Manual Ventilation Performance in First Responders using a Flow-Rate Limiting Device (Sotair®)

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Introduction

- Manual ventilation with a resuscitator bag is life-saving
- Performance is highly variable
- Risk of pulmonary barotrauma and gastric insufflation with incorrect ventilation
- Sotair is a flow-rate limiting valve designed to control peak pressures and tidal volumes

Figure 1: Sotair flow rate limiting device by SafeBVM

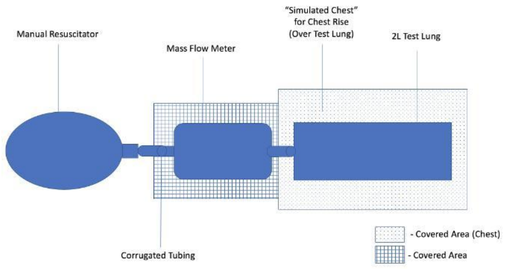

Figure 2: Schematic of ventilation simulator

Methodology

217 participants from 3 Tennessee fire departments

60 seconds of manual ventilation on a simulated lung

Peak inspiratory pressures, tidal volumes, and respiratory rates measured

Brief educational intervention on Sotair including video and supplementary materials

60 seconds of manual ventilation on a simulated lung USING THE SOTAIR

Peak inspiratory pressures, tidal volumes, and respiratory rates measured

Figure 3: Participant manually ventilating test lung

Results

- Mean peak inspiratory pressure was lower with Sotair (15.70 cm H2O +/- 1.50) compared to the bag alone (17.57 cm H2O +/- 5.06) p < 0.01
- Mean tidal volume was also significantly lower with Sotair (525 mL +/- 31) than the bag alone (594 mL +/- 141) p < 0.01

Conclusion

- After an educational intervention, the Sotair device minimized interprovider variability with manual ventilation
- Tidal volumes and peak pressures were significantly lower yet still within adequate clinical parameters
- Future research about how providers from other medical backgrounds manually ventilate

Peak Pressures and Tidal Volumes Delivered by 217 providers

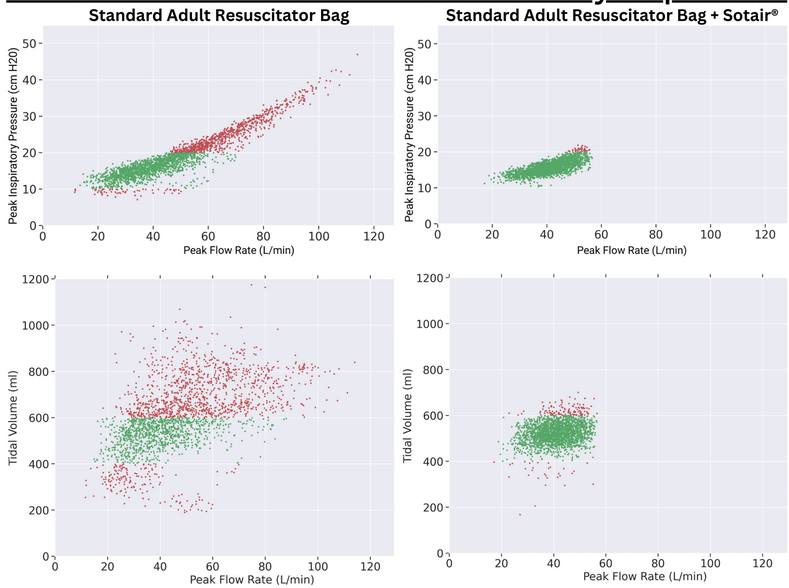

Figure 4: Peak pressures and tidal volumes delivered by participants with a resuscitator bag versus a resuscitator bag with the Sotair device. The green color indicates values within safe manual ventilation parameters (10 to 20 cmH20 peak inspiratory pressure and 400 to 600 mL tidal volumes) whereas the red color indicates values outside this range.

References

1. Brady MF, Weber NK, Walker, III R, et al. Feasibility of manual ventilation replacing mechanical ventilation. *BMJ Innovations* 2021;7:297-301.
2. Neth MR, Idris A, McMullan J, Benoit JL, Daya MR. A review of ventilation in adult out-of-hospital cardiac arrest. *J Am Coll Emerg Physicians Open* 2020;1(3):190-201.
3. Neth MR, Benoit JL, Stolz U, McMullan J. Ventilation in Simulated Out-of-Hospital Cardiac Arrest Resuscitation Rarely Meets Guidelines. *Prehosp Emerg Care* 2021;25(5):712-720.
4. Ni SA, Carpenter RS, Walker JR, Holley J, Brady MF. Emergency Medical Services Responder Manual Ventilation Performance. *Prehosp Emerg Care* 2023;27(4):496-500.
5. Baez AA, Qasim Z, Wilcox S, Weir WB, Loeffler P, Golden BM, et al. Prehospital Mechanical Ventilation: An NAEMSP Position Statement and Resource Document. *Prehosp Emerg Care 2022;26(sup1):88-95.*

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