Diagnosis and treatment of sleep disorders: How to sleep well to live well

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40% of Adults (>20) have problems sleeping in Japan

With sleep problem: Pittsburgh Sleep Quality Index ≥5.5
Japanese Society for Sleep Research 2005
25% of Japanese suffer from sleep disturbance

Up to 79Y  20~25%
Over 80Y  30~40%

Edison  Napoleon  Einstein
3~4 hours  >10 h

No evidence supporting that we need 8h sleep.

Daytime performance reflects the sufficient sleep.

But, The amount and quality of sleep are reduced as one grows older.
Outline of today’s talk

1. Two different mechanisms for sleep
   a. Homeostatic regulation
   b. Circadian clock regulation

2. Diagnosis of different sleep disorders

3. Symptoms and treatment of sleep disorders

4. How to have healthy sleep
Homeostatic and Circadian Regulation of sleep and wakefulness

**Homeostatic regulation**
The longer the wake time, the longer the sleep time
The harder the work load, the deeper the sleep
Sleepiness increases monotonously during wake time

**Circadian regulation**
Sleepiness depends on the time of day
Morning brings arousal even after staying up
Sleepiness rhythmically changes during day time

**Major circadian rhythms in physiological functions**

- **Plasma melatonin** peaked at the middle of sleep
- **Core body temperature** starts to decrease before bed-time, starts to increase while sleeping
- **Growth hormone** is secreted during the slow-wave sleep at the beginning of sleep
- **Blood pressure** decreases during the night, and starts to increase before wake-up
- **Phase-relation** of each rhythm to a day-night cycle, and that to other rhythms should be stable

(Sleep stage, W: wake, R: REM sleep, N1~N3: Non REM sleep 1-3)
Circadian period of humans circadian clock is ~25h

Sleep-wake rhythms in the temporal isolation facility

Honma et al. 1989, Biological Clock

Bright light reset the circadian clock

- Clock in the brain receives photic signals from the retina
- Photic signals phase-shift the clock, the direction depends on the clock phase

Up to 10,000 lux light from the ceiling in the sleep laboratory

Morning light advances the rhythm

Evening light delays the rhythm
Each cell has its own clock that generates ~24h rhythms molecular feedback loop involving clock genes and proteins.

Brain master clock is reset by light and regulates peripheral clocks

Homeostatic regulation

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The harder the work load, the deeper the sleep
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Wake centers
- Lateral Hypothalamus (Orexin)

Sleep centers
- Ventrolateral Preoptic nucleus (GABA)
- Acetylcholine
- Histamine
- Serotonin
- Dopamine
- Noradrenaline
- Lateral Hypothalamus (Orexin)
- Ventrolateral Preoptic nucleus (GABA)

Sleep starts with Non REM stage.
Stage 3/4 (slow wave sleep) is most abundant in the beginning of sleep
REM sleep is regulated by the circadian clock and increases in the latter part of sleep
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Major symptoms of sleep disturbances

**Insomnia (troubles of sleeping)**
- Difficulty in falling asleep
- Difficulty in staying asleep (frequent wakening)
- Early wakening, a lack of sleep satisfaction

**Trouble of waking**

**Daytime sleepiness**
- Excessive sleepiness, sudden muscle weakness
- **Sleep related respiratory problem**
  - Obstructive sleep apnea, snoring

**Sleep related behavior disorders (Parasomnia)**
- Unpleasant feeling of legs, periodic movement of limbs, urge to move
- Move as you dream, Movements during sleep (walk, shout, eat),
- Nightmare, Sleep bruxism

Seek a diagnosis for therapeutic prospects

1. Monitoring sleep/wake rhythms & subjective symptoms
   - Sleep diary (subjective symptoms)
   - Actigraphy (Actiwatch, Sleep monitor, etc.: objective symptoms)

   - **Home sleep test**
     measure breathing, blood oxygen level and sleep position for simple diagnosis of sleep apnea.
2. Polysomnography (PSG) for diagnosis of sleep disorders

- PSG is powerful to find the etiology and severity of sleep disturbances
- For the diagnosis of hypsomnias, multiple sleep latency test is required on the following day

