



## CE ARTICLE

Visit [www.medlineuniversity.com](http://www.medlineuniversity.com) and login or create an account. Choose your course to take the test and receive 1 FREE CE credit. Course is approved for continuing education by the Florida Board of Nursing and the California Board of Registered Nursing.

# IN THE HEAT OF THE MOMENT

## Malignant Hyperthermia Calls for Action

by **Katie Beam, DNP, RN, ACNS-BC, CWS**

Clinicians, particularly nurses, working with patients during or after surgery understand that an emergency situation with a patient who has malignant hyperthermia (MH) instantly can become a matter of life or death. As a result, nurses should be aware of the signs and symptoms that identify malignant hyperthermia and know how to respond immediately and appropriately.<sup>1</sup> The challenge for these clinicians, then, is assessing accurately which patients may have or be susceptible for having this rare condition and preparing adequately to handle any case of malignant hyperthermia before it becomes catastrophic for a patient and his or her family.

The information in this article provides an overview of malignant hyperthermia, describes how nurses can prepare an effective malignant hyperthermia cart for use in their facilities and encourages nurses to connect patients and their families with appropriate resources about MH. Familiarity with this type of knowledge is crucial for staff members caring for patients who have received general anesthesia.<sup>1</sup>

# MANAGING MALIGNANT HYPERTHERMIA

at **Dignity Health** Woodland Healthcare, Woodland, CA

Fortunately, we have not had a malignant hyperthermia (MH) case at Woodland for more than ten years. Nevertheless, we perform several drills every year and require nurses in the Perioperative, Emergency Department, Maternal Child and Intensive Care Unit (ICU) to complete 90 minutes of an annual MH Competency training that includes hands-on mixing of Dantrolene, and observation of a mock drill video from MHAUS. We also keep one fully stocked MH cart in our surgical services department and another one in our outpatient surgery center, which is located in a separate building adjacent to the hospital. The two carts are set up exactly the same way and each drawer of the MH cart is standardized to provide quick and easy access for needed supplies in an MH emergency. A laminated copy of the cart contents is kept on the top of each MH cart for reference and the drawers are labeled on the outside to assist the staff, and minimizes confusion. This is because many staff float between the surgery center and the main hospital OR. In addition, Dignity Health recently implemented the identical MH cart, educational program, policies, and procedures at their sister hospitals in the greater Sacramento/San Joaquin region of California.

When a malignant hyperthermia (MH) episode occurs, we make an announcement on the overhead page system, “Your attention please, Malignant Hyperthermia Alert (location)” which prompts the nurse supervisor to locate the MH cart and bring it to the patient location within five minutes. Although MH often occurs in the OR, it could also

occur in the emergency department (ED), intensive care unit or in the maternal/child unit in mothers who have Cesarean sections. We recently performed a drill with a mock MH patient in the ED, and the nursing supervisor arrived with the MH cart in two minutes and 45 seconds. Our next drill this year will involve a mock patient in the surgery center. The drill will involve the use of the MH cart for a patient in the recovery area of the surgery center and then test our system of communication and teamwork after stabilization from the initial MH event and transporting the patient to the emergency department at the hospital. From there, the MH patient will be admitted to the ICU for observation because 25 percent of patients who experience MH can have a spontaneous recurrence within 48 hours of the first episode. For this reason, all patients with MH must stay in the ICU for at least 48 hours after being treated and stabilized.

Getting Dantrolene to our patient within the five-minute window, and making certain that our staff feels confident in recognizing and treating MH is a priority to our organization because treating MH is all about speed. MH occurs suddenly and affects multiple body systems simultaneously; the muscles, the heart, the brain, and the kidneys. Knowing how to recognize MH, how to prioritize treatments, understanding their roles in the care of the patient and how important it is to get Dantrolene on board quickly to reverse the hypermetabolic state that initiates the deadly MH cascade, will give our patients their best chance for survival.

