1. Sleep through the Ages

Sleep Through the Ages

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2. Quote

“Don’t ever go to sleep. Too many people die there.”

Mark Twain

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What Is Sleep?

Definition

“A reversible behavioral state of perceptual disengagement from and unresponsiveness to the environment."

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Two Stages of Sleep

- Non-rapid eye movement (NREM)
- Rapid eye movement (REM)

NREM

- Four Stages
- Based on EEG patterns:
  - Synchronous
  - Characteristic waves

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7. NREM stages

NREM Stages

- Stage 1: light sleep, drowsy, theta
- Stage 2: 50% of sleep, K complex spindles, transition stage
- Stage 3: 20-50% delta waves
- Stage 4: >50% delta waves

8. REM

REM

- EEG activation, beta
- EMG atonic
- Episodic bursts of rapid eye movements
- Dream state

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9. Sleep architecture

Sleep Architecture

- Enter sleep through NREM usually
- REM occurs after ~ 80 minutes
- Cycle repeats itself every 90 minutes, 4-6 times/night

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10. Sleep architecture

Sleep Architecture

- Wake: <5%
- Stage 1: 2-5%
- Stage 2: 45-55%
- Stage 3: 3-8%
- Stage 4: 10-15%
- REM: 20-25%

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11. How is sleep evaluated?

12. Normal sleep

**Normal Sleep**

- Average human need is 8.3 hours
- Normal sleep latency: 10 minutes
- Normal sleep structure
  - 5% stage 1
  - 50% stage 2
  - 15-25% stages 3 and 4 (slow wave sleep)
  - 25% REM
- Napping occurs at the beginning and the end of life (in our culture)
Sleep States in Newborns

Quiet Sleep

Active Sleep

Indeterminate

Active Sleep is analogous to REM
• It is present by 32 weeks conception age
• The EEG has a low voltage irregular pattern
• REM's are present
• EMG tone is variable
• Heart and respiratory rate is variable, frequent body movements, grimaces and twitches

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15. Sleep states in newborns

**Sleep States in Newborns**

*Quiet sleep is analogous to NREM Sleep*

- Discontinuous EEG pattern
- Intermittent bursts of electrical activity alternates with quiescent periods
- Regular respiration and heart rate
- Sustained EMG activity
- Few body movements

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16. Ontogenesis of sleep: 24-28 weeks conceptional age

**Ontogenesis of Sleep**

*24-28 weeks Conceptional Age*

- Cannot differentiate sleep from wake prior to 24 weeks conceptional age
- EEG is a discontinuous pattern relatively flat periods of up to 3 min separated by activity burst less than 20s of mixed frequencies

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17. Ontogenesis of sleep: 28-32 weeks conceptional age

**Ontogenesis of Sleep**

*28-32 weeks Conceptional Age*

- Discontinuous pattern persists
- “Delta brushes” emerge at about 30 wks
- 10-20 Hz activity riding on slow waves
- Delta brushes persists until term

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18. Ontogenesis of sleep: Alpha rhythm development

**Ontogenesis of Sleep**

*Alpha rhythm development*

- Awake, eyes closed posterior dominant rhythm is present at 2 months at 4 Hz
- At 12 months the frequency is 6 Hz
- At 24 months the frequency is 6-7 Hz
- By 36 months the frequency increases to 7-8 Hz
- Well developed alpha activity by 8 years

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Ontogenesis of Sleep

- Sleep spindles begin to appear at 4 wks as immature forms
- Mature forms by 8 weeks
- Abnormal development of NREM sleep if not present by 3 months

Ontogenesis of Sleep

K-complexes
- First appear by 4-6 months of age
- Has the same morphology as adults
- May appear in response to external stimuli

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Ontogenesis of Sleep

Tracé alternant pattern

- NREM sleep pattern at term
- 2 to 6 seconds burst of high amplitude slow waves separated by 4 to 6 seconds of low voltage mixed activity
- Seen at 32 wks post-conception and gone by 4 weeks post-term
- Replaced by high voltage, slow wave pattern

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Ontogenesis of Sleep

Tracé discontinu pattern

- EEG shows burst of high voltage pleomorphic slow waves separated by long periods of low voltage activity
- Starts between 24-27 wks post-conception and gone by 32 wks

