Methemoglobinemia is a potential negative side effect associated with the use of benzocaine for topical anesthesia. A healthy patient admitted for an outpatient orthopedic procedure developed the clinical symptomatology of methemoglobinemia after topicalization of the airway with benzocaine. The patient subsequently responded to appropriate treatment and was fit for discharge the same day. Methemoglobinemia should be suspected in cases where decreased pulse oximeter readings develop in patients who have received benzocaine preoperatively. Appropriate steps should be taken to support the airway and oxygenation and monitor the patient while medication is administered to reduce methemoglobin to hemoglobin.

Key words: Benzocaine, differential diagnosis, methemoglobinemia, methylene blue, oxidation.

Suspected methemoglobinemia following awake intubation: One possible effect of benzocaine topical anesthesia—A case report

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Methemoglobinemia is a potential negative side effect associated with the use of benzocaine for topical anesthesia. This case report discusses a patient whose abnormally low intraoperative pulse oximeter readings were suspected to result from methemoglobinemia.

Case report

A 28-year-old, 71-inch tall, 95-kg male patient with no known drug allergies, was scheduled to undergo an open reduction and internal fixation of his left radius. His prior medical history was unremarkable. His surgical history was significant for a recent open reduction and internal fixation under general anesthesia of his right orbit and mandible resulting in a wired jaw. The patient had no complications from this general anesthesia.

In preparation for an awake nasal intubation, intravenous sedation and upper airway anesthesia was administered in the preoperative holding area. A total of 7 mg of midazolam, 75 µg of fentanyl, and 5 mg of droperidol was titrated intravenously. Simultaneously, the left naris was dilated with successively larger nasal airways, each lubricated with a combination of 2% viscous lidocaine and phenylephrine. Bilateral superior laryngeal nerve blocks were accomplished with a total of 4 mL of 4% lidocaine. Awake, fiberoptic nasal intubation via the left naris was accomplished with moderate difficulty, during which time the field of vision through the fiberoptic bronchoscope became obscured with blood from the nasopharynx. The patient's SpO2 ranged from 92% to 95% during intubation.

Following induction, the patient's SpO2 was 92%. The patient was provided 100% oxygen, and the proper position of the endotracheal tube was confirmed by fiberoptic bronchoscopy. Additionally, the endotracheal tube was suctioned, and 5 cm H2O of positive-end expiratory pressure was added to the breathing circuit. Following these measures, SpO2 was 94% to 95%. Postoperatively, the patient, still intubated, was admitted to the intensive care unit (ICU) for observation.

Shortly after admission to the ICU, the patient was evaluated by the anesthesiologist on duty in the ICU who then suspected methemoglobinemia. Methylene blue, 100 mg, was administered intravenously. In fewer than 10 minutes, the patient's SpO2 began to improve. Within 1 hour the patient was awake and extubated with an SpO2 of 100% on room air.

Discussion

Methemoglobin is formed by the oxidation of the iron in hemoglobin from the ferrous (divalent) to the ferric (trivalent) form. Once oxidized, methemoglobin is unable to participate in normal oxygen transport. This reaction occurs continuously in red blood cells, where methemoglobin also is reduced continuously to hemoglobin. Normally, a balance is maintained such
that methemoglobin constitutes approximately 1% of total hemoglobin. Methemoglobinemia refers to a rare state in which production of methemoglobin exceeds its reduction so that excessive levels of methemoglobin accumulate, potentially compromising tissue oxygenation. Methemoglobin levels are well tolerated up to 20%, but symptoms occur at higher levels. At levels greater than 70%, death may ensue. Many drugs may precipitate this state, including benzocaine. Measurement of methemoglobin by co-oximetry was not done in this case. Methemoglobinemia was suspected due to the clinical presentation before treatment with methylene blue. The patient's response to the treatment lends further credibility to the provisional diagnosis of methemoglobinemia.

Signs and symptoms of methemoglobinemia vary with the amount of methemoglobin present and include cyanosis, brownish-colored blood, dyspnea, fatigue, tachycardia, and neurological symptoms progressing from confusion to death if severe methemoglobinemia goes untreated. Signs and symptoms are usually apparent within 20 to 60 minutes of drug administration. Pulse oximetry readings may be inaccurate and may either underestimate or overestimate the level of oxyhemoglobin present. Arterial blood gas analysis is generally not helpful in diagnosing methemoglobinemia, as PaO₂ and SaO₂ are typically normal. However, drawing blood does allow visual assessment of its color. Co-oximetry quantifies the level of arterial methemoglobinemia. Treatment consists of administering 1 to 2 mg/kg of methylene blue intravenously over 5 minutes. Left untreated, the rate of conversion of methemoglobin to hemoglobin in normal individuals is approximately 15% of the methemoglobinemia per hour. Methylene blue potentiates the reduction of methemoglobin to normal hemoglobin, restoring the oxygen-carrying capacity, which leads to prompt resolution of symptoms.

When a low SpO₂ is noted in a patient who previously received benzocaine, methemoglobinemia should be suspected. The recommended dose of 20% benzocaine spray is a one-half second spray, repeated in 15 to 30 seconds, as necessary. It seems prudent to use the minimum amount necessary to achieve the desired effect as the severity of methemoglobinemia may be dose dependent. Other potential causes of low SpO₂, such as a low delivered concentration of O₂, aspiration of blood or gastric contents, hyperventilation, and ventilation/perfusion mismatches should all be considered. In this case, aspiration was initially under consideration as a potential cause of the low SpO₂ readings. It was felt that the possibility existed that blood from the nasopharynx, observed during fiberoptic bronchoscopy, might have masked the aspiration of gastric contents. However, other indicators of aspiration were not present as lung sounds were clear bilaterally, peak airway pressures were not elevated, nor was hypotension or tachycardia noted.

In the case under discussion, the patient received 4 sprays of 20% benzocaine, approximately one-half second in duration each, for a total of 2 seconds. The average rate of expulsion of benzocaine from its aerosol container is 200 to 295 mg/s. Thus, the patient in this case likely received between 400 and 600 mg. Benzocaine has been found to cause methemoglobinemia with administration of as little as 150 to 300 mg in adults.

Although our patient was a young, healthy ASA physical status I male, able to easily tolerate SaO₂ levels in the low 90s, patients with severe anemia, heart failure, or coronary artery disease cannot. Further, the use of prilocaine, also implicated as a cause of methemoglobinemia, is not recommended in obstetrics due to neonatal cyanosis resulting from the conversion of fetal hemoglobin to methemoglobin.

In retrospect, it is clear that potential morbidity and an admission to the ICU may have been avoided had methemoglobinemia been recognized and treated intraoperatively, rather than the quick assumption made that aspiration was the likely cause. We recommend that methemoglobinemia be considered in the differential diagnosis when benzocaine or prilocaine has been used and the SpO₂ is abnormally low.

REFERENCES

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