

Diagnostic Testing for Sleep Disorders

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Objectives of Talk

- Describe the most common types of sleep tests
- Explain how and why we test for sleep disorders
- Briefly review the most common sleep disorders that require testing

Diagnostic Tests for Sleep Disorders

- Polysomnography (PSG, Sleep Study)
- Overnight Oximetry
- Actigraphy
- Multiple Sleep Latency Test (MSLT)
- Maintenance of Wakefulness Test (MWT)f

Diagnostic Tests for Sleep Disorders

Sleep Test	Quality Measured
Polysomnography	Simultaneous recording of multiple biophysiological signals to study and characterize sleep and sleep disorders.
Overnight oximetry	Monitor oxygen saturation and heart rate in bed overnight.
Actigraphy	Measure sleep/wake patterns over long periods of time by monitoring body movements.
Multiple Sleep Latency Test	Test ability to fall asleep during the day when permitted and whether REM sleep appears earlier than usual.
Maintenance of Wakefulness Test	Test ability to stay awake with low levels of stimulation without resorting to extraordinary measures.

Polysomnography

- 4 Levels of Polysomnograms
- Conducted during the patient's typical sleep time
- Varying levels of complexity
 - # of signals recorded simultaneously
 - Whether attended by a sleep technologist
 - In-laboratory vs. home

Level I	Full PSG, in-lab, attended
Level II	Full PSG, unattended
Level III	Partial PSG, ≥ 4 cardiorespiratory parameters, unattended, typically done at home
Level IV	Partial PSG, 1-2 cardiorespiratory parameters, unattended, typically done at home

Level I Polysomnography – “Gold Standard” Evaluate:

- Sleep-related breathing disorders
- Narcolepsy or idiopathic hypersomnia
- Significant parasomnias (atypical, potential to cause injury)
- Nocturnal seizures when clinical evaluation and daytime EEG are inconclusive
- Rarely helpful for insomnia
- Not the first choice for restless legs syndrome
- Treatment: titration of PAP (positive airway pressure) therapy

