

SLEEP DISORDERS



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INSOMNIA

- Insomnia is characterized by difficulty falling asleep, difficulty staying asleep, or non-refreshing sleep, despite adequate time and opportunity for sleep, along with impairment in daytime functioning



EPIDEMIOLOGY

- One year prevalence of short-term insomnia in adults is 15-20%
- Chronic insomnia with poor sleep most nights of the week, lasting more than three months, occurs in 10% of the population



INSOMNIA DUE TO MEDICAL CONDITION

- Sleep apnea
- Parasomnia
- Narcolepsy
- CPAP use
- Chronic pain of any kind
- Chronic obstructive pulmonary disease
- Degenerative brain disorders
- Medicines including some antidepressants, antihypertensives, steroids, antiparkinsonians, theophylline, stimulants
- Sedative withdrawal, alcohol and drugs



INSOMNIA AND AROUSING NEUROTRANSMITTERS

- Decreasing serotonin (5HT_{2A}) receptor activity improves sleep and anxiety, as with trazodone and mirtazapine
- Decreasing orexin receptor activity improves sleep, as with suvorexant (Belsomra^R)
- Decreasing histamine receptor activity improves sleep, as with doxepin



SLEEP RELATED BREATHING DISORDERS

Obstructive Sleep Apnea Syndromes

- Obstructive Sleep Apnea, Adult
- Obstructive Sleep Apnea, Pediatric



SYMPTOMS OF SLEEP APNEA

- Snoring
- Excessive daytime sleepiness/ fatigue
- Observed apneic episodes in sleep
- Waking up choking or gasping for breath
- Morning headaches
- Uncontrollable hypertension

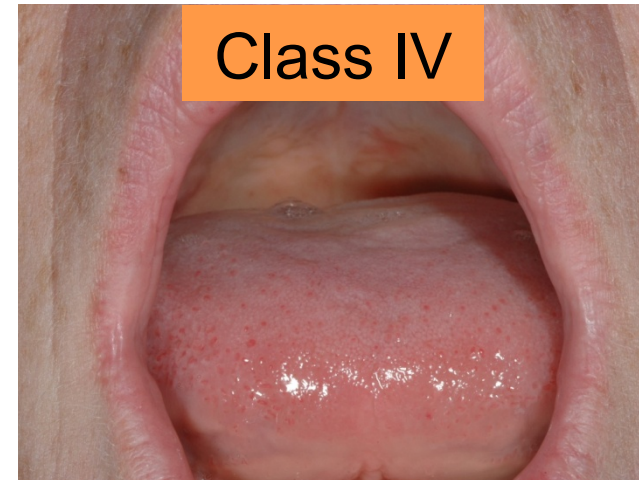


SIGNS OF SLEEP APNEA

- Obesity, especially upper body obesity
- Large neck
- Small or recessive mandible
- Large tongue
- Large uvula and tonsils
- Crowded posterior pharyngeal space



EXAM: OROPHARYNX



STOP-BANG

- Snoring (loud)
- Tiredness or sleepiness
- Observed apnea in sleep
- Pressure (High Blood)
- BMI >35
- Age >50 yrs
- Neck circumference >16"
- Gender male



STOP-BANG PREDICTS OSA

- If STOP-BANG is 3 or more, there is a significant likelihood of obstructive sleep apnea
- If STOP-BANG is 5-6 or more, there is an 80% pre-test probability of obstructive sleep apnea



POLYSOMNOGRAPHY IN SLEEP APNEA

- Repeated apneas, hypopneas with desaturations, and hypopneas with arousals
- Increased stage 1 sleep
- Decreased REM sleep
- Brady-tachy-arrhythmia with respiratory disturbances
- Related premature contractions and asystoles



OBSTRUCTIVE VS. CENTRAL APNEA

- Primary central sleep apnea is rare
- Central sleep apneas (no effort on inductance plethysmography) and periodic breathing may occur in heart failure and late stages of neurological diseases
- Opioid pain medicines can cause central sleep apnea
- Central sleep apneas may be seen when CPAP is used to control obstructive sleep apnea. This is called complex or treatment –emergent sleep apnea



