

# How Polio Survivors Can Avoid Tracheostomies

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Dr. Bach is in charge of the Center for Noninvasive Mechanical Ventilation Alternatives and Pulmonary Rehabilitation and has spoken and written extensively.

(See "Management of Patients with Neuromuscular Disease" by Hanley & Belfus (2003).

Dr. Bach wrote "Respiratory Muscles Aids to Avert Respiratory Failure and Tracheostomy," which can be found at <http://www.ventusers.org/edu/ConfCall2013Bach.pdf>. His talk supported the premise that "polio survivors can virtually ALWAYS avoid tracheostomies even if continuously (noninvasively) ventilator dependent." However, If you can't speak or swallow, then you do need a tracheostomy.

Dr. Bach describes his patients. My first patients were those who used ventilators since having had polio. Then, I started seeing patients who had used iron lungs but had weaned from them but now need to use noninvasive ventilation. There are also some people who never before needed assisted ventilation until recently.

Dr. Bach on the first decision. First, it should be determined if polio survivors are symptomatic for nocturnal under ventilation. It is also possible that there could be a second condition like lung disease (failure of oxygenation) especially if one was a heavy smoker. Most of the time, though, the symptoms are from muscle weakness (failure of ventilation) for which the treatment is nocturnal ventilation. This is most likely for the survivors of polio. The treatments are very different. For lung issues, the solutions include bronchodilators and oxygen. But, for muscle weakness the treatment is the use of respiratory aids which include noninvasive ventilation and mechanical coughing aids. If a patient has both problems, eg, lung problems due to smoking and neuromuscular weakness due to polio, a decision may need to be made as to which is the primary problem and treat it.

Dr. Bach on breathing muscles. Inspiratory muscles assist with inhaling. Shortness of breath when lying flat (orthopnea) is a sign of a weak diaphragm (an inspiratory muscle). Many polio people use pillows to support their backs to prevent shortness of breath when they sleep, but the best solution for weak inspiratory muscles is intermittent positive pressure ventilation (air under pressure when inhaling) from a ventilator and via a nose interface. It takes about 20 ml of water pressure to ventilate someone who has severe muscle weakness.

Expiratory muscles (mostly the abdominals) assist with coughing. If survivors get a cold, they may not complain of shortness of breath but of anxiety and difficulty sleeping due to high blood carbon dioxide levels.

It is not helpful to use CPAP and only minimally helpful to use bilevel devices if breathing muscles are weak, because the air blowing in when we exhale is counterproductive.

Bulbar (throat) muscles protect the airways. There isn't anything to be done for bulbar muscle weakness when it results in continuous aspiration of saliva into the lungs but in polio that almost never happens which is why tracheostomy tubes are unnecessary.

Dr. Bach on weak coughing muscles. Weak coughing muscles keep one from getting rid of the bacteria, etc. in the lungs, which results in pneumonia risk. The first thing an ER physician normally would do is to give oxygen, and if the CO<sub>2</sub> is already high it will "go through the roof." This is why and how many polio survivors get intubated and, after the pneumonia clears up, many are trached. It is not necessary. If a person could speak and swallow at least a little before getting intubated he/she certainly does not need a tracheostomy. Do polio people have trouble swallowing? No. But, people with ALS have trouble swallowing and they can need tracheostomy tubes.

Dr. Bach on CoughAssist (Philips Respironics). Some people who have a trach think that it is easier to suction mucus when they have a cold if they have a trach. The only people who think this are those who don't know how to use the CoughAssist through the nose and mouth. For that matter, it is also much better than suctioning the airways to use it via a trach tube too. It is best to use the CoughAssist with an abdominal thrust and at least 35 ml of water pressure in and out. A manually assisted cough will get most polio people a functional cough to help them through most problems, so a cough machine is not as necessary for everybody. Dimi Italia s.r.l., Seoil Pacific Group, B & D Electromedical and Siare Engineering International Group S.r.l. also manufacture cough devices.

Dr. Bach on trach tubes. Four out of five people who get a trach will die because of the trach. Problems include mucus plugs, a fistula between the esophagus and trachea (windpipe), and granulations around the trach that bleed when the trach is changed. The tube itself can puncture the windpipe or trachea, or even an artery. People with trach tubes also carry many bad pathogens, so it is not surprising that people with trachs have a greater number of serious infections

than those who use noninvasive ventilation. Trach tubes should be removed in those who can speak and swallow food and can cooperate and communicate.

