Cyclic vomiting syndrome (CVS) is characterized by intense vomiting, recurrent emergency department visits, and return to usual health status between episodes. This syndrome was first described in 1882 in a case series of pediatric patients, but there is growing understanding that CVS may occur in other age groups. This case report describes a 23-year-old with a history of CVS diagnosed in adolescence presenting for revision of a tibial plateau fracture. The patient underwent general anesthesia and had an uneventful perioperative course. Although not much is known about CVS in patients presenting for surgery, this report reviews the pertinent literature and explores anesthetic implications for patients with this challenging syndrome.

**Keywords:** Anesthesia, cannabinoid hyperemesis syndrome, cyclic vomiting syndrome, migraine.

A 23-year-old man, measuring 182.9 cm (72 in) and weighing 77 kg, presented for revision of his tibial plateau fracture repair 1 week after the initial injury due to skiing. The patient underwent an open reduction internal fixation of his tibia at an unaffiliated hospital. On his return home, follow-up with an orthopedic surgeon showed a displaced lateral tibial plateau fracture and unstable ligament. He was scheduled for a revision to the open reduction internal fixation of his tibial plateau. The patient reported satisfaction with his previous general anesthetic, noting that his postoperative nausea resolved after a single episode of vomiting. His parents, however, were dissatisfied with his perioperative vomiting.

The patient had received a diagnosis of CVS at age 18 years after 2 presentations to the emergency department with protracted nausea and vomiting. Until his presentation and diagnosis, the patient’s only notable medical history included recreational marijuana use and a remote history of postviral gastroparesis at age 5 years. His mother had celiac disease, and his father was healthy. His 2 sisters had migraine headaches. He was initially treated with cyproheptadine during admissions for CVS exacerbation and nortriptyline for maintenance therapy. The patient was currently maintained on a daily regimen of amitriptyline, 20 mg, as well as physician-approved marijuana and lorazepam, 2 mg, as needed. He followed a gluten-free diet to manage his CVS symptoms. His ASA physical status classification was 2. He had a Mallampati class 1 airway. His blood pressure was 129/83 mm Hg, heart rate was 102/min, and oxyhemoglobin saturation was 98%. At age 18 years, the patient underwent several examinations to evaluate his CVS. An air-contrast upper gastrointestinal tract series showed moderate gastroesophageal reflux. The patient had a gastric emptying (GE) study, with results indicating a slower-than-normal GE time: 15% at 30 minutes, 29% at 60 minutes, 42% at 90 minutes, and 55% at 120 minutes. Normal (reference) mean adult values are 31% at 60 minutes and 76% at 120 minutes. An upper endoscopy at that time showed a normal esophagus with erythematous gastropathy. His last emergency department presentation for CVS exacerbation occurred 17 months before his tibial plateau fracture and 3.5 years after his initial diagnosis.

On initial assessment before his revision surgical procedure, the patient was anxious and complaining of nausea. He noted that he had been fasting for 14 hours. Midazolam, 2 mg, was administered intravenously (IV) in the preoperative holding area and repeated in 5 minutes, after which the patient reported resolution of his nausea and anxiety.
After the patient’s transfer to the operating room and application of standard monitors, general anesthesia was induced with propofol, 200 mg, IV. Lidocaine, 100 mg, and fentanyl, 150 μg, IV were used to blunt the sympathetic response to laryngoscopy. Succinylcholine, 120 mg, was administered IV to facilitate tracheal intubation. Cricoid pressure was maintained during induction. The trachea was unevenly intubated with a 7.5-mm endotracheal tube using a Macintosh size 3 blade. After induction, general anesthesia was maintained with 2.5% sevoflurane with a combined 1 L flow of air and oxygen. Dexamethasone, 4 mg, was administered for prophylaxis of postoperative nausea and vomiting (PONV). Neuromuscular blockade was maintained with rocuronium. Of note, the patient’s heart rate consistently remained above 100/min throughout the case despite fluid resuscitation with 1,300 mL lactated Ringer’s solution and administration of 500 μg of fentanyl and 2 mg of hydromorphone. The patient received 4 mg of ondansetron and 1 mg of haloperidol for additional PONV prophylaxis. Metoclopramide, 10 mg, was administered IV for its gastrointestinal prokinetic properties. Neuromuscular blockade was antagonized with glycopyrrolate and neostigmine, and the patient’s heart rate decreased to 80/ min. The patient emerged from general anesthesia, and the trachea was extubated without incident. The patient was transferred to the postanesthesia care unit (PACU), where he received hydromorphone, 0.5 mg, by the nurse anesthetist before transferring care to the PACU team. In the PACU, the patient was connected to a patient-controlled analgesia system containing morphine and received an additional 4 mg of ondansetron and 2 mg of lorazepam orally for nausea and anxiety. The patient did not require additional antiemetic medications after transfer from the PACU to the orthopedics unit, and he was discharged home the following day. The patient reported he was doing well during a telephone interview 3 days after his hospital discharge.

Discussion

Cyclic vomiting syndrome is defined by symptoms without abnormal findings of laboratory, radiologic, and endoscopic testing. Patients must meet specific criteria for a diagnosis of pediatric CVS (Table 1). The syndrome may present or persist into adulthood. There is increasing literature on an atypical CVS that is diagnosed in adulthood. Several case reports describe patients who have been treated by anesthesia practitioners in the setting of inpatient admissions for CVS. A review of the literature indicates this may be the first article describing CVS in the perioperative setting.

