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BRIEF REPORT

The World Trade Center Health Program: Obstructive sleep apnea best practices

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ABSTRACT

The events of September 11, 2001 exposed nearly half a million community residents and workers engaged in rescue and recovery and clean-up to dust, debris and toxic chemicals, as well as psychologic and physical stressors. Early studies showed an excess of aerodigestive diseases including rhinosinusitis and gastroesophageal reflux. Several studies of World Trade Center (WTC) responders report an excess of obstructive sleep apnea among patients who developed new onset or worsening chronic rhinosinusitis. High quality clinical diagnostic and treatment guidelines are available from The American Academy of Sleep Medicine and the Department of Veterans Affairs/Department of Defense. For enrolled members, the WTC program covers diagnostic evaluation and treatment for sleep apnea in members diagnosed with WTC-related upper and lower respiratory disease and gastroesophageal reflux.

ARTICLE HISTORY

KEYWORDS
Occupational diseases; adults; respiratory diseases; workers

Background

The events of September 11, 2001 (9-11) exposed nearly half a million people, emergency responders and residents and workers and students attending school in local buildings near the disaster site, to dust and toxic chemicals. The responders included those people involved in search, rescue, recovery and clean-up efforts in the New York City (NYC) and the Pentagon in Washington DC and Shanksville, Pennsylvania. A significant number of people exposed to dust and debris reported new onset or worsening upper airway disease (UAD) and gastroesophageal reflux disease (GERD) and obstructive sleep apnea (OSA). An early study showed upper respiratory symptoms were persisting in 69% of patients surveyed 5 years after 9-11 service.[1] Patients reported increases in snoring and daytime somnolence which are both symptoms suggestive of obstructive sleep apnea.[2,3] Several studies in NYC responders suggest that chronic rhinosinusitis is present in a majority of 9/11-exposed patients.[4] OSA is a chronic medical condition with recurrent episodes of partial and complete upper airway collapse during sleep. The main OSA risk factors are obesity, aging, and male sex. While OSA might be present in 34-50% of the general population, studies show that the rate of OSA is increased in WTC responders who have been diagnosed with 9/11-related chronic rhinosinusitis.[4]

This paper is one of a series of papers to promote high quality evidence based medicine when diagnosing and treating WTC related conditions.[5] It briefly summarizes diagnostic evaluation and treatment of obstructive sleep apnea extracted from clinical practice guidelines (CPG) published by American Academy of Sleep Medicine and the Department of Veterans Affairs/Department of Defense.

Sleep apnea is a common sleep disorder characterized by brief breathing interruptions during sleep. The most common type of sleep apnea is obstructive sleep apnea (OSA). OSA occurs when the upper airway collapses or becomes blocked during sleep, thus reducing or stopping airflow.

There is a very high prevalence of OSA among members in the WTC Health Program. It may be as high as 75% (61% are mild OSA and 39% are moderate to severe).[4] In contrast, in one population study of the Wisconsin Sleep Health Cohort between the ages of 30 and 70 years, OSA prevalence is lower (~34%

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among men and ~17% among women);[6] however, the severity distribution is similar to that found in the WTC Health Program. Given the homogenous nature of the ethnicity of this cohort, more recent population studies have found that OSA prevalence may vary among ethnic groups ranging between 13 and 47%.[7] Globally, national prevalence may vary between 9–84% for men and 3–71% for women.[8] Given that elevated BMI is a risk factor for OSA,[6] the relatively high prevalence of obesity among Program members[9] may, in part, explain the higher OSA prevalence in the Program. However, other pathophysiological mechanisms such as low arousal threshold, high loop gain and increased pharyngeal collapsibility are being explored.

