SLEEP – DISORDERS, APNOEAS, CARDIORESPIRATORY EFFECTS & OTHER EMERGING PROBLEMS

DR. COL (RETD) S. C. TEWARI

Introduction

We all know sleep as a very essential part of body circadian rhythm characterized by reduced awareness of environment, period of bodily rest. However, a number of problems of grave clinical significance and other important aspects of human health related to sleep disturbances are emerging and sleep studies have become a very important study world over¹,²,³

Keywords: SDB- Sleep Disordered Breathing, OSA- Obstructive Sleep Apnoea, RDI- Respiratory Disturbance Index, AHI- Apnoea Hypopnoea Index, UARS- Upper Airway Resistance Syndrome.

Importance of Sleep Studies

We all sleep some more than others. Most don’t realize that sleep occupies over 1/3rd of human existence time and this period of life is regulated by fine tuned autonomic sympathetic and parasympathetic drives, homeostatic sleep- wakefulness drives and circadian inherent rhythm. Minor aberrations of sleep rhythms as depicted below are themselves quite disturbing for humans such as–

a) Insomnia- Affects 30- 40% in West and industrialized nations.
b) Narcolepsy- A neurologically based disorder also called as sleep paralysis.
c) CSRD (Circadian Rhythm Sleep Disorders) - Consists of jetlag, shift wake sleep disorder, advanced sleep phase syndromes.

However, more devastating effects of sleep disturbances termed apnoea, both OSA and also central apnoea are proving to be intricately related to today’s more dreaded lifestyle diseases like Hypertension, IHD, NIDDM⁴,⁵,⁶,⁷ Metabolic syndromes and not to forget the US data of over 70 million Americans suffering from these and over 30% of Road and other accidents being related to these⁸,⁹.

Following data is illuminating about problem of sleep disturbances. White et al diagnosed OSA in 2% women and 4% men in middle age. Wisconsin’s cohort study had 9 to 24% men and 4 to 9% women while studies in Israel and Australia estimated as high as 20 to 25% in the employed. Amongst these people systemic hypertension is seen in 50 to 70% OSHAS; a factor which was independent of obesity, age, alcohol and smoking (Nieto, 2000)⁶. Insulin resistance was seen in a very high percentage of these (15%). In a study by Punjabi & others by Irwin et al (2002 to 2004), oxidative stress was very high⁰.

Impact of Sleep on Breathing

Respiratory drive is decreased in NREM sleep and is irregular in REM sleep. Minute ventilation decreases by 1 to 2 lit/ min, arterial PCO₂ increases by 2 to 8 mm Hg, PO₂ decreases by 5 to 10 mm Hg and there is a general increase in upper airway resistance. These have negligible effect in health but have profound clinical consequences in cardio- respiratory disorders¹¹.

Address for correspondence:
Dr. S.C.Tewari, Department of Medicine, Rural Medical College, Pravara Institute of Medical Sciences, Loni, Taluka - Rahata, Ahmednagar, Maharashtra-413 736, India.
E-mail: medicine@pmtpims.org
Also sleep deficits result in prolonged health, safety, economic consequences, intellectual and social performances, quality of life in social and sexual interactions too.

Sleep & Cardiovascular Changes
In NREM sleep there is decrease in metabolic rate, sympathetic activity and blood pressure and cardiac output. In REM sleep there is increased sympathetic flow and blood pressure. Disruptive sleep in OSA stresses the heart and circulation.

Definitions
Apnoea is cessation of airflow for at least 10 seconds. It is of 3 types - Central, Obstructive & Mixed. Hypopnoea is reduction in airflow more than 50% with 4% desaturation. Respiratory Disturbance Index (RDI)/ Apnoea Hypopnoea Index (AHI) is number of apnoeas/hypopnoeas per hour of sleep. RDI more than 15 confirms OSA. Upper Airways Resistance Syndrome (UARS) where crescendo snoring leads to apnoea and arousal. Arterial oxygen saturation may or may not change.

Obstructive Sleep Apnoea (OSA)
OSA causes daytime sleepiness, accidents, and a much higher incidence of sudden deaths due to being superimposed on IHD, Asthma and COPD. Its incidence is 2% of middle aged females & 4% of males with progressive increases with age. A large study has shown following figures:

- RDI >5: 7 - 18 million in USA affected
- RDI >15: 1.8 - 4 million

In one of the few Indian studies, Udawadia et al reported prevalence of SDB in 19.5% of the city population and OSA was in 7.5%.

