

Suspected Intraoperative Anaphylaxis to Gelatin Absorbable Hemostatic Sponge

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Anaphylaxis under anesthesia is a life-threatening medical emergency that requires rapid identification and treatment. Allergies to agents with which the general population are likely to come into contact are usually identified, but patients are exposed to uncommon agents during anesthesia and surgery. Here, we describe a case of anaphylaxis under anesthesia implicating Gelfoam sponges.

Key Words: Anaphylaxis; Gelfoam; General anesthesia; Pediatric; Williams syndrome

Life-threatening anaphylactic reactions are rare events in anesthesia. It is estimated that the incidence of allergy under anesthesia is 1:6000 to 1:20,000 but is most likely underreported in the literature with suboptimal accuracy, completeness, and varying reporting protocols.¹⁻⁵ It is well known that muscle paralyzers are the most commonly implicated agent with anaphylaxis under general anesthesia.⁶ However, the patient is exposed to a wide variety of anesthetic, surgical, and supportive agents in the operating theater. As such, not all cases of allergic reactions are due to anesthesia. Here we report a case of anaphylaxis possibly associated with Gelfoam (Pfizer Canada) sponge.

CASE REPORT

A 2-year-old, 11-kg female patient with William's syndrome presented for dental rehabilitation under general anesthesia at the Hospital for Sick Children, Toronto, Ontario, Canada. She had undergone 3 prior general anesthetics because of her syndrome: 1 for examination under anesthesia and ptosis repair and 2 general anesthetics under bypass for correction of aortic stenosis, pulmonic stenosis, atrioventricular septal defect, and aortic arch hypoplasia. Propofol, fentanyl, rocuronium, sevoflurane, and acetaminophen were used for these surgeries.

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No anesthetic difficulties were experienced or noted. Echocardiogram after the surgeries indicated good biventricular function with no obvious atrial or ventricular septal defects, no pulmonic stenosis, and an adequate-sized proximal pulmonary artery. There was no evidence of right or left ventricular outflow tract obstructions or aortic stenosis. Electrocardiogram showed right axis deviation and left bundle branch block. She had no known drug or food allergies. She was not on any medications.

Upon evaluation on the day of the planned dental rehabilitation, she was not in any distress from her cardiovascular history. A characteristic elfin facies with a relatively large lower lip and proptosis were observed along with developmental delay. She had no limitations in physical activity, and her parent stated that she was well and at her baseline on the day of surgery.

Clinical Events

The patient was brought to the operating room, and general anesthesia was induced with sevoflurane and 60% nitrous oxide. A 22-gauge intravenous catheter was placed, and 50 µg of atropine was given with good effect due to bradycardia during induction. In preparation for intubation, 20 mg of propofol and 20 µg of remifentanyl were given, and the patient was successfully intubated through the right nares. The patient was then maintained on 1.5% sevoflurane and 60% nitrous oxide with stable hemodynamics of 90/40 mm Hg and heart rate of 85

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bpm. Intraoperatively, 5 µg of fentanyl was given. Lactated Ringer's was used as the maintenance fluid.

The dental treatment consisted of composite and glass ionomer restorations, stainless-steel crown placement, and extractions. After 45 minutes from induction, close to the end of treatment, the pediatric dentist gave a "10 minutes until finish" warning and proceeded to extract the unrestorable teeth. Sevoflurane and nitrous oxide were turned off, and the pediatric dentist placed gelatin sponges (Gelfoam) in the extraction sockets along with placement of sutures.

Over the next 2 minutes, a systolic blood pressure drop from a consistent 90 mm Hg to 70 mm Hg was seen. At this point, the intravenous line was opened to support her blood pressure with fluids. Within the next 5 minutes, a further decline in blood pressure from 70/40 mm Hg to 50/30 mm Hg was seen, the pulse oximeter tracing deteriorated, and the heart rate began to decline to the low 80s. Atropine 50 µg was given, which resulted in a rise in heart rate. As these events appeared remarkable for an otherwise uneventful anesthetic, an operating room code was declared.

Patient assessment at this time revealed a normal end-tidal CO₂ tracing and value with an unchanged peak pressure. There were no abnormal respiratory or dermatologic signs. The blood pressure cuff was not able to detect a blood pressure on the patient's left arm or leg, and new T-wave inversions on the electrocardiogram were seen along with absent peripheral pulses and weak carotid pulses.