Diagnostic evaluation

The WTC Health Program uses sleep studies to diagnose sleep apnea by recording the number of episodes of reduced air flow or stopped breathing (apnea) detected per hour of sleep. Diagnostic testing is performed via in lab polysomnography (PSG) or home sleep apnea testing (HSAT)

When PSG is used, the Apnea- Hypopnea Index (AHI) should be used during diagnostic testing to determine the presence and severity of sleep apnea. The AHI score is equivalent to the number of apneas and hypopneas recorded during the sleep study per hour of sleep. The AASM Scoring Manual recommended definition requires that changes in air flow be associated with a 3% oxygen desaturation event or a cortical arousal, also termed AHI 3% but allows an alternative definition that requires association with a 4% oxygen desaturation without consideration of cortical arousals. (AHI 4%). Depending on which definition is used, the AHI may be considerably different in a given individual.[10]

More recently home sleep apnea testing devices have been used to diagnose OSA. Most unattended studies use devices that measure limited cardiopulmonary parameters; two respiratory variables (e.g., effort to breathe, airflow), oxygen saturation, and a cardiac variable (e.g., heart rate or electrocardiogram). Since these devices do not measure sleep, the term Respiratory event index (REI) is used rather than an AHI as measurement of hypopneas by standard PSG requires EEG to determine sleep and arousal to meet the standard definition. Other unattended devices such as the WatchPAT uses peripheral arterial tonometry (PAT) and changes in arterial tone instead of airflow sensing to determine respiratory disturbance events. Thus, they provide a readout of pAHI 4, pAHI 3, and pRDI.[11]

Severity using the AHI/REI scale is categorized as follows:

Low/not present: AHI $<$ 5 per hour
Mild: AHI/REI $\geq$ 5 but $<$15 per hour
Moderate: AHI/REI $\geq$ 15 but $<$ 30 per hour
Severe: AHI/REI $\geq$ 30 per hour

If the member has a low AHI, the Respiratory Disturbance Index (RDI) can also be used to diagnose sleep apnea. Members with a low AHI may be diagnosed with sleep apnea if their Respiratory Disturbance Index (RDI) score is 15 or greater. RDI is PSG-determined and measures apneas and hypopneas, as well as respiratory effort-related arousal (RERAs) and other respiratory events per hour of sleep. Hypoxia or arrhythmias during sleep study can also be used to justify an increase in OSA severity level.

For more information on OSA diagnosis, the diagnostic testing guideline from the American Academy of Sleep Medicine (AASM) is a helpful resource. It is available at this link: https://aasm.org/resources/clinicalguidelines/diagnostic-testing-osa.pdf.

Treatment

There are two clinical practice guidelines (CPG) that represent best practices:

- *American Academy of Sleep Medicine (AASM)*, February 2019 – this CPG includes a very helpful flow chart. Note that this CPG provides detailed guidance on treatment with Positive Airway Pressure (PAP) modalities only. It doesn't discuss non-PAP treatments. The CPG is available at this link: https://jcsm.aasm.org/doi/pdf/10.5664/jcsm.7640
- *Department of Veterans Affairs/Department of Defense*, 2019 – this CPG discusses many different types of treatment of adult OSA, including PAP, oral devices, hypoglossal nerve stimulation and nasal surgery. The CPG is available at this link: https://www.healthquality.va.gov/guidelines/CD/insomnia/VADoDSleepCPGFinal508.pdf.

World Trade Center Health Program coverage

Please note that OSA diagnostic and treatment services are covered by the WTC Health Program, assuming they meet certain criteria. Those criteria and other

details on Program coverage for OSA are available at the WTC Health Program's Administrative Manual at this link: https://www.cdc.gov/wtc/ppm.html#medical_sleep_apnea.

Disclaimer

The contents of this article are the sole responsibility of the authors and do not necessarily represent the official views of, nor an endorsement, by the National Institute for Occupational Safety and Health (NIOSH), the Centers for Disease Control and Prevention of the U.S. Department of Health and Human Services (CDC/HHS), or the U.S. Government."

Disclosure statement

The authors report there are no competing interests to declare.

Institutional review board (IRB) review

This activity did not involve human subjects and therefore did not require IRB review.

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