COPD Hypoxic Drive

Nut Shell from medical book: The hypoxic drive theory is a result of chronic CO2 retention not the other way around. The body has a high CO2, low oxygen, and low pH(whether it's due to respiratory or metabolic) drive to breath. As the body becomes accustomed to chronic CO2 retention the pH normalized (by bicarb increasing or compensating), low oxygen becomes the drive to breath. That is why chronic CO2 retainers are more sensitive to oxygen.

Here is my explanation using my simple "Tom level of thinking":

Normal Breathing:

The central chemoreceptors, also in the medulla, sense high CO2 levels.

The carotid peripheral chemoreceptors sense low O2 levels.

What are normal arterial blood gas levels (ABG):

O2 is 80-100% normal range

CO2 is 35 to 45% normal range

PH is 7.35 to 7.45 normal ranges

How does the flip in receptors take place – general rule:

First look at the 02 Levels: Due to COPD (chronic bronchitis and emphysema) we still get O2 in but not as effective. So over time the carotid chemoreceptors start to adjust to a lower level of O2 in the blood. It is a gradual change over time so the body will adjust.

Secondly look at the CO2 Levels: Due to COPD (chronic bronchitis and emphysema) we still get CO2 out but not as effective – so we "retain" a higher level of CO2. So over time the central chemoreceptors start to adjust to a higher level of CO2 in the blood. It is a gradual change over time so the body will adjust. As the CO2 sensor is exposed to increased levels it gradually has a lowered response. So the O2 sensors take over.

When does the flip happen?

When the CO2 levels rise from normal (35 to 45%) to greater than 60%.

When the O2 levels drop from normal (80 to 100%) to less than 60%.

When this happens we start to register not CO2 levels as much but the O2 levels. So when we saturate the body with high flow O2 for example the body registers the increase and says we have enough O2 slow down the breathing. "The Hypoxic Drive"

The goal is to maintain the levels that the patient's body is used to… a little hypercapnic (higher CO2) and a little hypoxic (low O2 level). That's why a pulse-ox sat of 90-92% is acceptable in a COPDer. Do not confuse pulse-ox and ABG numbers. Pulse-Ox of 95 to 100% is normal range and ABG O2 normal levels are 80 to 100%.

The key to all of this: Just watch the pH. As a result of the increase of CO2 in the body the COPDer has to fight off more/higher acid levels. CO2 is acid. As long as the Ph level is acceptable (7.35 to 7.45) we are looking good. So who stops breathing? The COPD "retainer." When the ABG Ph is normal and the CO2 levels sky rocket as a result of ineffective respiration/ventilation exchange (most commonly cause by a breathing medical emergency expisode). These COPD "retainers" are very rare to see. They are the ones who stop breathing over time. A major majority of COPDers exchange the CO2 in and out just fine so they will not stop breathing.

To recap it is the COPDers who retain the CO2 when in crisis and not release it in addition to the normal COPD hypoxic drive problems (lower O2 – higher CO2 levels) that stop breathing. Do not forget about the CSF (cerebrospinal fluid) Ph levels play a role in this also as they are influenced by CO2 (acid). And, of course, in an emergency give 100% O2.