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4. How to have healthy sleep
**a. Insomnia, currently called Sleep-wake disturbances**

Troubles during night time such as
- Difficulties in falling asleep
- Difficulties in staying asleep
- Early morning wakening
- Waking-up feeling not well rested

Troubles during night time such as
- Waking up feeling tired/not well rested
- Feeling tired or very sleepy during the day
- Having trouble focusing on tasks
- Feeling anxious, depressed or irritable

Insomniac patients have both nighttime and daytime problems
- acute insomnia: having troubles more than 3 times/w,
- chronic insomnia: having troubles more than 3 months

**Find the cause of sleep problems**

**Find the secondary insomnia / treat the primary disorders**
- e.g. Depression, Pain, Atopy, Urticaria, Asthma, Drug use,

**Background of Primary insomnia**
- Stress
- Sleep hygiene (environment e.g. sound, light, beddings)
- Preferences and life styles
  - amount and timing of smoking, and alcohol/caffeine intake
  - amount and timing of exercise,
  - habit to spend evening
  - (TV, PC, Games, cellphones, etc.)

**Sleep education for good sleep,**
**Learn sleep physiology**
b. Hypersomnia (excess sleepiness during daytime)

Secondary hypersomnia: treat the primary problems

- lack of sleep time
- inadequate timing of sleep
- insufficient sleep due to other diseases

Circadian sleep-wake rhythm disorder

- Sleep apnea, Parasomnia

• Narcolepsy: MSLT test for diagnosis, and start drug treatment

  - uncontrollable urge to sleep
  - excess sleepiness and sleep episodes almost everyday
  - catalepsy with a strong emotion
  - sleep paralysis and hypnopompinc hallucination

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c. Circadian rhythm sleep wake disorder

Diagnose with behavior monitoring

- Bright light at specific timing, Melatonin agonist

  - too early: Early sleep phase syndrome

  - too late: Delayed sleep phase syndrome

  - gradual shift: Non-24h sleep-wake syndrome

  - non systematic: Irregular sleep-wake syndrome
d. Sleep apnea \(\rightarrow\) diagnose with PSG

- Snore
- Episodes of stop breathing during sleep
- Feeling of insufficient sleep
- Awakening with a dry mouth
- Daytime sleepiness

\[\text{Male 63Y}\]

- CPAP (Continuous Positive Airway Pressure)
- Weight control for obese patients.
- Mouth piece, chin strap and sleep posture for mild sleep apnea

\[\text{Male 47Y}\]

5 min PSG record with consecutive obstructive apnea (REM at 1:26)
**e. Parasomnias → diagnose with PSG**

Abnormal movements, emotions and perceptions during sleep

**Disorder of arousal from non REM sleep:** Sleep walking, Sleep terror, Sleep related eating disorder

**REM parasomnias:** REM sleep behavior disorder - an αSynucleinopathy (e.g. Parkinsonism, Dementia with Lewy body)

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**f. Sleep related movement disorders → diagnose with PSG**

- **Restless leg syndrome**
- **Periodic limb movement syndrome**

Male 65Y
difficulty in falling asleep
 twitching of muscle at night

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Periodic leg movements
622 times/night
106.5 times/h
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• Good sleep prevents life-style related illnesses
  Hypertension, Hyperlipidemia, Diabetes mellitus, Depression

• Daytime performance reflects sufficiency of sleep

• Nap should be taken till 2pm, up to 20 min

• Bright light in the morning resets your body clock

• Avoid bright light before bed-time
  refrain from internet, games, cellphone at bed-time

• Keep regular sleep time both in weekday and weekend

• Try something to relax before going to bed: stretch, warm bath, deep breathing

• Go to bed when you feel sleepy, wake-up at regular time.
Improve your life-style and sleep environments

Avoid stress, use proper illumination at proper time
refrain from smoking especially at night,
regulate timing and amount of alcohol and caffeine intake
get out of bed when you are not sleepy
daytime activities determine the quality of sleep and vice versa

Sleeping pill is not the first choice but the last resort

Sleep apnea CPAP
For mild cases, Mouth piece Chin strap

Rhythm disorder Bright light therapy

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