

# Sleep Apnea : Part-I

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## Abstract

**S**leep Apnea is a sleep disorder characterized by abnormal pauses in breathing or instances of abnormally low breathing. A description of normal sleep physiology and causes and effects of sleep deprivation has been discussed. Types of apneas and diagnostic parameters for apneas have been elaborated. Sleep apnea in children and effects of not diagnosing and treating the same has been discussed in this part of the series on Sleep Apnea.

**Keywords:** Sleep Apnea, Sleep disordered breathing, Apnea index, Charaka Samhita on sleep.

## Introduction

SLEEP is a naturally recurring state characterized by reduced or absent consciousness, relatively suspended sensory activity and inactivity of nearly all voluntary muscles.

A verse from CHARAKA SAMHITA (circa 200-300BC) aptly describes significance of sleep in our lives:

- Nidraayattam Sukham dukham pushtih kaarshyam balaabalam I
- Vrishataa kliibataa jnaamam ajnaanam jivitam na cha II

## Translated

“Happiness, misery, nourishment, emaciation strength, weakness, virility, sterility knowledge, life and death all depend on proper or improper sleep”

This shows how the importance of sleep was recognized way back in India in 2<sup>nd</sup> or 3<sup>rd</sup> century B.C.

The purpose and mechanisms of sleep have not been unraveled totally even to this day and are the subjects of intense research.

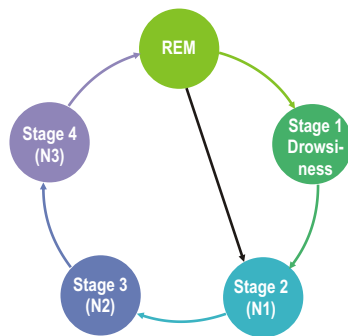
Quality of sleep depends not only on number of hours of sleep per day, but also on how deeply a person sleeps. While we sleep, our brain remains very active. Brain activity goes through cycles. Every cycle takes about 90 to 110mins

1. Stage 1- Drowsiness
2. Stage 2- Light sleep (N1 phase of NREM sleep)
3. Stage 3- Deep Sleep (N2 phase of NREM sleep)
4. Stage 4- Slow wave (N3 phase of NREM sleep)
5. REM sleep- Rapid eye movement

The two main types of sleep are rapid-eye-movement (REM) sleep and non-rapid-eye-movement (NREM) sleep. On an EEG, REM sleep, often called “Active Sleep”, is identifiable by its characteristic low-amplitude (small), high-frequency (fast) waves and alpha rhythm, as well as the eye movements for which it is named. Many sleep experts think that these eye movements are in some way related to dreams. Typically, when people are awakened from REM sleep, they report that they had been dreaming, often

extremely vivid and sometimes bizarre dreams. In contrast, people report dreaming far less frequently when awakened from NREM sleep. Interestingly, during REM sleep muscles in the arms and legs are temporarily paralyzed. This is thought to be a neurological barrier that prevents us from “Acting Out” our dreams.

NREM sleep can be broken down into three distinct stages: N1, N2, and N3. In the progression from stage N1 to N3, brain waves become slower and more synchronized, and the eyes remain still. In stage N3, the deepest stage of NREM, EEGs reveal high-amplitude (large), low-frequency (slow) waves and spindles. This stage is referred to as “deep” or “slow-wave”- sleep.



**Fig.1 Stages of Sleep**

A disruption in the sleep cycles can have many adverse effects on the health and well being of the patient

Sleep deprivation<sup>1,2,3</sup> can lead to:

1. Decrease in core body temperature.
2. Decrease in immune system function (measured by white cell count and activity).
3. Decrease in release of growth hormone.
4. Increased heart rate variability.
5. After 24 hours of sustained wakefulness, the metabolic activity of the brain decreases significantly (upto 6% for the whole brain and upto 11% for specific cortical and basal ganglionic areas).

Growth hormone is released during deep sleep (slowwave sleep or N3 phase of NREM) growth hormone is essential for growth in children and for normal tissue repair in adults. Release of growth hormone is also stimulated by peptides, sex hormones, fasting, vigorous exercise and laughter.

Sleep or lack of it has been implicated in the release of peptides like ghrelin and Leptin. Ghrelin stimulates hunger and Leptin signals satiety to the brain and suppresses appetite. Sleep loss stimulates appetite and stimulates craving for high-fat, high carbohydrate foods.

