Hypoxic Drive STEAM project

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We all know by now in this class that our respiratory drive is driven by carbon dioxide (C02). But that's just in healthy folks who don't have any major respiratory problems. People with Chronic Obstructive Pulmonary Disease (COPD) have a hard time with the respiratory drive if the case is severe enough.

The respiratory system is our primary buffer mechanism to fight against acidosis or alkalosis. We'll change our rate and depth depending on whether we are more acidic or basic. Our respiratory drive is based on CO2 levels in the body. If we have too much CO2 then we breathe just a little bit more and take deeper breaths. If we don't have enough then we'll increase or decrease our respiratory rate to tailor to our needs.
For those who have COPD and or other chronic respiratory illnesses, their body can get tolerant to the high CO2 levels and see that as the "new normal". After this transition, the primary respiratory drive is based on oxygen (O2) levels. This type of respiratory drive is called the Hypoxic Drive. The Hypoxic drive in simple terms is when the oxygen saturation starts to fall and so then the person inhales and exhales. Once the oxygen demand is met the respiratory rate starts to decrease. Once the O2 levels start to drop, the person inhales and exhales. Rinse and repeat.

The dangerous part of this is taking away the respiratory drive when treating patients with this condition. If I give a patient who is running off their hypoxic drive oxygen, there's potential that I may take away their entire respiratory drive (not forever). The patient and the rest of us on this planet don't always have to be at 100% oxygen saturation all of the time. We just need to be at an adequate level and our bodies usually take care of that for us, at least in healthy people. If I give a patient who is running off of their hypoxic drive high-flow oxygen because I got scared as a provider seeing 84% on the SpO2 then I can potentially do more harm than good. Some patients live with low oxygen saturation at their normal baseline. I have to base my decision on the current event, the patient's chief complaint, respiratory rate and effort, lung sounds, SpO2, pulse rate, skin color, and mental status. If the patient is in full respiratory arrest then I'm giving all of the oxygen I can and transporting immediately. If the patient is conscious and alert, is a little short of breath, and is wheezing then I'll start off with a little bit of supplemental O2 and see how that affects their breathing. I can still give a patient who has COPD and hypoxic drive oxygen, however, I don't need to put them at 100% oxygen when their normal baseline O2 levels are around 90%. I can't fix their chronic COPD or hypoxic drive but I can fix the symptoms they're experiencing until they get to a higher level of care.

Resources cited:

Zahedi, M., Keshavarz, B., Montazery, M., & Shahmirzadi, A. (2017). Central hypoventilation syndrome and hypoxic drive disorder. *Annals of Tropical Medicine and Public Health, 10*(4) doi:https://doi.org/10.4103/ATMPH.ATMPH_249_17

Csoma B, Vulpi MR, Dragonieri S, Bentley A, Felton T, Lázár Z, Bikov A. Hypercapnia in COPD: Causes, Consequences, and Therapy. *Journal of Clinical Medicine*. 2022; 11(11):3180. https://doi.org/10.3390/jcm11113180

Inkrott, Jon C. (2016, July 7). Understanding Hypoxic Drive and the Release of Hypoxic Vasoconstriction. https://www.sciencedirect.com/science/article/pii/S1067991X16300633#section-cited-by

Diagram of the Human lungs picture:
https://www.pinterest.com/pin/567172146827237416/

Emphysema diagram:
https://my.clevelandclinic.org/health/diseases/9370-emphysema

Person holding paper lungs picture:
https://www.cnet.com/health/medical/5-signs-your-lungs-arent-as-healthy-as-you-think/

Bronchitis diagram:
https://acil.bwh.harvard.edu/chronic-bronchitis/

Hypoxic Drive Theory YouTube video:
https://youtu.be/t1mkFw6obYg?si=OH_n1C8Rcvx1OXqY