A Review of Current Literature of Interest to the Office-Based Anesthesiologist

Simpao A, Randazzo I, Chittams J, et al. Anesthesia and sedation exposure and neurodevelopmental outcomes in infants undergoing congenital cardiac surgery: a retrospective cohort study. *Anesthesiology*. 2023;139(4):393–404. doi: 10.1097/ALN.0000000000004684

Children undergoing complex cardiac surgery are exposed to substantial cumulative doses of sedative medications and volatile anesthetics and are more frequently anesthetized with ketamine as compared with otherwise healthy children. This study hypothesized that lower neurodevelopmental scores would be associated with this population at 18 months of age due to increased exposure to sedation and anesthesia. Cumulative minimum alveolar concentration hours of exposure to volatile anesthetic agents and all operating room and intensive care unit exposures to sedative and anesthetic medications were collected before assessment with the Bayley Scales of Infant and Toddler Development, third edition (Bayley III) at 18 months of age. The study cohort of 110 patients included 41 (37%) single-ventricle and 69 (63%) 2-ventricle patients. Exposures to volatile anesthetic agents, opioids, benzodiazepines, and dexmedetomidine were not associated with abnormal Bayley III scores. However, after adjusting for confounders, at 18-month follow-up, each 1-mg/kg increase in ketamine exposure was associated with a 0.34-point (95% confidence interval, −0.64 to −0.05) decrease in Bayley III motor scores ($P = .024$). The authors concluded that total cumulative exposures to volatile anesthetic agents were not associated with neurodevelopmental impairment in infants with congenital heart disease undergoing various imaging studies and procedures, whereas higher ketamine doses were associated with poorer motor performance.

Comment: Anesthetic protocols for 110 neonates undergoing congenital cardiac surgery within 2 to 11 days after birth were studied. By the time of the 18-month follow-up, all had been exposed to some combination of volatile agents, opioids, dexmedetomidine, benzodiazepines, ketamine, and/or propofol. Neurodevelopment was assessed at 18 months using the Bayley Scales of Infant and Toddler development. No association was found between test scores and exposure to any of the agents except for ketamine, which displayed dose-dependent decreases in motor scores. Ninety-two percent of the children examined in this cohort received ketamine, making it the second most commonly used anesthetic drug in this study next to fentanyl. The mean weighted exposure dose was 5.4 mg/kg of ketamine. An editorial accompanying this article notes that this is a single study and that there is currently no consistent preclinical data to suggest ketamine may be more toxic to neurons than any other anesthetic.

In addition to the concern about the use of ketamine, this study contains important limitations that temper interpretation of its data. Neurodevelopmental deficits in higher cognitive tasks, such as executive function and social skills, may not be apparent until later in life. The Bayley scales would not be able to detect these deficits at 18 months of age. Furthermore, in utero brain maturation is delayed in most children with congenital heart disease, and many present with cerebral lesions before surgery.[1] While this study provides a degree of assurance for anesthesiologists and parents of young children undergoing general anesthesia, the concern for potential neurotoxicity remains.

Iliff HA, Baxter A, Chakladar A, Endlich Y, McGuire B, Peyton J. Airway topicalization in pediatric anesthesia: an international cross-sectional study. *Pediatr Anesth*. 2023;00:1–8. doi: 10.1111/pan.1478

The primary aim of this cross-sectional study was to determine current international dosing practices for lidocaine airway topicalization in children. The secondary aims included examining aftercare instructions for those receiving lidocaine airway topicalization and instances of local anesthetic systemic toxicity secondary to lidocaine administration for airway topicalization. A validated questionnaire was distributed to anesthesia providers throughout Europe, North America, South America, Australia, Asia, and Africa, resulting in 1638 responses. After initial exclusions, 1501 participants from 69 countries, across 6 continents, were included. Results showed marked heterogeneity in dosing and timing regimens and evidence that dosing may contribute to adverse outcomes. The maximum dose (median [interquartile range]) reported by participants who use lidocaine for airway topicalization as part of their normal practice was 5 mg/kg (4–6 mg/kg [0.5–50]) over 2 hours (1–4 hours [0–30]).

