Pediatric Sleep Disorders and Sleep Clinics

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SLEEP

Sleep is an active, not passive, process that serves many functions.

The organization and regulation of sleep and wakefulness are complex, highly active physiologic processes that involve the interaction of multiple central nervous system components.

It is estimated that by the age of 2 years the average child has spent about 9,500 hours (or a total of 13 months) sleeping, in contrast to 8,000 hours for all waking activities combined.

Between the ages of 2 and 5 years, children spend equal amounts of time awake and asleep. Throughout childhood and adolescence, sleep continues to account for about 40% of a child's average day.

Definition of Sleep

Sleep may be defined as a behavioral state characterized by the following:

- Reduced motor activity
- Decreased interaction with and responsivity to the environment
- Specific postures (e.g., lying down, eyes closed)
- Easy reversibility

It is also true that sleep is a complex amalgam of physiological and behavioral processes.

Why sleep is important for childhood?

Sleep is the time for restoration and for children's bodies to recharge and retain the information they have learned throughout the day.

During deep non-REM sleep, the body’s energy is restored, growth and repair occurs and important brain development hormones are released.

Insufficient sleep can also manifest in the following manner:

Fatigue and daytime lethargy, including increased somatic complaints (headaches, muscle aches)

Mood disturbance, including complaints of moodiness, irritability, emotional lability, increased negative emotions, depression, and anger.

Cognitive impairment, including problems with memory, attention, concentration, decision making, and problem solving.

Daytime behavioral disinhibition, including hyperactivity, oppositional, defiant, and aggressive behavior, impulsivity, and noncompliance.

Poor impulse control and increased risk-taking behaviors, Slower reaction times and more accidents especially in adolescents.

Academic problems, including chronic tardiness related to insufficient sleep and school failure resulting from chronic daytime sleepiness.

Use of stimulants, and other alertness enhancers such as caffeine and nicotine, to artificially maintain wakefulness and combat daytime fatigue.

•**Overeating**

Thus Sleep is an essential building block for your child's mental and physical health.

The American Academy of Pediatrics estimates that sleep problems affect 25 to 50 percent of children and 40 percent of adolescents.

Understanding their sleep needs is the first step towards providing better sleep for your children.

Through a combination of sleep hygiene, age-appropriate routines, and close attention to any sleep disorders.

Normal sleep in kids

- Birth to 1 year:
  - Sleep 50-75% of day, gradually decreases
  - Circadian rhythm begins by 6 mo., still 2-3 naps
  - NREM-REM cycles shorter (50 min/50 wga), gradually increases
  - More REM: 40-50% of TST
- Preschool kids:
  - 12-14 hours sleep/24h
  - Usually phase advanced
  - Take 1-2 naps
  - Behavioral sleep problems start

How much sleep does my child need?

AGE GROUP	HOURS PER NIGHT
Infants 4 - 12 months old	12 - 16 hours per 24 hour period
Children 1 - 2 years old	11 - 14 hours per 24 hour period
Children 3 - 5 years old	10 - 13 hours per 24 hour period
Children 6 - 12 years old	9 - 12 hours per 24 hour period
Teens 13 - 18 years old	8 - 10 hours per 24 hours

Naps included, according to the American Academy of Pediatrics

Sleep and dreams have perplexed human beings since the dawn of humanity.

However, it is really the major advances that occurred during last 100 years or so that have immensely increased our knowledge and understanding of sleep and sleep disorders and their treatment

Polysomnography, the objective scientific method used for studying sleep, developed in the second quarter of the twentieth century

The genesis and development of the field of pediatric sleep medicine in the United States owe much to the work of Richard Ferber, MD.
As a co-founder and former director of the Center for Pediatric Sleep Disorders at Boston Children's Hospital,

Ferber was instrumental in introducing clinicians to the ways of identifying and treating children's sleep problems, from general sleeplessness to more complex medical conditions such as sleep apnea.

The Pediatric Sleep Disorders Clinic is dedicated to providing comprehensive evaluation and treatment for a wide range of sleep disorders such as obstructive sleep apnea, nocturnal hypoventilation in neuromuscular and genetic diseases, respiratory failure and narcolepsy.

