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Letter to the Editor

Use and safety of nitrous oxide during lumbar puncture for the diagnosis of childhood narcolepsy☆

Narcolepsy is diagnosed as either narcolepsy type-1 (NT1) or narcolepsy type-2 (NT2), on the basis of clinical features (cataplexy being pathognomonic of NT1), of neurophysiological testing, and of cerebrospinal fluid hypocretin-1 (CSF hcrt-1) assay, according to current criteria [1]. Lumbar puncture (LP) for CSF hcrt-1 assay is part of the diagnostic protocol for suspected NT1. However, LP is not widely carried-out especially in children, because it could be painful and generate anxiety. In addition, given the high prevalence of overweight/obesity in NT1 children it could also represent an anesthesiological risk. We reviewed 31 (mean age 10.5, range 6–12 years-old) consecutive children and adolescents with suspected NT1 who underwent LP under anesthesia (16 patients) and analgesia with equimolar-mixture-of-oxygen-and-nitrous-oxide (EMONO) (15 patients): Our study aims to evaluate (1) overall procedure safety further contrasting the different approaches; and (2) the diagnostic relevance of CSF hcrt-1 assay. Clinical, neurophysiological and biological data are reported in Table 1. The protocol was approved by the local ethics committee, and patients' parents signed a written informed consent for the study.

Our data disclosed the better clinical management using EMONO at the patient's bedside compared to general anesthesia in the operating room to reduce the distress related to the procedure. Moreover, using EMONO further showed the utility of CSF hcrt-1 assay to define the diagnosis, allowing to rule-out or confirm NT1 in a subset of ambiguous cases (25.8% of this case series) given the limitations of polysomnographic diagnosis confirmation in children. Indeed, factors such as (1) the lack of normative values for the multiple sleep latency test (MSLT) in prepubertal children; (2) the possibly confounding neurophysiological results in sleep-deprived adolescents or in subjects with circadian rhythms disorders; (3) the difficulty in complying with or in understanding test instructions, coupled with the hyperactivity, irritability, distractibility, and aggressiveness that often NT1 children display [2,3], can bias MSLT results thus requiring test repetition [4]. These claim an extensive approach, including LP for CSF hcrt-1 assay. Thus, the use of EMONO limits psychological consequences and concerns.

Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: https://doi.org/10.1016/j.sleep.2018.12.003.

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Table 1
Clinical, neurophysiological and biological data.

ID	Age	Sex	BMI	Comorbidity	EDS	Suspected Cataplexy	SP	HH	AHI	MSLT SL	MSLT SOREMP	Inconsistent findings	Procedure	CSF hcrt-1	Final Dg	Collateral effects
1	9	M	14.72	Depression	Yes	No	No	No	1.68	16.0	0		EMONO and GA	345	Normal	Switch to GA because of psychomotor agitation
2	9	M	23.32	None	Yes	Yes	Yes	No	0.00	0.5	4		EMONO	39	NT1	none
3	12	M	18.90	None	Yes	Yes	No	No	1.26	1.6	5		EMONO	33.82	NT1	none
4	8	M	22.50	None	Yes	Yes	No	No	0.00	6.6	5		EMONO	34	NT1	none
5	12	M	23.40	ADHD	Yes	No	No	No	0.91	20.0	0		EMONO	298	IH	none
6	12	F	30.85	Epilepsy, Mental Retardation	Yes	Yes	No	Yes	0.00	17.8	2	SL > 8′	EMONO	414.39	***NT2***	none
7	7	F	21.30	None	Yes	Yes	No	No	0.12	0.6	5		EMONO	16.7	NT1	none
8	11	M	15.00	Fecal Incontinence	Yes	No	No	No	0.80	16.7	0		EMONO and GA	418	IH	Switch to GA because of psychomotor agitation
9	9	M	24.26	None	Yes	Yes	No	No	0.00	3.0	5		EMONO	61	NT1	none
10	6	F	20.75	None	Yes	Yes	No	Yes	0.23	5.0	5		EMONO	12.35	NT1	none
11	11	M	17.58	NREM Parasomnia	Yes	No	No	No	0.52	18.4	0		EMONO	340	Normal	none
12	11	M	18.78	None	Yes	No	No	No	0.00	6.5	4	No cataplexy history	EMONO	72.6	***NT1***	none
13	11	M	29.75	None	Yes	Yes	No	No	0.28	0.5	7		EMONO	72.58	NT1	none
14	9	M	21.00	None	Yes	No	No	No	0.12	18.7	0		EMONO	335.7	Normal	orthostatic headache
15	9	M	29.34	None	Yes	Yes	Yes	Yes	5.76	0.7	5		EMONO	0	NT1	none
16	8	F	24.46	Prader Willi Syndrome	Yes	Undefined (hypotonia)	Yes	Yes	3.56	6.9	1	SOREMP<2, undefined cataplexy history	GA	372	***Secondary HS***	none
17	10	M	18.66	Depression	Yes	Yes	No	No	0.40	13.6	3	SL > 8′	GA	16	***NT1***	lumbar pain
18	9	M	21.03	Depression	Yes	Yes	No	No	0.30	3.4	5		GA	35	NT1	none
19	11	M	32.03	None	Not confirmed by scales	Yes	No	No	0.00	0.6	5		GA	0	NT1	none
20	8	M	22.70	None	Yes	Yes	No	Yes	1.60	4.8	2		GA	0	NT1	none
21	16	M	25.95	None	Yes	Yes	No	No	0.00	2.1	2		GA	25	NT1	none
22	11	F	31.96	None	Yes	Yes	No	Yes	0.00	0.5	5		GA	0	NT1	none
23	14	F	21.30	None	Yes	Yes	Yes	Yes	0.00	0.9	5		GA	0	NT1	none
24	7	F	14.54	None	Yes	No	No	No	0.00	15.8	1		GA	334	Normal	none
25	14	F	31.74	Epilepsy	Not confirmed by scales	Yes	No	No	0.40	16.9	2	EDS not confirmed by scales; SL > 8′	GA	308	***Epilepsy***	none
26	17	M	24.24	None	Yes	Yes	No	No	0.00	16.4	1	SL > 8'; SOREMP<2	GA	291	***Conversion Disorder***	none
27	12	M	39.64	Metabolic Syndrome, Aortic Stenosis	Yes	Yes	No	No	2.30	0.7	5		GA	0	NT1	none
28	13	F	18.75	None	Yes	Yes	No	No	0.00	2.1	5		GA	12.2	NT1	none
29	11	M	26.80	X Fragile Syndrome	Yes	Yes	No	No	0.00	18.6	0	SL > 8'; SOREMP<2	GA	310	***Normal***	none
30	6	F	20.00	None	Not confirmed by scales	No	No	No	2.20	19.5	0		GA	303	Normal	none
31	11	F	19.81	Precocious Puberty	Not confirmed by scales	No	No	No	0.00	7.1	5	EDS not confirmed by scales; No cataplexy history	GA	17.8	***NT1***	none

EDS (excessive daytime sleepiness); SP (sleep paralysis); HH (hallucinations); Dg (diagnosis); SL (sleep latency); NT1 (narcolepsy type 1); NT2 (narcolepsy type 2); GA (general anesthesia); HS (hypersomnia).

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