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Hypersomnolence and narcolepsy ; a pragmatic diagnostic neurophysiological approach

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Abstract

Out of a group of 250 consecutive patients who were examined for various disorders of sleep and waking at Ghent University Hospital within a period of 24 months, 30 patients with hypersomnolence associated with a suspected underlying neurological etiology were selected. The population consisted of 15 males and 15 females with mean age of 36 years (range : 16-60 years). Twenty-one patients had had hypersomnolence for more than 2 years. All patients underwent a single night polysomnography (PSG) and a 4-nap multiple sleep latency test (MSLT). PSG was normal in 23 patients. Sleep onset REM period (SOREMP) was defined as the occurrence of REM sleep within 15 min. after initiation of sleep. PSG demonstrated SOREMP's in only 1 patient and showed evidence of obstructive sleep apnea in 4 patients. Two patients had a low sleep efficiency. MSLT demonstrated hypersomnolence in 17 patients of whom 6 showed SOREMP. Significant hypersomnolence was defined as a mean sleep latency ≤ 5 min. 4 patients fulfilled the classical clinical and polygraphic criteria (≥ 2 SOREMP) of narcolepsy. In 8 patients the tentative diagnosis of idiopathic CNS hypersomnolence was made. 13 patients did not sleep during MSLT. These results emphasize the relative importance of MSLT. Our limited 4-nap MSLT protocol proved useful in distinguishing narcolepsy from idiopathic CNS hypersomnolence.

Key words : Hypersomnolence ; narcolepsy ; multiple sleep latency test (MSLT) ; polysomnography (PSG).

Introduction

Narcolepsy is a neurological condition related to dysfunction of the brainstem sleep-wake mechanisms that is characterized by a tetrad of 4 major clinical symptoms : 1. hypersomnolence or excessive daytime sleepiness (EDS) ; 2. cataplexy or sudden loss of muscle tone in association with emotion ; 3. sleep paralysis and 4. hypnagogic hallucinations (Broughton, 1990) . Although the disease was recognized earlier, Gélineau in 1880 was the first to fully describe the syndrome and to coin the term "narcolepsy" (Gélineau, 1880). The classical tetrad was defined by Yoss and Daly in 1957 (Yoss & Daly, 1957). Narcolepsy is not a rare disease. Prevalence in Europe is estimated to be between 1 per 1000 and 1 per 10000 (Dement *et al*., 1973 ; Shapiro & Dement, 1993). Men and women are equally affected. There have recently been several important advances in understanding the underlying pathophysiology. Narcolepsy is very strongly linked to HLA-DR2 DQw1, indicating the presence of a specific narcolepsy-susceptibility gene on chromosome 6 (Honda & Matsuki, 1990). This correlation is among the highest known for HLA-associated diseases. However, since DR2 DQw1 is present in 25% of normal Caucasian populations, a large number of false positives can be expected (Honda *et al*., 1986). Making the diagnosis of narcolepsy on historical grounds only can be problematic. A history of cataplexy is sometimes difficult to determine. Cataplectic attacks are uncommonly witnessed during consultation in ambulatory practice. Moreover, cataplexy usually presents only months to years after the appearance of hypersomnolence and tends to decrease with age (Guilleminault *et al*., 1976). At the present time, most sleep disorder centers use both nighttime (polysomnography, PSG) and daytime (multiple sleep latency test, MSLT) polygraphic recordings to confirm the clinical diagnosis of narcolepsy (Carskadon *et al*., 1986). The former investigation is mainly used to evaluate classic dyssomnias, such as the obstructive sleep apnea syndrome, periodic limb movement disorder etc.... Also in narcolepsy, PSG proves to be useful as the occurrence of SOREMP is characteristic for this disorder. The goal of performing MSLT is to document and quantify EDS. Recent studies have addressed the sensitivity and specificity of PSG and MSLT using conventional protocols (Carskadon & Dement, 1979 ; Thorpy, 1990 ; Billiard *et al*., 1993 ; Aldrich, 1990 ; The American Sleep Disorder Association, 1992 ; Chaudhary & Husain, 1993 ; Moscovitch *et al*., 1993). The purpose of this paper is to report our own diagnostic experience in patients with hypersomnolence using a simple one-night PSG and a 4-nap MSLT protocol.