EPIDEMIOLOGY OF SLEEP APNEA

- Among 30-70 year olds, 34% of men and 17% of women have apnea-hypopnea (with 4% desaturation) index >5
- 13% of men and 6% of women have moderate to severe obstructive sleep apnea (AHI >15)
- 9% of men and 3% of women have mild obstructive sleep apnea (AHI 5-14/h) with sleepiness
- Thus, 22% of men and 9% of women have either moderate to severe OSA, or mild OSA with sleepiness, and need treatment



PATHOPHYSIOLOGY OF SLEEPINESS

- Repetitive arousals lead to interrupted sleep with consequent fatigue/sleepiness
- Recurrent desaturations lead to oxidative stress injuries of the brain cells, which may lead to cognitive decline and fatigue/sleepiness



CARDIOVASCULAR DISEASE IN SLEEP APNEA

- With moderate to severe sleep apnea, after adjustment for other risk factors, relative risk ratio is 2-3 for
 - Hypertension
 - Myocardial infarctions
 - Congestive heart failure
 - Cerebrovascular accidents especially with AHI(with desat) >36/h (Yaggi et al, NEJM 2006)
- This is in line with independent relative risk ratios attributed to high cholesterol, hypertension, smoking, obesity, etc.



OSA AND ATRIAL FIBRILLATION

- CRP elevation predicts Atrial Fibrillation (AF) recurrence
- Untreated OSA patients have 82% recurrence of AF within 12 months of cardioversion, whereas patients without OSA have a 50% recurrence rate (Kanagala et al, Circulation 2003)
- Treated OSA patients have a 42% recurrence rate



SLEEP APNEA AND CONGESTIVE HEART FAILURE

- 11-37% of patients with congestive heart failure have obstructive sleep apnea
- Optimally medically treated CHF patients with RDI > 20/h sleep treated with CPAP compared to patients not treated with CPAP (Kaneko et al, NEJM 2003)
 - Systolic blood pressure decreased from 128 to 118 mm Hg
 - Left ventricular ejection fraction increased from 25% to 34%



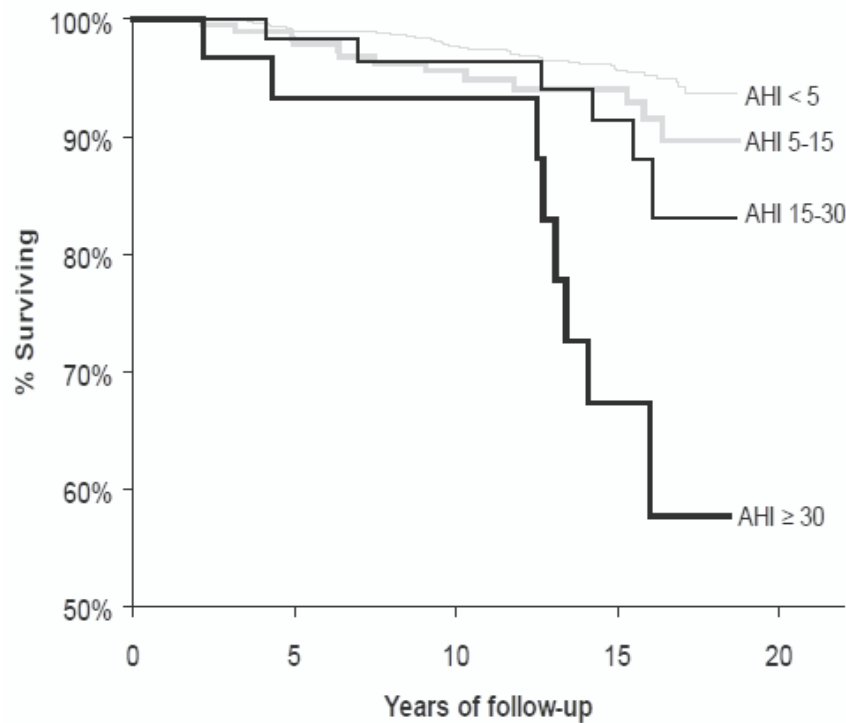
SLEEP APNEA AND MORTALITY

- 10 year prospective study shows untreated severe OSA (AHI with desat $>30/h$) triples risk of fatal and non-fatal cardiovascular events compared to healthy controls matched for age and BMI (Marin et al, Lancet 2005)
- Patients with AHI 5-15, AHI 15-30, simple snorers and AHI >30 treated with CPAP had no increase in events
- Deaths in OSA patients much more likely at night (12 midnight to 6 am) compared to general population (Gami et al, NEJM 2005)



