first two years after an initial night attack 43 patients had continuing sleep attacks, 14 stopped having sleep attacks, and 13 had started waking attacks. After this the rate of ceasing epilepsy or developing day attacks lessened. By the end of three years' follow-up 34 patients had continuing sleep attacks, 15 had stopped having sleep attacks, and 16 had started waking attacks (cumulative totals). Each year some patients changed the pattern of their attacks. After 10 years' sleep epilepsy some patients continued to suffer sleep attacks, three eventually stopped having epilepsy at all without ever experiencing a waking attack, and one finally developed waking attacks.

Of the 76 patients followed from one to 42 years, 23 stopped having epilepsy and 23 developed waking attacks.

Discussion

For the past quarter of a century there has been a close interest in epilepsy and sleep E.E.G.s (Gibbs and Gibbs, 1946; Dement and Kleitman, 1957; Hess, 1964; Gastaut and Broughton, 1964). From these studies has come a deeper understanding of the phenomenon of sleep, which is now known to be organized into various stages (Hess, 1964). The drowsy stage is characterized by the persistence of alpha rhythm (8-13 Hz) which gives place to progressively deepening sleep with beta (> 13 Hz) and theta (4-7 Hz) activity, transient high-voltage K slow waves, and, finally, in stage 4, replacement of all activity by delta slow waves (< 4 Hz).

The pattern of a normal night's sleep is to sink initially into stage 4 sleep and then through the rest of the night to rise and fall through progressively lighter stages until finally awakening. Superimposed on this pattern of night sleep are the periods of dreaming which are associated with so-called rapid eye movements (R.E.M.) sleep, these taking up 20% of the total sleep time of adults (Hess, 1964). Daytime sleep is not associated with R.E.M. (Davidson, 1973).

Sleep will bring out abnormalities in patients' E.E.G.s not apparent when awake (Gibbs and Gibbs, 1946; White *et al.*, 1962). Grand mal seizures tend to occur at the end of slow wave sleep whereas focal seizures tend to occur in R.E.M. sleep (Passouant, 1967; Delange *et al.*, 1967; Frank, 1970). Though sleep will often show activation of the E.E.G. with discharges clinical epilepsy is much more common by day than by night.

Various attempts have been made to classify the pattern of epileptic seizures by the time at which they occurred in the nyctohemeral cycle (Hopkins, 1933; Janz, 1962; Kaitor, 1962) (table IV). Previous studies are not strictly comparable with our series principally because the definition of groups was merely by the predominant distribution of attacks. A more rigid system was necessary to find the behaviour of patients with sleep seizures.

TABLE IV—Patterns of Epilepsy in Other Studies

Series	No. of Patients	Percentage Distribution of Epileptic Attacks		
		Awake	Diffuse	Sleep
Hopkins (1933)	336	51	30	19
Janz (1962)	2,110	34	45	21
Kaitor (1962)	300	26	57	17
Present series	645	77	17	6

Further points of difference are illustrated by comparison with the largest of the previous series, which is also the best documented. Janz (1962) in his study of 2,110 patients included only those who had had five or more attacks and had

been followed up for two or more years in the same neurological clinic. To elucidate prognosis we included all those who had had one or more motor seizures. They had been followed up in several clinics within the hospital group, including one at a children's hospital, and many of them had been inpatients.

The age of onset in idiopathic daytime epilepsy is nearly always between 10 and 30 years. Idiopathic nocturnal epilepsy is said to begin at any age (Janz 1962). Our patients' attacks were not subdivided into symptomatic or idiopathic but the mean age of onset and its standard deviation were similar in all our groups. In waking epilepsy 10% of patients have symptomatic attacks and in night epilepsy 25%, but in diffuse day and night attacks most patients (53%) have symptomatic seizures (Christian 1960). It was therefore somewhat surprising that our sleep-seizures group did not have an older age of onset. This could be explained partially by the inclusion of many children in our series.

Gastaut and Broughton (1964) tried to show an association between all episodic night phenomena—for example, seizures, enuresis in children, nightmares, night terrors, and hypnagogic myoclonus—but this was speculative and probably unjustifiable (Poussaint, 1967). We considered only those patients with definite major seizures. Temporal lobe seizures at night may easily be missed both clinically and electrically. In fact, there was only one patient who had a typical temporal lobe seizure while asleep.

Janz (1962) claimed that the waking E.E.G. is more likely to appear normal in patients with sleep epilepsy than in those with waking epilepsy, but we could not confirm this. Nine of our 38 "sleep only" epileptic patients had sleep E.E.G.s. In one an abnormality became apparent, in another the E.E.G. became more normal, and the remainder of the tracings were essentially unchanged. There does not seem to be any distinct difference between patients with sleep or waking epilepsy. Though the pattern initially established for seizures tends to persist many who began with only day attacks later developed some sleep attacks and a very few changed entirely to sleep attacks. In patients with sleeping attacks the sleep epilepsy sometimes became diffuse in distribution, with day and night attacks, but never changed to entirely waking seizures. Initially-diffuse epileptic seizures are likely to remain in this category. In sleep epilepsy attacks tend to cluster in the early phase of sinking into deep sleep and also in the early morning. It has been suggested that patients with nocturnal epilepsy pass rapidly into slow wave sleep and are more lightly asleep in the early morning than normal subjects, but this is uncertain (Tinant, 1956; Ross *et al.* 1966; Bordas-Ferrer *et al.*, 1967; Delange *et al.*, 1967; Popoviciu, 1971).

Hypnotic and anticonvulsant drugs interfere with sleep rhythms depleting R.E.M. phases, inducing rapid transition into the initial slow wave sleep, and leaving subjects comparatively wakeful in the early morning (Pompeiano, 1969; Bergonzi *et al.*, 1970). In view of this we should be cautious before using medication to suppress sleep seizures. "Anticonvulsant" agents may possibly make attacks worse by ad-

versely altering sleep rhythms. It has been claimed, without supportive data, that barbiturates do not help night seizures (Janz, 1962; Gastaut and Broughton, 1972) whereas phenytoin does.

We can reasonably regard sleep seizures as relatively benign, with the important reservation that they tend to be symptomatic rather more often than daytime seizures. Because the first two years is the commonest period in which to develop waking epilepsy or to cease nocturnal epilepsy a prognosis is less reliable during this period. This was only relative, however, and many very longstanding patterns altered. In view of the difficulty in forecasting the prognosis for individuals with epilepsy and the lack of evidence that epileptic patients who are legally permitted to drive have an increased incidence of road traffic accidents, it might be reasonable to allow patients to drive private vehicles until their first waking seizure. If this is felt to be too permissive then the period before allowing driving could reasonably safely be reduced from the present three years.

The main criteria for using drug-therapy are suppression of associated waking attacks, prevention of postictal "hang-over" phenomena, and prevention of frequent seizures which are a serious inconvenience to patients or spouses. One or a few sleep attacks do not themselves justify therapy. Until a proper trial is published the physician must be alive to the possibility of worsening the patient's seizures with his medication (Gordon, 1973).

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