A CASE OF NARCOLEPSY WITH ONEIRIC MANIFESTATIONS.

By DIOGO FURTADO,

Professor of Neurology and Psychiatry of the Faculty of Medicine, Lisbon; Honorary Member of the Royal Society of Medicine; and

F. E. PULIDO VALENTE,

House Physician in the State Hospitals, Lisbon.

[Received December 12, 1943.]

THE observation of cases of narcolepsy does not to-day constitute a rarity worthy of notice. There are references in the literature to some hundreds of these cases, and we ourselves possess several observations which do not differ from the type described in monographs and text-books. However, in recent months there has come to our notice a case which presents rather peculiar characteristics. The truly remarkable amount of detail in the clinical picture, the rapid evolution of the disease, its combination with a syndrome of very marked oneiric manifestations at night, make the case in question worthy of note.

Further, it was possible to analyse the course the of paroxysmal phenomena by means of cinematography, and we even made an attempt to study the action of drugs whose effect has recently been discussed with regard to the affection.

All these facts give us occasion to make a concise revision of the question of the narcolepsies and of their relations with the problem of sleep. The designation "narcolepsy" was originally given by Gelineau (1880), and was attributed by him, in his own words, to "a rare neurosis . . . characterized by an imperative desire to sleep, sudden but of short duration, repeating itself at intervals." Earlier cases, as those of Willis ("pathological sleep," 1677), of Fournier ("pernicious sleep," 1813), of Bright (1813), give us no guarantee that the disturbance of sleep which they presented really belonged to the condition with which we are dealing.

There has been much discussion about this new morbid state, ever since the simple description by the French author. This discussion has principally been concerned with—

(*a*) Its classification either as a separate entity, or merely resulting from the conjunction of diverse causes, many already known.

(*b*) The nomenclature attributed to the syndrome itself, or to the phenomena which constitute it.

(*c*) And finally its relationship to epilepsy on the one hand and natural sleep on the other.

The number of cases of narcolepsy has grown considerably in the last 20 years, and this increase appears to be not unrelated with the spread of epidemic encephalitis following the last war. As in the case of epilepsy, there appeared a series of causes which favoured the evolution of the morbid complex of narcolepsy.

We shall have occasion later on to study these causes in greater detail. But beside this undoubtedly large group of narcoleptic syndromes of known etiology, there remains another even greater group in which the whole illness consists of the clinical complex of narcolepsy without any discoverable cause or characteristic anatomical picture. It is principally to these syndromes, which we may call essential narcolepsy, by analogy with epilepsy, that the following clinical summary refers. Contrary to what Gelineau described, it is known to-day that the picture of narcolepsy is not exclusively made up of sleepiness. Since Loewenfeld (1902) and later Henneberg (1915) there has been added to it another type of crisis, alternating with the others, and called by the latter author cataplectic crisis or cataplexy. Thus narcoleptic and cataplectic crises constitute the nucleus of the syndrome, to which other manifestations may be added. It should be noted, however, that Gelineau, besides referring to the sleep crisis, also spoke of the patients' falls or

astasias, a phenomenon probably corresponding to the new type of crisis described by Henneberg.

The narcoleptic attack, or attack of sleep, begins abruptly. A certain number of causes may favour its onset. Perhaps the most frequent is the fact of the patient sitting, or working sitting down, at a monotonous occupation. Besides this, other circumstances which normally favour sleepiness, such as " after meals," a warm atmosphere, after coitus, frequently provoke the advent of a crisis. At other times there are causes whose influence appears paradoxical: conversation, riding, driving a car, the beginning of coitus, professional activity, the emotional state produced by bombing, etc. A certain number of patients fall to the ground at the onset of the crisis. In one soldier whom we had occasion to observe recently, these falls caused various traumatic lesions. In some patients the attack passes with the patient sleeping standing up; the sleep is then similar to that described by Rosenthal in exhausted soldiers who continue marching (*corticalen Übermüdungschlaf*), the consciousness alone being asleep while the muscular tone is maintained active and equilibrating.

The majority of patients, however, have time to sit or lie down, and thus find a position comfortable for sleep. Sometimes the sleep is heralded by various phenomena—repeated yawning, feeling of acute fatigue, paraesthesiae. At other times there is no prodromal sign before the first manifestations of sleep.

The sleep of the narcoleptic, in the opinion of the most experienced authors (Adie, Redlich, Murphy, etc.) and our own, does not differ from normal sleep. Wilson, however, strenuously contests this point, and the controversy aroused about his opinion leads us to analyse the characteristics of narcoleptic sleep in more detail.

The patient's face becomes slightly congested, its expression is lost and its tone diminishes. The breathing becomes slower and deeper than in the waking state; there is also a certain slowing down of the cardiac rhythm and a moderate fall of arterial tension. The pupils, which are difficult to investigate, generally appear small, dilating when the patient wakes up. In one case of Strauss' there was no reaction to light; this passed off on waking. The sleep is not generally very deep, and it is almost always possible to wake the patient. In some cases the existence of a certain amount of consciousness during the attack has been affirmed, the patients hear and are able to remember what is said to them, but do not move or answer and give the impression of being asleep (Redlich, Guleke, Fisher, Loewenfeld). Such cases are exceptional; in the majority, as we shall presently describe, the state of consciousness is that of normal sleep.

Some patients have dreams during the attacks, dreams which are no more than those which occur in their normal sleep. In yet other very rare cases, hypnagogic hallucinations have been noted.

The awakening of the patients is generally marked by reactionary movements; the patient tries to lift his head, move his arms or open his eyes, but these movements are opposed by the lack of tone and for this reason are repeated and incomplete. This phenomenon of lack of tone on waking from a crisis, described by Weir Mitchell and by Wilson, belongs to the manifestations of dissociation of the constituent elements of sleep which will concern us later on.

