Symbiosis

SOJ Anesthesiology & Pain Management

Appendix

Cases with > 100 minutes between the first sign of MH and administration of dantrolene

These cases occurred between 2007 and 2013

Case 1:

This ~ 25 yr old man was undergoing an elective orthopedic surgery with a 275 minute anesthesia that included desflurane and rocuronium. He developed generalized muscular rigidity 120 minutes into the procedure. However, he did not begin showing other signs until later in the operation and dantrolene was not administered until after surgery was completed. He then developed hypercarbia (maximum expired CO_2, 120 mmHg), sinus tachycardia, and rapidly increasing elevated temperature (Tmax = 39C). His peak creatine kinase was 2,796 U/L. He was given dantrolene 240 min after the first MH sign. It was noted that he was "getting better" before the infusion began. He had no MH-related or dantrolene-related complications from the episode.

Case 2: Increased Hypercarbia "Treated" Initially with Increased Minute Ventilation

This ~ 40 yr old woman with fibromyalgia was undergoing an elective ENT procedure including desflurane, rocuronium, and succinylcholine. She developed hypercarbia during the case (maximum expired CO_2, 69 mmHg). The anesthesia team increased her minute ventilation requirement. She later developed sinus tachycardia and rapidly increasing temperatures in the PACU (Tmax = 38.2C). She was given dantrolene 150 min after hypercarbia began and her signs of MH were alleviated. She was noted to have a change in consciousness level in the PACU as well as severe bilateral upper extremity phlebitis from the dantrolene administration.

Case 3:

This ~ 40 yr old woman was undergoing an elective general and plastic surgery procedure with a 195 minute anesthetic including isoflurane and rocuronium. She developed sinus tachycardia at 135 minutes into the procedure and then proceeded to have a rapidly increasing elevated temperature (Tmax = 40.9C) and hypercarbia (maximum expired CO_2, 70 mmHg). Her peak creatine kinase was 12,418 U/L. The procedure was terminated and she was given dantrolene 108 min after, tachycardia, the first MH sign, was recognized She suffered hepatic dysfunction.

Case 4: First signs of MH in the ICU

This ~ 60 yr old man was undergoing an elective, urgent cardiothoracic surgery including rocuronium and sevoflurane. He first began to have signs of MH while intubated in the ICU (7 hours after anesthesia induction). He had generalized muscular rigidity and hypercarbia (maximum expired CO_2, 67 mmHg). Then his temperature increased

rapidly to Tmax = 39C. He was given dantrolene 137 min after the first signs of MH, generalized rigidity and hypercarbia. He had no MH-related or dantrolene-related complications from the episode.

Case 5: Intubation with Succinylcholine

This ~70 yr old man presented to the ED with acute pulmonary edema and was intubated after IV midazolam, etomidate and succinylcholine. His history included diabetes and atorvastatin treatment. Ten minutes after the intubation, he was noted to be hyperkalemic but did not show elevated temperature until 3 hours after he received succinylcholine (Tmax = 39.6C). Because of the late onset of elevated temperature, he was not treated with dantrolene until 435 min after he received succinylcholine. His did not show signs of rigidity and had a peak creatine kinase of 10,429. He suffered from change in consciousness and renal dysfunction as a result of the MH episode. It may be argued that this was not an MH episode, but an episode of rhabdomyolysis produced by succinylcholine in the presence of chronic statin ingestion and diabetes. It is included in this case series because dantrolene was given.

Case 6: "Mild MH"

This ~ 40 yr old woman was undergoing an elective orthopedic procedure with a 223 minute anesthesia including desflurane and rocuronium. Sinus tachycardia, hypercarbia (maximum expired CO_2, 55 mmHg), and increased anesthetic requirement were noted early in the operation (10 min) but the anesthesia was not stopped. Dantrolene was not given until 320 min after the induction of the surgery, 310 min after the first sign of MH. Muscle weakness was seen as a complication of the dantrolene administration and a change in consciousness with the MH episode. The reporter commented that it was "mild MH."

Case 7: "Uncertain MH"; Delayed and Initial under-Treatment of MH

This ~ 15 yr old male was undergoing an emergent orthopedic procedure with a 150 min anesthesia including desflurane and rocuronium. He started to have cola colored urine and generalized muscular rigidity one hour into the procedure. He then showed signs of sinus tachycardia, hypertension, elevated temperature (Tmax = 39.9C), tachypnea, and brief hypercarbia (maximum expired CO_2, 68 mmHg). The anesthetists were "uncertain that the episode was MH" and administered only 1.1mg/kg of dantrolene 360 min after anesthetic induction, 300 min after the first sign of MH, recognition of dark urine. He did experience muscle weakness from the dantrolene administration, but no complications from the MH episode.

