**Connection Between Asthma and Sleep Apnea**

**Introduction**

Asthma is one of the chronic diseases which are characterized by inflammation and narrowing of the airways. The hallmark of asthma is the hypersensitive reaction of the airways. There are cardinal features that characterize asthma which is the tightness of the chest, coughing, breath shortness as well as wheezing (Alkhalil, & Getsy, 2013).On the other hand sleep apnea is a disease that makes one to experience periods of lack breathing while sleeping. This period that is characterized by lack of sleep normally last for around ten seconds or more. There are quite a number of studies that have been carried out to try and find out whether asthma and sleep apnea are linked and if yes, how are they related. Majority of the research indicated that the two are related in a number of ways.

**Asthma and Sleep Apnea**

A likely cause high prevalence of sleep apnea symptoms in patients who have asthma is due to the presence of high incidence of obstruction of the nasal parts in these patients. Naturally, breathing via the nose while sleeping is healthy and when there is the presence of nasal obstruction there occurs disorganized breathing. Chronic sinusitis, as well as rhinitis, are two examples of diseases that cause congestion of the nasal pathway with subsequent obstruction of the upper airway (Julien et al. 2012). With increase occurrence of a nasal obstruction in patients with asthma, there is the induction of an increased resistance in the nose which in turn leads to increased negative pressure along the upper part of the airway in the process of breathing which is a substantial factor in the development of sleep apnea (Julien et al. 2012).

Sleep apnea has been found to worsen asthma in a patient through different mechanisms. These include mechanisms such as gastro esophageal reflex; reflex especially neuromechanical, constriction of the bronchus, either systemic or local inflammation and induction of cardiac dysfunction dyspnea (Alkhalil, & Getsy, 2013). For the case of neuromechanical reflex, individuals with sleep apnea experience an increased vagal tone while asleep and this is secondary to complete or incomplete obstruction of the airway taking place during the apneic period.  The mechanism of stimulation of the vagus nerve is that of inspiratory effort against a glottis that is closed. This increased tone of the vagus nerve occurring during periods of apnea is a possible cause of asthma attacks at night in patients with sleep apnea (Alkhalil, & Getsy, 2013).

Studies have found that the hiked vagal tone cause a stimulatory effect to the muscarinic receptors that are found in the central airways thus causing bronchoconstriction. In addition to neuromechanical reflex, the neural receptors located at the glottis inlets as well as at the laryngeal have a powerful bronchoconstriction effect (Alkhalil, & Getsy, 2013). Thus in instances of continuous stimulation of receptors in these two regions in the course of sleep apnea and heavy snoring leads to bronchoconstriction that is neural induced in nature. Also during sleep apneas, there is the occurrence of increased negative intrathoracic pressure which tends to intensify the pulmonary capillary blood volume. This decrease in lung volume brings about a deleterious effect of the development of bronchoconstriction at night in patients with sleep apnea (Alkhalil, & Getsy, 2013). Another way in which reflex bronchoconstriction is triggered by sleep apnea is through hypoxic stimulation of the carotid body. This is because any level of hypoxia causes an increase in airway response to stimuli that are capable of causing constriction of bronchus via a vagal pathway.

Apneic condition is known to cause upper and lower respiratory tract inflammation.  The mechanism of inflammation of airway in sleep apnea entails exertion of frictional forces on the mucosal covering by the increased undesirable pressures produced by high inspiratory effort during the apneic period that is directed against a closed airway pathway. A repeated pattern of mechanical trauma on the airway especially upper airway tract is a trier of local inflammation around the pharyngeal and nasal mucosa (Teodorescu et al. 2015). A high number of increased polymorph nuclear leukocytes and other mediators of inflammation for instance bradykinin have been found in the local mucosa of the nasal region in patients with sleep apnea. Other findings include the presence of prolonged irritation of the soft palate as well as increasing tissue edema and inflammation of the muscles of the upper airway. Presence of inflammation of the airways affects the caliber of the airways, the flow rates in addition to worsening of the bronchial hyper responsiveness which increases susceptibility to having bronchospasms (Teodorescu et al. 2015). Thus local airway inflammation that is present in sleep apnea is a trier for asthma.

Apneic condition has a link to quite a number of cardiovascular consequences that are associated with sleep apnea which in return tend to complicate the coexisting obstruction of the airway in the asthmatic individuals. Sleep apnea also put patients at risk of ischemic heart disease in addition to congestive heart disease. Congestive heart disease then causes airway obstruction (Teodorescu et al. 2010). The mechanism by which it causes airway obstruction is due hyper response to cholinergic stimuli which is followed by constriction of the smooth muscles of the airway. Airway hyper responsiveness in congestive heart disease occurs via down-regulation of the beta receptors in the lungs with subsequent reduction in the adenylyl cyclase function. This leads to a resultant significant alteration in the airway relation that is mediated by the cAMP (Teodorescu et al. 2010).Also, other possible mechanisms include edema in the lungs which induce airway constriction by the vagal reflexes, thickening of the bronchial walls, alteration of the water and sodium transport in the epithelium, increased levels of the endothelins as well as activation of the nonspecific bronchial C-fibers. Thus sleep apnea aggravates cardiac dysfunction which further stimulates hyper responsiveness of the airway in patients with asthma (Teodorescu et al. 2010).

Patients with asthma have been found to be more predisposed to developing sleep apnea compared to the general population. Symptoms associated with sleep apnea such as snoring and apneic periods have been found to be very common in the majority of patients with asthma (Julien et al. 2012). Others have noted that there the same relationship between asthma and apnea and they found that there is increased frequency and sleepiness during the day in patients with asthma. This is probably pointing to a possibility of sleep disease in such patients. Other findings are a high occurrence of snoring in young ladies who have an atopic reaction and as well as a finding of a close association of snoring with asthma (Julien et al. 2012)

**Conclusion**

Overall, it is evident that the two conditions are directly detrimental to each other. But the most recent research indicates that sleep apnea is a characteristically independent risk factor for worsening the asthmatic condition, and on the other side, sleep apnea symptoms are very common in asthmatic patients equated to the rest generation. So sleep apnea has evidence of worsening asthma condition and vice versa is true. Therefore health workers need to have a clear understanding of the relationship between the two diseases and how the two are diagnosed and treated.

**References**

Alkhalil, M., Schulman, E., & Getsy, J. (2013). Obstructive sleep apnea syndrome and asthma: what are the links?. Journal of clinical sleep medicine: JCSM: official publication of the American Academy of Sleep Medicine, 5(1), 71.

Julien, J. Y., Martin, J. G., Ernst, P., Olivenstein, R., Hamid, Q., Lemière, C., ... & Kimoff, R. J. (2012). Prevalence of obstructive sleep apnea-hypopnea in severe versus moderate asthma. Journal of Allergy and Clinical Immunology, 124(2), 371-376.

Teodorescu, M., Barnet, J. H., Hagen, E. W., Palta, M., Young, T. B., & Peppard, P. E. (2015). Association between asthma and risk of developing obstructive sleep apnea. Jama, 313(2), 156-164.

Teodorescu, M., Polomis, D. A., Hall, S. V., Teodorescu, M. C., Gagnon, R. E., Peterson, A. G., & Jarjour, N. N. (2010). Association of obstructive sleep apnea risk with asthma control in adults. Chest, 138(3), 543-550.