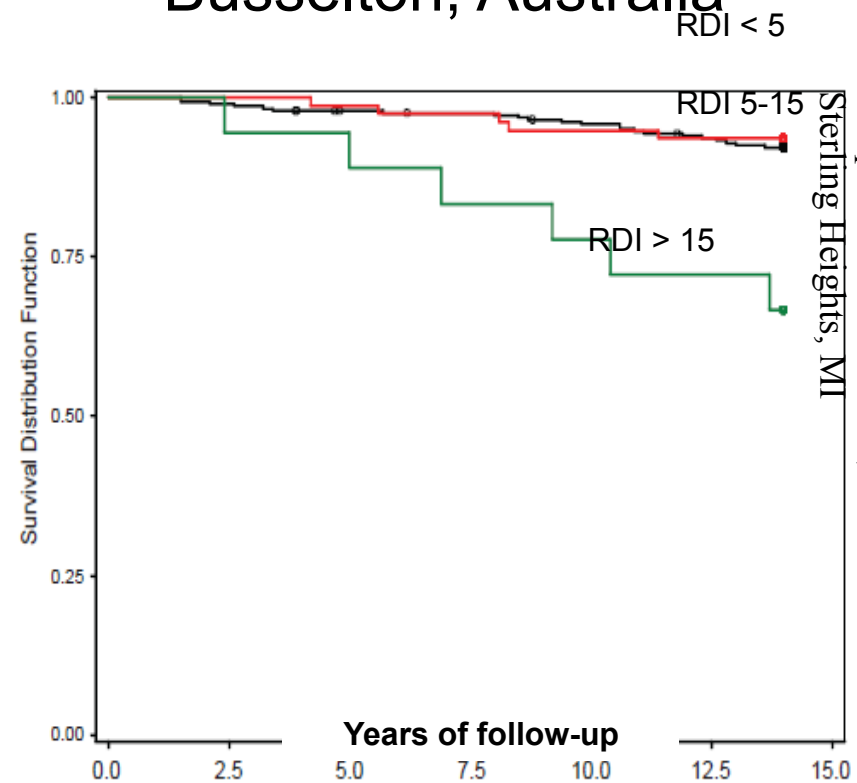
CONSEQUENCES: MORTALITY

Wisconsin



Young et al. Sleep 2008; 31:1071-1078

Busselton, Australia



Marshall et al. Sleep 2008; 31:1079-1085

TREATMENT OF OBSTRUCTIVE SLEEP APNEA

The rationale for treatment is:

- Decreasing risk of cardiovascular disease
- Allowing better control of concomitant hypertension
- Controlling sleepiness and cognitive impairment



TREATMENT THRESHOLDS

- When Apnea-Hypopnea Index >15 , treat to prevent cardiovascular disease regardless of symptoms
- When Apnea-Hypopnea Index >5 , treat in presence of concomitant excessive sleepiness
- Generally use AASM definition ages 13-64, and CMS definition ages 65 or older




CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP)

- Continuous Positive Airway Pressure (CPAP) is the most effective treatment
- It mechanically splints the airway open, thus eliminating snoring and preventing respiratory disturbances in sleep
- It requires titration to the correct pressure during a second night of polysomnography following a diagnostic polysomnography



CPAP COMPLIANCE

- 59% of patients started on CPAP nationwide are compliant in one 30 day period during the first 90 days (defined as average nightly use of 4 hours or more)
 - 90% of patients started on CPAP at our offices are compliant in one 30 day period during the first 90 days (defined as average nightly use of 4 hours or more)
 - In other words, compliance could be a lot better. But all said and done, it is comparable to other chronic treatments
- 

