NAMS Regional Symposium on Sleep Medicine
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SLEEP DISORDERED BREATHING: OBSTRUCTIVE SLEEP APNEA, CENTRAL SLEEP APNEA, PATHOPHYSIOLOGY AND DIAGNOSIS

SYNOPSIS

The obstructive sleep apnea (OSA) is the repetitive interruption of ventilation during sleep caused by collapse of the pharyngeal airway and the central sleep apnea (CSA) is the repetitive cessation of ventilation during sleep resulting from loss of ventilatory drive. OSA is defined as cessation of airflow $\geq$ 10 seconds despite continuing ventilatory effort with five or more such episodes per hour of sleep and is usually associated with a decrease of $\geq$ 4% in oxyhemoglobin saturation. Hypopnea is characterized by a reduction of $\geq$ 50% in airflow for > 10 seconds associated with a $\geq$ 3% decrease in oxygen saturation and/or arousal. The obstructive sleep apnea syndrome (OSAS) defined as OSA associated with excessive daytime sleepiness, affects 2 to 4% of middle-aged adults. Risk factors for development of OSA are classified as non-modifiable and modifiable factors. The important non-modifiable risk factors are age, male gender, anatomical abnormalities of craniofacial regions and upper airway, thick neck with circumference more than 17 inches and a genetic predisposition. The important modifiable risk factors are obesity, use of alcohol or sedatives, narrowed airways due to enlarged tonsils or adenoids, smoking, chronic nasal congestion, myxedema and menopause. OSA-induced biological changes include intermittent hypoxia, intermittent hypercapnia, intra thoracic pressure changes, and sympathetic activation and sleep fragmentation. These biological changes lead to oxidative stress, systemic inflammation, metabolic dysregulation, and hypercoagulation and neurohumoral changes. Studies had demonstrated that there was an increase in thiobarbituric acid-reactive (TBARS) levels in patients with severe OSA compared with healthy control subjects and treatment with continuous positive airway pressure (CPAP) reduced the lipid peroxidation events. A marked increase in TNF-α and CD40 ligand in CD8 T cells was reported. Increased circulating levels of CRP have been consistently reported in both adults as well as in children. The increase in

sympathetic activity during sleep may be due to the activation of peripheral chemoreceptors by hypoxia, hyper-capnea and apneas leading to peripheral vasoconstriction and increase in blood pressure. The endothelial dysfunction results in increased vasoconstriction and reduced vasodilation. Nitric oxide which is a powerful vasodilator is decreased in OSA and the decreased levels of nitric oxide may contribute to reduced vasodilation and platelet adhesion and aggregation. Recurrent hypoxemia has been found to increase the endothelin levels in OSA and there is a reduction in endothelin levels on treatment with OSA. Endothelin is a potent vasoconstrictor which causes elevated blood pressure.There are elevated levels of plasma fibrinogen, exaggerated platelet activity and reduced fibrinolytic activity suggesting that there is a hypercoagulable state. The repetitive inspiratory efforts against a closed upper airway observed in OSA lead to increased negative intrathoracic pressure resulting in an increase in transmural gradients across the atria, ventricles and aorta. These changes in transmural gradients can result in autonomic and hemodynamic instability. The cardinal features of OSA are loud snoring and excessive daytime sleepiness. The assessment of sleepiness can be done with Epworth sleepiness scale or Stanford sleepiness scale. The gold standard for diagnosis of OSA is polysomnography in which there is simultaneous monitoring of nasal and/or oral airflow, thoracoabdominal movement, electroencephalogram, electro-oculogram, and electromyogram and oxygen saturation.

SUGGESTED READING

1. Iber C, Ancoli-Israel S, Chesson AL Jr, Quan SF, for the American Academy of Sleep Medicine. The AASM manual for the scoring of sleep and associated events: rules, terminology and technical specifications. Westchester, IL: American Academy of Sleep Medicine; 2007.
2. Young T, Skatrud J. Peppard PE (2004). Risk factors for obstructive sleep apnea in adults. *JAMA* **291**: 2013-6.
3. Gozal D and Gozal LK (2008). Cardiovascular Morbidity in Obstructive Sleep Apnea Oxidative Stress, Inflammation, and Much More. *Am J Respir Crit Care Med* **177**: 369–375.