Ten participants reported a single incident of local anesthetic systemic toxicity secondary to airway topicalization with lidocaine in which they were personally involved. Two known doses of lidocaine were reported, 6 mg/kg over 2 hours and 5 mg/kg over 1 hour; in both of these cases, the child presented with seizures. Three estimated doses were reported, 7 mg/kg over 1 hour, 3 mg/kg over 1 hour, and 5 mg/kg over an unknown period of time. Two of these cases presented somnolence and 1 with a seizure.

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Additional signs and symptoms reported upon presentation included twitches, tachyarrhythmia, or perioral tingling.

Comment: The authors of this article note that the maximum safe dose of lidocaine that can be used for airway topicalization is unknown. The maximum recommended dose varies across nations, with most ranging between 3 and 5 mg/kg. A lack of consensus also exists for the body weight type that should be used for calculations. The Difficult Airway Society recommends using lean body weight in adults; however, these results show the majority of anesthesia providers in this study used actual body weight. The most common indications for airway topicalization among respondents were microlaryngoscopy, awake tracheal intubation, and flexible endoscopic airway examinations.

These results are of interest to dentist anesthesiologists who may wish to administer intraoral local anesthetic for perioperative pain control in addition to topicalization of the vocal cords during intubation. The US Food and Drug Administration Center for Drug Evaluation and Research, Office of Pharmaceutical Science, Informatics, and Computational Safety Analysis cites a maximum recommended dosage of 4.5 to 7 mg/kg for lidocaine, depending on whether epinephrine is added to the solution.[2] These limits suggest it is likely that optimal dosing can be achieved for both dentoalveolar local anesthesia and topicalization of the vocal cords for intubation.

Zhang J, Yin J, Li Y, et al. Effect of dexmedetomidine on preventing perioperative respiratory adverse events in children: a systematic review and meta-analysis of randomized controlled trials. *Exp Ther Med.* 2023;25(6):1.

The most common critical incidents in pediatric anesthesia are perioperative respiratory adverse events (PRAEs). This meta-analysis aimed to assess the preventive effect of dexmedetomidine on PRAEs in children. Dexmedetomidine is a highly selective α2-adrenoceptor agonist that provides sedation, anxiolysis, and analgesic effects without causing respiratory depression. Dexmedetomidine can diminish airway and circulatory responses during extubation in children. Original randomized controlled trial data were analyzed to study the putative effect of dexmedetomidine on PRAEs. By searching the Cochrane Library, EMBASE, and PubMed, a total of 10 randomized controlled trials (1,056 patients) were identified. PRAEs included cough, breath holding, laryngospasm, bronchospasm, desaturation (percutaneous oxygen saturation <95%), body movement, and pulmonary rales. Compared with placebo, dexmedetomidine resulted in a significantly reduced incidence of cough, breath holding, laryngospasm, and emergence agitation. The incidence of PRAEs was significantly reduced in dexmedetomidine compared with the active comparators group. Moreover, dexmedetomidine decreased heart rate and increased postanesthesia care unit stay duration by 11.18 minutes. This study showed that dexmedetomidine improved airway function and decreased risks associated with general anesthesia in children and suggested dexmedetomidine may be a good choice to prevent PRAEs in children.

Comment: Several studies have shown dexmedetomidine to be associated with a decrease in emergence agitation and delirium following general anesthesia.[3] This study focuses on the association between dexmedetomidine administration and the decreased incidence of PRAEs, including cough, breath holding, and laryngospasm, in addition to emergence agitation. The analysis is very general, and the sample size is small, limiting the ability to interpret the results. Additional limitations include a lack of information regarding airway management and a significant potential for bias. Still, the information is noteworthy for practitioners who continue to incorporate this drug into their office-based practices.

Young S, Osman B, Shapiro F. Office-based anesthesia: a contemporary update on outcomes, incentives, and controversies. *Curr Opin Anesthesiol.* 2023;36(6):643–648.

