Basics of Sleep and Sleep Related Disordered Breathing for a Primary Care Physician

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Basics of sleep

Your ability to function and feel well while you're awake depends on whether you're getting enough total sleep and enough of each type of sleep. It also depends on whether you're sleeping at a time when your body is prepared and ready to sleep.

The brain controls a sleep and wakefulness cycle following a typical 24 hour repeating rhythm called the circadian rhythm. Two processes interact to control this rhythm.

First, is a pressure to sleep that builds with every hour that you're awake. This drive for sleep reaches a peak in the evening, when most people fall asleep. While you're awake, the level of adenosine in your brain continues to rise which signals a shift towards sleep. While you sleep, your body breaks down adenosine.

Second, involves our internal body clock. This clock is in sync with certain cues in the environment. Light, darkness, and other cues help determine when you feel awake and when you feel drowsy. When it gets dark, your body releases a hormone called melatonin which in turn signals your body that it's time to prepare for sleep, and it helps you feel drowsy.

As the sun rises, your body releases cortisol. This hormone naturally prepares your body to wake up.

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Control of breathing during sleep

Neutrons with respiratory related activity are located within the ventrolateral medulla and brainstem. Sleep onset is associated with loss of the wakefulness, influences on breathing, changes in chemosensitivity and a sleep related reduction in metabolism that combine to produce blood gas changes. The ability to maintain stable breathing during sleep onset is a function of how the respiratory control system responds to ventilatory perturbations that occur at this time.

Once the neural regulation is functioning smoothly, anatomical factors like oropharynx and naso-pharynx play a role in obstructive sleep disorders. Factors such as obesity, age, sex and decreased transverse axis of the airway influence upper airway anatomy and are in turn risk factors for obstructive sleep disorders.

Lung volume influences the activation of the pharyngeal dilator muscle. Reduced lung volume leads to increased pharyngeal resistance and in turn making them more collapsible. Upper airway geometry and neuromuscular activation affect critical closing pressure. Obesity enhances passive critical pressure directly or by lowering lung volume and weight loss can reduce the pressure by recovery of the neuromuscular control.

Factors that can influence sleep physiology -

Brain -> Nasopharynx, Oropharynx,

hypopharynx anatomy -> lung volume -> neuromuscular control -> weight/ age/ genetic factors.

Sleep cycle

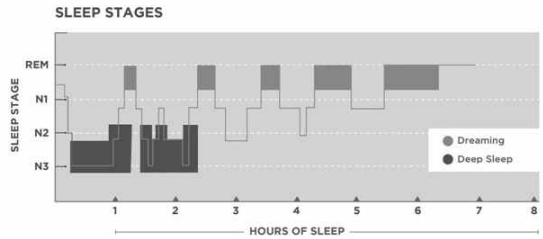


Fig 1: Typical hypnogram of a young male through the night over 8 hours. Cycles repeating on average every 90 minutes.

The sleep cycle normally consists of REM (rapid eye movement) and NREM (non-rapid eye movement). Both cycles are important for different functions in the body. If either of the cycle is interrupted multiple times throughout the night due to any reason, we miss out on vital body process, which can affect our health and well being the next day and long term.[1]

NREM sleep	REM sleep
75 - 80 % of total sleep time	20 - 25% of total sleep time
Tissue growth and repair, restoration of energy and hormones which are essential for growth and development are released.	Dreaming occurs and is essential for consolidating emotions, memories and stress. Vital for learning and developing new skills.
HR, RR, BP, temperature, muscle tone reduced	HR, BP, RR, muscle tone increased

Sleep Disorders

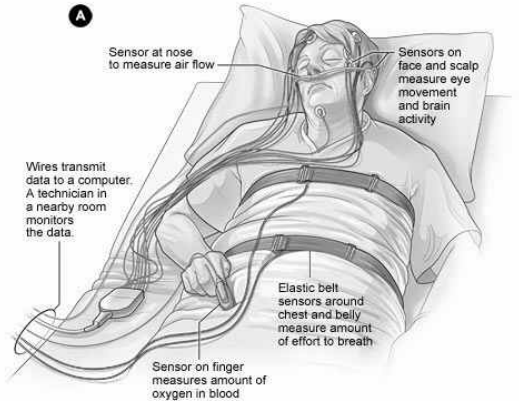
Sleep disorders are a group of disorders (> 80 disorders) associated with either excessive sleep (narcolepsy and associated disorders), less sleep (insomnia and associated disorders), sleep related breathing disorders (obstructive, central sleep apnoea), or sleep related movement disorders. In this article we will be discussing and understanding about sleep related breathing disorders.

