RESEARCH SNAPSHOT THEATER: PROCEDURES, ADULT AND PEDIATRIC

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VACUUM EXTRACTION OF AN OBSTRUCTING CLOT IN MASSIVE PULMONARY HEMORRHAGE USING A MECONIUM ASPIRATOR

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INTRODUCTION: Massive hemoptysis can cause life-threatening ventilation obstruction, especially if clots form in the trachea. These can be managed like an obstructing food bolus with bronchoscopy suction, basket retrieval, or removal via Magill forceps. In this case, we describe vacuum extraction with a meconium aspirator to relieve complete airway obstruction.

DESCRIPTION: A 53 year-old male with tricuspid endocarditis and septic pulmonary emboli was intubated for respiratory failure. On day two he developed blood-streaked secretions that progressed to frank blood with clots. He began to desaturate and exhibit high peak pressures on volume cycled mechanical ventilation, with exhaled tidal volumes of 50 mL. Bag-valve-mask ventilation was started, but manual breaths required significant force. Attempts to pass a suction catheter down the endotracheal tube (ETT) were unsuccessful. Bronchoscopy revealed a clot obstructing the lumen of the ETT. The patient was rapidly extubated and re-intubated by the ICU team. However, the clot did not come out with the ETT. Significant resistance to manual ventilation remained. The bronchoscope was re-introduced and a large clot was visualized overlying the carina and intermittently protruding into the ETT causing complete obstruction in a ball-valve manner. A meconium aspirator was attached to the ETT and connected to wall suction. Suction was engaged by occluding the side hold of the meconium aspirator and the clot was removed with the ETT en bloc. The patient was intubated again, and bag-valve-mask ventilation was easily performed. Repeat bronchoscopy demonstrated non-occlusive clot at the carina originating from an occluded right upper lobe bronchus; there was no ongoing bleeding. The patient went to IR for selective right sided bronchial artery embolization. The remaining clot was subsequently removed from the right mainstem via bronchoscopy with cryotherapy.

DISCUSSION: Vacuum extraction of an occlusive airway clot using a meconium aspirator attached to an ETT proved to be quick, safe, and effective in reversing complete airway obstruction. This technique has previously been described to successfully remove obstructing food boluses, thick emesis, and copious airway secretions. To our knowledge, there are no reports of this technique being used in an adult intensive care unit.

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CONTROLLING POTENTIALLY INFECTIOUS FUGITIVE BIOAEROSOL EMISSIONS DURING NEBULIZER TREATMENTS

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INTRODUCTION: Nebulizer treatments can create aerosolized spread of highly-contagious airborne viruses (eg, COVID-19). With increased risk of aerosolized spread within confined ambulance compartments, this study specifically evaluated a specially-designed nebulizer mask modified with expiratory-port filters and a sealing faceplate to minimize fugitive bio-aerosol emissions (FBAE).

METHODS: As FBAE carrying contagious viruses typically range from 0.5 to 1.5 micron (μ), a 6-port (0.3–10μ) *Kanomax 3889* particle measurement (PM) counter was placed 78 cm from each of 15 rotating adult volunteers (non-patients; beardless; 7 women, 8 men; ages 18-59 yrs) sitting upright in one of 3 rotating fleet ambulances using the EMS agency's usual jet-nebulizers on day 1 with either a conventional mask (CM) or an aerosol-controlling mask (ACM). Each person returned on another day using the other mask as indicated. Ambient ambulance PMs (PM_{amb}) were sampled before subjects entered. After re-closing the door and waiting 5 mins, a pre-nebulization PM (preNeb-PM) was made. Jet-nebulizers (using H_2O solutions) were then applied (either by CM or ACM) for 5 min followed by post-neb PMs (Post1) and 2 successive PMs (Post2/Post 3), all 5 mins apart, with masks remaining in place.

RESULTS: After "treatment", mean 1μ CM PMs ($Post1_{CM}$) were 152.2-fold larger (p=0.001) than mean 1μ ACM PMs ($Post1_{ACM}$), remaining 49.6-fold (p=0.005) and 7.2-fold (p=0.006) larger at Post2 and Post3 readings. PM_{amb} and preNeb-PM were all similar (NSD) for both ACM and CM across all PM sizes (0.5, 1.0, 3.0 μ) including 1μ ACM preNeb-PMs of 6,977/cf vs. 5.683/cf for CM preNeb-PMs (NSD). While mean 1μ $Post1_{ACM}$ readings decreased (-31.7%) from ACM pre-Neb-PM (6,977 to 4,662/cf; p=0.002), the 1μ $Post1_{CM}$ readings rose 14,500.1% (5,683 to 700,549.93/cf; p=0.002) with corresponding elevations for 0.5μ (p=0.001) and 3μ (p=0.002) particles using CM. Of additional note, ACMs were uniformly well-tolerated over the 15 mins being worn.

CONCLUSION: Compared to conventional methods, a modified mask system designed specifically to limit aerosolization of inhaled solutions did provide profound control of fugitive aerosolized particle emissions during nebulizer applications. The findings indicate a much safer approach to treating COVID-19 patients and all others requiring nebulization.