The crises are repeated during the day a variable number of times, from one crisis every ten minutes or every time the patient sits down to one or two per day. Their duration also varies from seconds to many hours (12 in Redlich's case, and 36 in Noak's).

The problem to be discussed here, and one of great interest in regard to the pathology of the syndrome, is that of the relation of narcoleptic to normal sleep. As we have said, the majority of authors consider the two phenomena as analogous. Kinnier Wilson, however, advocated its clear differentiation. His principal arguments are as follows: In some patients there is sleep with persistence of partial consciousness (the cases already cited); the attacks are not preceded by somnolence or the feeling of the necessity for sleep, as in normal sleep; sometimes the crises of narcolepsy are provoked by an emotion, which is never the case with sleep; its onset is generally abrupt; after a crisis the awakening is also sudden—contrary to what happens in normal sleep; lastly, Wilson maintains that there is a complete independence of narcolepsy from the nocturnal sleep of the patient, the latter being normal in narcoleptics.

Nielsen, in his recent treatise on neurology, corroborates the opinion of Wilson, considering the sleep of narcoleptics different from physiological sleep and more nearly approximating to the state of coma.

The majority of Wilson's arguments are, however, refuted, as can be deduced from our description, from the study of consciousness chiefly after the work of that author.

The precursors of sleep, just as the gradual awakening, constitute the fact of the narcoleptic crises, as in normal sleep; the cases of narcolepsy with partial persistence of consciousness, in the same way as those provoked by emotion, are marked exceptions. Only the sudden onset, the immediate and imperative necessary for sleep, distinguish the two phenomena.

Wilson's last argument, the normal nature of nocturnal sleep of narcoleptics, requires a few words.

Contrary to what the great English neurologist affirmed, to-day it may be considered that in the greater number of cases the nocturnal sleep of narcoleptics is *not* normal.

Most patients (Redlich, Notkin and Jelliffe) have disturbed sleep, with much movement, constantly turning over. In many of them somnambulism occurs, and attacks of anxiety of the nature of night-terrors. Both Rosenthal and Bonhoeffer think that there is in these cases a dissociation of the sleep mechanism, the cortical function being less paralysed than the subcortical. The phenomenon, to which we have already referred, of lack of tone after waking from the attacks, giving rise to reactionary movements, incomplete and repeated, also occur with a certain frequency, after the nocturnal sleep of narcoleptics, and have been accepted as a proof of the functional dissociation of the elements of sleep.

Some patients wake abruptly from their nocturnal sleep, while in others confusional states following sleep, or states of sleepy intoxication, have been described (Jelliffe).

From the facts given it can be deduced therefore that the nocturnal sleep of narcoleptics is not normal, and that it is impossible to observe an essential difference in these patients between the pathological sleep of the crises and spontaneous nocturnal sleep. From the clinical aspect the sleep of narcoleptic attacks is, in the main, analogous to physiological sleep, and in one or other detail in which it differs from it, it differs equally from the nocturnal sleep of the same patients, also pathologically modified in many cases.

In recent years two new arguments of an experimental nature have helped to establish this idea, already held by most clinicians, of the identical nature of sleep of narcoleptics and physiological sleep; we refer to the pharmacological action of sympatheticomimetic compounds, similar to adrenaline, and to the curve of the electroencephalogram.

The favourable effect of ephedrine, benzedrine and similar substances upon narcolepsy was first discovered by Janota and Skala, in Czechoslavakia, and by Doyle in America in 1930. As is known, the basis of these is sympathetic stimulation, identical with that of adrenaline, but further endowed with a specific action on the superior nervous centres and the psychic region (stimulant action, causing euphoria and the inhibition of fatigue), which adrenaline does not possess. During the period of administration of these drugs, the narcoleptic attacks disappear completely. Further, many of the patients improve and are even cured, which state is maintained after the treatment is stopped. The effect of such drugs, as we shall see in connection with our case, is clear and almost constant.

Of course, these substances have a strong antisomnolent action. It is well known that the administration of ephedrine and its synthetic derivatives (benzedrine, pervitin) at night retard and even prevent sleep; and that on the contrary, its administration in the morning, producing the characteristic psychic and sympathetic excitement during the day, facilitates a compensatory sleep the following night. This group of drugs, specific in producing the state of wakefulness, therefore acts equally on physiological sleep and on narcolepsy, which is an incontrovertible argument in favour of the identical nature, or close relation of these two states.

Even more important is the argument derived from electroencephalographic studies. Since the work of Davis, Roomès, Hartry and Hobbart, the electroencephalographic tracings of normal sleep are well known, and so characteristic and unmistakable are they that they can be easily recognized.

Dynes and Finley studied the findings of the electroencephalogram in cases of narcolepsy, and verified that in 17 patients, in which the disease took a primitive form, that is, it did not have a distinct etiology and was not accompanied by permanent organic symptoms, the tracings taken during the attacks were absolutely identical with those of physiological sleep, and the various electroencephalographic phases followed each other in the same manner and in the same rhythm (as the latter). In only 5 cases in which the narcolepsy was accompanied by organic neurological symptoms and was consequent on an affection of the central nervous system did the electroencephalographic tracings present anomalous appearances.

From all this analysis of narcoleptic attacks we can, therefore, deduce the conclusion that the sleep occurring in them is analogous to normal sleep, and that the basis of the disease is merely a disordered regulation or perhaps a facilitation of the normal mechanisms of sleep. This conclusion seems to us to be of great importance in the pathology of the disease.