Sleep apnea is one of the disorders under the group called Sleep Disordered Breathing (SDB) which has been described by D.Sinha and Guillemant as being characterized by the repetitive collapse or partial collapse of the

pharyngeal airway during sleep and the need to arouse or awaken to resume ventilation. Sleep is thus disrupted causing daytime sleepiness and diminished neurocognitive performance.<sup>4</sup>

The term sleep 'disordered breathing' comprises the whole continuum, from chronic snoring to obstructive sleep apnoea and the so called Pickwick syndrome. Burwell et al in 1956 coined the term Pickwickian syndrome after the somnolent boy Joe from the Pickwick Papers. Of course it was Charles Dickens the narrator of the Pickwick Papers who 1835 was the first to describe the Pickwickian syndrome but his interest was purely literary<sup>5</sup>

In relation to cardiovascular complication of the sleep apnoea syndrome Macgregor et al in 1970 the described sudden death as a complication of the Pickwickian Syndrome<sup>6</sup> In 1972 Coccogna et al demonstrated a relationship between pulmonary as well as systemic hypertension and sleep disordered breathing<sup>7</sup> In 1983 Guilleminault et al described cardiac arrhythmias and conduction disturbances in relation to obstructive sleep apnoea syndrome<sup>8</sup> Common Sleep Apnea symptoms include:

- Waking with a very sore throat and/or dry throat
- Loud snoring
- Occasionally waking up with a choking or gasping sensation
- Sleepiness or lack of energy during the day
- Sleepiness while driving
- Morning headaches
- Restless sleep
- Forgetfulness, mood changes and a decreased interest in sex
- Recurrent awakenings or insomnia
- Sleeping in a sitting position.

People with sleep apnea actually stop breathing upto 400 times throughout the night. These interruptions last 10 to 30 seconds and are often followed by a snort when breathing resumes. This breaks the sleep cycles and can leave the subject tired during the day.

Three types of sleep apnea have been described viz:

1. Central Sleep Apnea(CSA)
2. Obstructive Sleep Apnea (OSA)
3. Mixed Sleep Apnea (both central sleep apnea and obstructive sleep apnea)

In central Sleep Apnea, the basic neurological controls for breathing rate malfunction and fail to give the signal to inhale, causing the individual to miss one or more cycles of breathing. If the pause in breathing is long enough, the percentage of oxygen in the circulation will drop to a lower than normal level (hypoxaemia) and the concentration of carbon dioxide will build up to a higher than normal level (hypercapnia). There is no effort made to breathe during the

pause in breathing, there are no chest movement and no struggling. After the episode of apnea, breathing may be faster (hyperpnea) for a period of time, a compensatory mechanism to blow off retained waste gases and absorb more oxygen.

Obstructive Sleep Apnea is the most common type of sleep apnea. It happens when the tongue, tonsils or other tissues in the back of the throat block the airway either completely or partially such that air cant get through. There may be a complete stoppage of airflow or it may include atleast a 4% drop in oxygen in the blood a direct result of the reduction in the transfer of oxygen into the blood when breathing stops.

Apneas are usually measured during sleep<sup>9</sup> (preferably in all stages of sleep) over a two-hour period. An estimate of the severity of apnea is calculated by dividing the number of apneas by the number of hours of sleep, giving an apnea index (AI in apneas per hour), the greater the AI, the more severe the apnea.

A hypopnea is a decrease in breathing that is not as severe as an apnea. Hypopneas usually occur during sleep and can be defined as 69% to 26% of a normal breath. Like apneas, hypopneas may also be defined as a 4% or greater drop in oxygen in the blood. Hypopneas also disrupt the levels of sleep.

A hypopnea index (HI) can be calculated by dividing the number of hypopneas by the number of hours of sleep. The apnea-hypopnea index is an index of severity that combines apneas and hypopneas. Sleep apnea has been formally defined as an apnea-hypopnea index of atleast 15 episodes /hour if they do not have medical problems that are believed to be caused by the sleep apnea. This is the equivalent of approximately one episode of apnea or hypopnea every 4minutes. High blood pressure, stroke, daytime sleepiness, congestive heart failure or mood disorders can be caused or worsened by sleep apnea, in the presence of these conditions , sleep apnea is defined as an apnea-hypopnea index of at least five episodes per hour . This definition is stricter because these individuals may be already experiencing the negative medical effects of sleep apnea and it may be important to begin treatment at a lower apnea-hypopnea index.

