Pediatric Patient with Severe Asthma Treated with a Vibrating Mesh with Valved Adapter

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Introduction
The patient described in this case study was well known to us with several previous intubations and lengthy hospital admissions associated with severe asthma exacerbations. He was not responding to aerosol delivery with a vibrating mesh (Aerogen Solo) adapted to an open aerosol facemask. Vibrating mesh nebulizers are more efficient than jet nebulizers. However bench studies have shown that the use of an open aerosol facemask demonstrates similar efficiency to a jet nebulizer with an open aerosol facemask voiding the benefits associated with the vibrating mesh.1

Respiratory therapists have always believed that mouthpiece delivery is more effective than an open aerosol facemask. Alcoforado, et al. demonstrated a 22.8% ± 9.83 lung dose from vibrating mesh nebulizer with valved adapter (Aerogen Ultra) via mouthpiece as compared to 4.5% ± 1.35 from a jet nebulizer via mouthpiece in healthy volunteers inhaling radio-tagged aerosol.2 During this episode, we had exhausted all of our standard aerosol bronchodilator delivery strategies and it appeared that our only recourse for this patient would be intubation. We theorized that the use of the vibrating mesh with valved adapter via mouthpiece could potentially produce a positive outcome and prevent the escalation of care.

Case Summary
A 12 year old male with a history severe persistent asthma requiring frequent hospitalizations and several intubations presented in the emergency room in severe respiratory distress. The patient refused less invasive treatment i.e. high flow nasal cannula (HFNC) and bipap applications. He was placed on 80/20 heliox at 8 lpm with an open aerosol facemask with no improvement (note: the patient refused to wear a valved mask or HFNC). It was determined that since the heliox could not be properly administered due to the patient’s lack of cooperation that it should be discontinued.

He was scored utilizing a modified woods clinical asthma score 0-2 (mild), 3-4 (moderate) and >5 (severe). His asthma score at that time was a 5 severe, with diminished breath sounds, tight inspiratory and expiratory wheezing, a prolonged expiratory phase, substernal retractions and nasal flaring. He received 7.5 mg albuterol via vibrating mesh (Aerogen Solo) with an open aerosol facemask with no change in asthma score post treatment. One hour later he received another 7.5 mg of albuterol with marginal to no improvement.

Despite intensive treatment he was still in moderate to severe asthma exacerbation, which required transfer to the PICU. Upon arrival the therapist changed him to a vibrating mesh nebulizer with a valved adapter (Aerogen Ultra) via mouthpiece, and 15 mg of Albuterol was administered. Post treatment re-evaluation revealed improved aeration, decreased accessory muscle use, subsided nasal flaring, reduction in asthma score severity to mild (2) and improved patient comfort. The patient stated that he felt better.

After another dose of 15 mg of albuterol his asthma score remained mild (2) and for the next 8 hours he received Q2 hour albuterol with dose cut in half (7.5 mg). In the morning he was weaned to Q4 hours and was discharged later that day. See Image 1 (above) documenting the patient clinical asthma scores after each treatment.

Discussion
With this frequent flyer, we believe that intervention with the combination of mesh nebulizer with adapter via mouthpiece and the greater inhaled dose made a substantial improvement resulting in clinical improvements leading to discharge.
Conclusion
We concluded that using a mouthpiece for aerosol delivery should be the preferred method versus a facemask when tolerated. The addition of a valved adapter to the vibrating mesh improves lung dose, reduces aerosol loss to the environment, improves patient clinical response to aerosolized medications and improves patient satisfaction. Further clinical studies are warranted to support this hypothesis.

References
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