Obstructive Sleep Apnea: Recent Mortality Studies and Their Implications

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Sleep related breathing disorders have received much attention over the past 10-15 years. A brief review of obstructive sleep apnea will be given followed by the results of two recently published mortality studies on this syndrome. Implications of these findings for the insurance industry will be given.

There are three types of sleep related breathing disorders: central, obstructive and mixed. Central disorders comprise 2-3% of sleep related breathing disorders while obstructive disorders comprise 90%. The mixed variety, a combination of both central and obstructive mechanisms, comprises the other 8%. This paper will focus on obstructive sleep related breathing disorders and their implications.

Control of respiration is quite complex, requiring inputs from a variety of sources working in concert to provide the neuromuscular interface necessary to maintain respiratory drive. In obstructive sleep apnea, the upper airway becomes blocked and marked effort on the part of the individual is required until the obstruction is broken, allowing respiration to occur again. If the apnea is sustained and frequent, one may see end organ damage. Muscle tone and neural output is changed during sleep. In obstructive sleep apnea, the majority of people have no difficulty breathing during the day, however during their normal sleeping time, these neuromuscular inputs are altered in such a fashion that the obstruction occurs. It is not uncommon for a Mueller type maneuver to occur, which increases vagus tone leading to bradycardia, sinus arrest and even asystole. Hypoxemia leads to increased sympathetic discharge which in turn can lead to systemic hypertension.

The key clinical features of obstructive sleep apnea are excessive daytime sleepiness, noisy snoring interrupted by apnea episodes, and nocturnal insomnia. These changes may also be accompanied by abnormal motor activity during sleep, intellectual and personality changes, sexual impotence, morning headache, systemic hypertension, pulmonary hypertension leading to cor pulmonale and heart failure, polycythemia and unexplained nocturnal death. The key features to look for are the excessive daytime sleepiness, which can lead to a variety of "near misses," particularly while driving. How many driving near misses is a key question to be asked during the initial interview. Also key is to ask the spouse or sleeping partner about the length of the apnea episodes. Episodes lasting longer than thirty seconds require further investigation with a sleep lab study.

Key features on the physical exam generally show that these individuals are obese and have upper airway abnormalities. These upper airway abnormalities may include a big tongue, short neck, large uvula, and increased adipose tissue in the neck. There may also be a malocclusion.

Treatment modalities are wide ranging. Typically, weight loss is the initial recommendation. This at times will be supplemented by a variety of medications which include tricyclic antidepressants, Provera and Protoprol. Nocturnal oxygen has been given in the past, however this by itself does not work very well. More recently, mechanical devices have been employed, particularly nasal CPAP, which provides continuous positive airway pressure to help overcome the upper airway mechanical obstruction. More aggressive treatment includes uvulopalatopharyngoplasty, which attempts to permanently alleviate obstructive abnormalities of the upper airway surgically. The definitive treatment for severe obstructive sleep apnea is tracheostomy which simply bypasses the entire upper airway.

Recently, two studies have been published looking at the long term mortality of individuals treated by various modalities with obstructive sleep apnea. Partinen et al., from Stanford, studied 198 obstructive sleep apnea syndrome patients who were treated either conservatively with weight loss or aggressively with tracheostomy. They followed these individuals over five years and looked at the mortality rate at the end of that time. Mortality rates were calculated using expected vs. observed death rates and age standardized death rates. They then subdivided their population groups not only on treatment modalities but also subdivided these into individuals with previous cardiac events. The overall mortality rate for the conservatively treated group was 11 per 100 patients for five years. There were no deaths monitored in the tracheostomy group, giving a death rate of 0. The "vascular mortality" in the conservatively treated group was 6.3 deaths per 100 patients per five years. In the tracheostomy patients, it was felt that one possible death may have occurred due to a combination of cardiovascular disease and obstructive sleep apnea. The adjusted odds for vascular death during a five year period for this group would be 4.7 per 100. This again was considerably different from the 6.3 found for the conservatively treated group. Their conclusion was that the risk of death was always higher for the conservatively treated group vs. the aggressively treated group. Their feelings were that an aggressive approach for the treatment of obstructive sleep apnea was warranted based on their findings.
The second paper dealing with this syndrome and mortality was by He and Conway, et al., from the Henry Ford Hospital in Detroit. Their paper focused on determining what the cumulative survival of untreated patients with sleep apnea was, what apnea index was associated with increased mortality, what the effect of age was on mortality and, finally, what the effect of therapy was on mortality. The sleep apnea index is defined as the number of apneas lasting longer than 10 seconds per hour of sleep. A life table approach to mortality was used with the starting point being date of initial evaluation of the patient; the end point being death. Three hundred eighty five males above the age of 15 were entered into this study and an overall five year survival rate of 92% was found vs. an eight year survival rate of 78%.

