[NM-266] Sevoflurane exposure in MAC-hours for common pediatric cases

McDermott W, Liu Y, Vakey K, Andropoulos D, Carling N, Baijal R, Stayer S, Watcha M
Texas Children's Hospital , Houston , TX, USA

Background: Approximately 4-6,000,000 pediatric patients receive general anesthesia annually for various procedures. There are concerns that inhalation anesthetics have a dose-related effect on the developing brain (1). Anesthetic gas exposures are quantified in MAC-hours, defined as an exposure at 1 times the minimum alveolar concentration that prevents movement with a noxious stimulus in 50% of subjects (MAC) for 1 hour (2). This MAC concentration varies with the age of children (3). In the absence of clear cut 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 less than 5 years old who had undergone common surgical procedures such as circumcision (CIR), adenoidectomy (ADE) and tonsillectomy and adenoidectomy (T&A) during a 3 month period from June 1 to Aug 30 2012. Fifteen patients in each surgical group were randomly chosen from primary data pool of 39, 90 and 71 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-hours 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 and $P < 0.05$ was considered as statistically significant.
Result: 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 % ($p=0.8107$), duration of exposure was 53.47+/-13.30, 34.60+/-12.93 and 36.13+/-6.23 minutes ($p<0.0001$) and surgery time was 26.00+/-8.41, 17.6+/-6.90 and 19.73+/-6.26 minutes ($p=0.006$) respectively. 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. 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. Thirteen of 15 patients undergoing CIR received a caudal epidural nerve block and 1 had penile block before surgery.
Conclusion: This study showed that in our current practice, the mean and peak concentrations of sevoflurane during CIR, ADE and T&A did not differ, even though regional anesthesia supplemented general anesthesia for most of CIR patients. However, the MAC-hours exposure to sevoflurane differed between the three surgical groups because of differences in the duration of surgery and anesthesia. Information from this study can be used in future studies aiming to decrease exposure to potentially neurotoxic inhalation anesthetics in pediatric patients.
Reference:
1. Jevtovic-Todorovic V. J.Neurosci. 2003.
2. Eger EI. Anesthesiology 1965.
3. Mapleson WW. Br.J.Anaesth. 1996.

Table 1: Sevoflurane exposure and duration of surgery in patients undergone circumcision (CIR), adenoidectomy (ADE) and adeno-tonsillectomy (T&A).

Variables	CIR (n=15) Mean (SD)	ADE (n=15) Mean (SD)	T&A (n=15) Mean (SD)	Overall p value	p value between two groups		
Duration of sevoflurane exposure	53.47 (13.30)	34.60 (12.93)	36.13 (6.23)	<0.0001	*	#	
Duration of surgery	26.00 (8.41)	17.6 (6.90)	19.73 (6.26)	0.008	*	#	
Mean end-tidal sevoflurane concentration (%)	2.74 (0.49)	2.79 (0.41)	2.86 (0.56)	0.8107			
MAC from sevoflurane	1.22 (0.26)	1.22 (0.18)	1.25 (0.24)	0.9350			
MAC-hours from sevoflurane	1.06 (0.24)	0.69 (0.21)	0.74 (0.13)	<0.0001	*	#	
Peak end-tidal sevoflurane concentration (%)	5.66 (0.98)	5.76 (0.66)	5.85 (0.53)	0.7920			

* if $p < 0.05$ when mean of Circumcision vs. mean Adenoidectomy
# if $p < 0.05$ when mean of Circumcision vs. mean T&A
$ if $p < 0.05$ when mean of Adenoidectomy vs. mean of T&A