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CASE REPORT

Succinylcholine: A Drug to Avoid in Bariatric Surgery

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Abstract Succinylcholine is a paralytic agent regularly utilized in anesthesia. There are numerous adverse effects of succinylcholine ranging from mild to fatal; one such effect is succinylcholine myalgia. We report the case of a 34-year-old woman who received succinylcholine while undergoing laparoscopic Roux-en-Y gastric bypass and later developed succinylcholine myalgia leading to a prolonged hospital stay and subsequent pneumonia. In the presence of suitable alternative paralytic agents, succinylcholine should be avoided in patients undergoing bariatric surgery. The use of a designated anesthesia team familiar with bariatric operations can help maximize peri-operative management and minimize complications.

Introduction

Succinylcholine is a depolarizing skeletal muscle relaxant that is widely used in anesthesia, particularly in cases requiring rapid sequence intubation (RSI) [1]. Its use in RSI as well as in the ambulatory setting where procedures are often shorter, is attributable to its ability to produce immediate and extensive neuromuscular blockade with rapid cessation of effects [1, 2]. However, succinylcholine has well-known side effects which can produce profound morbidity in surgical patients. These effects include succinylcholine myalgias, increased intragastric pressure, malignant hyperthermia, increased serum potassium levels, and increased intraocular pressure [2, 3].

The bariatric population is at higher risk for peri-operative complications when compared to their non-bariatric counterparts [4]. Minor complications which are more common in the bariatric population include increased postoperative pain and ileus [4]. Major complications are cardiopulmonary and wound-related in nature, and include increased risk of pneumonia, pulmonary embolism, and wound infections [4]. Rhabdomyolysis also occurs with increased frequency in the bariatric population and is generally associated with long operative procedures [5]. The incidence of rhabdomyolysis according to one study was up to 22.7% in bariatric patients, with increased risk for patients with massive obesity (BMI>60 kg/m^2) and those undergoing operations of long duration [6].

Minimizing the occurrence of these complications is important in bariatric surgery. In this report, we describe a patient who underwent laparoscopic Roux-en-Y gastric bypass with succinylcholine induction and experienced succinylcholine myalgia resulting in extended hospital stay and postoperative pneumonia. To our knowledge, this type of case has not yet been reported in the medical English literature.

Case Report

A 34-year-old morbidly obese woman presented for her initial bariatric consultation weighing 265 lbs with a body mass index of 42.7 kg/m^2. Her past medical history included gastroesophageal reflux disease, obstructive sleep apnea, and migraines. She had undergone multiple

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prior abdominal surgeries including laparoscopic cholecystectomy, appendectomy, and cesarean section. She reported no personal or family history of adverse reaction to anesthetics.

The patient underwent an uneventful laparoscopic Roux-en-Y gastric bypass with the creation of a 45-cc gastric pouch and a 100 cm Roux limb. The gastrojejunostomy and jejunojejunostomy were created entirely with linear GIA staplers (Autosuture™, Mansfield, MA). The routine anesthesia team that is most familiar with patients undergoing a bariatric operation was not available and, therefore, a less-experienced team was present and used succinylcholine for induction.

Postoperatively, the patient was placed on patient controlled analgesia with good effect. On postoperative day one, the patient's diet was advanced per gastric bypass protocol. In the afternoon, the patient developed generalized pain throughout her chest, abdomen, and legs, and had difficulty ambulating. The immediate concern was for an intra-abdominal complication warranting surgical exploration. While waiting for an operating room to become available, a CT scan of the chest, abdomen, and pelvis and Doppler ultrasound evaluation of the lower extremities were performed and yielded no abnormal findings. When the anesthesia team evaluated the patient for re-operation, they suggested that her symptoms may be from the succinylcholine used for the initial operation. With more detailed questioning, the patient recalled having a similar constellation of symptoms following laparoscopic cholecystectomy during which succinylcholine was administered. A clinical diagnosis of succinylcholine myalgia was made and the patient was managed appropriately with supportive care.

The patient improved slowly over the next few days; however, she continued to experience significant generalized myalgias making ambulation extremely difficult. On postoperative day four, the patient became febrile with a temperature of 38.5°C. Chest radiographs, urinalysis, and complete blood counts were performed to assess for pneumonia and urinary tract infection. The only significant finding was that of atelectasis on the chest radiograph. The patient subsequently defervesced and was discharged home on postoperative day five with a normal white blood cell (WBC) count.

While at home, the patient had recurrence of fever to 38.9°C. She was evaluated at an outside emergency room and readmitted for pneumonia, which was diagnosed based on an elevated WBC count, chest X-ray and clinical exam findings. She was treated with antibiotics on an inpatient and outpatient basis. One month after the operation, the patient continued to have residual myalgia, although it was slowly improving.