Symptoms Of
SLEEP DISORDERS

Difficulty falling asleep

Increased movement during sleep

Excessive daytime sleepiness

Daytime tiredness

Fatigue and dizziness

Experiencing irritability

Slow responses during social interactions

Haphazard sleeping patterns

Short sleep duration

Making frequent errors

Irregular breathing patterns

Experiencing headaches

Mental disorders

MIND HELP

MINDJOURNAL

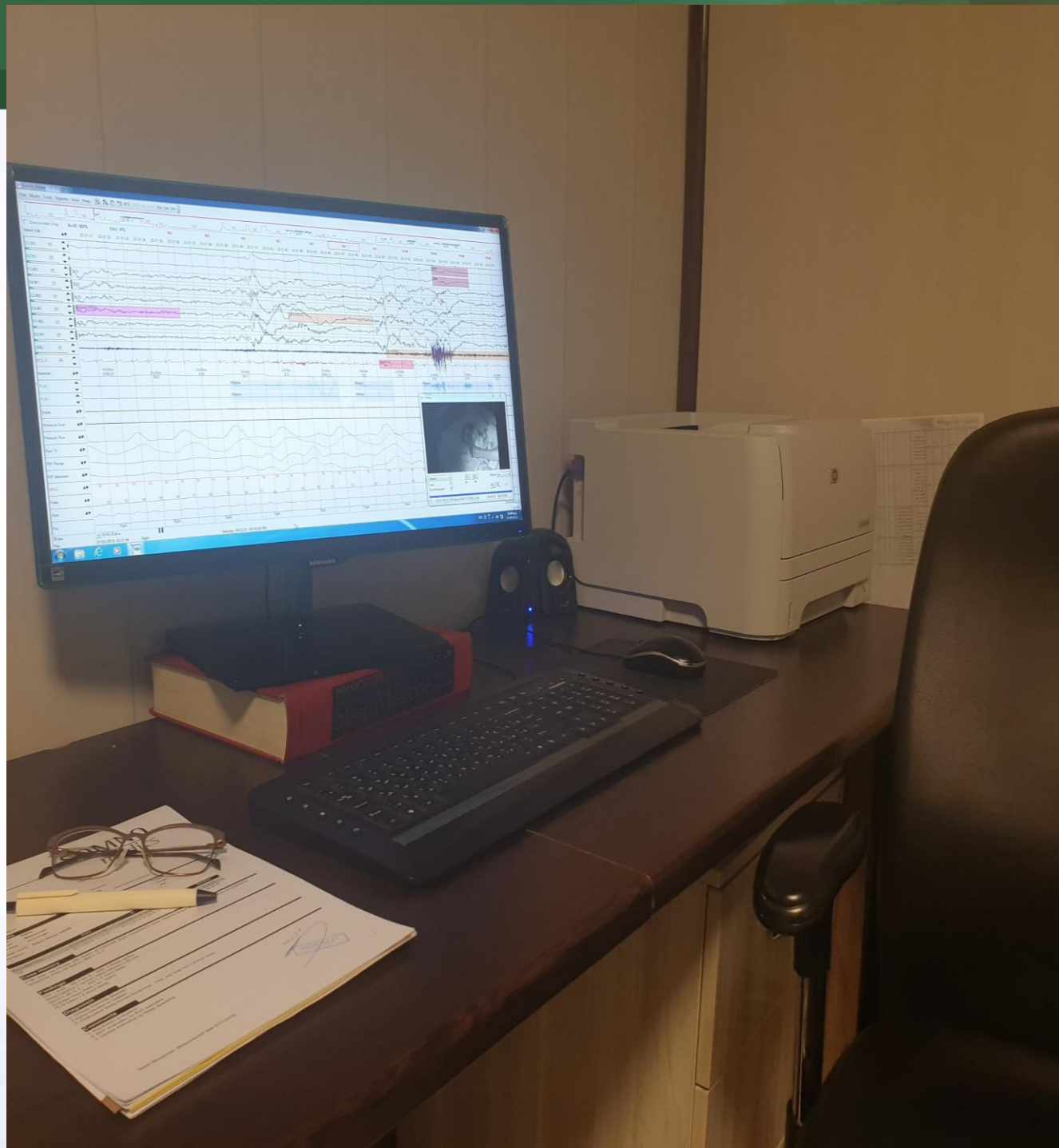

SLEEP WAKE DISORDERS
Insomnia Disorder
Hyper - somnolence Disorder
Narcolepsy
Breathing-related sleep disorders
Circadian Rhythm sleep-wake disorders
Non-REM sleep arousal disorders
Nightmare disorder
REM sleep behavior disorder
Restless Leg Syndrome
Substance /Medication induced sleep disorder

Pediatric Sleep Lab

The lab provides a safe, comfortable sleeping environment for an overnight study, we can monitor brain waves, breathing, movements and sleep cycles as a child sleeps. It's a way to get the most complete information possible about child's sleep experience and helps ensure an accurate diagnosis. One parent can stay through the night.

During the sleep study we will monitor many parameters through sensors on your child's body and video. Your child will be fitted with an array of monitoring equipment: electrodes for EEG and EOG; breathing sensors, belts to check the chest and abdomen movements; pulse oximeter to check oxygen levels; capnograph to check carbon dioxide levels; leg leads to check for leg movements; chin lead to check for bruxism; and ECG leads.

All the monitors are placed with tape or gel, and none hurt. A registered pediatric polysomnographer will set child up for the study and monitor him/her through the night.



INDICATIONS of refer to children s sleep center

1-VENTILATORY CONDITIONS

Snoring ,Mouth Breathing, Drooling, Nocturnal choking, Gasping, or Dyspnea,

Obstructive sleep apnea (OSA) is defined as pauses in breathing that frequently occur with snoring or gasping. An obstruction of the airway caused by enlarged tonsils and adenoids and/or ***obesity*** is often the cause of OSA. Conditions related to decreased muscle tone or craniofacial abnormalities seen in ***Down syndrome*** ,achondroplasia or in children with nasal obstruction. Apnea of infancy conditions potentially affecting ventilatory control (congenital or acquired),