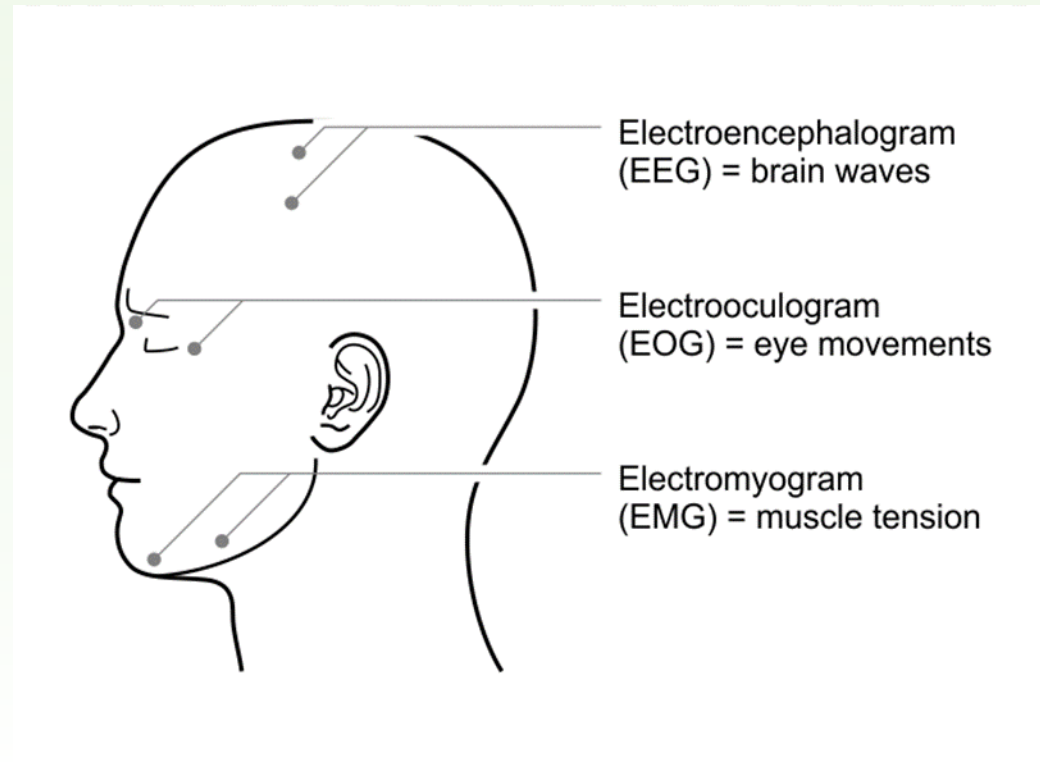
Level I Polysomnography - Parameters

- Electroencephalogram (EEG)
- Electrooculogram (EOG)
- Chin electromyogram (EMG)
- Leg electromyogram (EMG)
- Airflow signals
- Respiratory effort signals
- Oxygen saturation
