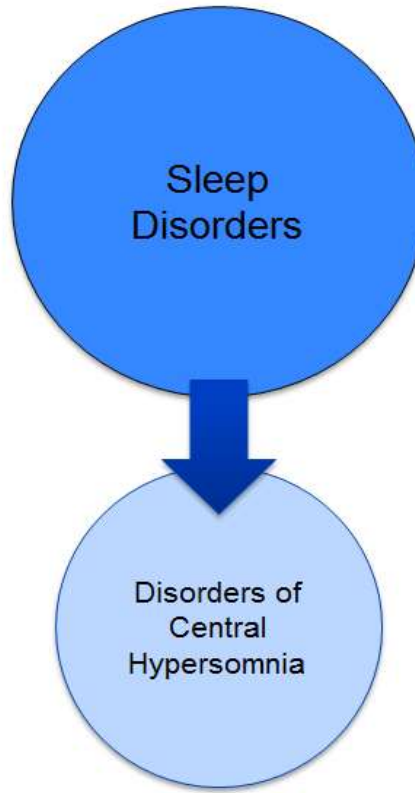


Case

- 14 year old girl
 - Sleepy since 3rd grade
 - ? ADHD (Connor scales were borderline)
 - Sleeping 13-14 hours/night
 - Initial psych w/u negative
 - Teachers say she is falling asleep and “zoning out”
 - Fell asleep during rock concert, pool, bath



More common are the following:

- Insufficient sleep
- OSA
- Circadian rhythm disorders

Central Disorders of Hypersomnia

- **Narcolepsy type 1**
- **Narcolepsy type 2**
- **Idiopathic hypersomnia**
- **Kleine-Levin syndrome**
- Hypersomnia due to a medication or substance
- Hypersomnia associated with a psychiatric disorder
- Insufficient sleep syndrome

International Classification of Sleep Disorders-3rd Edition (ICSD-3)

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Narcolepsy Overview

- Chronic neurologic disorder characterized by the following:
 - **Excessive daytime sleepiness**
 - Worse when sedentary
 - Automatic behavior
 - +/- irresistible sleep attacks
 - **Cataplexy**
 - Sudden loss of muscle tone triggered by strong emotions
 - **Hypnagogic and/or hypnopompic hallucinations**
 - **Sleep paralysis**

Median time to diagnosis has been reported as **10.5 years!**

Sleep Comorbidities with Narcolepsy

- **Disrupted nighttime sleep**

- 30-95% of patients
- Inability to stay asleep with frequent awakenings, excessive shifts to N1 or wake from deeper sleep stages

(Roth T et al. JCSM 2013)

- **Vivid dreams/Nightmares**

- 83% of patients report confusing dreams with reality vs 15% controls

(Wamsley E et al. SLEEP 2014)

Sleep Comorbidities with Narcolepsy (cont'd)

- **REM behavior disorder**

- Clinically reported frequency of 45-61% vs. 1.6% in general population
- REM without atonia detected on PSG in 36-43% among patients with narcolepsy

(Cipolli C et al. Sleep Med 2011; Franceschini C et al. Sleep Med 2011; Dauvilliers Y et al. Sleep Med 2013)

- **Periodic limb movements**

- Index >5/hour (25% of patients)
- Index >15/hour (10% of patients)

(Sasai-Sakuma et al. PLOS One 2015)

Sleep Comorbidities with Narcolepsy (cont'd)

- **Obstructive Sleep Apnea**

- 25% of narcolepsy patients in one adult study had an AHI > 10/hour
- 10/33 patients were diagnosed with OSA resulting in delayed diagnosis of mean 6 years!
 - (Sansa G et al. 2010)
- High rate of obesity at onset of disease symptoms may contribute to OSA co-morbidity