Cyclic vomiting syndrome consists of recurring well phases and episodic phases of nausea and vomiting, often requiring emergency department presentation and hospital admission. There is no clear consensus on the etiology of CVS. Suggestions include migraine variant, mitochondrial disease, autonomic dysfunction, and altered hypothalamic response to stress. There appears to be a link between migraine and CVS. Patients commonly have a high family prevalence of migraine (39%-81% of cases report a family history of migraine), and patients themselves often experience migraines along with CVS. Children with CVS often experience migraine headaches in adolescence once the CVS manifestations decrease in severity, although some stop having manifestations of CVS altogether. Antimigraine therapy is often effective in these patients. Patients with CVS have indicated relief after administration of sumatriptan, a selective 5-hydroxytryptamine1D agonist. There are strong associations in children of CVS with motion sickness, gastroesophageal reflux, psychological symptoms, and irritable bowel syndrome.

Cyclic vomiting syndrome may be associated with various metabolic diseases, specifically fatty acid oxidation disorders. A case report from Ireland described a 20-year-old patient with a 10-year history of CVS experiencing cardiac arrest and death was later determined to have multiple acyl coenzyme A dehydrogenase deficiency (MADD), a very rare metabolic disorder also known as glutaric aciduria.

Avoiding triggers during well periods can lead to fewer illness episodes. Triggers can include infections, emotional stress, lack of sleep, exhaustion, and specific foods. When episodes of CVS occur frequently or do not respond to abortive therapy, patients generally are prescribed prophylactic medications. Amitriptyline is the first choice of medication for CVS prophylaxis in children older than age 5 years, with propranolol being a second choice.

The described patient found relief from his symptoms with marijuana use. Recently, an association of symptoms similar to those of CVS was observed in conjunction with long-term cannabis use and termed cannabinoid hyperemesis syndrome. The cyclic vomiting symptoms resolved when the individuals were able to discontinue

Table 1. Diagnostic Criteria for Pediatric Cyclic Vomiting Syndrome

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cannabis use. There is concern that marijuana may contribute to CVS in the adult patient. Other reports have described a large number of adults with CVS who self-administer marijuana daily, generally improving their nausea, anxiety, and appetite.3

The only published information of anesthesia in patients with CVS comes from anesthesia practitioners who treated these patients outside a perioperative setting. A case series from Khasawinah et al7 and Tobias9 describes 3 pediatric patients who received dexmedetomidine infusions in the pediatric intensive care unit during inpatient admission due to CVS. These 3 patients, ranging in age from 5 to 14 years, had resolution of their symptoms with dexmedetomidine infusions; therapy was transitioned to oral medications before discharge. The 5-year-old patient was discharged on an oral regimen of clonidine after 2 successful inpatient treatments with dexmedetomidine but did not respond to dexmedetomidine during a third admission. The second patient was eventually discharged on a regimen of phenobarbital.

Another case report, from Palmer and Cameron,9 describes a patient who was referred to the anesthesia-run postoperative pain service for assistance in management of his CVS symptoms. After oral pizotifen and IV hydration failed to resolve his symptoms, symptom improvement was obtained with an infusion of low-dose midazolam, and symptoms completely resolved with clonidine administration. Until further research is conducted in these patients earlier in the day and to provide specific fasting guidelines to decrease fasting time, such as encouraging them to drink clear juices until 2 hours preoperatively. Until further research is conducted in these patients in the perioperative setting, anesthetic techniques that minimize exposure to triggers may decrease complications and increase patient satisfaction.

Peripheral nerve blocks generally are avoided in patients with tibial plateau fractures because of concerns about compartment syndrome. A spinal technique was considered in the current case, but the anesthesia practitioners believed that the surgery length would likely outlast the spinal duration. Nitrous oxide was avoided because of concerns, albeit controversial, over an increase in PONV risk. The patient underwent general anesthesia with a volatile agent, but he may have benefited from total intravenous anesthesia, which has been shown to decrease the incidence of PONV. Ondansetron, haloperidol, and dexamethasone were administered, according to the Society for Ambulatory Anesthesia Consensus Guidelines for the Management of PONV.12 These guidelines recommend 2 or more PONV prophylaxis interventions for adults at high risk of PONV.

Because there is a paucity of information on these patients in the perioperative setting, it is not known whether these patients are at higher risk of postoperative nausea and vomiting. As stress and fasting may be triggers of episodes, it seems reasonable that surgery may exacerbate CVS symptoms. The patient described here had fasted for more than 12 hours before induction of general anesthesia. It may be prudent to schedule these patients earlier in the day and to provide specific fasting guidelines to decrease fasting time, such as encouraging them to drink clear juices until 2 hours preoperatively. Until further research is conducted in these patients in the perioperative setting, anesthetic techniques that minimize exposure to triggers may decrease complications and increase patient satisfaction.

Table 2. Triggers for Cyclic Vomiting Syndrome

<table>
<thead>
<tr>
<th>Triggers for Cyclic Vomiting Syndrome</th>
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<tbody>
<tr>
<td>Excessive excitement1-3</td>
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<tr>
<td>Energy-depleted states (fasting, infections)1-3</td>
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<tr>
<td>Lack of sleep1,3,4</td>
</tr>
<tr>
<td>Foods (chocolate, cheese, monosodium glutamate)1-4</td>
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<tr>
<td>Menstrual periods (catamenial CVS)1-4</td>
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<tr>
<td>Motion sickness1-4</td>
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REFERENCEs


**AUTHOR**

Jennifer Garces, DNAP, CRNA, is a nurse anesthetist at Massachusetts General Hospital in Boston. She received her MSNA and DNAP from Virginia Commonwealth University in Richmond, Virginia. Email: jkgarces@partners.org.

**DISCLOSURE**

The author has declared no financial relationships with any commercial interest related to the content of this activity. The author did not discuss off-label use within the article.

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