The definition of apnea(duration and type) and the apnea index (number of apneas per hour of sleep) were introduced by Guilleminault et al in 1973<sup>10</sup>

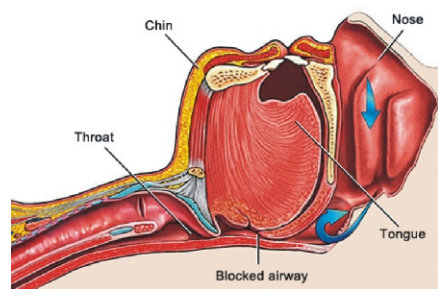


Fig 2. Obstructive sleep Apnea

The following are seven health problems related to sleep apnea:

1. High blood pressure
2. Heart diseases: Low oxygen and stress of waking can lead to Heart disease . Stroke and atrial fibrillation are also associated with obstructive sleep apnea
3. Type 2 diabetes: Although no clear link has been established between sleep apnea alone and Type 2 diabetes, sleep deprivation can cause insulin resistance which is a precursor to diabetes.
4. Weight gain: Sleep apnea impairs the body's endocrine systems, causing the release of the hormone Ghrelin , which makes you crave carbohydrate and sweets. Lower metabolism due to being tired and sleepy because of sleep apnea also contributes to weight gain.
5. Adult asthma: Although the link has not been established , people who are treated for sleep apnea may find that they have fewer asthma attacks
6. Gastroesophageal reflux disease (GERD) No direct link has been established but patients have reported reduction in GERD after treatment of sleep apnea
7. Car accidents due to waking somnolence: A huge percent of road accidents are due to errors made by drivers due to sleepiness

The patients coming with sleep apnea symptoms should be checked for the following problems which can addressed before attempting any radical treatment:

- Low thick soft palate
- Enlarged tonsils
- Nasal congestion
- Overweight
- Alcohol consumption

**Sleep Apnea in Children:**

Children may present a different set of symptoms like:

- Snoring
- Frequent arousals
- Enuresis
- Hyperactivity
- Sleeping in a sitting position

Those with Down Syndrome, midface hypoplasia or neuromuscular disorders are at higher risk for developed SDB.

Sleep Disordered breathing (SDB) results from having a structurally narrow airway combined with reduced neuromuscular tone and increased airway collapsibility.

Obstructive Sleep Apnea must be recognized and treated early in children or it may result in various complications viz.

1. Learning difficulties
2. Memory loss
3. Long term increase in risk of hypertension
4. Depression
5. Poor Growth or failure to thrive

The line of treatment in children may involve:

- Tonsillectomy and adenoidectomy
- Rapid maxillary expansion
- Allergy treatment

- Continuous Positive Airway Pressure (CPAP)
- Radiofrequency ablation of nasal turbinates
- Weightloss in the overweight

In adults the patients should avoid alcohol and other depressant recreational drugs, which may worsen their sleep apnea. They should avoid sedating medications when possible.

Infants and children with obstructive sleep apnea may have serious respiratory embarrassment when given any sedative medication. Caution is necessary during any medical or dental procedures requiring conscious sedation.<sup>11</sup>

Treatment options include surgical and non surgical.

Non Surgical treatment for sleep apnea include:

- Behavioral changes,
- Dental appliances,
- CPAP (continuous positive airway pressure), and
- medication.

Surgical Options to treat obstructive sleep apnea include :

- Nasal airway surgery,
- Palate implants,
- Uvulopalatopharyngoplasty,
- Tongue reduction,
- Genioglossus advancement,
- Hyoid suspension,
- Maxillomandibular procedures,
- Tracheostomy,
- Bariatric surgery, and
- Combinations of the above.

The treatment options for sleep apnea including a comprehensive comparison of the dental devices available will be discussed in detail in the second part of this series on Sleep apnea.

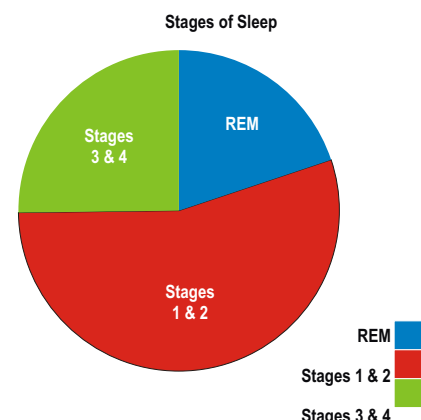


Fig 3 Stages of Sleep

**References**

For a complete list of references are available on request. Please mail us at editor@healtalkht.com