- Body position
- Electrocardiogram (ECG)



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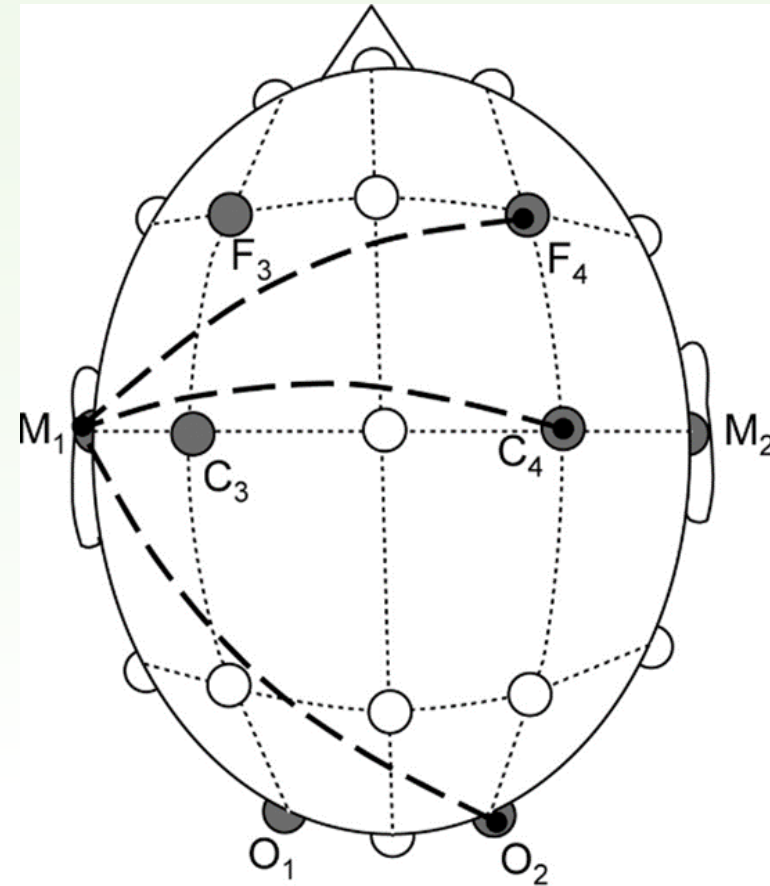
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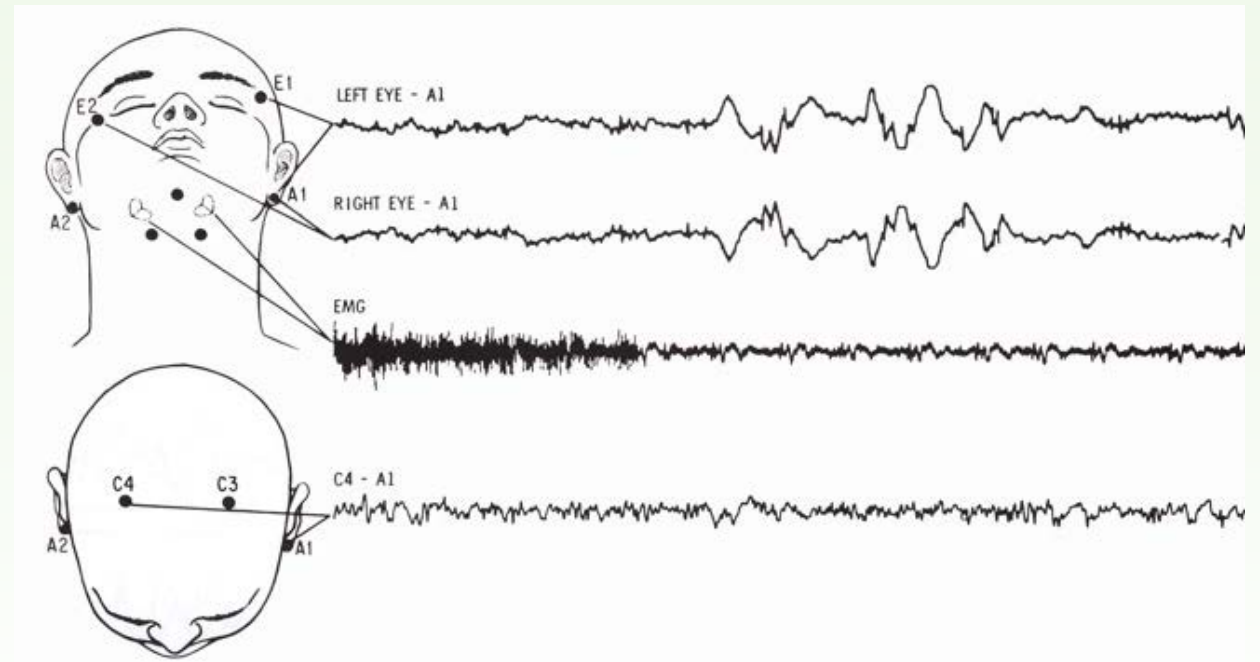
Level I Polysomnography