Central apnea occurs when the part of the brain that controls breathing doesn't properly maintain the breathing process. It is fairly common in very premature infants because the respiratory center in the brain is immature. to neuromuscular diseases such as muscular dystrophy or cerebral palsy

Hypoventilation is inadequate breathing or ventilation at night. It can lead to abnormal blood gas levels. Hypoventilation in children is typically associated with conditions such as obesity or muscular dystrophy.

2-SLEEPING DIFFICULTIES

•**Insomnia** is trouble falling asleep or staying asleep. It can be caused by poor sleep habits and routines. Sometimes insomnia is caused by conditions such as obstructive sleep apnea or restless leg syndrome.
•Infant settling difficulties

•**Circadian rhythm sleep disorders** cause a child or teenager to sleep at late or irregular times. This occurs when their internal body clock is disrupted. Teenagers commonly have delayed sleep phase and are late to bed and late to rise.

•**Narcolepsy** and disorders of excessive daytime sleepiness
• is a sleep disorder characterized by excessive sleepiness, dream-like activity while awake and a sudden loss of muscle tone.
•**Parasomnias** are disorders that cause unusual or abnormal behaviors while falling asleep, sleeping or waking up. They include Sleepwalking, Night terrors, Sleep eating, Night mare and confusional arousals.

3- MOVEMENT DISORDERS

•**Restless leg syndrome** is a condition that causes a strong urge to move the legs. In some cases, runs in families. Dopamine that helps control motion may be low in children with restless leg syndrome. It may also be related to low iron levels in the brain. Iron is required for proper dopamine activity.

•**Periodic limb movement disorder** causes frequent twitching or movements of the legs or feet during sleep. These frequent movements can interrupt sleep and lead to daytime sleepiness.

Rhythmic movement disorder (head banging, etc)
in children with Night Seizure especially in resistant epilepsy if there is clinical suspicion of an accompanying sleep-related breathing disorder

What is an indication for a sleep study in children?

