Background: Approximately 4-6,000,000 pediatric patients receive general anesthesia annually for various procedures in the United States. There are concerns that inhalation anesthetics may have a dose-related effect on the developing brain. Anesthetic gas exposures are quantified in MAC-hours, defined as an exposure at 1 time the minimum alveolar concentration that prevents movement with a noxious stimulus in 50% of subjects (MAC) for 1 hour. This MAC concentration varies with the age of children. In the absence of clear evidence proving a neurotoxic effect of inhalation anesthetics, it may be prudent to reduce anesthetic gas exposure. However, there are no published data quantifying inhalation gas exposure during common surgical procedures in children.

Method: In this IRB approved retrospective study, data were collected from the automated anesthesia records of children who had undergone common surgical procedures such as (1) circumcision (CIR), (2) adenoidectomy (ADE) and (3) tonsillectomy and adenoidectomy (T&A). Fifteen patients in each surgical group were randomly chosen from primary data pool of 780, 600 and 726 patients respectively. The recorded end-tidal sevoflurane concentration (ET-Sevo) at 1 minute intervals was extracted from medical records along with the duration of the procedure. The MAC hour exposure was calculated using the age-related MAC and duration of exposure. One-way ANOVA was used to detect any significant differences between three surgical groups.

Result: The duration of sevoflurane exposure during CIR, ADE and T&A was 53.47+/-13.30, 34.60+/-12.93 and 36.13+/-6.23 minutes (p<0.0001) and surgery was 26.00+/-8.41, 17.6+/-6.90 and 19.73+/-6.26 minutes (p=0.006) respectively (Figure 1). The mean concentrations of ET-Sevo during CIR, ADE and T&A were 2.74 +/-0.49%, 2.79 +/-0.41% and 2.86 +/-0.56 % (p=0.8107); Peak concentration of ET-Sevo for CIR, ADE and T&A were 5.66 +/-0.98, 5.76 +/-0.66 and 5.85 +/-0.53 (p=0.7920), respectively (Figure 2). Sevoflurane exposure in MAC-hours for CIR, ADE and T&A were 1.06 +/-0.24, 0.69 +/-0.21 and 0.74 +/-0.13 (p<0.0001) respectively (Figure 3). Thirteen of 15 patients undergoing CIR received a caudal epidural nerve block, and 1 had penile block before surgery. We used the One-way ANOVA and considered P values < 0.05 as significant.

Conclusion: This study showed that in our current practice, the mean and peak concentrations of sevoflurane during circumcision, adenoidectomy and T&A did not differ, even though regional anesthesia supplemented general anesthesia for most of the circumcision patients. However, the MAC-hour exposure to sevoflurane differed between the three surgical groups because of differences in the duration of anesthesia. Information from this study can be used in future studies aiming to decrease exposure to potentially neurotoxic inhalation anesthetics in pediatric patients.

Reference:
2. Eger EI. Anesthesiology 1965; 28: 756-63