The second type of attack which exists in narcolepsy consists of the cataplectic crises. It is the phenomenon which was described by Gélineau under the name "astasia," by Lowenfeld as *Kataplektische Starre*, by Henneberg as *Kataplektische Hemmung*, and by Redlich as *Affektiver Tonusverlust*.

These attacks are associated with narcolepsy in 72 per cent. of cases. They are characterized by loss of muscular tone provoked by emotional states. Generally, as happens in our case, laughter provokes the attacks; at other times emotions, or even the mere memory of an emotion which has previously caused an attack will bring on another (Sommer).

Some cases have spontaneous attacks of cataplexy without any exciting cause. These cases are in opposition to those already referred to in which the emotional cause provokes not only cataplexy, but also sleep attacks. There are, therefore, cases in which there exists such an intimate dependence of the emotional state on the attack that it causes narcolepsy; side by side with others in which this dependence does not exist, not even for cataplexy.

The relation of cataplexy to laughter constitutes an exaggeration, so to speak, of a physiological phenomenon; the manifestations of hypotonia, both of the voluntary and involuntary musculature which follow attacks of laughter, are well known, being expressed in various languages by phrases such as "to be helpless with laughter," "to die of laughter," etc. Crushmann and Prange stress this phenomenon, considering that the hypotonia of the disease is a usual form of reaction to emotion. The relaxation of the vesical, and even rectal sphincter is also frequently observed in such circumstances.

The description of the crises is well known. Between the emotion and the cataplexy there are sometimes certain prodromal symptoms: the patient feels throbbing in his head, and a diffused warmth, or breathlessness. At other times, immediately following on the laughter and as it grows more intense, he progressively loses tone. Generally, hypotonus of the extensors precedes that of the flexors; the head drops, the trunk becomes flexed, the arms hang down and the patient finally falls. Owing to the lack of tone his fall is very characteristic, the complete lack of attitude resembling that of a partly stuffed sawdust doll. As he does not fall immediately and the loss of tone is not simultaneous in all groups of muscles, the patient tries to balance himself by making repeated reactionary movements; their abrupt appearance, jerkiness and incompleteness have led some authors to take them for epileptic contractions, or choreic movements. In reality they are simply voluntary reactionary movements to which the special distribution of lack of tone gives an unusual appearance. Generally they are movements of lifting the head or arms, attempts to lift the trunk, movements of pronation and supination of the hands, or mimicking movements of the face.

In some acute forms of cataplexy there are incontinence of urine, paraesthesiae in the limbs and, at times, difficulty in breathing. Congestion of the face is frequent; in certain observations fever was noted during the attack.

The neurological examination has repeatedly been made during the cataplectic state, but the results are of little interest. Villaverde (quoted by Redlich), Wilson and Mankowsky note loss of tendon reflexes, but in the majority of cases only a more or less pronounced diminution is found.

The pupils react normally to light; the conjunctival reflexes may be abolished. In isolated cases the plantar responses may be extensor (Wilson). In general,

although they exist together in the same patient, the narcoleptic attacks are independent of those of cataplexy. Between them there are, however, all forms of transition and association, the pathological interest of which it is useful to stress.

Thus there exist:

(1) The typical cases (72 per cent., according to Redlich), in which the narcoleptic attacks alternate with cataplexy, though the former may be more frequent than the latter.

(2) Cases in which there are only the narcoleptic attacks; these are quite common, especially (as also happens in the following group) among the symptomatic types.

(3) Cases in which there are only cataplectic attacks (Sommer, Berliner, Hoff and Schilder, etc.).

(4) Cases in which the patients present, at different times, the two types of attacks (Symonds, Hilpert, Sperling and Wimmer, etc.).

(5) Cases in which the crises are associated, the somnolence following immediately upon the cataplexy, or vice versa.

(6) Cases in which the symptomatology make it possible to affirm that the attacks result from the association of both types of disturbance (cataplexy with serious disturbance of consciousness, sleep with marked loss of tone, which is dissociated chronologically, appearing before or after the attacks).

This series of intermediate forms allows us to establish an intimate relation between narcolepsy and cataplexy, both undoubtedly originating in one mechanism.

The rest of the symptomatology is slight, the mental symptoms alone being worthy of a more detailed reference.

Thus in some patients endocrine symptoms have been met with.

Above all there exists a marked tendency to obesity, as in Dickens's "fat boy" who used to go to sleep with the food in his mouth. A considerable number of narcoleptics present a certain degree of obesity; nevertheless, severe endocrine obesity, of the type of Frölich or other, is not met in these cases.

Posterior pituitary symptoms are otherwise rare, even in the cases following on encephalitis; patients with polyuria or thermic alterations are exceptional. The radiological picture shows in almost all cases a small sella turcica. In some observations the co-existence of simple goitre has been noticed. In one single case the narcoleptic attacks began after a thyroidectomy.

There have also been noted cases with genital dystrophy, some even with genital infantilism, but these associations are far from frequent. In women, where the disease is much more rare than in men (1 : 6 according to Wilson, 1 : 4 according to Redlich), some instances have been noted in which the narcoleptic crises coincided with the menstrual period (Fisher, Ballet). More noteworthy is its relative frequency during pregnancy—a fact which the majority of authors mention. The blood picture in many cases shows modifications which various authors have noted. These modifications consist of a lymphocytosis (from 34 per cent. to 53 per cent. according to Redlich), with some eosinophilia (about 7–10 per cent.). Wilson tends to attribute these modifications to the thymo-lymphatic state, frequently present in these patients.