EFFECT OF CPAP ON SLEEPINESS

- Sleepiness improves dramatically with CPAP, within about two weeks.
- However, sleepiness (and other measures of brain function) may not quite return to normal
- Does chronic use finally cause normalization of cerebral function? We do not know



EFFECT OF CPAP ON CARDIOVASCULAR DISEASE

- Many measures of cardiovascular disease improve, such as CRP, recurrence of AF, ejection fraction, monocyte adhesion, serum amyloid, thiobarbituric reactive substances and peroxides
- Retrospective and prospective studies suggest dramatic improvement in hospital readmission and mortality rates (Milleron et al, Eur Heart J, 2004)



PROBLEMS WITH CPAP

- CPAP can be hard to use in the presence of chronic nasal congestion. Nasal steroids help
- CPAP can worsen nasal congestion. Heated humidification of the system helps
- Mask comfort and fit is crucial
- CPAP can worsen sleep. Resultant insomnia may need to be treated



CPAP, PRESSURE RELIEF AND BPAP

- CPAP gives constant air pressure through inspiration and expiration. Patients can have difficulty exhaling against it.
- Pressure relief (C-Flex or EPR) lowers the pressure 1-2 cm during expiration and helps with this problem
- BPAP can give a much lower pressure through exhalation, so the airway can collapse. By forcing air into the lungs, it may produce hypocarbia and central apneas. More expensive



AUTO-PAP

- Unlike the ECG, airflow is not a highly superimposable and unchanging signal
- No reliable and valid method of automatically scoring for respiratory disturbances exists
- Auto-PAP devices use unknown patented methods to detect respiratory disturbances. They use these methods (of limited reliability and validity) to automatically adjust CPAP pressures through the night, depending on presence of breathing abnormalities
- They may administer pressures that are too high making it difficult to tolerate, or too low so that apnea is not well controlled



ORAL DEVICE

- Mandibular repositioning (fully adjustable and articulable, allowing opening of mouth) devices aim to mechanically advance the mandible beyond the maxilla, thus increasing posterior pharyngeal space
- Patients may find it hard to wear this all night
- It may be useful in mild to moderate OSA
- It is not sufficient in severe OSA



SURGICAL TREATMENT

- Uvulo-palato-pharyngo-plasty (along with tonsillectomy if tonsils enlarged) may help in mild to moderate OSA patients who are not obese and do not have a large tongue. It is not useful otherwise, or in patients with severe sleep apnea. Robotic surgery does not improve outcomes
- Radio-frequency ablation of the tongue or uvula/ palate is not effective
- Maxillo-mandibular advancement (MMA) following UPPP is very effective in controlling OSA with 90% success rates, requires orthodontic treatment before surgery



PEDIATRIC SLEEP APNEA

- Pediatric Sleep apnea is common (1-2% of children)
- It is usually missed
- It has consequences (sleepiness, hyperactivity, attention and school problems)
- It also has cardiovascular consequences (early hypertension, cor pulmonale, pulmonary hypertension)
- In children under age 13, AHI (with >3% desaturations or arousals) >1/h sleep is abnormal
- In older children (>12 years), adult criteria may be followed



WHEN TO SUSPECT PEDIATRIC SLEEP APNEA

- Snoring with
 - Labored breathing during sleep
 - Gasps/ snoring noises/ observed apnea in sleep
 - Secondary sleep enuresis (bed-wetting)
 - Sleeping seated or with the neck hyperextended
 - cyanosis



WHEN TO SUSPECT PEDIATRIC SLEEP APNEA (CONTD)

- Snoring with
 - Headaches on awakening
 - Daytime sleepiness
 - Attention-deficit/hyperactivity disorder
 - Learning problems
 - Underweight or overweight
 - Tonsillar hypertrophy



