Overview of Clinical Aspects of Normal Human Sleep

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Clinical Polysomnography and Sleep Medicine Course
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Normal Sleep

• Biological Rhythm
• Cyclical Event
• Individual Differences
Sleep is part of a 24 hour cycle of sleeping and waking behavior.
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[Diagram showing 24 hours, 28 days, and 65 days cycles, with graphs for Growth Hormone, Body Temperature, and Cortisol levels throughout the day.]
Normal Sleep

- Behavioral definition
- NREM sleep
- REM sleep
Normal Sleep

Behavioral definition:
- a reversible state of perceptual disengagement from and unresponsiveness to the environment

Usually (but not always) accompanied by:
- postural recumbency
- physical quiescence
The patterning of these three measures defines waking and two different states of sleep: REM and NREM

Sleep Onset

- through NREM in normal adults
- precise definition still under debate
- defined by changes in EEG, EOG, EMG
Sleep Onset

- Behavioral concomitants of sleep
  - Simple behavioral task
  - Visual response
  - Auditory response
  - Response to “meaningful” stimuli
- Hypnic myoclonia
- Memory

NREM Sleep

- conventionally divided into 4 stages by EEG
- described as synchronous
- “depth of sleep” continuum (arousal thresholds lowest in stage 1, greatest in stage 4)
- usually associated with a dearth of mental activity

*Shorthand definition:* relatively inactive, yet actively regulating brain in a movable body
REM Sleep

- EEG activation
- Muscle atonia
- Bursts of rapid eye movements
- Not divided into stages- but distinction between tonic and phasic aspects
- Mental activity usually associated with dreaming

_Shandown definition:_ A highly activated brain in a paralyzed body

REM Sleep

- Tonic aspects
  - EMG background
  - EEG background

- Phasic aspects
  - EMG short bursts
  - REMs, ↑ variability heart and respiration rate
<table>
<thead>
<tr>
<th></th>
<th>NREM</th>
<th>REM</th>
</tr>
</thead>
<tbody>
<tr>
<td>heart rate</td>
<td>regular</td>
<td>variable</td>
</tr>
<tr>
<td>respiration rate</td>
<td>regular</td>
<td>variable</td>
</tr>
<tr>
<td>blood pressure</td>
<td>stable</td>
<td>irregular</td>
</tr>
<tr>
<td>skeletal muscle tone</td>
<td>tonic</td>
<td>atonic</td>
</tr>
<tr>
<td>brain O₂ consumption</td>
<td>decreased</td>
<td>increased</td>
</tr>
<tr>
<td>response to ↓ O₂</td>
<td>decreased</td>
<td>decreased</td>
</tr>
<tr>
<td>response to ↑ CO₂</td>
<td>decreased</td>
<td>decreased</td>
</tr>
<tr>
<td>temperature</td>
<td>homeothermic</td>
<td>poikilothermic</td>
</tr>
<tr>
<td>penile tumescence</td>
<td>occasional</td>
<td>frequent</td>
</tr>
</tbody>
</table>

*Figure 2. Typical Sleep Pattern of a Young Human Adult*
Distribution of Sleep Stages

<table>
<thead>
<tr>
<th>NREM</th>
<th>75%</th>
<th>REM 25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>Stage 2</td>
<td>45%</td>
<td></td>
</tr>
<tr>
<td>Stage 3</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td>Stage 4</td>
<td>13%</td>
<td></td>
</tr>
</tbody>
</table>

Factors modifying sleep stage distribution

- Age
- Poor sleep hygiene
- Circadian rhythms
- Temperature
- Drug ingestion
- Pathology
Figure 6: Mean Development of Human Sleep Over a Lifetime

- 50% awake
- 40% REM sleep
- 30-25% non-REM sleep

Total daily sleep hours:
- Age 3-5 mo: 15-18 hrs
- 6-23 mo: 14-18 hrs
- 3-5 yrs: 12-18 hrs
- 10-13 yrs: 10-16 hrs
- 14-18 yrs: 9-14 hrs
- 19-30 yrs: 8-13 hrs
- 50 yrs: 7-11 hrs
- 90 yrs: 6-9 hrs

4 Habits That May Improve Sleep

- Establish regular arousal time
- Limit bed time
- Maintain steady daily exercise
- Eat a light bedtime snack

4 Factors That May Destroy Sleep

- Excessively noisy surroundings
- Excessively hot room
- Chronic use of hypnotics
- Caffeine in the evening
- Alcohol before bed
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PART I—SECTION 1: NORMAL SLEEP AND ITS VARIATIONS

C3/A2

ROC/A1

SEM, ASLEEP, SEMs

LOC/A2

SAT

GAP

GAP
ASLEEP AT THE WHEEL

Their health is our concern