Lumbar puncture has been performed in many patients, without any pathological findings in the fluid. Rathner alone mentions raised pressure in one case. Lhermitte saw one case cured after lumbar puncture—a phenomenon which has not been observed again.

In the analysis of the mental symptoms of narcoleptics we must distinguish between the constitutional psychical disturbances, or those co-existent with narcolepsy, and the symptomatology really due to the disease. Thus, one meets descriptions of a certain number of oligophrenics (two cases of Redlich, one of Noak, one of Boas, etc.). In another of Redlich's cases he speaks of a boy whose obsession was to discover perpetual motion. In at least two cases the patients ended by committing suicide. In the cases of Edees and Henneberg the patients were schizophrenics, and one of Redlich's suffered from periodic melancholia.

Some types following on epidemic encephalitis show signs of post-encephalitic psychopathy. In all these cases we are clearly dealing with psychoses or defective mental states which are associated with narcolepsy without being pathologically related to it. Some other symptoms, however, appear to depend on hypnotic attacks. Putting on one side the sleep phenomena, true dreams, already referred

to as being possible in narcoleptic attacks, hallucinations have also been observed during the cataplectic attacks. Thus in Fisher's patient these were visual and the patient felt that they were real hallucinations; these phenomena were accompanied by the sensation of " things already seen " identical with what is observed in epileptic attacks and in lesions of the temporal lobe.

In Brook's patient the visual hallucinations had the peculiar characteristics of hallucinations; the patient, though he was vividly aware of them, realized clearly their unreality.

It is pointed out, however, that the appearance of these oneiric manifestations in cataplexy is remarkably rare. In the same way there is no mention of hallucinatory phenomena apart from the attacks. There exist cases with somnambulism and night terrors, but not references to typical oneiric phenomena.

Recently Levin has described a permanent psychological disturbance peculiar to narcoleptics, consisting of a difficulty in thinking, which the author, theoretically following the doctrine of Pavlov, attributes to the state of cortical inhibition. As a consequence of this disturbance, certain associative mechanisms and study in particular become extremely difficult. In one case seen by him it was the learning of a new language that became impossible; the act of learning each word demanded the establishment of a new conditioned reflex, which the repeated cortical inhibitions made difficult in the extreme. We have not been able to verify the symptom described by Levin in two cases in which we sought for it.

Also among the psychical alterations related to narcolepsy are certain paroxysmal disturbances of memory. In some cases what are in effect amnesic blanks are found following on the cataplectic attacks, sometimes of an anterograde nature.

Lastly, in very rare observations, there have been noted changes in disposition and character following on a long period of the illness. Thus, in the recent case of Pfeffer, after many years of narcolepsy a state of slowing down of activity and loss of initiative leading to complete invalidism was established.

From the résumé of the psychical symptomatology of narcolepsy, it is concluded that the picture, such as the one which we will describe later in our patient, of very intense " nightmares " completely independent of sleep, is a truly exceptional phenomenon.

The differential diagnosis of the two types of attacks characteristic of narcolepsy is worth mention, especially in regard to epilepsy.

Cataplexy is differentiated from hysterical attacks, without much difficulty, the latter being characterized as a rule by the variety and artificiality of the manifestations, by the concomitant symptoms, and by the patient's personality; from catalepsy, by the positions of sustained immobility, with or without disturbance of consciousness, with the appearance of sleepy and waxy flexibility, belonging generally to hysteria or to the picture of catatonia.

The differential diagnosis from familial periodic paralysis or myoplegia is also not difficult. The crises of the latter have a slowly progressive beginning and ending, a much longer duration, and are independent of emotional factors. Besides this the development of the illness, its familial nature and certain metabolic characteristics make the diagnosis easy. But it is difficult to distinguish from the attacks which Oppenheim calls " *lachschlag*," and which are actually called " geloplegia "; here, also, one is dealing with an abrupt loss of tone brought on by laughter, in typical cases almost identical with those of cataplexy. In the majority of cases they are actual observations of narcolepsy as the subsequent course of the disease shows, with the appearance of attacks of sleep. In some cases the geloplegia appeared to be merely a form of the aura of epilepsy. It is doubtful, therefore, whether geloplegia exists as a separate entity, the cases described probably belonging in reality to the cycle of narcolepsy with pure or transitory forms of cataplexy. The differentiation between narcolepsy and the prolonged states of sleep—" sleeps of Gowers "—is also generally not difficult. As a rule the patients are neurotics with schizophrenic psychoses or organic syndromes (encephalitis or tumours) which should not be confused with the characteristics of narcolepsy.

The most complex distinction is that which refers to epilepsy. As is known, there exist in this, as in narcolepsy, paroxysmal phenomena, with loss of consciousness, recurrent and transitory, and which in exceptional cases may be provoked by emotion (emotional epilepsy). Laughter may constitute the aura for the attacks,

and sleep may be intimately related with them, appearing as their equivalent or following them. If to these facts we add the existence of transitional cases in which epilepsy and narcolepsy coexist or alternate chronologically (Worster-Drought, Goldflam, Feré, Redlich, Wilson), the tendency of many authors, Wilson amongst them, to consider both phenomena as belonging to the same morbid process can be understood.

The Jacksonian conception, which Wilson has always defended, adapted itself perfectly to the existence of these two types of disturbance, which reveal the different degrees of functional release. However, clinically there exist very marked differences between epilepsy and narcolepsy.

In the first place, in epilepsy, the importance of hereditary-constitutional factors is decisive; increasingly so as a dominant influence in the etiology of essential epilepsy. In the narcolepsies, hereditary and constitutional factors do not appear to play an important part; a study made from the exceptional cases already referred to shows that the great majority of narcoleptics do not belong to the hereditary-biological cycle of epileptics.