Patients and methods

In a period of 24 months, 250 patients were admitted for polysomnography at the Sleep Disorders Center at the Ghent University Hospital. Out of this larger population, 30 patients were selected who presented with hypersomnolence as the main and often single complaint and consequently underwent MSLT. Patients who besides hypersomnolence presented other complaints or signs suggestive of e.g. obstructive sleep apnea such as loud snoring and marked obesity were excluded. All patients underwent a detailed interview using the Dutch version of the Sleep Questionnaire and Assessment of Wakefulness (Miles, 1982). Psychotropic drugs such as analeptics or antidepressants were progressively tapered and stopped at least 2 weeks before diagnostic evaluation.

Patients were admitted for polysomnographic examination on a given day at 4.00 PM. A set of 6 scalp EEG electrodes were placed on standard International 10-20 System electrode positions (Fpz, Fz, Cz, Oz, C3, C4) along with 2 electro-oculographical (EOG) electrodes, 2 chin electromyographical (EMG) electrodes and 2 tibial EMG electrodes (Rechtshaffen & Kales, 1968). Additional probes recorded the electrocardiogram (ECG), thoracic and abdominal respiratory excursion, oronasal air flow pressure and temperature and oxygen saturation. Snoring, body position and pulse rate were also monitored. All these parameters were recorded on a 16-channel Nihon-Kohden polygraph. Table 1a. shows the PSG recording montage. After calibration of the signals, the patients were allowed to go to sleep when feeling sleepy (usually at about 11.00 PM.). Quality of the recording was monitored throughout the night by a sleep laboratory technician. PSG recording was stopped at 6.00 am.

MSLT was performed on the morning following PSG. The same scalp-EEG electrodes positions (Fpz, Fz, Cz, Oz, C3, C4) were used. In addition 2 EOG and 2 cutaneous EMG chin electrodes were applied. Table 1b. shows the actual 7-channel MSLT montage using during all recordings. The examination room was specifically equipped with dim light and acoustic insulation. The 4-nap protocol consisted of consecutive 20 min. recording sessions at 9.00 am, 11.00 am, 1.00 PM and 3.00 PM. If patients fell asleep, they were awakened after 20 min. In between naps, the patients were requested to stay awake and to refrain from smoking and drinking coffee. After removing of the electrodes at 5.00 PM, patients could leave the sleep laboratory.

Reported results reflect a consensus between two independent observers (DP, PB) who read all PSG and MSLT recordings. Careful manual analysis and scoring of 30 sec epochs yielded standard hypnograms that complied with the American Electroencephalographical Society guidelines (Frost, 1992). The main sleep parameters that were scored included total sleep time, mean sleep latency, rapid eye movement (REM) sleep latency. "Clinically significant" hypersomnolence was defined as a mean sleep latency of ≤ 5 min. Sleep onset REM period (SOREMP) was defined as the occurrence of REM sleep within 15 min. after initiation of sleep. Because of high costs, HLA determination was only performed in some of the patients who reported cataplexy and in whom MSLT showed ≥ 2 SOREMP.

After diagnostic evaluation, patients were followed at regular intervals of 1-6 months by either one of the sleep laboratory physicians or by their referring specialists. For the purpose of this study, patients were systematically contacted by phone for assessment of their clinical status using a standard checklist.

Table 1a

PSG montage ; EEG electrode positions according to 10-20 International System

channel	PSG montage
1	L EOG - Fpz
2	R EOG - Fpz
3	–
4	Fz - Cz
5	Cz - Oz
6	C3 - A2
7	–
8	chin EMG
9	R tibial EMG
10	L tibial EMG
11	ECG
12	–
13	nasal air flow
14	thorax excursion
15	abdominal excursion
16	oxygen saturation
17	snoring
18	C4 - A1

Legend : L : left ; EOG : electrooculogram ; R : right ; ECG : electrocardiogram.

Table 1b

MSLT montage ; EEG electrode positions according to 10-20 International System

channel	montage
1	L EOG - Fpz
2	R EOG - Fpz
3	–
4	Fz - Cz
5	Cz - Oz
6	C3 - A2
7	C4 - A1
8	chin EMG

Legend : L : left ; EOG : electrooculogram ; R : right ; ECG : electrocardiogram.