- Apneas
- Hypopneas
- Apnea/hypopnea index (AHI)
- Oxygen saturation nadir
- Positional effects
- Arousals and what due to
- Sleep architecture
- Parasomnias, especially REM sleep behavior disorder

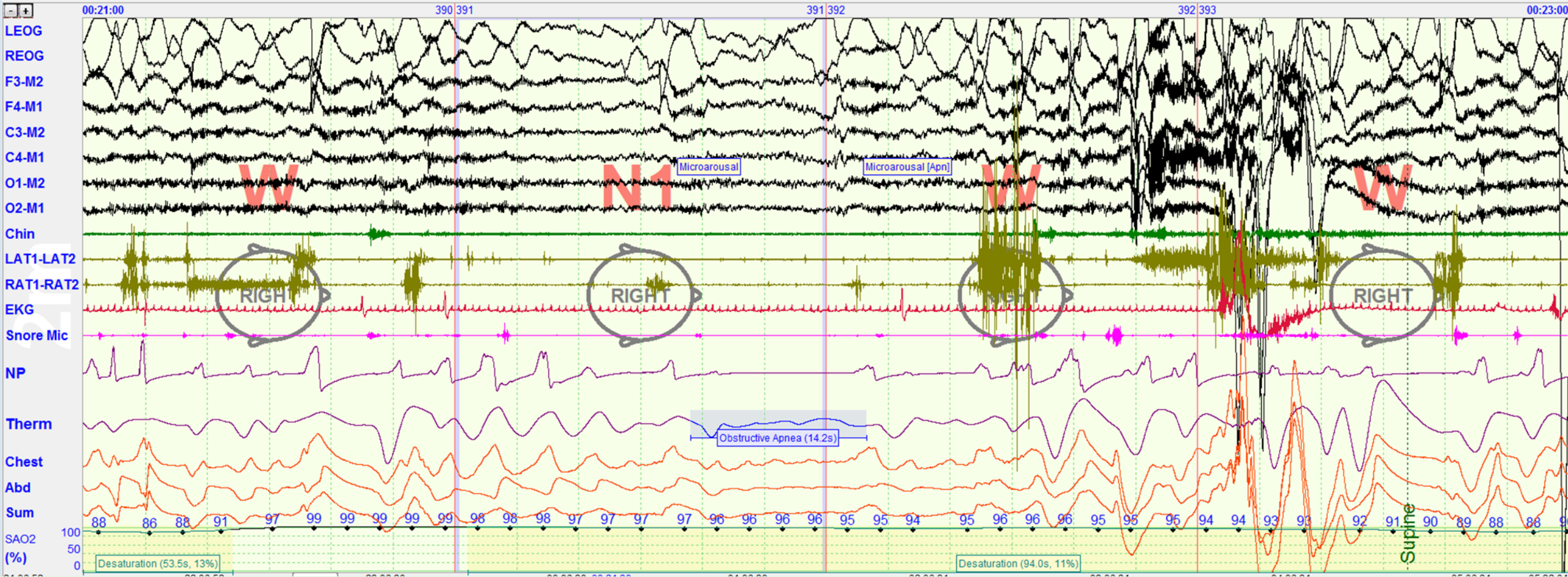


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Level I Polysomnogram – 2-minute view



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Level I Polysomnography

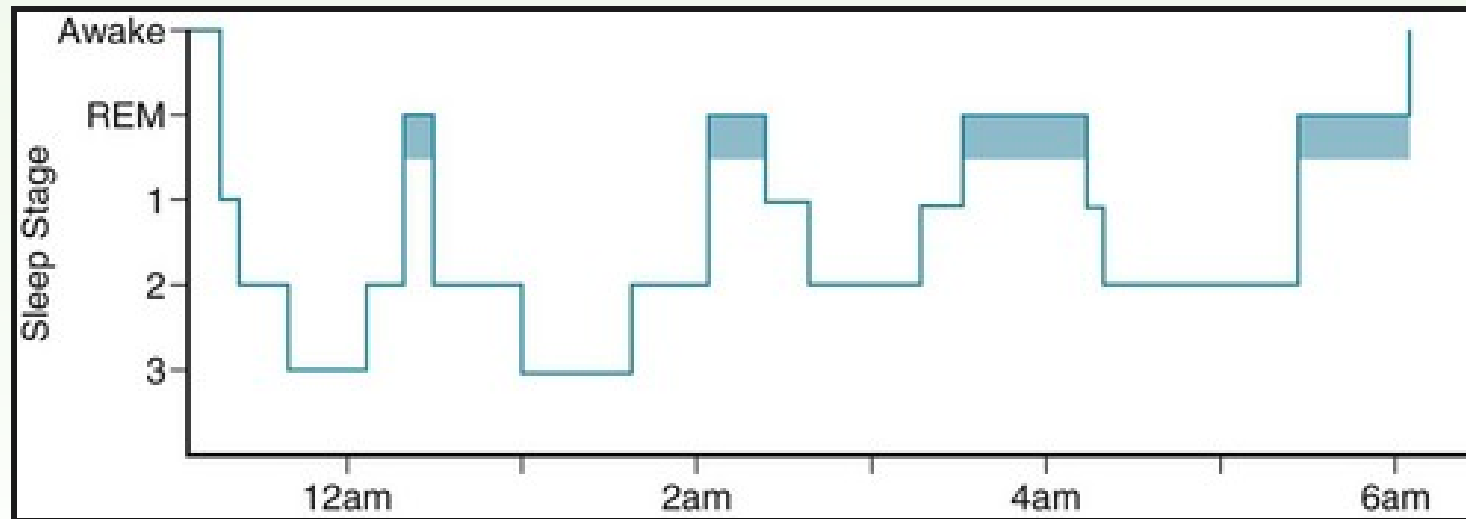
APNEA/HYPOPNEA INDEX =
average number of apneas and
hypopneas per hour of sleep