Narcolepsy Definitions by ICSD-3

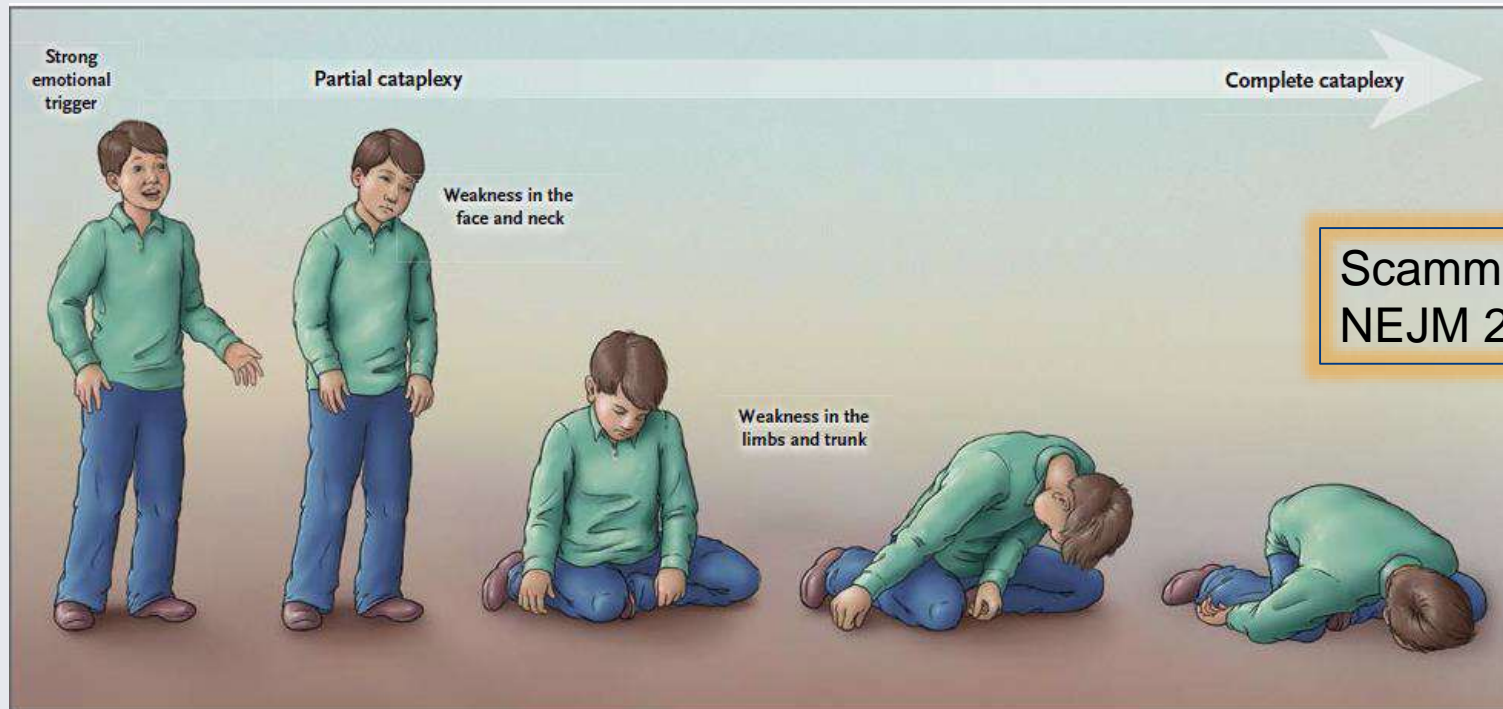
- **Narcolepsy Type 1** (Narcolepsy with Cataplexy)
 - EDS for at least 3 months
 - At least one of the following:
 - Cataplexy **and** positive MSLT*
 - Hypocretin deficiency (<110 pg/ml or <1/3 normal)
- **Narcolepsy Type 2** (Narcolepsy without Cataplexy)
 - EDS for at least 3 months
 - Positive MSLT*
 - No cataplexy and normal CSF hypocretin if measured



*Positive MSLT=mean sleep latency of ≤ 8 minutes and 2 or more SOREMP's.

(A SOREMP on PSG may replace one on MSLT)

Cataplexy



Scammell, TE
NEJM 2015

Figure 1. Cataplexy.

Cataplexy is characterized by sudden, emotionally triggered episodes of muscle weakness with preserved consciousness. These episodes typically begin with weakness of the muscles of the face and neck that then spreads to involve the muscles of the limbs and trunk.

enter



Serra L et al., Movement Disorders. 2008

Hypersomnia

- 14 year old girl
 - Sleepy since 3rd grade
 - **? ADHD** (Connor scales were borderline)
 - Ritalin—emotionally labile
 - Initial psych w/u negative
 - Sleeping 13-14 hours/night
 - Teachers say she is falling asleep and “zoning out”

Primary hypersomnias

- Easy to misdiagnose in children
 - Wakefulness drive is high
 - Sleepiness causes behavioral change/inattention
 - Often diagnosed early adulthood but symptoms present for 10 years prior
- Treatment with stimulants
- Often co-morbid mood disorder

Idiopathic Hypersomnia

- Lapses of daytime sleep occurring for at least 3 months
- Cataplexy is absent
- No increased REM pressure
 - <2 SOREMPs on MSLT
 - If there is a SOREMP on PSG, no SOREMP on MSLT
- Presence of one of the following:
 - MSLT ≤ 8 minutes for adults, age specific for kids
 - Total 24 hour sleep time ≥ 660 minutes on 24 hour PSG or Actigraphy with total sleep time ≥ 660 minutes averaged over at least 7 days
- Insufficient sleep syndrome is ruled out
- Hypersomnolence not better explained by another sleep disorder