Table 2

General patient characteristics

n	patient initials	sex	age	duration hyper-somnolence (yrs)	cata-plexy	other REM-sleep associated symptoms	psychotropic drug treatment	remarks	final diagnosis or identified underlying etiology of hypersomnolence
1	BL	M	26	< 6 m	–	–	–	–	IHS
2	CL	M	46	1	+	hh, sp	–	–	clin. narcolepsy
3	DBF	F	26	8	–	–	–	obesity	IHS
4	DDF	F	38	2	+	hh	–	–	typ.narcolepsy
5	DGP	M	26	< 6 m	–	–	–	obesity	chronic sleep deprivation
6	DGE	F	22	3	–	–	–	–	no hypersomn.
7	DKH	M	45	5	–	–	–	–	alcohol & nicotine abuse
8	DMM	F	40	2	–	hh	amitriptyline	–	IHS
9	DPI	F	21	5	–	hh, sp	–	–	IHS
10	DSK	F	30	< 6 m	–	sp	propranolol	headache	no hypersomn.
11	DK	M	16	3	+	hh,sp	–	–	typ. narcolepsy
12	GR	M	51	2	–	–	–	–	no hypersomn., OSA
13	HC	F	47	< 6 m	–	–	–	–	no hypersomn.
14	HF	M	17	3	–	hh	–	–	atyp. narcolepsy, OSA
15	LF	F	41	25	–	hh, sp	–	–	no hypersomn.
16	LE	M	40	16	+	–	–	–	typ. narcolepsy
17	MAS	F	32	12	–	–	cbz, dph	CPE	no hypersomn., CPE
18	MR	F	29	< 6 m	–	–	–	–	no hypersomn.
19	MES	F	22	5	–	–	amitriptyline	–	no hypersomn.
20	PMH	F	52	12	+	hh, sp	–	–	clin. narcolepsy
21	SJ	F	46	< 6 m	–	–	–	–	IHS
22	VDE	M	52	8	+	hh, sp	methylfenidate	–	clin. narcolepsy, OSA
23	VDS	M	24	7	–	–	prolintane	–	IHS
24	VGP	M	27	4	–	–	–	–	no hypersomn.
25	VHS	F	20	1	–	–	–	hyper–thyreosis	no hypersomn.
26	VLH	M	60	10	–	–	vpa, vgb	CPE	no hypersomn., OSA, CPE
27	VM	F	39	15	–	hh, sp	fluoxetine, trazodone	–	no hypersomn.
28	VE	M	39	10	–	–	–	–	atyp. narcolepsy
29	VW	M	44	4	+	hh, sp	–	–	typ. narcolepsy
30	VJ	M	46	1	–	–	–	–	IHS

Legend : M : male ; F : female ; m : months, hh : hypnagogic hallucinations ; sp : sleep paralysis ; vasc : vascular ; cbz : carbamazepine ; dph : fenytoin ; CPE : complex partial epilepsy ; vpa : valproate ; vgb : vigabatrin ; IHS : idiopathic CNS hypersomnolence ; clin. narcolepsy : diagnosis of narcolepsy based on clinical grounds only ; typ. narcolepsy : diagnosis of typical narcolepsy ; atyp. narcolepsy : diagnosis of narcolepsy in the absence of cataplexy ; no hypersomn. : absence of hypersomnolennce during MSLT, OSA : obstructive sleep apnea.

Results

General patient characteristics (Table 2)

Thirty patients, 15 males and 15 females with hypersomnolence were prospectively studied. Mean age at time of admission was 36 years (range : 16-60 years). Hypersomnolence or excessive daytime sleepiness (EDS) was the most common presenting symptom in all patients. In 3 patients, this was associated with episodes of loss of consciousness, depression, and refractory headache, occurring each in 1 patient. Mean duration of hypersomnolence was 8 years (range : < 6 months - 25 years). Despite the fact that a large majority of patients had long-standing complaints, only 8 were on psychotropic medication. Two patients were taking central analeptic drugs ; 3 were on tricyclic (TC) or serotonine re-uptake blocking (SSRI's) antidepressants. In these patients, psychotropics were tapered and stopped without significant side effects, at least 2 weeks before laboratory studies were performed. Two patients were taking anti-epileptic drugs. One patient with migraine was on long term prophylactic treatment with propranolol. Table 2 summarizes the general patient characteristics.

