Fresh Gas Flow Effects on Provider Volatile Gas Exposure

Dua Anderson, M.D., M.S., Cathy Lammers, M.D., and Peter G. Moore, M.D., Ph.D.
UC Davis Department of Anesthesiology and Pain Medicine

Background

- Pediatric anesthesia providers often use inhalation induction, releasing waste anesthetic gases (WAG) during induction itself or when the circuit is disconnected for intubation or LMA placement.
- Occupational exposure to WAG: Differences identified between exposed and non-exposed hospital personnel using biological markers of exposure. Operating room (OR) and recovery room exposed and non-exposed hospital personnel using biological markers of exposure.
- Positive correlations between levels of exposure and:
  - rates of neutrophil apoptosis
  - sister chromatid exchange rates
  - halogen-induced occupational asthma
  - hepatic autoantibodies
  - pregnancy outcomes
- Pediatric anesthesiologists have higher levels of exposure, with increased biomarkers and pregnancy outcome risk.
- Current practice: provider-to-provider variation

Study Design

We measured and compared the ambient level of sevoflurane (agent) during simulated mask induction of pediatric patients with four different fresh gas flow (FGF) and agent settings:

- Mock inductions using an infant lung model
- Trials were repeated for an n=3 for each group, with conditions standardized to represent current anesthetic practice
- Sevoflurane levels were recorded every 5 seconds and compared between groups

Results

- Significant reduction in max level shown in Groups 3 & 4 (p = 0.02 and 0.03 respectively) but not in Group 2 (p = 0.25)
- With time-weighted averages, significant reductions were seen with all three experimental settings, Groups 2, 3, & 4 (p = 0.01 for Group 2, p < 0.01 for Groups 3 & 4)

Discussion

- Ultimate goal: To reduce chronic occupational exposure of anesthesia providers to waste anesthetic gases during pediatric inhalation induction
- Real-time mass spectrometry showed reproducible difference in ambient sevoflurane levels by turning down flow in the anesthesia circuit
- No adjustment was needed to the volatile agent level in order to see significant reduction
- Peak levels occurred within a few minutes of mock induction then returned to baseline

Conclusion

- Single dial adjustment (FGF) prior to disconnecting patient from circuit yields significantly lower ambient sevoflurane levels, reducing both peak and time-weighted average exposure levels

Specific Aims

- Determine whether adjusting the fresh gas flow rate during induction has a measurable effect on ambient sevoflurane levels, thereby reducing anesthesiology provider exposure.
- If a simple modification in practice yields a reproducible reduction in WAG levels, then a “best practice” guideline can be recommended to reduce exposure.

References