- Total # of apneas + hyopneas
- Divided by # of hours of sleep



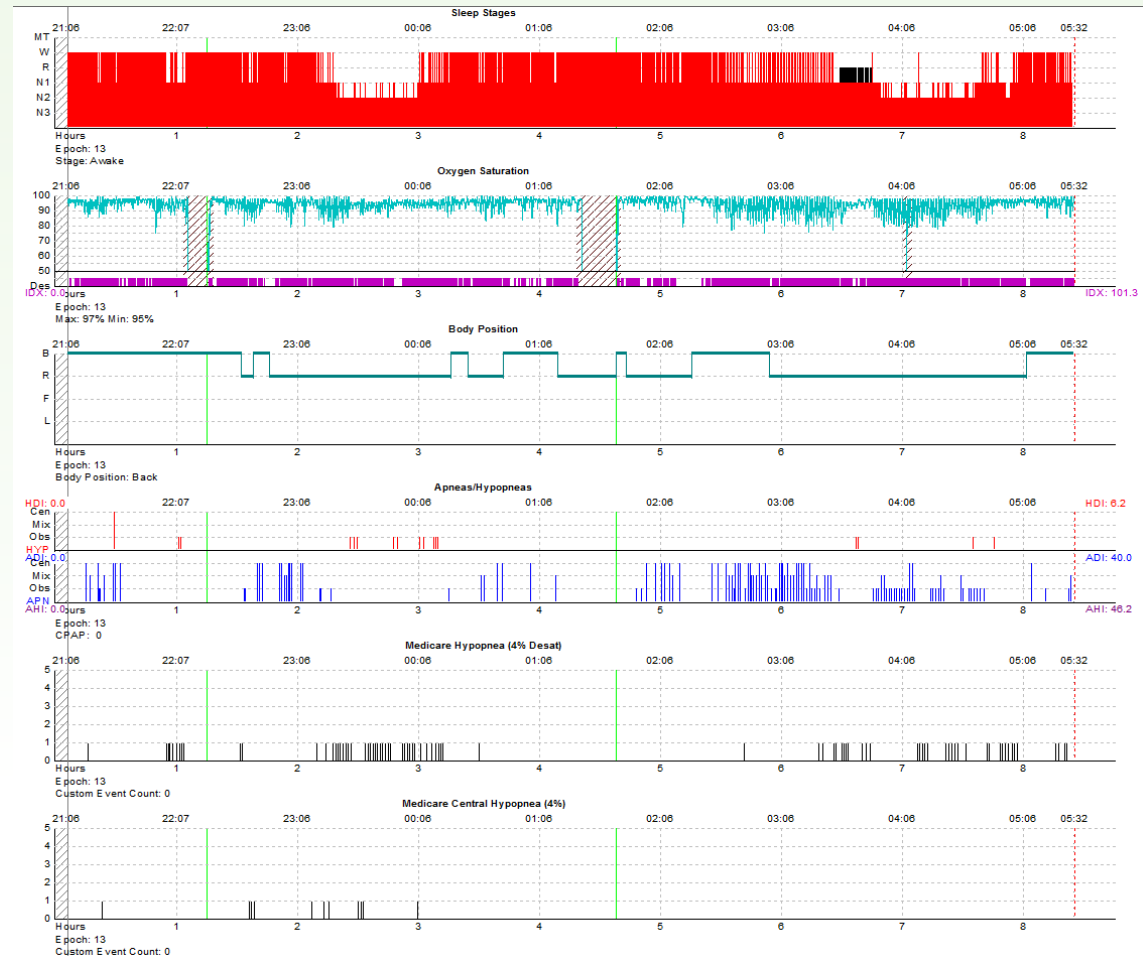
Level I Polysomnography

- Sleep Architecture



Level I Polysomnography

- Hypnogram



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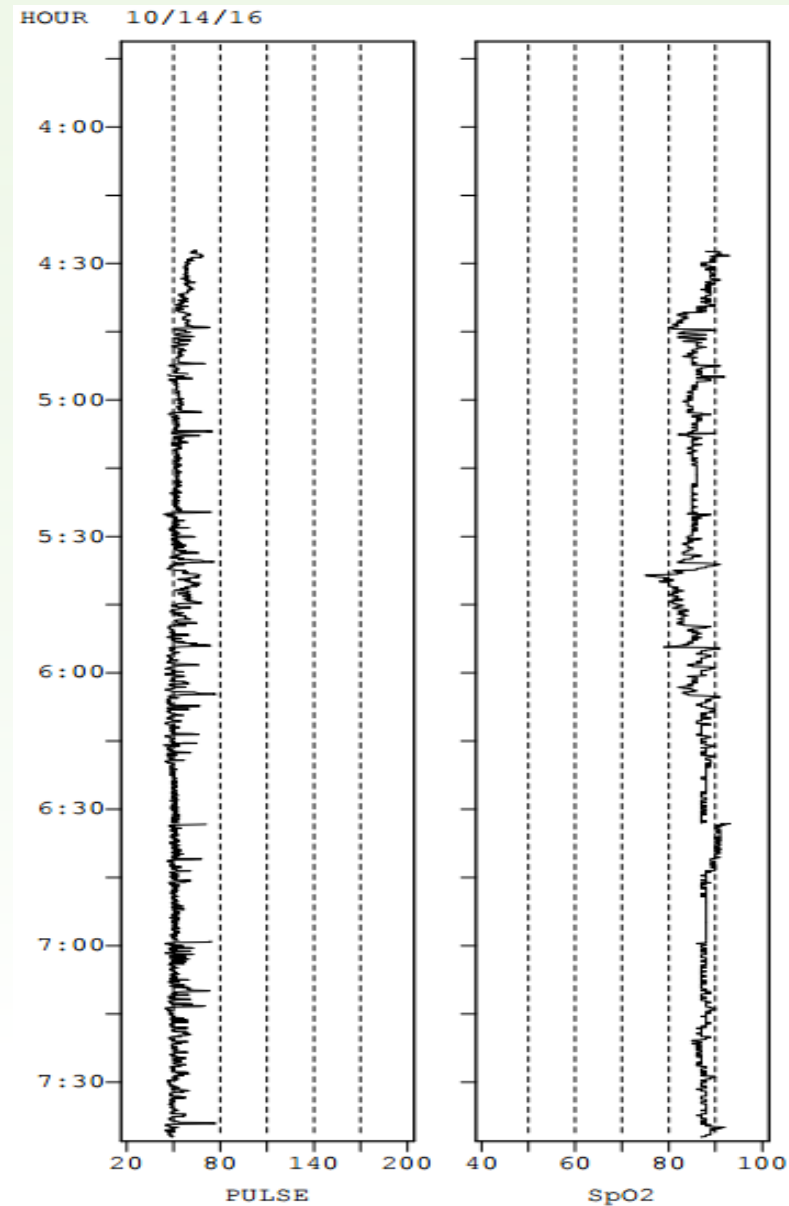
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Overnight Oximetry

- Monitor oxygen saturation with pulse oximetry overnight
- Usually done at home – sometimes also used in inpatient setting
- Not able to tell when patient is awake or asleep



Actigraphy

- Monitoring sleep/wake patterns over long periods of time
- Monitors body movements (think "Fit Bit")
- Assumes periods of inactivity represent sleep
- Assumes periods of activity represent wakefulness
- Especially helpful when compared to a sleep log



Multiple Sleep Latency Test

- Evaluate excessive daytime sleepiness
- Measures the physiological tendency to fall asleep in quiet situations
- Evaluate inappropriate early appearance of REM sleep after sleep onset
- Test used to diagnose narcolepsy vs. idiopathic hypersomnolence