In the second place, in epilepsy, the long continuance of the affection frequently leads to a state of permanent psychic alteration quite characteristic; the cases of narcolepsy in which a stable psychic defect becomes established are, as we have said, very exceptional (only two or three), different in every other respect, in all those cases, from the characteristic epileptic alteration.

In the third place it has not been possible to observe movements of a convulsive type in narcoleptics. The cases indicated refer to confusion with the reactionary movements already noted.

Disturbance of consciousness is characteristic of epilepsy; in narcolepsy there is either no loss of consciousness (cataplexy), or if there is it generally takes the form of sleep—a phenomenon which by itself can never be characteristic of epilepsy.

In narcolepsy a part of the phenomena is spontaneous, but another considerable part is provoked by emotional states. In epilepsy the provocation of phenomena by emotion is rare, and the sequence of emotion and attacks is not so immediate and typical as in narcolepsy. Certain epileptic attacks are preceded by laughter as an aura, but it is Wilson himself who rightly points out that the laughter in this case is different from the laughter that provokes cataplexy; while the latter constitutes a normal spontaneous phenomenon, the former is experienced by patients as a strange, automatic happening independent of their emotional state.

The electroencephalograms also distinguish the two types of phenomenon, showing the tracing of normal sleep in narcolepsy and the characteristic series of waves of high voltage, typical of epilepsy.

Lastly, pharmacological findings: inefficacy of the anti-epileptics in narcolepsy; inaction, or even, perhaps, aggravation of the symptoms of epilepsy, by the adrenalin-like psycho-stimulants. The logical conclusion appears, however, at the moment to be that of independence of the two morbid groups, epilepsies and narcolepsies; the existence of certain points of contact, and even of rare cases in which both conditions appear in the same patient, do not in any way invalidate this conclusion.

A few words on the symptomatic types of narcolepsy. We have already said that along with the essential forms of narcolepsy, there exist other cases in which the attacks are secondary to cerebral lesions, and we have even stressed that the latter present, clinically, certain atypical aspects.

The factors noted as causal of these secondary narcolepsies are very varied. Epidemic encephalitis deserves first place. Then come cerebral tumours, cranial injuries, disseminated sclerosis, polycythaemia, cerebral arteriosclerosis. The frequency of these symptomatic forms is markedly less than that of the idiopathic.

If, for example, we look for epidemic encephalitis in Neal's recent book, where 700 cases studied by the Matheson Commission are described, only two cases of narcolepsy secondary to this illness are described, so we may assume its great rarity.

The site of these lesions is always the same, whether it be the floor of the third ventricle, or more definitely, the infundibular region.

As to the forms we call essential, the name itself indicates the lack of known etiological factors.

Homologous heredity does not play an important part. Only in some cases

(Westphal, Ballet, Newmark, Rosenthal, etc.) has a tendency to sleep been noted in the patients' forbears. Psychopathic heredity (Lowenfeld, Curschmann and Prange) has also been observed by some authors. Excluding these rare and indefinite factors, we do not know anything as regards the etiology of the affection. Whether one is dealing with a constitutional state, or the consequences of a specific infection still unknown to us, is a question which our present data do not allow us to decide.

Any discussion as regards classification, therefore, has no place. At present we are obliged to maintain the distinction between the essential forms of narcolepsy and those which are symptomatic. Whether the former be called hypnolepsy, as Singer and Purves-Stewart would like, *Einschlafsucht* as Curschmann wishes, Gélineau's or Westphall-Gélineau's syndrome as Redlich wants, or simply narcolepsy, following the majority of authors, seems to us a matter of indifference.

The last designation, though not perhaps the most correct, is that which custom has familiarized and which we shall continue to use.

Clinical Notes.

Victor S. R—, aged 14, labourer. Native of Barrocas (Tôrres Novas), Portugal. Admitted on April 2, 1943.

The present illness began in the middle of August last year with a sudden attack of sleep, which lasted for one hour. Since then he has had attacks of sleep of variable duration—from half to one hour at first, and latterly for a little longer. He says he goes to sleep just as much when lying down, walking, or during his work. Several times when hoeing wheat he has gone to sleep standing up leaning on his hoe. On another occasion he walked for over a mile (1·5 km.) along a path leading by a river and intersected by gullies, sleeping all the time, only being woken up on arriving at his destination by the people who were waiting for him.

During the narcoleptic attacks he ceases to see and hear what is going on around him. He sleeps normally and frequently dreams. His dreams are varied and are not of any special interest. He always sleeps soundly at night, however much he may have slept in the daytime. He has never had insomnia.

At the same time as these attacks started, others of quite a different nature began to present themselves. The patient describes them as sudden attacks of loss of strength, which last for some minutes and cause him to fall to the ground when they become sufficiently intense. The patient himself points out that they are always brought on by laughter, and that no other emotional state is capable of provoking an attack. While it lasts he hears and feels but does not see, and once the attack has passed off he is able to repeat more or less correctly all that went on around him.

The patient knows the attack is coming on by feeling himself overcome by great weakness. Sometimes he hears a sibilant sound like the buzzing of a bee and sees a white spot dancing in front of his eyes.

The attacks of loss of tone are frequently followed by attacks of sleep.

Since the onset of the illness he has complained of frontal headaches, which are slight and of short duration. He never had any temperature or polyuria. He has frequent epistaxis.

Past history.—Measles at five years old. He did not have—or remember having—any other illness till April of last year, four months before the onset of the present symptoms. Then he was in bed with headaches and a temperature for three days. A week later he was perfectly well again. He returned to school, and two months later was able to do his examination for Grade 2.