Discussion

Succinylcholine use has been associated with a relatively high incidence of myalgia in the postoperative state, making it a common occurrence [7]. The incidence of succinylcholine myalgias varies from 1.5% to 89%, with studies reporting an average incidence around 50% [7], though some anesthesiologists believe it to be much lower [8]. The typical duration of myalgia is two to three days, but instances lasting weeks to months have been reported [7]. Implicated risk factors include female gender, non-pregnant women, age greater than 50 years, poor muscular fitness, early ambulation postoperatively, and administration of smaller doses of succinylcholine [7]. Interestingly, although smaller doses are associated with an increased incidence of myalgia, anesthesiologists commonly use smaller doses in order to shorten recovery time after the operation [2]. Obese patients may be at particular risk of receiving doses that are too small if dosing is based on ideal body weight or an adjusted body weight rather than actual body weight, which leads to a dose smaller than the ideal dose of 1 mg/kg actual body weight as determined by Lemmens and Brodsky [9].

Numerous methods to reduce myalgias after the use of succinylcholine have been reported [2, 7]. These methods are based on a principle of pretreatment with other medications prior to administration of succinylcholine [2, 7]. Such pretreatments include phenytoin, magnesium, chlorpromazine, and small doses of succinylcholine prior to administration of the full dosage [7]. None of these methods for pretreatment have been shown to have a significant effect in reducing the incidence of postoperative myalgias [7].

Bariatric patients have an increased risk of postoperative deep venous thrombosis and pulmonary embolism, with a combined incidence of approximately 2% [10]. Additionally, there is a well-described increased risk for all other pulmonary complications in morbidly obese patients [11]. Early ambulation helps to decrease the incidence these complications. However, if a patient receives succinylcholine, early ambulation may be precluded due to the associated increased risk of developing myalgias [7]. Furthermore, if myalgias do occur, ambulation is more difficult secondary to pain. In either case, a patient ambulating later or less often has an increased chance of developing a pulmonary complication, as did our patient. In addition, the hospital stay for these patients may be prolonged [11].

Another notable side effect of succinylcholine relevant to bariatric surgery is increased intragastric pressure [12] resulting from contractions of the gastric muscle [13]. Increases in intragastric pressure have been studied by anesthesiologists in the context of aspiration of gastric

contents during induction [13]. This is of particular concern in bariatric patients because of the high incidence of gastroesophageal reflux disease [14, 15] which further increases the risk of aspiration during induction. Pretreatment with a non-depolarizing agent can reduce fasciculations causing increased gastric pressure, but this does not prevent the other potential adverse effects of succinylcholine use [16].

A potentially dangerous rise in serum potassium levels is another side effect of succinylcholine, particularly in patients with certain preexisting conditions [12]. Such conditions include muscle injury, previous upper motor neuron diseases such as stroke, and lower motor neuron diseases such as the muscular dystrophies [12]. Increases in intraocular pressures have also been well documented and are secondary to tonic contractions of the extraocular muscles involved during the initial phase of the succinylcholine's activity [12]. One of the most worrisome effects of succinylcholine is malignant hyperthermia, and although its incidence is rare, deciphering who is susceptible to the condition is difficult [17].

Given the high incidence of postoperative myalgias and other possible complications with the use of succinylcholine during induction, use of this drug for bariatric surgery should be avoided. Suitable alternatives to succinylcholine do exist. Rocuronium has similar efficacy to succinylcholine in inducing paralysis in patients that need to undergo rapid sequence intubation [18] and micacurium and vecuroium are regularly used in routine intubations. In fact, sugammadex, a new cyclodextrin that rapidly reverses rocuronium-induced neuromuscular blockade may potentially render succinylcholine obsolete if it can overcome its recent rejection by the U.S. Food and Drug Administration [19]. Suggamedex effectively and rapidly reverses the effects of longer-acting muscle relaxants, particularly rocuronium, without the untoward side effects associated with reversal using anticholinesterases [20]. Therefore, rocuronium can be given in sufficiently high doses to work quickly, and then be reliably and rapidly reversed.

Another aspect highlighted by this case is the importance of a routine anesthesia team familiar with bariatric operations [21]. Specialized expertise is required for several aspects of care including airway issues, selection of anesthetics, and postoperative analgesics [21]. As mentioned previously, succinylcholine is not routinely used by our designated bariatric anesthesia team. In the case presented here, an anesthesiologist not familiar with treating bariatric patients administered succinylcholine, leading to the observed complications. Understanding the potential complications of the bariatric patient population is important in maximizing the quality of peri-operative management and minimizing complications [21].

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