Aerosol delivery through adult high flow nasal cannula: An in vitro comparison with heliox and oxygen

Patricia A. Dailey¹, Kyle Walsh¹, James B Fink², Robert Harwood², Arzu Ari ²
1 Baystate Medical Center, and 2 GA State University

Results

Heliox has been shown to reduce turbulence and improve aerosol delivery in a range of clinical settings. Delivery of aerosol with high flow nasal cannula (HFNC) has been applied to adults with severe asthma. A previously described model (Blaysham JAMPDD 2008) was modified to compare inhaled mass of albuterol with heliox and oxygen.

Heliox increased aerosol delivery via HFNC up to 71%. Decreasing flow increased aerosol delivery via HFNC in this model.

A vibrating mesh nebulizer (Aeroneb Solo, Aerogen) was placed at the inlet of a HFNC (Fisher & Paykel) A small adult cannula (Optiflow) was placed distal to the heated wire circuit with prongs placed into loose orifices simulating nares with a T-shaped trap and absolute filter connected to a breathing simulator (Vt 500 ml, 12 bpm, I:E of 1:2). 2.5 mg of albuterol sulfate in 3 mL was nebulized with Heliox (80:20) and Oxygen at 10, 30 and 50 lpm (n=3). Drug was eluted from the filter and assayed with UV spectrophotometry (276 nm).

At 50 and 30 lpm, inhaled mass of albuterol was greater (p<0.05) with heliox than O₂ {50 lpm - O₂=3.5% & heliox=6%; 30 lpm - O₂=11% & heliox=14%} but not at 10 lpm {O₂=27% & heliox=28%}. Heliox produced an increase of 71%, 27% & 4% respectively. Aerosol delivery was inversely related to flow with both heliox and O₂.

Conclusions

Heliox increased aerosol delivery via HFNC up to 71%. Decreasing flow increased aerosol delivery via HFNC in this model.