The volume of office-based surgery (OBS) has surged over the past 25 to 30 years; however, patients with increasing comorbidities are being considered for procedures in office locations. This review examined OBS outcomes, financial incentives driving this change, and associated controversies. Plastic surgery has low complications, but procedures such as buttock augmentation are associated with mortality. In ophthalmology, emerging controversial literature investigates the impact of anesthesia type on and whether anesthesia providers affect ophthalmology outcomes. Dental anesthesia continues to suffer occasional wrong-sided surgeries. Meta-analyses of ear, nose, and throat in-office surgeries have low complication rates. Vascular interventions are being driven toward offices due to reimbursements and may be safely performed. Health care economics appear to drive the push toward OBS with improved reimbursements, but there are rising out-of-pocket costs affecting patients. The authors conclude that anesthesiologists need to develop and implement safe and efficient systems to optimize patient outcomes in outpatient office settings. Further research and uniform standardized outcomes tracking are needed in the emerging specialties performing OBS.

Comment: This review provides an overview of the current office-based anesthesia landscape. It is unique in that it provides a perspective on dental office–based anesthesia from physician authors with deep experience with office-based anesthesia. A recent analysis of adverse events in the

military health system found wrong-site surgery constituted 63% of all reported sentinel events and were mostly due to low adherence to universal protocols. The presurgical time out, which is routinely practiced in surgery centers and hospitals, is a protocol designed to prevent wrong-site surgery and is easily integrated into dental office settings. As the migration of surgical cases from the operating room to the office-based setting continues, it is likely that universal protocols, such as the time out, will continue to influence the practice of anesthesia in the dental office.

Emerick T, Martin T, Ririe D. Perioperative considerations for patients exposed to psychostimulants. *Anesth Analg*. 2023;137(3):474–487. doi: 10.1213/ANE.0000000000006303

Concerns regarding the perioperative management of acute psychostimulant intoxication have been recognized for decades, but novel and diverse substances in this class continue to be developed. Despite the similarities in the mechanisms of action among psychostimulants, each subclass within this broad category has unique receptor specificity and different mechanisms that play a role in patient clinical presentation. These issues present challenges to anesthesia providers when caring for patients with either acute or chronic exposure to psychostimulants during the perioperative period. Challenges result from both physiological and psychological effects that influence the action of the primary anesthetic agent, adjuvant anesthetics, and analgesics used for the perioperative management of pain. The epidemiology, pharmacology, and perioperative implications of psychostimulant use are presented for amphetamines and similar-acting nonamphetamines, cocaine, and, finally, the mixed-action drugs known as entactogens that share stimulant and psychedelic properties. This information is then used as the foundation for safe and effective perioperative management of patients exposed to psychostimulants.

Comment: A 2016 survey from the National Surveys on Drug Use and Health reported an estimated 6.6% or 16.0 million adults used prescription stimulants. Among adults with any prescription stimulant use in the past 12 months, 31.2% misused prescription stimulants at least once, and 2.7% had a prescription stimulant use disorder.[4]

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REFEENCES

1. Dimitropoulos A, McQuillen P, Sethi V, et al. Brain injury and development in newborns with critical congenital heart disease. *Neurology*. 2013;81(3):241–248. doi: 10.1212/WNL.0b013e31829bfdcf

2. US National Library of Medicine. DailyMed. Accessed October 29, 2023. https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=a098ab6c-143f-77a5-e053-2a95a90a3e0a&type=display#:~:text=Adults%20For%20normal%20healthy%20adults, dose%20not%20exceed%20500%20mg

3. Yang X, Hu Z, Peng F, et al. Effects of dexmedetomidine on emergence agitation and recovery quality among children undergoing surgery under general anesthesia: a meta-analysis of randomized controlled trials. *Front Pediatr*. 2020;8:580226. doi: 10.3389/fped.2020.580226

4. Compton WM, Han B, Blanco C, Johnson K, Jones CM. Prevalence and correlates of prescription stimulant use, misuse, use disorders, and motivations for misuse among adults in the United States. *Am J Psychiatry*. 2018;175(8):741–755. doi: 10.1176/appi.ajp.2018.17091048