PSG

Indications

- **Respiratory**
  - Sleep related breathing disorders
    - OSA
    - Central sleep apnea
    - Sleep Hypoventilation
    - Periodic breathing
    - Sleep hypoxemia
- **Non-Respiratory**
  - Periodic limb movement of sleep (PLMS)
  - Narcolepsy
  - Nocturnal events
    - seizures vs. parasomnia
  - REM behavior disorders

Not indicated

- Typical Parasomnias
- Insomnia
- Circadian rhythm sleep disorders
- Restless legs syndrome

INDICATIONS FOR PEDIATRIC

POLYSOMNOGRAPHY

- Obstructive Sleep Apnea Syndrome (OSAS) ...
- Central Apnea, Periodic Breathing and Central Hypoventilation Syndromes. ...
- Neuromuscular Disorders. ...
- Chronic Lung Disease. ... chronic asthma, cystic fibrosis, pulmonary hypertension, bronchopulmonary dysplasia, or chest wall abnormality
- Continuous Positive Airway Pressure (CPAP) Ventilator Titration Studies. ...
- Tracheostomy Decannulation. ...
- Parasomnias??

INDICATIONS FOR PEDIATRIC POLYSOMNOGRAPHY

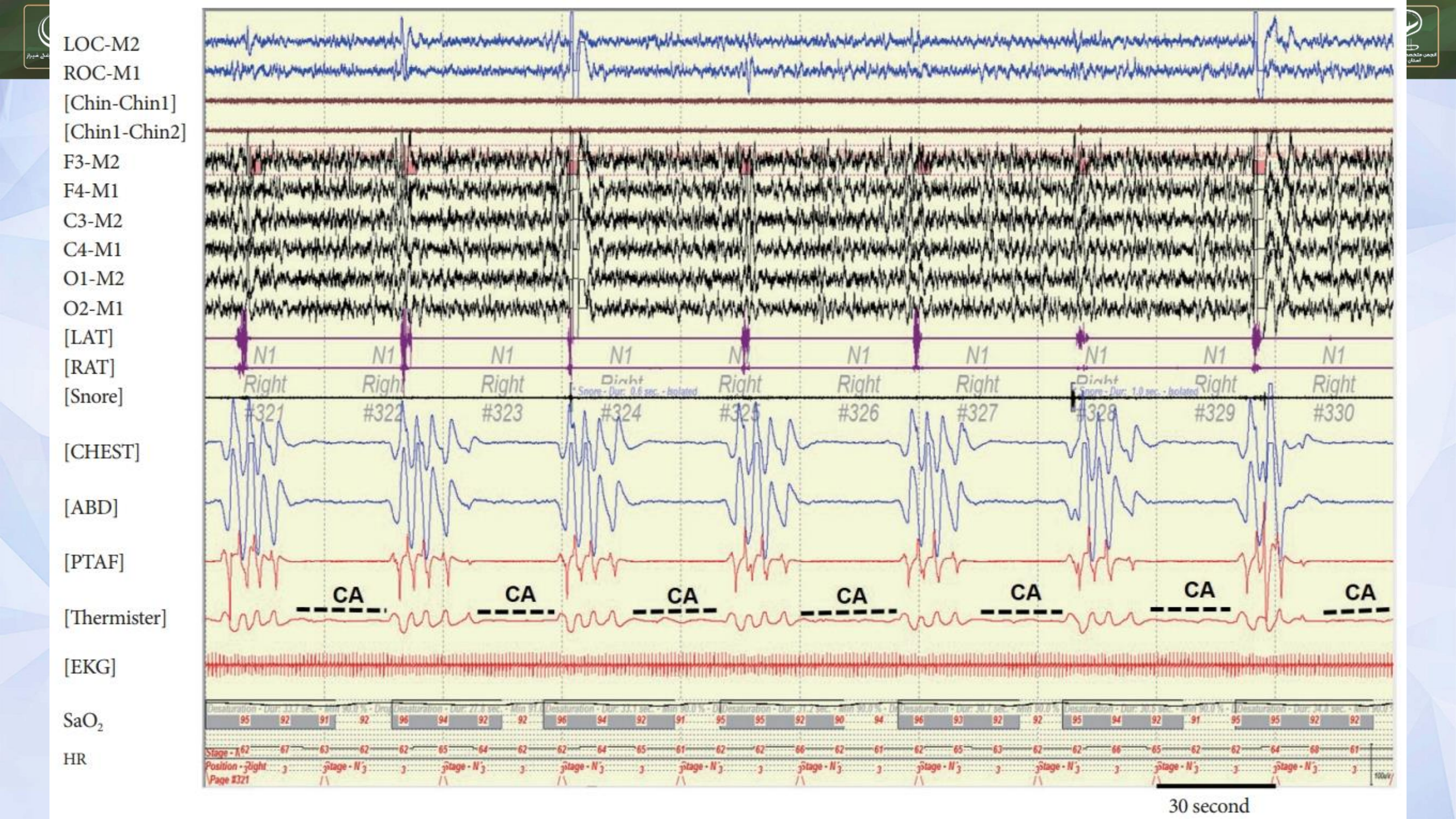
Obstructive Sleep Apnea Syndrome (OSAS)