DEFINITION OF SLEEP APNEA IN CHILDREN

- Includes apneas (obstructive, central, mixed) and hypopneas
 - Obstructive apneas are $\geq 90\%$ decrease in airflow (thermal recording) for ≥ 2 breaths, with respiratory effort throughout the event
 - Mixed apneas are $\geq 90\%$ decrease in airflow (thermal recording) for ≥ 2 breaths, with absent respiratory effort in the beginning followed by respiratory effort with continuing apnea
 - Central apneas are $\geq 90\%$ decrease in airflow (thermal recording) for ≥ 2 breaths, with arousal or $\geq 3\%$ desaturation, or an event duration of ≥ 20 seconds
 - Hypopneas are $\geq 30\%$ decrease in airflow (nasal pressure recording) for ≥ 2 breaths, with arousal or $\geq 3\%$ desaturation
- In children ≤ 12 years age, AHI $\geq 1/h$ sleep is abnormal, as is $pCO_2 > 50$ for $>25\%$ of time spent asleep
- In older children (>12 years), AHI $\geq 5/h$ sleep is abnormal

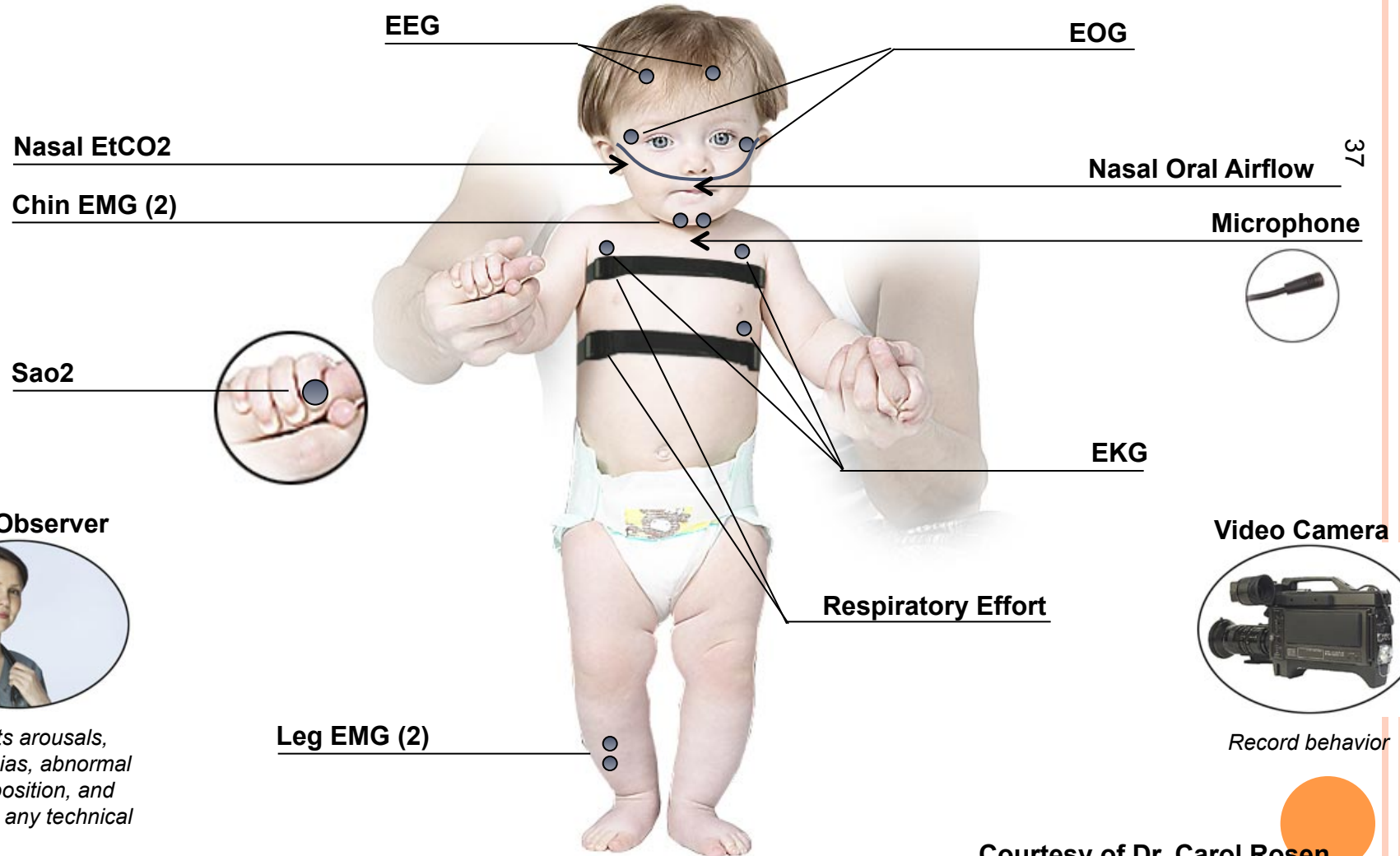


POLYSOMNOGRAPHY IN SLEEP APNEA

- Polysomnography in the sleep center, monitored by a technologist, is the gold standard for the diagnosis of sleep apnea.
- It monitors, sleep, breathing (airflow and effort), oximetry, ECG, leg activity, and the effects of breathing abnormalities on sleep, oximetry, ECG and leg activity
- It should be performed in a sleep disorders center accredited by the American Academy of Sleep Medicine
- It should be interpreted by a physician Board Certified in Sleep Medicine



Pediatric Polysomnography



Courtesy of Dr. Carol Rosen

TREATMENT OF PEDIATRIC OSA

○ Surgical

- Adenotonsillectomy (if tonsils enlarged, more common \leq age 12)
- Craniofacial surgery if craniofacial abnormalities

○ Medical

- Continuous positive airway pressure (1st line treatment if age >12 , after failed adenotonsillectomy or if tonsils not enlarged if age ≤ 12)
- Weight loss if obese

CHILDREN ON CPAP



CONCLUSION

- Pediatric Sleep Apnea is quite common
- It has consequences include behavioral and attention difficulties, sleepiness, and early hypertension
