

Breathing and Sleep Problems in Polio Survivors

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It is critically important that polio survivors, especially those diagnosed with post-polio syndrome, obtain proper testing, diagnosis, and management of breathing and sleep problems. The problems may result from weak breathing muscles in the chest and abdomen (diaphragm and intercostals).

Pulmonary function tests (mostly noninvasive) can measure the strength of respiratory muscles and usually include a test for forced vital capacity (FVC) – the maximum amount of air that can be exhaled. This test is typically administered when a person is sitting in the upright position, but *also* should be administered when a person is lying down (supine position). People who may not experience breathing problems sitting up may find themselves struggling to breathe when lying down. This problem is known as orthopnea, and a marked decrease in FVC while lying down indicates that the diaphragm is weak.

The late E.A. Oppenheimer, MD, a pulmonologist with years of experience treating polio survivors, described it, "As one ages with the late effects of polio, respiratory muscle strength may decrease. This may be particularly evident when you lie down, because in this position, the diaphragm has to work harder both to pull air in and also to push the intestines and other abdominal organs which are out of the way when one is upright due to gravity."

Polio survivors also may have obstructive sleep apnea (OSA), central sleep apnea (CSA), a combination of OSA and CSA, and/or hypoventilation (an imbalance in the gas exchange in the lungs due to too little breathing - carbon dioxide builds up and oxygen drops). In obstructive sleep apnea, the upper airway collapses and blocks the flow of air so the person stops breathing periodically. These cessations of breathing are known as apneas and hypopneas. An overnight sleep study may be helpful to confirm the presence of OSA if it is suspected, based on snoring and daytime sleepiness.

Most sleep laboratories are set up to detect obstructive sleep apnea, for which the appropriate treatment is continuous positive airway pressure or CPAP, but not to measure carbon dioxide levels directly, which would be the best way to detect hypoventilation, for which the appropriate treatment is bilevel or positive pressure ventilation. The test for a high carbon dioxide level would be to measure arterial blood gases (requiring blood to be drawn via needle from an artery – usually in the wrist) or to monitor end-tidal or transcutaneous CO₂, which is usually not done. However, sleep labs look for sustained drops in oxygen saturation during sleep that would be indicative of hypoventilation and then can proceed to additional testing to confirm hypoventilation, if needed.

When a bilevel device, a form of positive pressure ventilation, is prescribed, it will provide two levels of pressure; inspiratory (IPAP) to help blow air into the lungs, and expiratory (EPAP) to help keep the airways open and to blow off CO₂. These pressures can be set and adjusted separately. IPAP settings are higher than EPAP settings, with a span of at least 8 to 10 advised for adequate breathing assistance, e.g. IPAP of 14, EPAP of 4. Bilevel units with a backup rate are recommended for people who may not be able to initiate a breath on their own, particularly at night. The bilevel device can provide timed backup breaths.

It is important for individuals to understand that polio survivors do not "forget to breathe" when they become overly fatigued. What happens is that the muscles become too weak to

move sufficient air, especially during sleep. Post-polio syndrome can also sometimes cause central sleep apnea which causes the brain to temporarily "forget" to signal breathing muscles to take a breath. This is evident during a sleep study when there is no chest wall movement for at least 10 seconds, indicating that the individual is not breathing and is apneic. Bilevel ventilation administered using a nasal or face mask can help with either problem.

Although a polio survivor may not have breathing or sleep problems when initially diagnosed with post-polio syndrome, periodic testing is important because such problems may develop over time or a change of breathing machine and/or settings may be warranted. (See *Tests for Breathing Problems If You Have a Neuromuscular Condition.*)