Family history.—Father and mother healthy; has eleven brothers and sisters, the oldest 18 years, and the youngest six months; the patient is the third in order of age. All are healthy. He knows of no epilepsy in his near relations. A cousin of the patient became insane at the age of 20 and is at present in a mental hospital. Another distant cousin of the patient once suffered from nightmares, which were repeated on successive nights and afterwards passed off spontaneously without any recognizable cause.

Examination.—Physically is well developed—his apparent age agrees with his actual age. Bright, answers quickly and correctly to the questions put to him. Shows a certain amount of emotional instability with a tendency to laughter. Unstable facial expression. At times makes movements of a choreiform nature, with his arms and head.

Examination of organs and systems—normal.

Neurological examination—normal.

Mental examination (Terman's method): Passed all tests up to his age satisfactorily. Some less correct replies must be put down to his lack of education. Among these one can mention, for example, the test of definition of abstract concepts.

Analyses.

Blood count (19.v.43): R.B.C's., 3,840,000; haemoglobin, 68 per cent.; C.I., 0·89; W.B.C's.,

9,000; neutrophils, 65·5; eosinophils, 2·0; basophils, 0·0; lymphocytes, 28·5; monocytes, 4·0; slight anisocytosis.

Bleeding time 1 min. Coagulation time 5½ min.

C.S.F. (9/4): 1·2 cells per c.mm. Cytology: A few lymphocytes. Albumin: 0·25 gm. per cent. Pandy: Negative. Glucose: 0·68 gm. per cent. Normomastic curve normal.

W.R.: Negative (blood and C.S.F.).

Basal metabolism: — 9·2 per cent.

Fasting blood sugar (8/4): 0·93 gm. per cent.

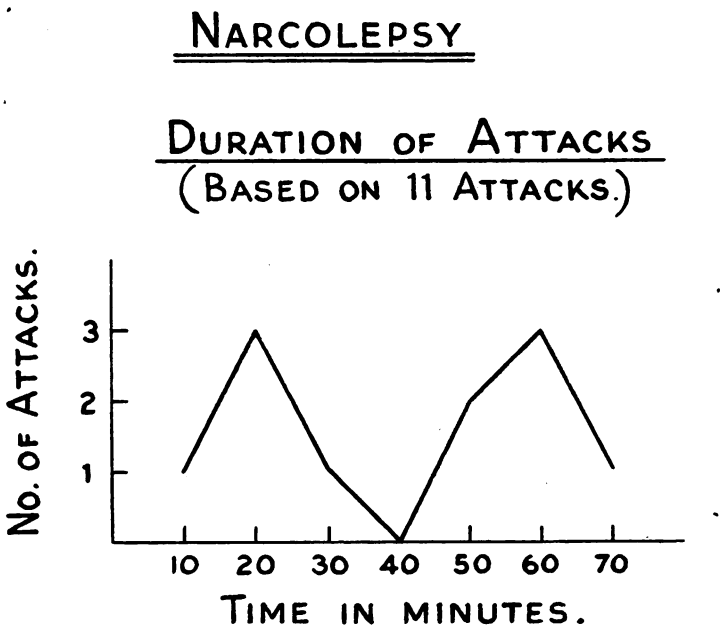
Examination of urine: Normal.

Examination of gastric juice: Normal.

We were able to verify the two types of attacks described. Their symptomatology will be described in detail later. Meanwhile a new phenomenon arose. At the beginning of May the patient presented himself with fever, caused by an acute infection, which lasted about a week, during which time the temperature sometimes reached 102·2°. The exact nature of the disease was not clear, the blood picture was normal and X-ray of the chest negative. We believe it was influenza. It was after this infectious state that the patient began to show oneiric manifestations. He appeared one morning saying that a ghost had come in the night and held him by his arms. Since that time the vision has appeared every night, taking one of three forms: a cat, a figure of a woman, and a rat. The hallucinatory phenomena are not limited to vision, there being an auditory component as well. These will be described in a special paragraph later, as also the narcoleptic and cataplectic attacks.

Narcoleptic attacks.—These attacks come without any apparent provocation. They have, according to the patient, an aura of ill-humour—he feels the onset of great boredom, something which he cannot easily explain, but which seems to be a depressive modification of the emotional state. Then, little by little he falls asleep. Sometimes at the beginning his attempts to resist the onset of sleep are obvious; he opens his eyes with difficulty, but he insists on opening them, yawns and tries to remain standing, but his resistance gradually gets less and finally he falls asleep. At other times, perhaps more often, the beginning of the narcoleptic sleep occurs suddenly.

The sleep during the attacks does not differ from normal sleep—respiratory rhythm, hypotonus of the soft palate as shown by snoring, the attitude in bed and distribution of tone are quite identical. The cardiac rhythm behaves in the same way. Just as in normal sleep, that of the narcoleptic attacks is liable to be broken by any violent stimulation, especially acoustic stimuli. The somnolent patient is able to reply to what we ask him, afterwards falling back into sleep. The waking up does not differ from that from normal sleep. The length of the attacks is very variable, lasting from a few minutes to an hour or more. Their frequency is very great. From admission the patient had some six to ten attacks daily, more severe in the afternoon than in the morning. Their average duration is expressed in the graph given below.



Cataplectic attacks.—These attacks are always conditioned by laughter. When the patient laughs sufficiently the face begins to be flushed, and then abrupt movements can be observed which at times have a choreic form and affect the head and upper extremities. The head slowly hangs down, to be afterwards raised by one of the abrupt movements referred to. The closing of the eyelids is accompanied by brisk blepharospasm. In the upper limbs the jerky movements begin at the base. Sometimes they accompany the rhythm of the laughter, at others they are independent of it. This first phase is followed by a progressive loss of tone: The head falls and the arms hang down, the body doubles up and finally falls to the ground. The average length of these attacks is 30 seconds.