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23. Sleep states in newborns

**Sleep States in Newborns**

* (NREM / REM cycle is different in infants)*

- No clear periodicity prior to 34 weeks
- From 34-36 weeks the cycle is 35-45 min
- At term the cycle is about 60 min
- The sleep cycle gradually increases to the adult average of 90 min
- Cycle starts with Active Sleep / REM.
  Unlike adults SOREM's are normal
- Sleep coalescence allows infants to sleep through the night by 3-6 months

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24. Sleep states in newborns

**Sleep States in Newborns**

*At term:*

- Infants sleep 16-17 hours
- Active Sleep is 50% of sleep time
- Quiet sleep is 35-45% of sleep time
- Premature infants may have as much as 80%
  Active Sleep

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25. Ontogenesis of sleep

Ontogenesis of Sleep

*Hypnagogic hypersynchrony*
- During drowsiness or sleep onset, medium to high amplitude synchronous activity in the theta range
- Typical age is 1-5 years
- May be seen as early as 6 months and still be present in teenagers

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26. Sleep deprivation

Sleep Deprivation

- Symptoms include:
  - fatigue
  - moodiness
  - depression
  - irritability
  - concentration and memory impairment

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27. Sleep deprivation

Sleep Deprivation

- In laboratory rats,
  - complete sleep deprivation leads to
    - failure to thrive
    - excessive food intake with decreased weight
    - loss of hair and skin abnormalities
    - hyperactivity
    - finally death of all rats at day 22

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28. Effects of sleep disturbance

Effects of Sleep Disturbance

- Impaired vigilance
- Impaired memory
- Increased upper airway collapsibility
- Impaired mood
- Decreased respiratory drive

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Poor Sleep Hygiene

- Daytime naps
- Irregular sleep/wake cycle
- Frequent periods of extended time in bed
- Routine use of alcohol, tobacco or nicotine
- Exercise too close to bedtime

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Poor Sleep Hygiene

- Uncomfortable sleep setting
- Little exposure to bright light
- Use of bed for non-sleep related activities
- Performing activities demanding concentration prior to bedtime

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31. Sleep hygiene

Sleep Hygiene

- Regular Wake and Sleep times 7 days/week
- At least 8 hours of sleep time per night
- Avoid caffeine, nicotine, alcohol
- Regular exercise but not within 5 hours of sleep time
- No mentally stimulating activity prior to bedtime
- Use of bed only for sleep

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32. Sleep changes with age

Sleep Changes with Age

- Increased awakenings and arousals
- Decreased REM sleep
- (Probably) decreased SWS
- Increased stage shifts
- Fewer “cycles”
- Reduced sleep efficiency
- Phase advancement

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Primary Sleep Disorders

- Dyssomnias:
  - Insomnia
  - Hypersomnia
  - Narcolepsy
  - Obstructive Sleep Apnea
  - Circadian Rhythm Disorder

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Primary Sleep Disorders

- Parasomnias:
  - Nightmare disorder
  - Sleep Terror disorder
  - Sleep Walking disorder

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35. Secondary sleep disorders

**Secondary Sleep Disorders**

- Sleep disorder due to:
  - Mental disorder such as depression, PTSD
  - Medical disorder such as arthritis, fibromyalgia
  - Substance such as alcohol, drugs, etc.

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36. Insomnia in the elderly

**Insomnia in the Elderly**

- 42% >65 yrs. Report insomnia  
  Foley et al, Sleep 1995

- A frequent cause of admission to nursing home.

- Impairs quality of life and can contribute to increased falls.  
  Ancoli-Israel et al, Sleep 2000

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37. Insomnia in the elderly

### Insomnia in the Elderly

- About 1/2 of elderly have insomnia
- Women are twice as likely to have insomnia
- Annual incidence rate is 5%
- Risk factors for insomnia in the elderly
  - Depression
  - Respiratory symptoms
  - Disability
  - Fair to poor perceived health
  - Widowhood

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38. Summary

### Summary

- Sleep is a vital body function
- Sleep quality and quantity changes with age
- Sleep disorders are common at all age ranges, but more so in the elderly
- Poor sleep hygiene is #1 problem in US adults with sleepiness

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