A large-bore IV was placed, and the patient was given a fluid bolus of 600 mL (55 mL/kg). A single noninvasive blood pressure reading of 30/10 mm Hg was obtained. At this point, periorbital and lip edema and puffy hands were observed. Anaphylaxis was now the presumptive diagnosis. Four micrograms of epinephrine was given intravenously, and the noninvasive systolic blood pressure responded to 60 mm Hg. Subsequently, 5 mg of diphenhydramine and 15 mg of hydrocortisone were given. Vitals continued to improve over the next 5 minutes, with a systolic blood pressure reading of 85 mm Hg. She did not require further hemodynamic support with epinephrine.

Stat echocardiogram and electrocardiogram did not show wall motion abnormalities or evidence of ischemia. The patient was extubated awake and taken to the postanesthesia care unit, where upon transfer, the nurse observed a large rash across the patient's back, which was not visible in the supine position. Cardiology and immunology were consulted, and the patient was admitted to pediatric medicine. Vitals at the time of admitting to pediatric medicine were heart rate 104 bpm, respiratory rate 23/min, SpO₂ 99% on room air, temperature 36.9°C (axillary), and blood pressure 121/

78 mm Hg. She received hydralazine overnight for high blood pressure; otherwise, her hospital stay was unremarkable, and she was discharged the next day with a prescription for prednisone (1 mg/kg) and Benadryl (1 mg/kg).

Venous blood gas and electrolytes drawn at the time of the episode showed pH 7.3, pCO₂ 42 mm Hg, pO₂ 65.5 mm Hg, glucose 5.0 mmol/L, lactate 4.6 mmol/L, Na 134 mEq/L, K 4.0 mEq/L, Cl 106 mEq/L, and Ca 1.2 mEq/L. The tryptase level within 1 hour of the episode was 21.6 µg/L (reference 3.8–11.4 µg/L).

Seven weeks later, the patient received skin prick and intradermal testing for all of the drugs administered and suspected agents. Concentrations for skin prick testing were propofol (Diprivan, AstraZeneca) 1:1, remifentanyl 50 µg/mL, atropine 1:100, and fentanyl 1:10. Concentrations for intradermal testing were propofol 1:10, fentanyl 1:100, remifentanyl 5 µg/mL, and atropine 1:1000. Suspected agents were pork, Gelfoam, latex, and nuts. Saline control was negative, and histamine reaction was 3 mm by 3 mm.

Testing was negative for all agents except Gelfoam, which caused a 5 mm by 5 mm reaction. The patient's mother was skin prick tested for Gelfoam to act as a control, as there is no standardized testing for Gelfoam. She developed a 3 mm by 3 mm reaction. Although allergy versus irritation was unable to be determined, it was recommended by the immunologist that the patient avoid Gelfoam in the future.

DISCUSSION

In dentistry, Gelfoam is used to aid hemostasis after extraction. It does not itself modify the coagulation cascade but helps to keep the formed blood clot in place. In the current literature, anaphylaxis related to Gelfoam or other gelatin-based hemostatic sponges is exceedingly rare, with only a handful of reported cases.^{7–9}

Gelfoam is primarily composed of purified porcine gelatin. The patient's family followed a vegetarian diet, and it is unlikely that the child would have been sensitized by a food source. Following this event, the mother described a previously unmentioned event at home in which the patient "turned blue" after eating a peanut-free granola bar. Emergency medical service was called, and she received management for anaphylaxis at the hospital. However, allergy testing later did not find a causative agent for the event, so allergy to an unspecified agent was documented.

Reactions by children following vaccination containing porcine or bovine gelatin are known and may be sensitizing events.^{10,11} The parent stated that the child

had received vaccinations with no history of abnormalities or reactions.

Several factors complicated the diagnosis and treatment of this patient. The diagnosis of William's syndrome with cardiac history along with hypotension as the sole presentation provided an unclear differential. In this case, anaphylaxis was a diagnosis of exclusion, as the periorbital, lip, and hand edema observed could have been due to the natural elfin facies of proptosis and large lips or the large amount of volume given for resuscitation causing additional edema. During treatment of this event, no cardiac compressions were initiated. Instead, hypotension and bradycardia were treated with rapid fluid bolus and vasopressor. American Heart Association pediatric advanced life support guidelines suggest that chest compressions should be initiated in children with weak carotid pulses. However, we withheld chest compressions because of the presence of unchanged end-tidal values and tracing throughout the event, even with weak peripheral and carotid pulses.

Although the intraoperative context of sudden onset of hypotension at the end of the procedure was consistent with the use of Gelfoam, the results must be interpreted with caution.

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