

## Changes in Intracuff LMA pressures with N2O Anesthetics

PA Seidman, SA Nigam, A Le, G Bradford, T Schwartz,

*Department of Anesthesiology, Pediatrics and Ophthalmology, West Virginia University School of Medicine, Morgantown, WV 26506*

**Introduction** The LMA cuff (LMA-Classic™, LMA North America Inc.) is composed of medical grade silicon rubber. The silicon cuff is permeable to a variety of gases, dependent on gas solubility and partial pressure. Nitrous oxide and carbon dioxide diffuse through the cuff membrane and increase the volume and pressure in the LMA cuff (1,2). Adult studies have demonstrated a relationship between LMA size and high cuff volume and postoperative sore throat and/or dysphagia (3,4). In addition, others have shown decreased incidence of sore throat with intraoperative decrease in LMA cuff pressure (5). We hypothesize that by using water rather than air for cuff inflation, N2O diffusion into the cuff would be minimized and intracuff pressures would remain stable. The purpose of this randomized controlled study is to determine the effect of nitrous oxide on pediatric LMA (size 2) cuff pressures using water-filled cuffs during short (less than 1.5h) outpatient pediatric procedures.

**Methods** After Institutional Board Review and parental informed consent, 10 ASA 1 or 2 pediatric patients undergoing strabismus repair under general anesthesia with LMA were randomized to air versus water into the LMA cuff. Each patient received preoperative sedation with midazolam (0.5 mg/kg PO or 0.2 mg/kg IN). Patients were taken to the OR and underwent routine inhalation induction with 2L O<sub>2</sub>, 4L N<sub>2</sub>O and 8% Sevoflurane. Intravenous access was obtained after induction of anesthesia. All patients received atropine 10 ug/kg, fentanyl 1ug/kg, ondansetron 0.1 mg/kg, and ketorolac 0.5 mg/kg upon IV placement. Patients were placed on 100% O<sub>2</sub> and the LMA was inserted under deep Sevoflurane anesthesia. LMA intracuff pressure (ICP) was measured by connecting the pilot balloon valve to a disposable pressure transducer and converted to digital display with automatic input into the computerized anesthetic record. After 5 minutes with 100% O<sub>2</sub> to stabilize pressures, anesthesia was then maintained with N<sub>2</sub>O:O<sub>2</sub> 2:1 ratio with 1-2% isoflurane at 3L total flow. Ventilation was assisted as needed, maintaining EtCO<sub>2</sub> < 60 mm Hg, SpO<sub>2</sub> > 90%, and peak airway pressures < 20 cm H<sub>2</sub>O. LMA cuff pressures were recorded from LMA inflation to deflation. At the end of the procedure, isoflurane was turned off, patients were placed on 100% O<sub>2</sub>, and the LMA was deflated and removed. LMA ICPs in the air and water groups were then compared. Mean rate of rise (slope) of ICP over time was calculated using ICP from time 0 (start of nitrous oxide maintenance) until time peak (peak ICP). We also calculated absolute change of ICP from time 0 to time peak. Data was analyzed for both groups using standard error of mean (SEM) and p values generated for slope and absolute increase in ICP.

**Results:** Mean absolute change in ICP from time 0 to time peak was 4-fold higher in the air group versus the water group (mean air ICP change 63.6 mm Hg ± SEM 9.7, mean water ICP change 15.6 mm Hg ± SEM 5.4). Time to achieve peak ICP was not different between the groups. Slope of rise in ICP over time was 3.9-fold higher in the air group versus the water group (mean air ICP slope 1.99 mm Hg/min ± SEM 0.50, mean water ICP slope 0.51 mm Hg/min ± SEM 0.11).

LMA CUFF	ICP ABSOLUTE CHANGE	ICP SLOPE
Air	63.6 ± 9.7	1.99 ± 0.50
Water	15.6 ± 5.4	0.51 ± 0.11

ICP = intracuff pressure; ICP absolute change mm Hg; ICP slope mm Hg/min. Mean values ± SEM; p<0.05 for both ICP absolute change and ICP slope.

**Discussion** We conclude that both the absolute change in intracuff pressure, as well as the rate of rise in LMA intracuff pressure over time, are lower in water-filled cuffs than in air-filled cuffs, and that this difference is statistically significant. In accordance with previous adult studies relating cuff volume to postoperative sore throat, we speculate that by inflating the LMA cuff with water rather than air the intracuff pressure would remain stable and result in a decrease in the incidence of postoperative oropharyngeal morbidity.

#### **References**

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