- It should be evaluated, at a sleep disorders center accredited by the American Academy of Sleep Medicine, by a physician board certified in Sleep Medicine
- Tonsillectomy in younger children and CPAP at all ages is an effective treatment
- The Sleep & Attention Disorders Institute in Sterling Hts, MI is the only AASM accredited sleep disorders center in the area which evaluates children as young as 1 year of age



NARCOLEPSY

- Narcolepsy is a disorder characterized by
 - Excessive daytime sleepiness
 - The narcoleptic triad may or may not be present
 - Cataplexy or loss of muscle tone when emotional
 - Sleep paralysis or waking up from sleep paralyzed
 - Hypnagogic hallucinations or vivid dreams before falling asleep/after waking up



NARCOLEPSY: DIAGNOSTIC TESTING

- Overnight Polysomnography is normal
- Multiple Sleep Latency Test involves four to five nap opportunities two hours apart
- On the MSLT, patients fall asleep quickly (<8 min), which in itself is not abnormal
- Patients also go into REM sleep within 15 min in at least two of the naps, this being diagnostic in the presence of otherwise unexplained sleepiness



TREATMENT OF NARCOLEPSY

- Sleepiness in narcolepsy is treated with stimulant medicines such as
 - Dopaminergic medicines like methylphenidate, amphetamines
 - Modafinil, which is also dopaminergic



IMPROVEMENT WITH STIMULANTS

- Stimulants improve but do not eliminate sleepiness
- The Maintenance of Wakefulness Test reveals improved but continuing difficulty maintaining wakefulness
- The DOT does not allow treated narcolepsy patients to get interstate truck driving certification



TREATMENT OF NARCOLEPTIC TRIAD

- REM suppressants such as protriptyline, the SSRIs (e.g., fluoxetine), control cataplexy, sleep paralysis and hypnagogic hallucinations
- Gamma-hydroxy-butyrate (GHB) at night is also effective in controlling cataplexy



IDIOPATHIC HYPERSOMNIA

- Idiopathic hypersomnia is characterized by unremitting excessive sleepiness, despite sufficient time in bed