Polysomnography (Table 3)

All patients underwent a single-night polysomnography, according to the protocol described above. PSG showed a normal sleep architecture in 23 patients. Four patients showed frequent arousal's and oronasal airflow interruption suggestive of obstructive sleep apnea (OSA). Two patients had a low sleep efficiency, possibly confounding the interpretation of the MSLT results. In 1 patient, a single SOREMP was demonstrated.

Table 3

Results of PSG and MSLT

n	patient initials	cata-plexy	result PSG	result MSLT	HLA-DR2	final diagnosis or identified underlying etiology of hypersomnolence
1	BL	-	normal	hypersomn.		IHS
2	CL	+	normal	hypersomn.		clin. narcolepsy
3	DBF	-	normal	hypersomn.		IHS
4	DDF	+	SOREMP's	hypersomn. + SOREMP's	+	typ.narcolepsy
5	DGP	-	normal	hypersomn.		chronic sleep deprivation
6	DGE	-	normal	no hypersomn.		no hypersomn.
7	DKH	-	normal	no hypersomn.		alcohol & nicotine abuse
8	DMM	-	normal	hypersomn.		IHS
9	DPI	-	normal	hypersomn.		IHS
10	DSK	-	normal	no hypersomn.		no hypersomn.
11	DK	+	normal	hypersomn. + SOREMP's	+	typ. narcolepsy
12	GR	-	airflow abn.	no hypersomn.		no hypersomn., OSA
13	HC	-	normal	no hypersomn.		no hypersomn.
14	HF	-	airflow abn.	hypersomn. + SOREMP's		atyp. narcolepsy, OSA
15	LF	-	low sleep eff.	no hypersomn.		no hypersomn.
16	LE	+	normal	hypersomn. + SOREMP's	+	typ. narcolepsy
17	MAS	-	normal	no hypersomn.		no hypersomn., CPE
18	MR	-	normal	no hypersomn.		no hypersomn.
19	MES	-	normal	no hypersomn.		no hypersomn.
20	PMH	+	normal	hypersomn.	n.p.	clin. narcolepsy
21	SJ	-	normal	hypersomn.		IHS
22	VDE	+	airflow abn.	hypersomn.	-	clin. narcolepsy, OSA
23	VDS	-	normal	hypersomn.		IHS
24	VGP	-	normal	no hypersomn.		no hypersomn.
25	VHS	-	normal	no hypersomn.		no hypersomn.
26	VLH	-	airflow abn.	no hypersomn.		no hypersomn., OAS, CPE
27	VM	-	normal	no hypersomn.		no hypersomn.
28	VE	-	normal	hypersomn. + SOREMP's		atyp. narcolepsy
29	VW	+	low sleep eff.	hypersomn. + SOREMP's	+	typ. narcolepsy
30	VJ	-	normal	hypersomn.		IHS

Legend : hypersomn. : hypersomnolence ; no hypersomn. : absence of hypersomnolence ; CPE : complex partial epilepsy ; IHS : idiopathic CNS hypersomnolence ; clin. narcolepsy : diagnosis of narcolepsy based on clinical grounds only ; typ. narcolepsy : diagnosis of typical narcolepsy ; atyp. narcolepsy : diagnosis of narcolepsy in the absence of cataplexy ; SOREMP's : sleep onset REM-episodes ; OSA : obstructive sleep apnea ; airflow abn. : abnormalities of oronasal airflow ; n.p. : not performed.

Multiple sleep latency test (Table 3)

A 4-nap MSLT was performed in all patients, demonstrating significant hypersomnolence, reflected by a short mean sleep latency (≤ 5 min.), in 17/30. In 6/17 patients, ≥ 2 SOREMP's were recorded. SOREMP's were always present during the first 3 naps. In 13/30 patients, no significant hypersomnolence could be demonstrated. Table 3 shows the results of the MSLT.

REM-sleep associated symptomatology

Cataplectic symptoms were reported by 7 patients. Other REM-sleep associated symptoms such as hypnagogic hallucinations and/or sleep paralysis were present in 6 patients, who also reported cataplexy. These last 2 features were also reported by respectively 2 and 3 patients in whom MSLT did not demonstrate hypersomnolence.