OSAS is the most common indication for polysomnography. OSAS is common in the pediatric age group, occurring in approximately 2% of young children.

The American Academy of Pediatrics recommends that all children be screened by history for snoring, recognizing that OSAS is common and is frequently under-diagnosed

Central Apnea, Periodic Breathing and Central Hypoventilation Syndromes

Pediatric polysomnography is indicated to evaluate infants and children with suspected pathologic central apnea, periodic breathing or central hypoventilation. These children may present with cyanosis, observed apnea during sleep, daytime symptoms, apparent life-threatening events, post-anesthetic respiratory depression or cor pulmonale. It is crucial to monitor end-tidal PCO_2 levels to evaluate for hypoventilation, which if not detected and treated promptly may lead to poor developmental outcomes.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Neuromuscular Disorders

Polysomnography is useful to evaluate underlying cardiorespiratory function in children with neuromuscular disorders. Polysomnogram is indicated to detect sleep disordered breathing if there has been a change in growth velocity, developmental progress, daytime symptoms (e.g., sleepiness, headache), pulmonary function, development of daytime hypercapnia, polycythemia or heart failure.

Children with respiratory muscle weakness may not show signs of labored breathing during sleep and may not manifest airway obstruction by snoring. CO_2 monitoring is crucial during polysomnography in these patients to evaluate for sleep hypoventilation.

ATTENTION:
Please Don't Clean
with ALCOHOL

Chronic Lung Disease

Polysomnography can be used to evaluate for nocturnal hypoventilation and hypoxemia in infants and children with chronic lung disease, as well as to titrate supplemental oxygen.

Children with chronic lung disease may have normal arterial oxygen saturation values during wakefulness, but desaturate during sleep.

In infants with bronchopulmonary dysplasia, maintaining arterial oxygen saturation levels ≥93% during sleep results in improved growth

Continuous Positive Airway Pressure (CPAP) Ventilator

Titration Studies

Pediatric polysomnography is used to titrate CPAP and bilevel pressures. One of the main differences in pediatric CPAP titration studies compared to adults is that split night studies (diagnostic studies converted to titrations after demonstration of clinically significant OSAS) are not commonly performed, for several reasons.

Often, the children referred to the sleep lab have complex medical issues, and the decision to initiate PAP is multifaceted and is best done in an office setting. In addition, since adenotonsillectomy is the first line of treatment for childhood OSAS, CPAP is often not necessary. Most importantly, placing CPAP on a child for the first time in the middle of the night can be frightening and disturbing for the child. This can result in behavioral issues which will unfavorably influence future CPAP adherence.

Tracheostomy Decannulation

Polysomnography is a useful tool to assess functional airway obstruction in children who is thought to be ready for tracheostomy decannulation. In pediatrics, tracheostomies are often placed temporarily, in a neonate requiring prolonged ventilatory support, or while awaiting adequate airway growth for an infant to tolerate airway reconstruction. Children may breathe adequately when the tracheostomy tube is capped during wakefulness, but develop upper airway obstruction due to hypotonia during sleep.

