Covid-19 and the Importance of Maintaining Respiratory Strength

By Tom Michaud, D.C.

As of April 1, Dr. Anthony Fauci, head of the White House Coronavirus Task Force, estimated that as many as 240,000 Americans will die from COVID-19 infection. Unlike typical seasonal influenzas, in which an affected person typically transmits the virus to 1.3 others (1), an individual infected with COVID-19 will transmit the disease to 2.2 other individuals (2). Fortunately, the vast majority of infected people develop only mild symptoms. Most common symptoms include fever, dry cough, and respiratory distress. The CDC lists significant comorbidity factors as hypertension, diabetes, obesity, and old age.

In an exploratory analysis of 44,672 confirmed cases of COVID-19 diagnosed as of February 11, 2020 (3), Chinese epidemiologists report that 81% of infected patients reported only mild symptoms with no mortality. Another 14% developed severe symptoms with no mortality while 4.7% had critical disease with the fatality rate of 49%. COVID-19 deaths increased with age, with a fatality rate of 1.3% in patients aged 50 to 59, 3.6% in patients aged 60 to 69, and 8% in patients aged 70 to 79. The worst mortality rate occurred in patients 80 years of age and older, with this group suffering a 14.8% mortality rate. In the first study release from China evaluating 1099 confirmed COVID-19 cases, severe illness happened in 16% of patients after admission, with 2.3% of this group being placed on mechanical ventilators, and 1.4% dying (4).

While mechanical ventilation is a life-saving intervention for those infected with COVID-19, as many as 40% of these individuals can experience significant difficulties upon being weaned off their ventilators (5). These patients are more prone to poor functional outcomes and have significantly higher risk for increased mortality (6). Several studies have shown that weakness of the muscles of respiration correlate with poor outcomes following mechanical ventilation (7,8). One study showed that diaphragm weakness (Fig. 1) was present in 63% of patients reporting poor outcomes when placed on mechanical ventilators (8).

In an attempt to understand the best possible ways to improve outcomes in patients requiring mechanical ventilation, researchers from Toronto suggest that success with ventilation requires more than a strong diaphragm
(9). They cite several papers showing patients with partially paralyzed diaphragms can still be weaned off ventilators as they become dependent upon secondary muscles of inspiration: notably, the scalenes, intercostals, and the sternocleidomastoid muscles (Fig. 2). The Canadian researchers performed a simple experiment where they placed EMG sensors over the secondary muscles of inspiration and compared maximum inspiratory pressure as subjects performed either exercises to strengthen their neck flexors, or inspiratory muscle training to strengthen their diaphragm.

The neck flexor exercises consisted of a series of quasi-isometric neck flexion exercises, in which subjects pressed their foreheads into a customized holder, generating 50% full effort for 2-seconds. This contraction was then followed by a 4-second rest and repeated until the subjects were fatigued, which took a little over 25 minutes. The group performing inspiratory muscle training also exercised at 50% full effort until fatigued, and the average duration of inspiratory muscle training was 38 minutes. The long exercise durations were specifically chosen in an attempt to increase endurance in these muscles, since it typically takes nearly an hour to wean the patient off of a ventilator (9).

After analyzing their data, the authors noted that the neck exercises were easier to perform and produced significant increases in neck flexor strength, particularly in the sternocleidomastoid muscle. Interestingly, the sternocleidomastoid was also vigorously recruited during inspiratory muscle training. The authors were not surprised by this finding as the sternocleidomastoid has the longest lever arm for increasing upward excursion of the ribs, making it a powerful synergist to the diaphragm. Because neck flexor exercises are easy to perform and increase strength in the secondary muscles of inspiration, they play a key role in respiration and can help offload an overworked and/or weakened diaphragm. The authors state: “Although addressing diaphragm weakness is of primary importance to facilitate weaning, improving the function of the neck and chest wall muscles will likely contribute to successful recovery following mechanical ventilation.”

Given the difficult times ahead, it seems logical that in addition to improving immune function with anti-inflammatory diet, vitamin D supplements, and mild to moderate exercise (all of which have been proven to reduce the risk of viral infection [10-12] ), everyone, especially high-risk individuals, should consider performing diaphragm and neck flexor exercises. These exercises are easy to do and can be done at home with inexpensive
equipment. A diaphragm strengthening device called Expand-A-Lung is available for less than $30. I typically recommend patients perform 2 sets of 30 repetitions at 70% full effort with this device. To strengthen the neck flexors, I have patients perform 4 sets of 25 repetitions of partial sit-ups with the neck in a neutral position and the chin pointing up slightly. Once the head is elevated a few inches from the floor, I have them hold this position isometrically for 5 seconds. Unlike deep neck flexor strength training, pointing the chin up slightly recruits the sternocleidomastoid muscle more effectively.

This routine can be repeated twice a day and the number of repetitions can vary depending upon the person’s fitness level. Within just a few weeks, you’ll get appreciable strength gains in both the diaphragm and neck flexor muscles. With any luck, by keeping our immune systems strong and our respiratory muscles functioning at maximum capacity, fewer people will require hospitalization following exposure to this difficult to treat virus.

References: