Learning From Others:

A Case Report From the Anesthesia Incident Reporting System

Anesthesia Quality Institute
ANESTHESIA INCIDENT REPORTING SYSTEM (AIRS)

Review of unusual patient care experiences is a cornerstone of medical education. Each month, the AQI-AIRS Steering Committee abstracts a patient history submitted to the Anesthesia Incident Reporting System (AIRS) and authors a discussion of the safety and human factors challenges involved. Real-life case histories often include multiple clinical decisions, only some of which can be discussed in the space available. Absence of commentary should not be construed as agreement with the clinical decisions described. Feedback regarding this article can be sent by email to **airs@asahq.org**. Report incidents or download the AIRS mobile app at **www.aqiairs.org**.

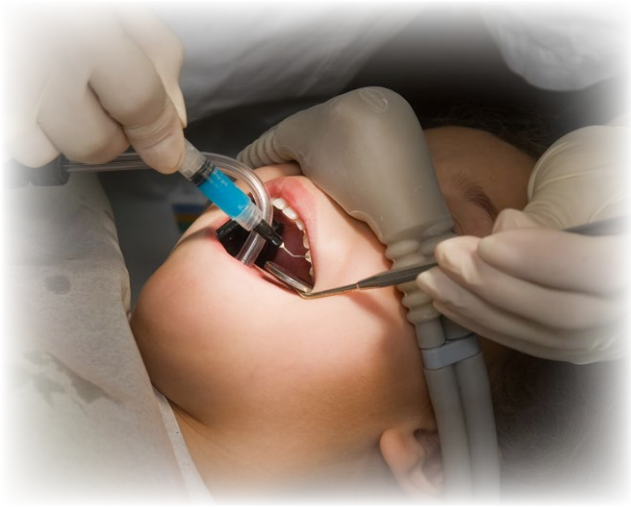
Case 2018-02: Anaphylaxis in the Dental Chair

After preoperative evaluation and examination of a pediatric patient, standard ASA monitors were applied, intravenous access was established and a precordial stethoscope was placed. Oxygen was delivered by nasal cannula with end tidal monitoring. Intravenous sedation was initiated with midazolam 2 mg. Fentanyl 50 mcg and propofol 50 mg was administered in 10 mg increments. The surgeon began infiltration of lidocaine with epinephrine followed by bupivacaine near the third molars.

An abrupt loss of breath sounds and end tidal CO_2 occurred without any herald signs or symptoms. Laryngospasm was suspected, so positive pressure ventilation was provided within 60 seconds with a bag-valve-mask device. Within 90 seconds some ventilation was occurring with end tidal CO_2 return, but absent breath sounds by precordial stethoscope. Bronchospasm was suspected and albuterol administered. Ventilation improved, but high-pitched wheezing and stridor remained. The decision was made to abandon the procedure and awaken the patient. Oxygen saturation throughout event was never lower than 90 percent. Transport to hospital was considered, but patient seemed to improve and was eventually discharged without sequelae.

Other medications administered prior to the event included clindamycin 600mg and dexamethasone 4 mg. Medication during and after the event included famotidine 20mg and dexamethasone 8 mg. Stridor with hoarseness continued after awakening. Patient was noted to have peri-ocular swelling, which gradually resolved over 45 minutes.

This case of pediatric anaphylaxis presented at a dental office while the patient was under the immediate care of an anesthesiologist. Anaphylaxis is categorized as a level 4 medical event and is considered a "near-death" experience. Pediatric patients with asthma or other conditions taking corticosteroids have a higher likelihood of fatal anaphylaxis.[1] In this case, the patient needed additional medical management and experienced temporary harm in the form of stridor, hoarseness and periocular edema. To the credit of the reporter of this case, close monitoring enabled the rapid detection of an adverse event, and prompt intervention was initiated, with logical progression through a differential diagnosis.



It is uncommon to experience anaphylaxis upon first exposure to an allergen, though it is possible that a patient may not remember first exposure, or the first exposure could have been accidental and not noted. This case could be due to a cross reaction, where the triggering molecule is similar to the original antigen.

This practitioner faced an evolving clinical crisis in which the suspected diagnosis changed with emerging symptoms. First, the reporter suspected and managed laryngospasm, then detected and treated bronchospasm. It appears that once wheezing was appreciated, bronchodilators, steroids and histamine blockers were administered. It is not clear if the anesthesiologist considered the possibility of an anaphylactic reaction, which could have been the true diagnosis in this case. In urgent situations, or evolving crisis situations such as this one, it is easy to fall prey to a fixation error, where the first diagnosis is the only one considered and treatment becomes "more of the same" (bronchodilators, histamine antagonists) instead of switching to a new diagnosis (anaphylaxis) and different treatment plan (epinephrine). The relative rarity of anaphylaxis in this setting increases the risk of a fixation error. The patient was treated for bronchospasm, not anaphylaxis, and improved because there

is considerable overlap in the treatments for bronchospasm and anaphylaxis. A "this and only this" fixation error can persist even when treatment is not effective, but will certainly be sustained if the clinical course and response to therapy is consistent with a partially correct diagnosis, such as here, where bronchospasm often occurs with an anaphylactic reaction. Fortunately, even though the patient did not receive epinephrine, the patient's condition did not progress further.

Anaphylaxis in pediatric patients may present differently from adults. As in this case, pediatric patients can initially present with respiratory symptoms that are only later followed by cutaneous symptoms.[2] The practitioner in this case describes laryngospasm and bronchospasm "without herald signs or symptoms." On awakening, the patient continued to experience respiratory symptoms such as hoarseness and stridor, probably due to angioedema. Only later did the patient develop a cutaneous symptom in the form of peri-orbital edema.

The initial steps in the management of anaphylaxis in a sedated patient with monitoring and I.V. access already in place should include calling for help, administering epinephrine and a crystalloid bolus if needed, followed by corticosteroids, antihistamines and bronchodilators. In this case, famotidine 20mg, dexamethasone (4 mg prior to event, 8 mg after) and albuterol were administered, but no epinephrine or other adjunctive agents. H1 blockers are more efficacious than H2 blockers such as famotidine. H1 and H2 blockers given in combination are even better. Hospitals often have standard anaphylaxis protocols available as well as additional staff to provide backup for this and similar emergencies, but even under those conditions it is easy to miss critical steps in diagnosis or treatment. For that reason, cognitive aids have been designed to guide and prompt clinicians through the diagnostic and therapeutic steps of managing rare critical events. Such cognitive aids can protect against common cognitive biases such as fixation error, as they provide reminders of alternative diagnoses. Much in the way checklists have reduced errors of omission or oversight, cognitive aids result in an increased number of correct steps taken, but they are not substitutes for knowledge, vigilance or critical thinking. Checklists serve as prompts and aids when rare high-acuity crises occur.[3,4] A useful resource for cognitive aids in medicine can be found at **cogaids.stanford.edu**.

If there is any doubt as to the true diagnosis of an allergic reaction during anesthesia, a tryptase test should be ordered.[5] The patient should receive a follow-up appointment for allergy panel testing. The National Institute of Allergy and Infectious Diseases (NIAID) expert panel recommends observing patients for a minimum of four to six hours to monitor for recurrence of symptoms or biphasic anaphylaxis.[6] Observation would require the availability of one-to-one observation with a skilled critical care or emergency nurse capable of managing potential late-phase anaphylaxis in the dental office. The physician would need to remain available in case the nurse identifies any sign of recrudescence. Many providers prescribe antihistamines and glucocorticoids for two to three days to prevent late recurrences after discharge.

Streamlined systems should be in place for escalation of care, as was suggested in this case. Hospital admission is required in patients who fail to fully recover, have persistent hypotension, experience recurrent symptoms, develop secondary complications such as end-organ ischemia, or need intubation. Several of these indications require admission to a critical care setting. Thresholds for admission are lower for pediatric patients and patients with significant comorbidities. This patient experienced symptomatic resolution and was discharged without sequelae.

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The safety of office-based anesthesia for dental procedures has been studied. One study provides clinical data from more than 7,000 patients to demonstrate low rates for overall complications among dental patients undergoing office-based dental anesthesia performed by a certified dental anesthesiologist.[7] This data suggests that anesthesia in a dental office is usually safe. A separate group used media reports to collect deaths related to anesthesia for a dental procedure from 1980 through 2011. The study found that of 44 deaths, 21 occurred among patients 2 to 5 years old, 22 occurred in an office setting, and 25 occurred among patients under the care of a dentist.[8] A meta-analysis found that patients with underlying endocrine disorders, hepatic cirrhosis, bacteremia and systemic diseases had higher mortality rates among patients undergoing anesthesia for dental procedures.[9]

Another study examined the safety of total intravenous anesthesia outside the O.R. and noted that, while major complications were rare, patient safety depended upon the practitioner's ability to handle more common minor complications.[10] The requirements for who may provide anesthesia for a patient in a dental office varies by state and by the degree of anesthesia. Sometimes, the dentist is both performing

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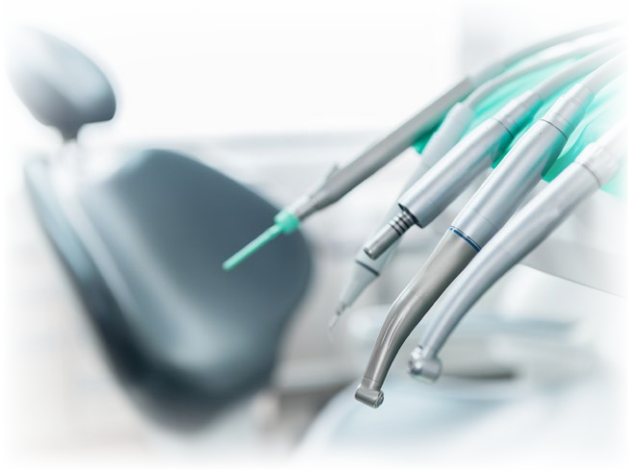
the procedure and supervising the anesthetic. A board-certified physician anesthesiologist or a dental anesthesiologist can join the treating dentist to provide anesthesia. A dental anesthesiologist is a dentist who has completed at least three years of full-time postdoctoral training in dental anesthesiology.

With an ever-increasing demand for dental and outpatient anesthesia, perhaps the true take-away message from this case is the need for better training, further research and continuing education regarding less common or more severe complications. Johnston et al. highlight this need by examining deficits among residents when facing less common complications, including anaphylaxis, malignant hyperthermia, and pulseless electrical activity. They found that residents were quick to call for an attending, but required an average of 7.6 minutes to diagnose anaphylaxis and only used epinephrine correctly 35 percent of the time.[11] This study suggested simulation training as a means for improvement. It is especially important to drill on emergency procedures when working in an office-based environment where emergencies are extremely rare. Additional postulated solutions to patient safety in the face of exponential growth in the quest for anesthesia include the use of checklists and posted protocols, encouraging physician board-certification and careful patient selection.[12,13] Physician anesthesiologists should not practice in an unaccredited freestanding outpatient facility.



This reported adverse event offers a wonderful opportunity to review patient safety in the remote outpatient setting. We appreciate our colleague's submission and this opportunity to review algorithms for management of airway complications and anaphylaxis. With the increasing trend for anesthesia outside the O.R., it is important to review safety precautions for patients experiencing adverse events. Here, we see the importance of well-established backups in the form of personnel, capable post-anesthesia nursing care and pre-arranged systems for escalation of care if it becomes necessary. We also see a need for careful patient selection and an opportunity for improvements in training.

References:

1. Choo KJ, Simons E, Sheikh As. Glucocorticoids for the treatment of anaphylaxis: Cochrane systematic review. *Allergy.* 2010;65(10):1205-1211.
2. Braganza SC, Acworth JP, Mckinnon DR, Peake JE, Brown AF. Paediatric emergency department anaphylaxis: different patterns from adults. *Arch Dis Child.* 2006;91(2):159-163.
3. Harrison TK, Manser T, Howard SK, Gaba DM. Use of cognitive aids in a simulated anesthetic crisis. *Anesth Analg.* 2006;103(3):551-556.
4. Clebone A, Burian BK, Watkins SC, Gálvez JA, Lockman JL, Heitmiller ES; for the Members of the Society for Pediatric Anesthesia Quality and Safety Commitee. The development and implementation of cognitive aids for critical events in pediatric anesthesia: the Society for Pediatric Anesthesia critical events checklists. *Anesth Analg.* 2017;124(3):900–907.
5. Gastraminza G, Lafuente A, Goikoetxea MJ, et al. Improvement of the elevated tryptase criterion to discriminate IgE from non-IgE mediated allergic reactions [published online November 17, 2017]. *Anesth Analg.* doi: 10.1213/ANE.0000000000002656
6. Boyce JA, Assa'ad A, Burks AW, et al; for NIAID-Sponsored Expert Panel. Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel. *J Allergy Clin Immunol.* 2010;126(6 Suppl):S1-S58.
7. Sepra AL, Saxen MA, Yepes JF, Jones JE, Sanders BJ. Office-based anesthesia: safety and outcomes in pediatric dental patients. *Anesth Prog.* 2017;64(3):144-152.
8. Lee HH, Milgrom P, Starks H, Burke W. Trends in death associated with pediatric dental sedation and general anesthesia. *Peadiatr Anaesth.* 2013;23(8):741-6.
9. Mortazavi H, Bahavand M, Safi Y. Death rate of dental anesthesia. *J Clin Diagn Res.* 2017;11(6):ZE07-ZE09.
10. Cravero JP, Beach ML, Blike GT, Gallagher SM, Hertzog JH; for Pediatric Sedation Research Consortium. The incidence and nature of adverse events during pediatric sedation/anesthesia with propofol for procedures outside the operating room: a report from the Pediatric Sedation Research Consortium. *Anesth Analg.* 2009;108(3):795-804.
11. Johnston EB, King C, Sloane PA, et al. Pediatric anaphylaxis in the operating room for anesthesia residents: a simulation study. *Paediatr Anaesth.* 2017;27(2):205-210.
12. Shapiro FE, Punwani N, Urman RD. Office-based surgery: embracing patient safety strategies. *J Med Pract Manage.* 2013;29(2):72-75.
13. Hicks CG, Jones JE, Saxen MA, et al. Demand in pediatric dentistry for sedation and general anesthesia by dental anesthesiologists: a survey of directors of dentist anesthesiologist and pediatric dentistry residencies. *Anesth Prog.* 2012;59(1):3-11.