Older Children and Adolescent Normative MSLT Data

Tanner Stage	Mean Sleep Latency (min \pm SD)
Stage 1	19.0 \pm 1.6
Stage 2	18.5 \pm 1.9
Stage 3	16.1 \pm 3.8
Stage 4	15.8 \pm 3.4
Stage 5	16.6 \pm 2.1
Older adolescents	15.7 \pm 3.4

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Adapted from Carskadon MA. The second decade. In Guilleminault C, ed, *Sleeping and waking disorders: indications and techniques*. Menlo Park: Addison Wesley, 1982: 99-125

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Evaluation strategies for the sleepy child

Multiple Sleep Latency Test

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Multiple Sleep Latency Test (MSLT)

- A series of four to five nap opportunities at 2 hour intervals between each nap
- The first nap should start 1.5 to 3 hours after awakening the patient from the PSG
- Quiet dark room with comfortable temperature
- Objective measure of tendency to fall asleep
- Sleep onset REM periods are identified

Results can be influenced by sleep disturbance, mood disorders, insufficient amount of sleep, OSA, medications, circadian factors

Preparing for MSLT

- It is strongly recommended that adequate sleep be documented by **sleep log** and whenever possible **actigraphy** for 1-2 weeks prior to PSG/MSLT
- Participants are encouraged to sleep as much as possible during the week and during the night prior to the MSLT
- **PSG** recommended immediately prior to MSLT
 - Rule out underlying sleep disorder
 - Ensure adequate sleep duration
 - AASM guidelines state **<6 hours** of sleep can reduce next day sleep latency time...should try to achieve **age appropriate** amount.

Littner MR et al. SLEEP 2005; ICSD 3rd ed

Medications

- Wake promoting agents, Stimulants, stimulant-like medications, and REM suppressing medications should be ***ideally*** stopped 2 weeks before the MSLT
- Use of the patient's other usual medications (anti-hypertensives, insulin, etc.) should be thoughtfully planned by the sleep clinician before MSLT testing

Drug Screening

- Drug screening may be indicated to ensure that sleepiness on the MSLT is not pharmacologically induced
 - Generally performed on day of MSLT
 - Timing and circumstances may be modified by clinician
 - Smoking stopped 30 min prior to each nap opportunity

Normative Data for MSLT in Children

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Older Children and Adolescent Normative MSLT Data

Tanner Stage	Mean Sleep Latency (min \pm SD)
Stage 1	19.0 \pm 1.6
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MSLT is Usually Abnormal in Children with Narcolepsy with Cataplexy

- MSLT is diagnostic in 92%
 - 85% prepubertal onset
 - 100% in peri- and post-pubertal onset children
- Mean Sleep Latency: 2.5 + 0.4 min
- SOREMPs: mean of 85% (4/5) of naps

(Aran et al. Sleep 2010)

MSLT is Usually Abnormal in Children with Narcolepsy with Cataplexy

	<u>Prepuberty</u> onset (n = 143)	Puberty onset (n =75)	Onset after puberty (n =53)
MSLT MSL (min)	3.2 ± 0.2	2.6 ± 0	4.0 ± 0.3
SOREM P #	2.1 ± 0.1	2.3 ± 0.2	3.1 ± 0.2
% MSLT +	96.4%	94.6%	92.3%

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Han F et al. Sleep 2011

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Comments about central hypersomnia...

- Children may present with new onset napping, paradoxical hyperactivity and behavioral problems.
- Narcolepsy most commonly begins in childhood so being able to appropriately evaluate it is important.
- There are special considerations when conducting a hypersomnia evaluation in children, ie age appropriate sleep amounts and fear of the dark during MSLT.
- Normal children have longer MSL on MSLT than adults.
- MSLT findings are abnormal in children with narcolepsy.

Kleine-Levin Syndrome (Recurrent Hypersomnia)

- At least two episodes of excessive sleepiness and sleep duration, each lasting for two days to five weeks.
 - **Recurs** at least once every 18 months and usually more than once a year
 - **Normal** alertness, cognitive function, behavior, and mood between episodes.
 - At least one of the following during episodes: cognitive dysfunction, altered perception, eating disorder (anorexia or hyperphagia), or disinhibited behavior (such as hypersexuality).
 - Hypersomnolence and related symptoms are not better explained by another sleep disorder; other medical, neurologic, or psychiatric disorder (especially bipolar disorder); or use of drugs or medications.

- ICSD-3

Conclusions

- Sleep needs in children are different than adults and vary across childhood
- Sleep disorders and insufficient sleep can have significant impact on neurocognition
- Excessive sleepiness in children may be related to **insufficient sleep**, primary sleep disorders (Narcolepsy, IH, OSA, RLS/PLMs), medications and/or underlying medical conditions

Thank you!

- Questions?

