

We are Nebulizing What Now? Nebulizing Nitro: Therapies for PE iNO More Excuses for PE Therapy

Mark Ramzy, DO EMT-P



With the rising number of COVID-19 cases nationally and the limited number of available ICU beds, emergency physicians should expect to see a greater number of critically ill patients boarding in their departments. The following case is not only more than likely to happen, it already IS happening in emergency departments across the nation:

A 34-year-old male named Darrell presents with significant shortness of breath and tachypnea. He was brought in for evaluation after being found minimally responsive by his girlfriend. She states that he has had a progressively worse cough and was in quarantine after he tested positive for COVID-19. He is currently tachycardic, hypoxic, confused, and has bilateral pulmonary infiltrates on his chest X-ray. Darrell is ultimately intubated for airway protection; however, there are no ICU beds and so he remains in the ED joining the list of many other patients in line for a bed. Several hours pass and the respiratory therapist informs you that Darrell is becoming increasingly more hypoxic despite increases in lung protective ventilation strategies and increases in PEEP. Bedside echo shows evidence of right-heart strain and he has remained persistently tachycardic. Now what?

Given Darrell's hypercoagulable state secondary to COVID-19, pulmonary embolism should be at the top of your differential. The literature is fraught with stories of these patients receiving Tissue plasminogen activator (tPA) and having successful outcomes.¹⁻³ Pharmacy informs you that given the high demand, there will be a bit of a delay in getting tPA started. Meanwhile, Darrell continues to remain hypoxic. Upon re-evaluation, he's been getting more hypotensive with escalating vasopressor requirements. Instead of waiting for him to further deteriorate and imminent code, consider the early use of inhaled pulmonary vasodilators such as nebulized nitroglycerin.

Darrell's body is responding to COVID and his PE by releasing inflammatory mediators that cause pulmonary vasoconstriction. Inhaled nitric oxide (iNO) as a vasodilatory has been studied in patients with PE and improved hemodynamics.⁴ When metabolized, nitroglycerin eventually yields that very same nitric oxide. Furthermore, the therapy can be targeted to the pulmonary vasculature by nebulizing it. *So how is it actually done?*

Most studies recommend a dose of 2.5 - 5 µg/kg/min, which equates to about 5 mg over 15 minutes. There are no studies on inhaled nitroglycerin directly for this indication but there are prior studies in pulmonary hypertension/cardiac surgery. More commonly used agents are iNO and epoprostenol but may not be readily available or available to the ED at all because of cost, need for specialized nebulization equipment, and other factors.

Many institutions carry nitroglycerin in 200 or 400 µg/mL which means 6 or 12 mL should be administered over 15 minutes. This can be connected to the ventilator circuit the same way other nebulizers are given to critically ill intubated patients. In non-intubated patients, it's important to remember that oxygen delivery should not exceed 6-8 L in order to appropriately nebulize any medication. Lastly, inhaled nitroglycerin's duration is only 20-30 minutes and thus should serve as a bridge to more definitive therapy such as tPA or continuous iNO.

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As emergency physicians, we excel in troubleshooting problems and improvising treatments with little to no resources. When considering pulmonary vasodilators for unstable PE don't settle for the extensive list of excuses: "Too expensive," "takes too long to set up," "we don't have it in the ED," etc. Inhaled nitroglycerin is a cheap, quick, and effective therapeutic option in these patients, the only difficulty is actually thinking of it in the moment. ●

References:

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