Correlation between clinical, PSG and MSLT diagnostic criteria for narcolepsy (Table 4)

The reporting of cataplexy and the occurrence of SOREMP's were not always associated. Of 6 patients in whom during MSLT ≥ 2 SOREMP's were recorded, only 4 also reported cataplexy. These 4 patients carry the final diagnosis of *typical narcolepsy*. Two patients with SOREMP's but without cataplexy had complained of excessive sleepiness for respectively 3 and 10 years. The combination of EDS with SOREMP's but without cataplexy is suggestive of narcolepsy since the onset of cataplectic symptoms is quite variable. These patients were considered to present with *atypical narcolepsy*.

In 3 other patients who had reported cataplexy, no SOREMP's could be demonstrated. These patients carried the diagnosis of *clinical narcolepsy*. In patients without cataplexy, in whom MSLT

Table 4

Correlation of results of PSG and MSLT

MSLT	hypersomnolence		no hypersomnolence
PSG	mean sleep latency < 10 min	≥ 2 SOREMP's	(normal sleep latency or no sleep recorded)
normal	13	3/13	10
SOREMP's	1	1/1	–
apnoe-hypnoe	3	1/3	1
no sleep recorded	1	1/1	1

Legend : SOREMP's : sleep-onset REM episodes.

showed short sleep latencies but no SOREMP's, the tentative diagnosis of *idiopathic CNS hypersomnolence* was forwarded. In 13 patients with complaints of excessive sleepiness, MSLT showed no abnormalities. Obstructive sleep apnea and epileptic EEG abnormalities were demonstrated respectively in 4 and in 2 patients. Alcohol and nicotine abuse and chronic sleep deprivation were identified as underlying etiologic factors for hypersomnolence in 2 patients. In the remaining 8 patients, no underlying etiology could be identified. No less than 13 patients with normal PSG showed hypersomnolence during MSLT.

Treatment and follow-up (Table 5)

After discharge from the sleep laboratory, 13 patients were followed up during at least 6 months and up to 30 months (average duration of follow-up : 13 months). Seventeen patients were lost in follow-up. These were mainly patients who were referred from different other medical centers throughout the country. In the group of patients that could be followed, psychotropic medication had been started immediately after evaluation in all. Medical therapy consisted of only central analeptics in 3 patients, only antidepressants in 2 patients and a combination of both types of medication in 7. In 1 patient, the medication regime (antiepileptic drugs) remained unchanged.

At the time of this evaluation, 9 of 13 patients in whom follow-up data were available, still reported excessive daytime sleepiness, which was often less severe (see Table 5 : "+/-") than before treatment. In 2 patients, analeptics were withdrawn because of side effects such as tachycardia and hallucinations. None of the cataplectic patients still suffered from cataplectic attacks. Ten patients reported a variable (see Table 5 : "+/-" Æ "+++") improvement in overall quality of life ; 3 patients reported no change ("-").

Illustrative cases

Case 1 : D.D.F., 38-years-old female nurse.

This patient had presented with hypersomnolence for many years, which was attributed to shift work. She had never taken medication although daytime sleepiness became clearly worse in the last 2 years. The patient was married and had 3 healthy children. She reported sleeping normally at night for 9 to 10 hours. While being used to take a one-hour afternoon nap for many years, she recently felt the need of sleeping in the morning between 10.30 and 12.00 am. Because of increasing daytime sleepiness she had to quit her job one year before the present examination and became progressively more impaired in her normal housekeeping activities. When specifically asked for, she mentioned having mild cataplectic attacks and hypnagogic hallucinations. A nephew was also reported with a history of hypersomnolence.

The patient was admitted for PSG and MSLT. PSG demonstrated a single SOREMP with latency of 8 min. MSLT demonstrated SOREMP's during every nap of the 4-nap protocol (latency for REM was respectively 4 min., 3 min., 2 min. and 8 min.). The patient was HLA-DR2 positive. Pemoline 10 mg and dosulepinehydrochloride (tricyclic antidepressant) 25 mg were started. Progressively increasing doses of pemoline of up to 40 mg controlled the hypersomnolence. The tricyclic antidepressant had to be withdrawn because of anticholinergic adverse effects. Eventually, fluoxetine 20 mg effectively controlled cataplexy.

Case 2 : V.D.S., 23-year-old male technician.