Dr. Bach on CO<sub>2</sub>. Too much CO<sub>2</sub> in the blood causes acidity just like CO<sub>2</sub> causes acid rain. Some CO<sub>2</sub> is needed to trigger the brain to tell muscles to breathe. Most labs do not measure end tidal CO<sub>2</sub> but do painful arterial blood gases which make people hyperventilate from the pain. Painless end-tidal CO<sub>2</sub> is actually much more useful.

Dr. Bach on oxygen use. It's a terrible mistake for polio survivors (without lung diseases) to use oxygen. Oxygen use turns off the drive to breathe, and causes the CO<sub>2</sub> levels to rise. Any polio survivor who has respiratory problems, sees a physician, and is sent home with oxygen will be back for treatment of pneumonia or respiratory failure sooner than if they had not been treated at all. The problems that polio survivors have are weak muscles and extra secretions, and there are solutions for both, ie, the treatment is either assisted ventilation and/or assisted coughing.

Dr. Bach on testing. Pulmonary function testing is for lung disease, not muscle weakness. What polio people need is the measurement of vital capacity, which is the largest breath one can take both while sitting and lying down. The difference between the two should be less than 7%. Other important spirometric tests include measuring air stacking ability. The needed tests are not done in pulmonary function labs and include the measurement of cough flows, both assisted and unassisted. The assisted-cough flow is measured when an Ambu-Bag (manual resuscitator) is used to "air stack," ie, retain consecutive volumes of air and hold it in the throat to attain the highest volume. Then pressure is put on the belly, if the abdominals are weak, to cause a cough, and the flow is measured. If the flow is more than 270 liters per minute a polio survivor has little chance to get pneumonia during a cold, but if less, any respiratory infection is likely to result in pneumonia.

Sleep studies (polysomnography) were never meant to test for post-polio muscle weakness, but can be useful to rule out other problems, such as obstructive/central sleep apnea which is NOT the principal problem of polio survivors. If a pulmonologist sends someone for a sleep study and they have weak inspiratory muscles, they will treat the patient incorrectly. CPAP is useless for those with breathing muscle weakness, and BiPAP suboptimal particularly at the usual settings used (Inspiratory pressure of 10; Expiratory pressure of 5).

Dr. Bach on oximeters. All polio survivors should have oximeters to assist with the protocol to prevent pneumonia. When sick, use the oximeter to be sure it never registers below 95%. If it does, it means one of two things. One, your CO<sub>2</sub> is high and ventilation is needed. Two, secretions are high and assistance with coughing is needed. If neither treatment is used, the situation worsens and when taken to the ER, oxygen is offered which often results in breathing arrest and emergency intubation, then unnecessary tracheostomy. Remember, if this happens, people can have the tube or trach removed and be successfully managed using noninvasive ventilation. (See Extubation of patients with neuromuscular weakness: a new management paradigm, Bach JR, Gonçalves MR, Hamdani I, Winck JC. Chest. 2010 May;137 (5):1033-9.)

Dr. Bach on ventilators. Ventilator use rests a weak diaphragm and weak inspiratory muscles during sleep, and the result is feeling stronger, better during the day and blood gases are better, ie. CO<sub>2</sub> is more normal. The way to rest the muscles is to use a ventilator using pressures of 18-20 cm of water, not by using CPAP or BiPAP. Remember: It is not possible to turn off the expiratory pressure on a BiPAP machine and the user cannot air stack using it. Air stacking is important to stretch the lungs to full capacity, because if the vital capacity is 50%, that means that half of your lungs are not being used and they "close down."

Dr. Bach on what breathing device to use. Many polio survivors used negative pressure machines (iron lungs, chest cuirasses, pulmowraps) in the early days, but they caused obstructive apneas and the users experienced desaturations and high blood pressure. I don't recommend negative pressure for anybody any more. I recommend the LTV Series (CareFusion), Trilogy Series (Philips Respironics), and Newport HT50, HT70 (Covidien) here in the United States.

Dr. Bach on nasal masks. There are hundreds of nasal masks on the market, and I recommend that people try several. If someone has trouble with the nasal mask leaking, then try an oral/nasal device such as the Hybrid™ Universal Interface (DeVilbiss Healthcare) or the lip cover Oracle™ 452 (Fisher & Paykel Healthcare), and the oro-nasal Mirage Liberty™ (ResMed Corp).

Dr. Bach on diaphragmatic pacers. A diaphragmatic pacer is completely useless for polio people because to use the device a person need a good phrenic nerve and a good diaphragm and if they had them they would need no help at all.