POLYSOMNOGRAPHY & MSLT

- Patients with idiopathic hypersomnia have normal polysomnography
- The Multiple Sleep Latency Test shows sleep latency less than 8 min, which is not in itself abnormal, or 24-hour sleep time is ≥ 660 min
- There is no REM pressure or excessive sleep onset REMs



TREATMENT OF IDIOPATHIC HYPERSONNIA

- Stimulant medicines may improve sleepiness, but response is usually partial. Examples are:
 - Methylphenidate and amphetamines which works through dopaminergic mechanisms
 - Modafinil, which is also dopaminergic



PARASOMNIAS

- A parasomnia is an undesirable physical event or experience that occurs during entry into sleep, within sleep, or during arousals from sleep
- Parasomnias may be disorders of arousals from NREM sleep or may be associated with REM sleep



DISORDERS OF AROUSAL FROM NREM SLEEP

- Confusional arousals, sleep walking and sleep terrors are common in childhood, occur in deeper stages of sleep, and usually disappear with age
- They become a problem when they are frequent enough to disrupt the family life, or lead to behavior that predisposes to injuries to self or others



CONFUSIONAL AROUSALS

- Confusional arousals are characterized by the patient awakening in a confused state
- The patient may be combative
- There is amnesia for the event



SLEEP WALKING AND SLEEP TERRORS

- Sleepwalking is characterized by the patient walking in sleep
- Sleep terrors are characterized by a cry or piercing scream and manifestations of extreme fear
- Attempts to awaken the patient lead to a confused and possibly combative patient
- There is amnesia for the event



SLEEP RELATED EATING DISORDER

- Sleep related eating disorder: involuntary eating/drinking during sleep period



REM RELATED PARASOMNIA

- Recurrent Isolated Sleep Paralysis is characterized by inability to move limbs and trunk at sleep onset or with awakenings, lasting seconds to minutes
- Nightmare disorder involves recurrent awakenings with recall of intensely disturbing dream involving fear or anxiety
- There is full alertness on awakening, with little confusion or disorientation



REM BEHAVIOR DISORDER

- REM behavior disorder is characterized by abnormal behavior including walking in sleep and fighting, occurring from REM sleep
- It typically begins in adulthood and is more likely to lead to injuries



POLYSOMNOGRAPHY IN POTENTIALLY INJURIOUS PARASOMNIAS

- In REM Behavior Disorder, the usual atonia in REM is absent, allowing patients to act out their dreams
- In arousal disorders from NREM sleep, polysomnography is normal. Abnormal behavior events occurring from deeper stages of NREM sleep may be seen
- Epilepsy (such as partial complex) and severe obstructive sleep apnea may mimic parasomnia symptoms



TREATMENT OF PARASOMNIAS

- Medicines that suppress arousals are useful in controlling arousal disorders from NREM sleep as well as REM behavior disorder
- The short-acting benzodiazepines such as lorazepam cause less hangover. Clonazepam may be more effective, but is more likely to cause a hangover



SLEEP RELATED MOVEMENT DISORDERS

- These are characterized by relatively simple, usually stereotyped, movements that disturb sleep
- Restless Legs Syndrome is the exception, where the movements are complex, occur in wake, and serve to avoid the unpleasant sensations of RLS



RESTLESS LEGS SYNDROME

- There is an urge to move the legs, in response to uncomfortable and unpleasant sensations in the legs
- These sensations occur or worsen during periods of rest or inactivity, and in the evening or night
- Movement such as walking or stretching relieves the sensations as long as the movement is continued



PERIODIC LIMB MOVEMENTS

- Characterized by repetitive, stereotyped movements in sleep that are
 - 0.5-5 seconds in duration
 - In a sequence of four or more movements
 - Separated by 5-90 seconds
- PLM disorder is present when frequent PLMs with arousals (>5/h in children, >15/h in adults) cause insomnia or daytime fatigue
- PLMs without sleep symptoms are common and probably a normal variant



TREATMENT OF RLS & PLMD

- Dopaminergic anti-Parkinsonic medicines such as pramipexole and ropinirole are effective
- Gabapentin may be beneficial
- Opioids such as codeine also help, but do not constitute the treatment of choice
- Clonidine may also be effective

