

ENT in a Nutshell

Sleep Physiology

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Sleep (0:55)

- Why is sleep important?: 4 important functions
 - Physical growth: Stage III sleep, Growth Hormone secreted
 - Memory consolidation: REM sleep
 - Energy Conservation
 - Immune function preservation
- How much sleep do we need?
 - Dependent on age: most adults 7-9 hours
 - Newborn: 14-17 hours
 - >65 y.o.: 7-8 hours
 - Dependent genetics, not well understood

Two Process model (2:50)

- Governing forces of sleep
 - 1) Circadian process: internal rhythm that all cells have, guides awake/asleep
 - Melatonin: hormone that increases sleepiness
 - Zeitgebers any external or environmental cue that entrains or synchronizes an organism's biological rhythms to the Earth's 24-hour light/dark cycle
 - Sunlight: stimulates retinohypothalamic tract to dictate melatonin release
 - Photic or light stimulus → Retina → suprachiasmatic nucleus (hypothalamus) → pineal gland → decrease melatonin release
 - 2) Homeostatic process: longer awake, more you want to sleep
 - Adenosine builds up with longer awake period, increasing sleepiness

Neuroanatomy/Physiology (5:30)

- Neurotransmitters:
 - Awake Promoting Neurotransmitters
 - Epinephrine, Norepinephrine, Serotonin, Histamine (Benadryl makes us sleepy), Dopamine, Orexin
 - Sleep Promoting Neurotransmitters

- Acetylcholine, glutamine, glycine, GABA (alcohol/benzodiazepine), adenosine
- Hormone regulation:
 - Many hormones also have a rhythm that mirrors sleep/wake
 - Growth Hormone: Rises during Stage 3. Important for adequate growth in children
 - Cortisol: Rises just before waking
 - TSH: peaks during sleep
 - Leptin/Ghrelin: leptin from adipose tissue (decreases hunger). Leptin (lean) generally decreases hunger, but resistance noted in OSA patients. Ghrelin increases hunger. Sleep and interaction with leptin/ghrelin not well understood, yet.

Sleep Deprivation (10:28)

- Acute: 1-2 days with little/no sleep
 - Recovery:
 - Day 1: Rebound slow (delta) sleep. Decrease sleep latency. Consolidated stage 3 sleep, deep sleep.
 - Day 2: Increase REM sleep
 - Day 3: Return to normal
 - Physiologic/hormonal implications:
 - Increased sympathetic tone
 - Decrease GH
 - Inflammatory state with decreased immune function
- Chronic: 3+ nights without significant sleep
 - Recovery:
 - REM rebound
 - Performance:
 - Subjective reporting of performance does not align with objective performance. Don't recognize deficits.
- Combatting sleepiness:
 - Nap
 - <15 minutes prevents deep Stage 3 sleep, but drives down Adenosine
 - Caffeine:
 - Non-selective adenosine antagonist
 - 100-150 mg caffeine
- Delayed sleep phase syndrome:

- Sleep schedule shifted later. Often due to mis-regulation of light and melatonin.
- Tenants of shifting sleep phases
 - Light:
 - Morning light/Evening dark: promotes phase shift and signals sleep/wake at appropriate times
 - Blue light is most stimulating light (computers, devices)
 - Melatonin:
 - Melatonin 5mg 30 min prior to sleep
 - Rhythm shift 0.5mg 5 hours before bed to shift earlier
 - Strict schedule:
 - Consistent sleep/wake time, 7 days per week