

Rapid repeated buccal administration of nitroglycerin ointment is highly effective in preventing intubation in patients with acute cardiogenic pulmonary edema without cardiogenic shock

Mohammad Reza Movahed¹

¹Affiliation not available

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Author: Mohammad Reza Movahed, MD, PhD ^{1,2}

University of Arizona, Phoenix, AZ¹ University of Arizona Sarver Heart Center, Tucson²

Correspondent:

M Reza Movahed, MD, PhD, FACP, FACC, FSCAI, FCCP

Clinical Professor of Medicine, University of Arizona Sarver Heart Center, Tucson

Clinical Professor of Medicine, University of Arizona , Phoenix

1501 N Campbell Avenue

Tucson, AZ 85724

Tel: 949 400 0091

Email: rmove@aol.com

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Abstract:

Patients suffering from acute pulmonary edema commonly require intubation until treatments take effect. However, using rapid repeated buccal administrations of nitroglycerin ointment can almost always prevent intubation by rapidly reducing pre- and afterload as long as systolic blood pressure is adequate, and the patient is not in cardiogenic shock. In this manuscript, 6 patients presented who were in severe pulmonary edema and needed immediate mechanical ventilatory support, but intubation was aborted in all of them by repeated rapid administration of buccal nitroglycerin ointment. Approximately a quarter of an inch of nitroglycerin ointment (nitro paste) was buccally administrated every 60 seconds as long as repeated blood pressure measurements before each repeated administration remained above 110 mmHg. This case series is followed by a review of the literature.

Background:

Acute pulmonary edema is related to left ventricular failure leading to increases in the feeling pressure and pulmonary congestion. If not rapidly treated, mechanical ventilation is necessary until congestion is resolved. Rapid preload and afterload reduction can lead to a very quick reversal of pulmonary edema thus preventing intubation. Nitroglycerin has been safe in reducing pre – and afterload as long as blood pressure can tolerate it. Rapid administration of high doses of nitroglycerin is crucial in order to reverse acute congestion. Nitroglycerin ointment can rapidly absorbed by buccal administration with some success but is a totally underutilized and relatively unknown method to the medical community. Hereby, six cases of successful buccal nitroglycerin administration are reported in severe pulmonary edema successfully preventing mechanical ventilation in all of these patients. This report is followed by a review of the literature.

Case 1: A 70-year-old male was admitted with diastolic heart failure. Had normal ejection fraction. After transfer to the medical floor, the patient suffered from severe pulmonary edema with oxygenation dropping to the mid-80s. examined revealed severe bilateral rales all the way to the upper lung. He was immediately put on 100% oxygen but did not improve in his respiratory effort. His BOP was 160/90 Respiratory therapist was called for immediate intubation while receiving 40 mg of IV furosemide. Immediate $\frac{1}{4}$ of an inch of buccal nitroglycerin ointment from available nitro paste was applied to his oral mucosa every 60 seconds. Within 15 minutes of treatment, respiratory distress resolved, O2 sat increased to 100% on 2 liters and intubation was avoided. Further diuretic and BP treatment gradually resolved his heart failure over the next couple of days.

Case 2: A 72-year-old female patient presenting with unstable angina underwent coronary angiography and stenting. Post-procedure, the patient developed acute contrast-induced nephropathy leading to severe congestive heart failure and pulmonary edema with hypoxia and O2 saturation in 80s. While the respiratory therapist was underway to perform intubation, the pt received a quarter of an inch of buccal nitroglycerin ointment every minute while checking BP before each administration. Systolic BP dropped gradually from 170 to 120 and within 30 minutes, respiratory distress and pulmonary edema resolved, and intubation was avoided with raise of O2 sat to 100% on 4-liter O2.

Case 3: 75 years 75-year-old male was admitted with congestive heart failure secondary to severe aortic valve regurgitation. After admission to the medical floor, while receiving IV diuretic therapy, the patient suffered from severe respiratory distress and pulmonary edema. O2 sat dropped to 70s. The pt was put on 100% non-rebreather and respiratory care was called for intubation. The pat was immediately treated with repeated doses of $\frac{1}{4}$ of an inch of buccal nitroglycerin ointment every 60 seconds with repeated BP measurements before each administration to make sure hypotension was not occurring. SBP from 190 gradually was reduced to 120 and within 20 minutes, respiratory distress resolved with a rise of O2 saturation to 100%. Intubation was avoided and the pt did well with diuresis.