Case 8:

This ~ 60 year old woman was undergoing an elective general surgery procedure including isoflurane, nitrous oxide, vecuronium and succinylcholine. Immediately following the induction of anesthesia, masseter spasm was noted. Her mouth could not be fully opened, but direct laryngoscopy was possible. The second sign, hypercarbia, (maximum expired CO_2, 60 mmHg) was not seen until 2 hours into the procedure. Rapidly increasing elevated temperature (Tmax = 38.4C), sinus tachycardia, darker colored urine, sweating, and oxygen desaturation followed the hypercarbia. Dantrolene, 2 mg/kg, was given three hours after induction, 177 min after the first recognized sign of MH, masseter rigidity. She experienced muscle weakness from the dantrolene administration but no complications from the MH-episode.

Case 9:

This ~ 60 yr old man was undergoing an elective cardiothoracic surgery. Anesthesia including isoflurane and cisatracurium, lasted 346 min. While intubated in the ICU, he was noted to have decreased level of consciousness 16 hours after induction. Sinus tachycardia and rapidly increasing elevated temperature (Tmax = 39.1C) followed. Dantrolene was given 105 minutes after decreased level of consciousness was noted. No adverse complications were experienced.

Case 10: Suspected Thyroid Storm

This ~ 30 yr old woman was undergoing thyroidectomy during sevoflurane anesthesia. Hypercarbia (maximum expired CO_2, 80 mmHg) was noted 180 min after induction of anesthesia. However, the physician taking care of the patient initially thought this was a case of thyrotoxicosis. Dantrolene administration was delayed until 300 minutes after induction, 120 min after hypercarbia was noted. She did not survive.

Case 11:

This ~ 35 yr old woman with a known family history of MH and personal history of scoliosis was undergoing emergent C-section. Anesthesia lasted 90 min and included propofol, sevoflurane and succinylcholine. It was initially intended that she receive spinal anesthesia, but cerebrospinal fluid could not be obtained despite multiple attempts, so general anesthesia with tracheal intubation was provided. Masseter spasm prevented complete mouth opening, but direct laryngoscopy and tracheal intubation was still possible. More signs of MH occurred with tachypnea, hypercarbia (maximum expired CO_2, 72 mmHg), sinus tachycardia, elevated temperature (Tmax = 37.2C), hypertension, and cola colored urine. She was given dantrolene after the end of the surgery, 165 minutes after masseter spasm. No adverse complications were experienced.

Case 12:

This ~ 70 yr old male with a known family history of MH was undergoing emergent cardiothoracic surgery. His 240 minute anesthesia included isoflurane and vecuronium. Eleven hours after induction, he was receiving positive pressure ventilation in the ICU when sinus tachycardia, hypercarbia, and elevated temperature (Tmax = 41.3C) were noted. His peak creatine kinase was 40,866 U/L. Dantrolene, 2.4mg/kg, was administered 15 hours after induction of anesthesia and 240 minutes after the first signs of MH. He did not survive the episode. He may have had pneumonia preoperatively.

Case 13:

This ~25 year old man was undergoing an elective oral surgery. His 77 minute anesthesia included sevoflurane and succinylcholine. Sinus tachycardia was noted within three minutes of induction. Prolonged (30 second) fasciculations were noted after succinylcholine administration. He also developed hypercarbia (maximum expired CO_2, 60 mmHg), elevated temperature (Tmax = 37.2C), cyanosis, and ventricular tachycardia. Peak creatine kinase was 276,000 U/L. Dantrolene was administered 179 minutes after anesthetic induction, 176 min after the first sign of MH. The patient suffered muscle weakness, but no long-term complications from the MH episode.

Case 14:

This ~ 10 yr old girl with a family history of MH was undergoing an emergent neurosurgery operation. Her 336 minute anesthesia included sevoflurane, desflurane, and rocuronium. Sinus tachycardia was noted 120 minutes after induction. Later rapidly increasing temperature (Tmax = 41.7C), hypercarbia (maximum expired CO_2, 105 mmHg), generalized muscular rigidity, and hypotension occurred. Dantrolene was administered 225 minutes after induction, 105 minutes after onset of tachycardia. Phlebitis, hyperkalemia, and muscle weakness were reported after administration of dantrolene. No complications from the MH episode were reported. A known MH causative mutation was found in the ryanodine receptor type one geneof this patient by postoperative testing of blood.

Unfortunately most of these patients did not report later testing of their MH risk, either by muscle contracture testing or genetic screening. Without this pathologic data one can question whether or not these perioperative complications are MH episodes. We report them here because dantrolene was given. Some of these cases do have all the signs of fulminant MH. Even when significant underlying disease may have been the primary cause of illness, if there are unexplained aspects that could be due to MH, it may be useful to perform MH diagnostic testing for the proband so that the MH risk of family members can be more easily defined in the future, see www.mhaus.org.

We express our sympathy to the families who lost relatives unexpectedly in the peri-operative period. We thank the many health care providers and volunteers, especially MH Hotline Consultants, who strive to protect their patients and are willing to take the extra steps of reporting these difficult events to the NAMHR.

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