This patient had a history of viral meningitis at the age of 4 without neurological sequellae. He suffered from toxoplasmosis at the age of 16. Excessive daytime sleepiness and sleep attacks lasting 30-120 min. had been present ever since. The patient reported having a normal sleeping time of approximately 10 hours. Hypersomnolence had become progressive and interfered considerably with his work as an air conditioning maintenance technician. The patient reported several episodes of falling asleep during driving between two customers. No cataplectic symptoms were reported.

PSG showed no specific findings ; MSLT clearly demonstrated hypersomnolence. The patient slept during all naps. Latency for sleep stage 1 was respectively 4.5, 4, 5, 4.5 min. However, no

Table 5

Patient treatment and follow-up

n	patient initials	final diagnosis or identified underlying etiology of hypersomnolence	pre-evaluation psychotropic drug treatment	treatment after evaluation (follow-up > 6 months)	continued hypersomnolence	continued cataplexy	subjective change
1	BL	IHS	–	no follow–up			
2	CL	clin. narcolepsy	–	CS, 3C–AD	+	–	+
3	DBF	IHS	–	SSRI–AD	+/–	–	+
4	DDF	typ.narcolepsy	–	CS, 3C–AD	+/–	–	+++
5	DGP	chronic sleep depriv.	–	no follow–up			
6	DGE	no hypersomn.	–	no follow–up			
7	DKH	alcohol & nicotine abuse	–	no follow–up			
8	DMM	IHS	amitriptyline	no follow–up			
9	DPI	IHS	–	CS	+	–	–
10	DSK	no hypersomn.	propranolol	no follow–up			
11	DK	typ. narcolepsy	–	CS, 3C–AD	–	–	+++
12	GR	no hypersomn., OSA	–	no follow–up			
13	HC	no hypersomn.	–	no follow–up			
14	HF	atyp. narcolepsy, OSA	–	CS, 3C–AD	+/–	–	+++
15	LF	no hypersomn.	–	no follow–up			
16	LE	typ. narcolepsy	–	CS, 3C–AD	+/–	–	++
17	MAS	no hypersomn., CPE	cbz, dph	no follow–up			
18	MR	no hypersomn.	amitriptyline	3C–AD	+/–	–	–
19	MES	no hypersomn.	–	no follow–up			
20	PMH	clin. narcolepsy	–	no follow–up			
21	SJ	IHS	–	CS	+/–	–	+
22	VDE	clin. narcolepsy, OSA	methylfenidate	no follow–up			
23	VDS	IHS	prolintane	CS, 3C–AD	+	–	++
24	VGP	no hypersomn.	–	no follow–up			
25	VHS	no hypersomn.	–	no follow–up			
26	VLH	no hypersomn., OSA, CPE	vpa, vgb	vpa, vgb	+	–	–
27	VM	no hypersomn.	fluoxetine, trazodone	no follow–up			
28	VE	atyp. narcolepsy	–	CS	–	–	+++
29	VW	typ. narcolepsy	–	CS, 3C–AD	–	–	+++
30	VJ	IHS	–	no follow–up			

Legend : cbz : carbamazepine ; dph : fenytoin ; CPE : complex partial epilepsy ; vpa : valproate ; vgb : vigabatrin ; IHS : idiopathic CNS hypersomnolence ; clin. narcolepsy : diagnosis of narcolepsy based on clinical grounds only ; typ. narcolepsy : diagnosis of typical narcolepsy ; depriv. : deprivation ; atyp. narcolepsy : diagnosis of narcolepsy in the absence of cataplexy ; no hypersomn. : absence of hypersomnolennce during MSLT, OSA : obstructive sleep apnea ; CS : central nervous system stimulants, 3C–AD : tricyclic antidepressants ; SSRI–AD : serotonine–reuptake inhibiting antidepressants ;

Follow–up data : – = no change ; +/– = periodic but slight improvement ; + = constant and worthwhile improvement ; ++ significant improvement ; +++ very significant improvement.

SOREMP's could be recorded. After additional neurological, endocrinological and serological examinations revealed no specific abnormalities, the diagnosis of idiopathic CNS hypersomnolence was made. A morning dose of pemoline 10 mg, the highest that the patient could tolerate, reduced the hypersomnolence to a minimal level. 100 mg of trazodonehydrochloride taken at night completely controlled sleep attacks.