Pathogenesis of OSA
During part of sleep, posterior movement of tongue occurs and gets apposed with posterior pharyngeal wall. There is occlusion of nasopharynx and oropharynx leading to hypoxia and arousal. Once the patient is aroused, the airway is restored and patient goes back to sleep. This cycle repeats itself indefinitely. These are beautifully captured in following MRI scans taken from a patient. (Figure1-4)
Risk Factors for OSA
Males are more predisposed than females in the ratio of 2:1. Incidence is more in obese people. Males with a neck collar size of more than 17” are at a higher risk. However, strongest risk factor is obesity, particularly central obesity by influence of this on upper respiratory fat deposition, affects airway size and compliance and abdominal loading causing hypoxia, and males have androgenic central fat deposition also on neck\textsuperscript{15,16}. Patients with retrognathia, micrognathia, tonsillar hypertrophy and deviated nasal septum are also more predisposed. Alcoholics and sedative users are at increased risk apart from patients of Down’s syndrome, Achondroplasia, Hypothyroidism and Acromegaly.

Clinical Features
History is usually provided by the bed-partner and complaints include loud habitual snoring, witnessed episodes of apnoea, nocturnal awakening, gasping/choking sensations in sleep, nocturia, unrefreshing sleep and morning heavy head. Other tell-tale symptoms are daytime sleepiness, automobile and work related accidents, irritability and memory loss apart from decreased libido of individual.

Cardiovascular Consequences
Increased sympathetic flow with a further increase at the end of apnoea and arousal time sympathetic surge leads to rise in blood pressure which increases the risk of acute coronary events. There is an increased incidence of tachy- and bradyarrhythmias and heart blocks. There is also a two-fold increase in the risk of stroke and nocturnal angina in all these patients\textsuperscript{15,16, 17}. A combination of COPD plus OSA would result in rapid development of cor pulmonale and right heart failure\textsuperscript{17, 18, 19}.

Sleep and Bronchial Asthma
Nocturnal exacerbations of asthma are common, estimated in upto 74% of patients with a large number of factors being implicated. The independent effect of sleep on bronchial hyper-responsiveness is still under study. There is a two-fold increase in lower airway resistance, all other factors being same\textsuperscript{21}. Paradoxically, the highest airway resistance is seen in stage 3 & 4 of NREM, rather than REM sleep.
Sleep In Congestive Heart Failure
There is a considerable overlap amongst the two entities, with 40 to 50% of CHF patients having OSA or CSR-CSA. There is a higher mortality in this sub-group of patients which can be significantly reduced by CPAP. A third of the sudden deaths in patients of CHF are due to acute cardiac events occurring during sleep[22, 23].

Sleep Apnoea and Atrial Fibrillation
Sleep apnoea and atrial fibrillation and other nocturnal arrhythmias are also known to be frequently co-existing[24, 25].

Diagnosis and Management Options
Last 20 years have seen a significant increase in awareness among Physicians about this disorder but still a large section of General Physicians need is to inculcate more knowledge about these.
An institutional or better a home-based polysomnographic study is now a standard method of diagnosing the disease[26].

Treatment Options in OSA
Medical treatment includes general measures like weight loss, cutting down on alcohol intake and sedatives. Pharmacologic agents like Acetazolamide, Probtryptiline and oxygen therapy are less effective. Specific measures include position therapy. Most effective therapy is Positive Airway Pressure (CPAP, auto CPAP or BiPAP) in addition to intra-oral devices to reposition the mandible and maintain the tongue in forward position. Though tolerance to these also requires long time persuasion of patients[27, 28].
Patients requiring surgical interventions need evaluation for accurate site and cause of obstruction prior to surgical intervention. Nasal surgeries like Septoplasty and sinus surgery, Tonsillectomy with or without Adenoidectomy, Uvulopalatopharyngoplasty (UPPP), Laser Assisted Uvulopalatoplasty (LAUP), Genioglossus Advancement with Hyoid Myotomy (GAHM) and Maxillomandibular Advancement Osteotomy are amongst the commonly performed interventions for patients suffering from OSA. These are required to be done in very selective cases and under expert hands.

Conclusion
We have come a long way in understanding and analyzing the clinical and metabolic consequences of sleep related disorders from the time first report of these by in early seventies. The intricate relationship of these OSA’s with serious cardiovascular and other consequences including hypertension, metabolic syndromes, sudden death, relationships with road and air accidents are quite apparent and deterioration in intellectual, social and sexual relationships of sufferers have become major health hazards.
These needs are now being addressed all over the world and in future the management strategy is changing from primary attention to treat these to prevention with special emphasis of relation of these disorders with obesity and other lifestyle modifications. This is now also true for countries like India where we are also seeing the epidemic proportional rise of obesity, etc. related problems.
The indications for treatment of OSA in future will need to be changed from symptomatic to prognostic reasons because obesity relation with addition of OSA, metabolic syndrome and serious impact on cardiovascular morbidity and mortality is likely to pose a great challenge for specialists in these studies even in countries like ours.

References


Medical Quote

The doctor who can no longer find time in his day for prayer and the inner life, time to prepare for his consultations in the presence of God and to seek his will for his patients, cannot bring to them the spiritual climate that is necessary if they are to open their hearts to him. Driven on by his devotion to the needs of his practice, he leads a fatiguing and unsatisfying life in which only more and more rarely does he find those peaceful moments on intimacy when he can provide what the patient most expects of him.

- Dr. Paul Tournier-