Multiple Sleep Latency Test

- Patients are allowed 4 or 5 opportunities to nap across their usual day beginning 1.5-3 hours after awakening
- During each nap opportunity, they have 20 minutes to “try and fall asleep”
- If sleep occurs in a given nap opportunity, the patient is allowed to sleep for 15 minutes in order to see if the patient will go into REM sleep within 15 minutes of sleep onset
- The appearance of REM sleep within 15 minutes of sleep onset is called a sleep-onset REM period (SOREMP)
- Two or more SOREMPs are abnormal except in infants
- Mean sleep latency is calculated from the 4 or 5 naps

Multiple Sleep Latency Test

- Normal onset for REM sleep is approximately 90 minutes (range 70 to 110 minutes)
- Normal adults have a mean sleep latency of 10-20 minutes
- An in-lab polysomnogram the night before to verify at least 6 hours of sleep
- Sleep log and actigraphy for 1-2 weeks before the MSLT
- Medications that could affect the results of the test are stopped several days before the MSLT, if possible
- Urine drug screen the morning of the MSLT

Narcolepsy Type 1

- Previously called Narcolepsy with Cataplexy
- Cataplexy AND mean sleep latency of ≤ 8 minutes AND two or more SOREMPs

Narcolepsy Type 2

- Previously called Narcolepsy without Cataplexy
- Mean sleep latency of ≤ 8 minutes AND two or more SOREMPs
- Cataplexy is absent

Idiopathic Hypersomnia

- Fewer than two SOREMPs
- The presence of at least one of the following:
 - Mean sleep latency of ≤ 8 minutes OR
 - Typical sleep time of 12-14 hours per day OR
 - Insufficient sleep syndrome is ruled out OR
 - Hypersomnolence not better explained by another sleep disorder, medical disorder, psychiatric disorder, or drug/medication

Maintenance of Wakefulness Test

- Tests a patient's ability to stay awake during low levels of stimulation without resorting to extraordinary measures
- Patient sits in a recliner and is instructed to "try to remain awake"
- 4 opportunities to resist falling asleep at 2-hour intervals across the patient's usual day
- The room should be dimly lit and quiet, with night light in the room
- Patient in street clothes
- Instructions: Please sit still and remain awake for as long as possible. Look directly ahead of you, and do not look directly at the light.
- Patient is not allowed to use extraordinary measures to stay awake such as slapping the face or singing

Maintenance of Wakefulness Test

- Sleep onset is defined as the first epoch of greater than 15 seconds of cumulative sleep in a 30-second epoch
- Trial is ended after 3 consecutive epochs of stage 1 sleep, or one epoch of any other stage of sleep

STOP-BANG Questionnaire

- **Snoring?**
 - Do you **Snore Loudly** (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night)?
- **Tired?**
 - Do you often feel **Tired, Fatigued, or Sleepy** during the daytime (such as falling asleep during driving or talking to someone)?
- **Observed?**
 - Has anyone **Observed** you **Stop Breathing** or **Choking/Gasping** during your sleep?
- **Pressure?**
 - Do you have or are you being treated for **High Blood Pressure**?

STOP-BANG Questionnaire

- **B**ody Mass Index more than 35 kg/m²?
- **A**ge older than 50?
- **N**eck size large? (Measured around Adam's apple)
 - For male, is your shirt collar 17 inches or larger?
 - For female, is your shirt collar 16 inches or larger?
- **G**ender = Male?

STOP-BANG Questionnaire

For general population

OSA - Low Risk : Yes to 0 - 2 questions

OSA - Intermediate Risk : Yes to 3 - 4 questions

OSA - High Risk : Yes to 5 - 8 questions

or Yes to 2 or more of 4 STOP questions + male gender

or Yes to 2 or more of 4 STOP questions + BMI > 35kg/m²

or Yes to 2 or more of 4 STOP questions + neck circumference 17 inches / 43cm in male or 16 inches / 41cm in female

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Chung F et al. Anesthesiology 2008; 108: 812-821,

Chung F et al Br J Anaesth 2012; 108: 768-775,

Chung F et al J Clin Sleep Med Sept 2014.

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THANK YOU

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