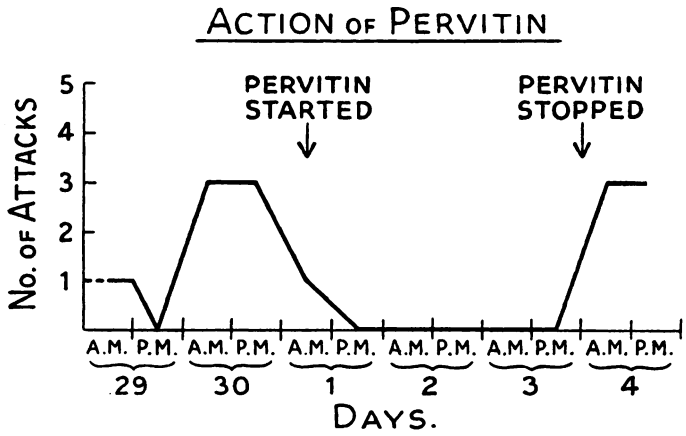
The complete loss of tone is followed after some seconds by various attempts at raising himself up; he lifts his head, tries to raise his arms and straighten his back. These reactionary movements are still abrupt and imperfectly co-ordinated. When the crisis is over the patient generally resumes his occupation; sometimes, however, the cataplectic attack is followed by prolonged sleep. During the attack the tendon reflexes remain normal, but we were able, on two occasions, to obtain extensor plantar responses.

When in cataplexy the patient does not reply to questions, but his consciousness seems to remain clear; once the crisis is over he is able to refer to everything which took place during it, and to reply to the questions which were put to him then. The loss of tone is not equal in the flexors and extensors. It is much greater in the latter: the head falls forwards, the body doubles up and the patient, as he falls, is in a position of flexion, unrolling when he reaches the ground. The movements which the patient makes, as much at the beginning of the attack as after the fall, give the impression of voluntary reaction to the loss of tone—attempts on his part to overcome the progressive paralysis. Not every attack gives the whole picture just described; some of them are limited to mere flexion of the head and trunk, with the arms hanging down and interrupted by reactionary movements antagonistic to the loss of tone. Even in these crises the redness of the patient is apparent, only disappearing at the end of the attack when its place is taken by pallor. The severity of the attacks seems to be proportional to the intensity of the laughter, and thus a frustrated attack can be turned into a complete one by tickling the patient. During the crisis, if it be mild, the patient automatically seeks a place where he can sit or lie down, doing the same thing when the attack passes if he has fallen on the ground. Immediately following this he is able to reply and converse.

Oneiric manifestations.—As has been said already, the patient complained of visions which he had had during the night and which distressed him greatly. He as frequently sees the head of a cat or rat as the figure of a woman with a kerchief on her head. These apparitions alternate, one appearing each night. Each of them comes up to the patient's bed, rarely remaining at the door of the ward. When it is the cat or the rat (the former is the most common of all) he sees them coming, jumping towards his bed. Then he hears a sound different from that usually made by these animals, a sound which he compares to that produced by goats' feet. The acoustic factor of his oneiric manifestations is not limited to this sound, however; he hears, as it were, a grunting, which he supposes is produced by the animal he sees. It even happens that the patient himself will make the sound; when he thinks that the rat is near the bed or underneath the bed-clothes, he strikes the bed with his hand and immediately hears the sound as if there were a cat or a rat there which had been frightened.

The intensity and the reality of the visual hallucinations is considerable; he sees the figures distinctly, fixes them in space, and their appearance covers up the outline of everything behind them. The details of sensory content of these visions is referred to, such as the colour of the cat's eyes and the hairs on the rat's snout, which shows how vividly the figures appear.

The oneiric phenomena are recorded perfectly by the patient; he gives a spontaneous and



detailed account of them, appearing every morning to complain of his visions of the previous night.

When the oneiric phenomena occur the patient generally has a considerable reaction of terror. He calls the night nurse, points to the place where he sees the vision, confesses his fear and begins to cry. By day, when he recounts his previous visions, he reveals a curious attitude of fear, and at the same time, of hostility towards our incredulity.

While these psycho-sensory phenomena have been experienced there has been a definite modification in the psychism of the patient. Before, he was submissive, most polite, habitually cheerful, listening respectfully to all that was said to him. Now he is difficult, showing a definite hostility to the staff and even to the doctors, replying impolitely at times. He often wants to take his own discharge, in a threatening way, saying that if it is not granted he will commit suicide. A definite change in his nature has been noticed: frequent "dysthymias" may be seen, sometimes irritation, and at others, weeping. He is suspicious, has doubts about the injections he is receiving, and looks on the other patients and even on us with suspicion.

The therapeutic action of a benzedrine substitute was tried on the patient—the hydrochloride of 1-phenyl-2-methylamino-propane, commercially known as pervitin. It shows its effect, as American authors affirm, efficiently and with safety. Its administration in doses of 6 to 9 mgm. daily, rapidly and almost completely checks the attacks. The second graph reveals its efficacy.

Our observations suggest several questions relating to the pathogenesis of narcolepsy. The whole discussion appears to us to revolve around the question of the identity of narcoleptic sleep and physiological sleep. Contrary to the opinion of Notkin and Jelliffe, who say that such a discussion is useless, owing to the frequency with which states of disturbed consciousness or coma in organic conditions are called sleep, we think that this discussion is essential for the pathology of the morbid state with which we are dealing.