Of importance was the effect of the apnea index. It was found that for those individuals who had an apnea index of less than 20, there was an overall eight year survival rate of 96%. For those individuals with an apnea index of less than 20 and under age 50, there was no mortality at eight years vs. 93% survival rate for those individuals with an apnea index less than 20 and over age 50. Individuals over age 50 and with an apnea index greater than 20 had a 53% survival rate at eight years. Therefore, age also has an effect upon survival in obstructive sleep apnea.

Figure 2
Effect of Age & Apnea Index on 8-Year Survival
Apnea Index (AI) = Number of Apneas >10 Seconds/Hour of Sleep

<table>
<thead>
<tr>
<th>Age</th>
<th>AI &lt; 20</th>
<th>AI &gt; 20</th>
</tr>
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<tbody>
<tr>
<td>&lt;50 Yrs.</td>
<td>100%</td>
<td>80%</td>
</tr>
<tr>
<td>&gt;50 Yrs.</td>
<td>93%</td>
<td>53%</td>
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Effects of treatment were looked at, particularly tracheostomy, continued positive airway pressure (CPAP) and uvulopalatopharyngoplasty (UPPP). Those individuals who had been treated with tracheostomy or CPAP had a 100% survival rate at eight years. Those individuals who had been treated with UPPP had an overall eight year survival rate of 78%. The survival rate with tracheostomy is expected since the etiology of the problem (upper airway obstruction) is bypassed. The positive survival rate for CPAP is explained on the basis that these patients had been shown to respond to this treatment modality in the sleep lab. The effect of UPPP and its somewhat surprising low survival rate indicates that these patients should be studied after surgery to see whether or not they were a surgical failure in terms of correcting their obstruction. Therefore, they require a sleep study prior to the surgery and a sleep study following the surgery. The current cost of sleep studies varies from coast to coast with estimates of $800-900 in the midwest vs. $1,200 on the east coast and $1,600 on the west coast.

Figure 3
Treatment Modality and Survival
- Tracheostomy: 100% (8 years)
- C-PAP: 100% (5 years)
- UPP Procedure: 78% (8 years)

The implications for the insurance industry would appear to be the following:

For medical insurance, individuals with obstructive sleep apnea are at increased risk because of the medical cost generated for the sleep study and potential cost for CPAP equipment vs. surgical procedure with tracheostomy or uvulopalatopharyngoplasty. Tracheostomy decreases this risk since it is a definitive treatment, though complications are now uncommon with ongoing tracheostomy care. CPAP has been used in obstructive sleep apnea for five to six years and what the long term consequences and results of this therapy will be are unknown. There appear to be no current long term complications at this time. These individuals will wear out machines which need to be replaced. In the midwest, the current costs are approximately $100 per month for rental vs. approximately $2,000 per machine. The machines appear to last anywhere from two to five years. The UPPP procedure, as indicated in the papers, may or may not be corrective and sleep study following the procedure needs to be done.

Disability insurance provides an interesting scenario in these individuals. In the conservatively treated group where weight loss is recommended, there appears to be some ongoing disability in terms of productivity at work, as well as “near misses,” particularly motor vehicular accidents. If treated with tracheostomy or CPAP, these individuals would appear to be at minimally increased risk since this produces marked clinical improvement. Other issues that need to be addressed for disability are end organ damage such as pulmonary hypertension, systemic hypertension and many of the sequelae following these.

Life insurance risk would need to be looked at in terms of apnea index, age, and treatment modality employed. For those individuals with an apnea index of less than 20 who are less than 50 years of age, there is minimal risk for premature death and any rating would appear unwarranted. For those individuals with a sleep apnea index less than 20 and over age 50, there is a slightly increased risk and a small rating.
may be warranted. For those individuals who are under 50 and with a sleep apnea index of greater than 20, there is a 20% increased mortality in those individuals who are untreated. This mortality increases to 47% in individuals who are over age 50 and are untreated. This is a significant risk. Depending on the underwriting philosophy of the company, some companies might take these individuals under age 50 at a moderate rating while other companies might decline untreated individuals with an apnea index of greater than 20, no matter what their age.

In those individuals who warrant treatment, the type of treatment modality affects overall survival. For those individuals who have been treated with tracheostomy and CPAP, there appears to be no decrease in survival. Rating these individuals for life insurance would not appear to be warranted based solely on their sleep apnea. Uvulopalatalpharyngoplasty with an increased mortality of 22% again would appear to warrant a moderate rating to decline, based on company philosophy.

References