Discussion

Hypersomnolence is frequently reported by patients seen in Sleep Disorders Centers. In our center, it was reported as the main complaint, in the absence op clinical signs and symptoms suggestive of obstructive apnea, by 30/250 (12%) of patients within a period of 22 months. The general characteristics of the presently studied population such as gender ratio, average age at the onset or average duration of hypersomnolence did not differ substantially from other published series (Guilleminault *et al.*, 1976 ; Aldrich, 1990 ; Chaudhary, 1993 ; Moscovitch, 1993).

If, in a given patient, hypersomnolence occurs in combination with cataplectic symptoms, the diagnosis of narcolepsy can be established with a high degree of certainty on clinical grounds only. However, laboratory studies need still to be performed for 3 main purposes : 1. to corroborate the clinical diagnosis ; 2. to disclose the presence of other disorders associated with excessive sleepiness such as sleep apnea, disorders of the sleep-wake schedule or endogenous depression ; 3. to identify malingerers who want to obtain stimulant medications (Brougthon, 1990). In clinical practice, PSG is most commonly performed in hypersomnolent patients to exclude sleep apnea syndrome. In our center where PSG and MSLT are performed on 2 consecutive days, an additional

rationale for PSG is to evaluate sleep the night before MSLT. A minimum of 6 hours of normal sleep is required in order for the MSLT, performed on the next day, to be interpretable (Aldrich, 1990). This requirement will avoid a false positive diagnosis of hypersomnolence due to poor sleep quality the night before the MSLT and is in agreement with the experience of other authors. PSG in itself may also contribute to the diagnosis of narcolepsy by demonstrating SOREMP's. In our population, this was the case in only one patient.

The MSLT has for long been shown to be the most useful diagnostic tool in hypersomnolent patients suspected of narcolepsy (Carskadon *et al*., 1986 ; Aldrich, 1990 ; The American Sleep Disorder Association, 1992 ; Moscovitch *et al*., 1993). Typically, only hypersomnolent and cataplectic patients in whom 2 or more SOREMP's can be recorded are considered true or "typical" narcoleptics. In our series this was the case in only 4 patients. Two patients had hypersomnolence and SOREMP's but no cataplexy. According to Billiard, in these patients, the diagnosis of "atypical narcolepsy" should be made (Billiard, 1993). Two other patients who fulfilled all clinical criteria for narcolepsy lacked SOREMP's. In these patients the diagnosis of narcolepsy on clinical grounds only or "clinical narcolepsy" was made. In patients with severe hypersomnolence but without cataplexy and SOREMP's the diagnosis of idiopathic CNS hypersomnolence is usually considered (Aldrich, 1990). Moscovitch *et al*. recently discussed the difficulties that are met when trying to make a positive diagnosis of narcolepsy (Moscovitch *et al*., 1993). These last authors clearly indicated that the finding of 2 or more SOREMP's was a poorer discriminant of narcolepsy than a positive history of cataplexy. However, cataplexy often appears only months after the appearance of the hypersomnolence. In our population, 2 patients with ≥ 2 SOREMP's, who were subsequently diagnosed with typical narcolepsy did not report cataplectic symptoms at the time of the sleep studies. One of these patients reportedly had hypersomnolence for less than 1 year, possibly suggesting that cataplectic symptoms could still develop. The classical MSLT protocol recommended by the American Sleep Disorders Association includes 5 naps at 2-hour intervals throughout the day (The American Sleep Disorder Association, 1992). Our finding of SOREMP's occurring always during the first three naps suggest that the classical 5-nap protocol could be replaced by a 4-nap protocol without inducing false negative results. A direct comparison between 4- and 5-nap protocols however seems necessary to confirm this suggestion.

The fact that in 13 patients with normal PSG, MSLT clearly demonstrated hypersomnolence confirms that PSG and MSLT are complementary laboratory investigations.

Although is was not the aim of this study to report long-term follow-up, some data are available. Not unsurprisingly, half of our patients who were adequately treated with analeptics and/or antidepressant were still complaining of hypersomnolence although a majority reported an improved overall quality of life. Medical treatment of cataplexy with SSRI's appeared successful in the few patients with typical narcolepsy.

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