Analysis of narcoleptic crises shows, as we saw, as much in the history of our case as in the considerations which preceded it, that the relation between narcoleptic sleep and physiological sleep can be affirmed with some certainty. An important part of the attacks which characterize narcolepsy consists of simple attacks of sleep; the conscious state, the loss of normal attitude, the lessening of muscular tone, the vegetative phenomena of vagal hypertonus, are identical with those which are found in physiological sleep. The possibility, which almost always exists, of waking the patients is another characteristic which relates narcoleptic to normal sleep, and separates it from states of coma.

The electro-encephalograms and pharmacological proofs finally complete this approximation.

If we accept the identity of narcoleptic sleep with the physiological phenomenon of sleep, we then have to seek what the disturbance of the hypnic mechanism consists in which constitutes narcolepsy.

We distinguish between two types of disturbance. In the first place there exists a disturbance in the rhythm of sleep; in the second, an alteration of the synergism of the phenomena which normally constitute sleep. The appearance of spontaneous or provoked attacks of sleep during the day constitute an alteration of the nocturnal rhythm of physiological sleep of man. We see no reason, contrary to what Murphy has recently written, to admit that we are dealing with a polyphasic rhythm of sleep, phylogenetically and ontogenetically early, as occurs in children and lower animals, as distinct from the monophasic rhythm of adult man. In our opinion there is no change of rhythm, since nocturnal sleep exists in narcoleptics as a general rule. What there is is an abnormal facility of the mechanisms producing sleep, a phenomenon which we consider as similar to that of a lowered threshold of stimulation.

There exists further, in narcolepsy, a second type of disturbance of the hypnic mechanism, just as important as the first. We refer to the phenomena of dissociation of the elements which constitute sleep. Earlier in this article, when dealing with the relationship between narcoleptic and cataplectic attacks we had occasion to allude to this dissociation. We consider the phenomenon of sleep as constituted by four varieties of manifestation, two of a negative nature, the dulling of consciousness and the disappearance of the erect position and of tone; and two of a positive nature, the hypertonus of the parasympathetic vegetative nervous system and the release of dreams. These four varieties of manifestation occur simultaneously in normal sleep.

Now the analysis of the clinical picture of narcolepsy shows precisely that in the greater number of paroxysms of the affection symptoms are present which

express the dissociation of the elements referred to, and that some of the types of paroxysm mentioned are exclusively made up of the isolated appearance of one of the elements normally blended in sleep. From this point of view our present case is extremely instructive. Simple attacks of sleep occur with normal falling asleep and waking; attacks of sleep in which on waking the persistence of loss of tone shows a dissociation between the course of this and that of the interruption of consciousness; crises of pure cataplexy with complete conservation of lucidity; and finally attacks of oneiric manifestations with very intense hallucinatory phenomena, independent, in their turn also, of the remaining phenomena referred to.

Between the dreams which occur in normal sleep, the so-called hypnagogic hallucinations, the pure oneiric phenomena of our patient, and even perhaps the "hallucinosis" described by Lhermitte in lesions of the tegmentum, all degrees of transition exist, constituting perhaps different forms of activity of the same functional mechanism.

The analysis of the attacks of the case referred to entirely justifies the affirmation we made, that they constitute the expression of the isolated and pathological appearance of one of the elements which constitute physiological sleep.

According to our conception, therefore, the physiopathology of narcolepsy can be summarized as a quantitative and qualitative disturbance of the mechanism of sleep.

This is tantamount to saying that the pathogenesis of narcolepsy enters into the problem of physiological sleep. The uncertainties existing even to-day as regards the mechanism of the latter are well-known problems which have their expression in a great number of theories, propounded one after another. If the cases of symptomatic narcolepsy, as those of prolonged sleep, due to inflammatory lesions or tumours of the meso-diencephalic region are in favour of the existence of a centre of wakefulness situated in the posterior part of the floor of the third ventricle, it is not less certain that the existence of the centre does not suffice, by itself, to explain either the mechanism of sleep or the pathogenesis of narcolepsy.

In sleep there exist functional phenomena of a different order and of physiological action apparently opposite, some negative, inhibitory, others positive, of release action, presupposing functions situated at different levels. Narcolepsy would then be the expression of a hyperexcitability and dissociation of these complex functional mechanisms.

Bibliography.

Adie (1926), *Brain*, **49**, 258.
Curschmann and Prange (1925), *Deut. Zeit. Nerv.*, **86**, 97.
Doyle, J. B., and Daniels, L. E. (1932), *J.A.M.A.*, February 13, 542.
Janzen and Behnsen (1940), *Arch. f. Psych.*, **111**, 178.
Lennox (1939), *Arch. Neur. Psychiat.*, **41**, 348.
Lhermitte and Tournay (1927), *Rev. Neur.*, **1**, 751.
Levin (1942), *Am. J. Psychiat.*, **98**, 5.
Murphy (1941), *ibid.*, **98**, 3.
Nielsen (1941), *Clinical Neurology*. New York.
Notkin and Jelliffe (1934), *Arch. Neur. Psychiat.*, **31**, 615.
Pfeffer (1940), *Med. Kl.*, **36**, 49.
Ranson and Magoun (1939), *Ergebn. der Physiol.*
Redlich (1931), *Zeit. f. d. ges. Neur. Psych.*, **133**, 151.
Rosenthal (1939), *Monat. f. Psych. Neur.*, **102**, 11.
Singer (1917), *Zeit. f. d. ges. Neur. Psych.*, **36**, 278.
Wenderowic (1924), *Arch. f. Psych.*, **72**, 459.
Wilson, S. A. K. (1928), *Brain*, **51**, 63.
Idem (1940), *Neurology*. London.