Types of SRBD as per ICD 10 classification

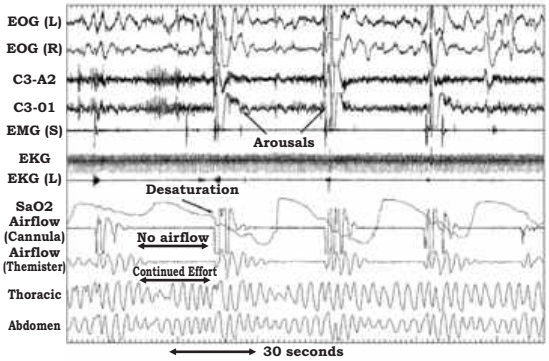
Central sleep apnoea (CSA)	Primary CSA CSA due to medical condition, drugs etc Cheyne Stokes Breathing Pattern
Obstructive Sleep Apnoea (OSA)	OSA, adult OSA, children
Hypoventilation -	Sleep Related Nonobstructive Alveolar Hypoventilation Obesity Hypoventilation Syndrome Sleep Related Hypoventilation/Hypoxaemia
Mixed / complex apnoea	Central Sleep Apnoea/Complex Sleep Apnoea
Others	Other Sleep Apnoea Dyspnoea, unspecified Other forms of dyspnoea Periodic breathing Snoring Other abnormalities of breathing Apnoea, not elsewhere specified Unspecified Sleep Apnoea

Polysomnography

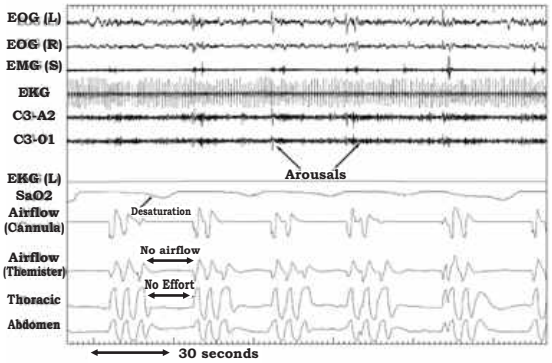
A polysomnogram is an overnight sleep study that records brain activity, eye movements, heart rate, blood pressure, oxygen levels, body movement, and more. Polysomnograms are used to help diagnose some sleep related breathing disorders such as obstructive sleep apnoea (OSA). Details of studies and interpretation described later. While these recordings are made, duration of cessation of sleeping is correlated with desaturations and respiratory effort and nasal flow and amplitude.



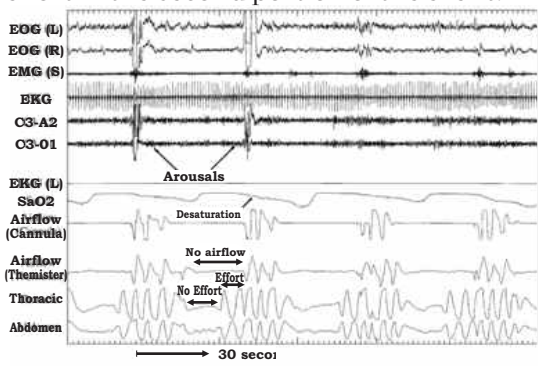
Obstructive Sleep Apnoea - Continued or increased inspiratory effort throughout the entire period of absent airflow.



Central Apnoea - Absent inspiratory effort throughout the entire period of absent airflow.



Mixed Apnoea - Absent inspiratory effort in the initial portion of the event, followed by resumption of inspiratory effort in the second portion of the event.



Symptoms of SRBD

Day	Night
Excessive daytime sleepiness	Snoring
Unrefreshing sleep	Apnoeas (witnessed by relatives)
Memory disturbances	Choking, gasping
Morning headaches	Arousals
Depression	Sweating
Decreased libido	Dry mouth
Stomach ache	Palpitation
	Nocturia

Evaluation and approach to a patient will be described in later sections.

References

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