During these polysomnograms, the patient is monitored initially with the tracheostomy uncapped. The tracheostomy tube is then capped and airflow and end-tidal PCO2 are monitored via the nose and mouth. It is necessary that oxygen, if required for chronic lung disease, be weaned to low flow so that it can be delivered through a nasal cannula.

Tracheostomy tube capping studies should only be done in patients who have tolerated capping of the tracheostomy during wakefulness.

Ideally, the tracheostomy tube should be downsized prior to the study.

Parasomnias

A common complaint evaluated in a pediatric sleep center is frequent night awakenings. In most cases, polysomnography is not indicated to evaluate this complaint. Good history will help determine if these night awakenings are due to sleep terrors or confusional arousals versus behavioral insomnia of childhood or some other cause.

However, there are uncommon cases where polysomnography is useful in determining whether there is a pathologic cause precipitating the night waking, such as gastroesophageal reflux or OSAS.

In some unusual cases, polysomnography can be helpful in differentiating parasomnias from seizures, hysterical conversion reactions or malingering (e.g., for school avoidance). In these cases, videotaping and good documentation by the sleep technologist are essential. Examining the EEG for epileptiform activity during unusual movements during sleep is useful in differentiating true seizure activity from other motor activity during sleep.

Restless Legs Syndrome And Periodic Limb Movement Disorder (PLMD)

It is our practice to place limb leads on every infant and child having a polysomnogram. Polysomnography is useful to evaluate for PLMD in young children with symptoms suggestive of restless legs syndrome in whom a definitive history can be hard to elicit; however it is not indicated in straightforward cases.

Excessive Daytime Sleepiness

In most cases of excessive daytime sleepiness, history, sleep diaries or actigraphy reveal the cause (such as insufficient sleep or poor sleep hygiene) and polysomnography is unnecessary.

Polysomnography is indicated in the evaluation of excessive daytime sleepiness if the history elicits suspicion of a pathologic cause such as OSAS, narcolepsy, PLMD or nocturnal seizures.

If narcolepsy is suspected, a multiple sleep latency test (MSLT) is indicated. The tendency to fall asleep during the day increases with increasing pubertal Tanner stage.

Ambulatory And Unattended Polysomnography

There are no randomized, controlled trials and limited information on pediatric unattended home polysomnography.

- **Before determining the need for tonsillectomy** the clinician should refer children with sleep-disordered breathing for polysomnography

if

- obesity, Down syndrome, craniofacial abnormalities, neuromuscular disorders, sickle cell disease, mucopolysaccharidoses.

- The clinician should advocate for polysomnography prior to tonsillectomy for sleep-disordered breathing in children without any of the comorbidities
- For whom the need for surgery is uncertain

or

- When there is discordance between tonsillar size on physical examination and the reported severity of sleep-disordered breathing.
- Clinicians should communicate polysomnography results to the anesthesiologist prior to the induction of anesthesia for tonsillectomy in a child with sleep-disordered breathing.

- Clinicians should admit children with obstructive sleep apnea documented on polysomnography for inpatient, **overnight monitoring after tonsillectomy** if
- They are younger than age 3

or

- have severe obstructive sleep apnea (apnea-hypopnea index of 10 or more obstructive events/hour, oxygen saturation nadir less than 80%, or both).

Following adenotonsillectomy

- Polysomnography is indicated following adenotonsillectomy in children with:
- preoperative evidence for mild moderate OSAS with residual OSAS,
- And in severe OSAS preoperative, obesity, craniofacial anomalies and neurologic disorders.

- Children with OSAS treated with an oral appliance should have clinical follow-up and polysomnography to assess response to treatment.

- Children treated with mechanical ventilation may benefit from periodic evaluation with polysomnography to adjust ventilator settings.

the American Academy of Pediatrics guidelines recommend that children with Down syndrome undergo polysomnography by the age of 4 years