Case 4: 46 years 46-year-old male was admitted to ICU with worsening renal failure leading to congestive heart failure, He had swan ganze insertion showing wedge pressure in his 30s. He failed diuretic therapy and developed worsening heart failure and pulmonary edema. His O2 sat dropped to the 80s and his wedge raised to 45. The patient was prepared for intubation. He immediately received $\frac{1}{4}$ of an inch of buccal nitroglycerin paste every 60 seconds. His wedge pressure was decreasing with each treatment with a final wedge of 18 in 30 minutes. Within 20-30 minutes, respiratory distress resolved. O2 sat improved to 100% on 4 liters, and his SBP normalized from 170 to 120. Iv nitro was started to keep his pre and after-load low and intubation was aborted.

Case 5: a 78-year-old male underwent PCI to his LAD for unstable angina. Post PCI, he suffered from respiratory distress and severe pulmonary edema. While awaiting intubation, $\frac{1}{4}$ of an inch of buccal nitroglycerin was administrated every 60 seconds with resolution of respiratory distress and pulmonary edema and normalization of his BP. Intubation was avoided

Case 6: A 68-year-old male on dialysis presented with acute anterior STEMI. He underwent successful PCI to 100% occluded proximal LAD. Post PCI, he developed severe pulmonary edema. His o2 sat dropped to 83% with severe hypertension with SBP in the 180 range. Immediate buccal $\frac{1}{4}$ of an inch nitroglycerin ointment

was administered every 60 seconds with blood pressure measurement before each repeat administration. His BP gradually dropped to the 130 range with a resolution of hypoxia and respiratory distress. Urgent dialysis was started later to prevent recurrent pulmonary edema. Intubation was avoided.

Discussion:

Acute pulmonary edema is a life-threatening condition requiring immediate treatment. Usual treatment such as intravenous diuretic therapy will take time to reduce congestion. Morphine administration can be helpful but by suppressing respiratory drive it can worsen respiratory failure and hypoxia. It is also not very effective in severe pulmonary edema needing intubation. Any agent that can rapidly and safely reduce pre and afterload is ideal for this situation. Nitroglycerin is an ideal drug in this setting. However, sublingual nitroglycerin will take a while to resolve. High-dose IV nitroglycerin has been effective in patients with acute pulmonary edema (1-3) including in pre-hospital settings (4) but is not rapidly available at the bedside. Furthermore, pharmacists and nursing staff are resistant to supply providers with high doses of IV nitroglycerin as they are not familiar with such dosing which is usually over 2-3 mg. Nitro ointment commonly called nitro paste is widely available with excellent rapid resorption if it is administered buccally. Buccal administration of nitro ointment has been shown to be superior compared to other nitroglycerin agents in patients with angina (5-8) In patients with chronic congestive heart failure buccal administration of nitroglycerin ointment has shown superior response in comparison to other forms of nitroglycerines for rapid onset, longer duration of drug effect and hemodynamic response using its effect on wedge pressure. (9-16). Nitroglycerin ointment contains 15 mg of nitroglycerin per one inch of paste that can rapidly absorbed by buccal application simulating intravenous nitroglycerin administration. Starting with a quarter of an inch of buccal nitroglycerin ointment, about 3-4 grams of nitroglycerin can be given rapidly with each administration which can lead to rapid pre- and afterload reduction thus dramatically reducing pulmonary congestion. An important part of this treatment is the presence of adequate blood pressure. This is the reason that this type of treatment should not be initiated in patients with cardiogenic shock and BP has to be rechecked before each buccal administration.

In the setting of acute pulmonary edema without cardiogenic shock, there are limited case reports and case series that have demonstrated the effectiveness of buccal nitroglycerin application. (17-19). However, this very effective treatment of patients with acute pulmonary edema without cardiogenic shock is hardly utilized as the medical community is not aware of this lifesaving treatment. Every time I have used this method, every single medical staff including nurses, residents, fellows, and cardiology attendings were unaware of this treatment and were surprised about its usage and effectiveness. This case series is the largest reported case series in this regard showing very effective and safe use of buccal nitroglycerin ointment. Due to ease of use, safety, and efficacy, the use of buccal nitroglycerin ointment should be the standard of care in patients presenting with severe pulmonary edema without cardiogenic shock in order to avoid imminent intubation and mechanical ventilation.

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