# Woodland Healthcare MH Cart Contents



## Drawer 1

MH Dose Chart (Laminated) • Current MH Policy • MH Documentation Forms  
MH Quick Reference Mix Sheet • MH Drug Stickers • (2) Dispensing Pins with  
Luer Lock Safesite valves • (36) Mini-Spike Dispensing Pins • 2) Urine collection  
containers for myoglobin level • ABG Kit • 1 box (100 count) CHG wipes  
• Paper tape - 1 inch and 2 Inch

## Drawer 2

NG tubes: (1) 12 Fr (1) 16 Fr (1) 18 Fr • Lubrication jelly • Yankaur  
Suction Tip • Nasal Airway (1) 26 (1) 30 • Oropharyngeal Airways  
• CVP Tray/kit • Pressure Monitoring Transducer with pressure bag  
• Arrow Arterial Line Catheter

## Drawer 3

(4) IV tubing sets • (2) Secondary IV sets • (2) t-connectors • (2) 20 inch  
extension sets • (4) 3-way stop cocks • (8) 3mL syringe with 20 gauge,  
1-1/2 inch needle attached • (10) 10 mL syringes (leur lock) • (36) 60 mL  
Luer Lock Syringes, to administer Dantrolene • (20) 18 gauge, 1-1/2 inch  
needles- (36) 60 mL Luer Lock Syringes, to administer Dantrolene • (20) 18  
gauge, 1-1/2 inch needles

## Drawer 4

(36) Dantrolene vials • (2) 1000 mL bags of Sterile Water for Injections  
(preservative free) • (5) Sodium bicarbonate (8.4%) – 50 ml prefilled syringes  
• (4) Furosemide 40 mg/4ml vial • (2) Dextrose (50%) - 50ml prefilled syringes  
• (2) Calcium chloride (10%) - 10ml prefilled syringe • (3) Lidocaine 100  
mg/10 ml in pre-filled syringes • (1) Regular insulin 100 units/ml 3ml vial  
(refrigerated) • (3) 1000 mL bags of cooled 0.9% Normal Saline (refrigerated)

## Drawer 5

(1) 18 Fr 5 cc Foley catheter, 1 20 Fr Foley Catheter • (1) 16 Fr Statlock Foley  
Insertion Tray • (1) Urine meter with drainage bag • (2) irrigation syringes,  
60mls with adapter for NG irrigation • Gastric Lavage Tubes (1) 24 Fr (1) 32 Fr  
• Gastric Lavage Kit • (4) Large (4) Small Clear Plastic Bags for Ice  
• (1) Bucket for Ice • (1) Large sterile drape (for rapid drape of wound)

## Recognizing malignant hyperthermia

Malignant hyperthermia is a genetic disorder and a hypermetabolic, or biochemical chain reaction, response.<sup>2,3</sup> Susceptible patients undergoing surgery may exhibit signs of malignant hyperthermia if they are exposed to the “trigger” muscle relaxant succinylcholine and select inhalation agents such as desflurane, enflurane, halothane, isoflurane, and sevoflurane.<sup>2-4</sup>

The symptoms of MH can be very specific and include muscle rigidity, increased CO<sub>2</sub> production, and fever escalating to 105 degrees F or higher.<sup>3,5</sup> Masseter spasm, which manifests as jaw muscle rigidity and corresponds with limb muscle flaccidity after succinylcholine has been given, often is the first sign of malignant hyperthermia.<sup>6</sup> It is important for clinicians to know that all patients who have had even mildly increased jaw tension should be observed carefully for signs of MH for at least 12 hours.<sup>6</sup> Non-specific symptoms of MH can include tachycardia, tachypnea, metabolic and respiratory acidosis and hyperkalemia.<sup>3,5</sup> Severe complications associated with MH include cardiac arrest, brain damage, internal bleeding or failure of other body systems, and even death.<sup>3</sup>

## How common is malignant hyperthermia?

It is estimated that for every 5,000 to 50,000 patients who are given anesthetic gases, one patient may have malignant hyperthermia.<sup>7</sup> Malignant hyperthermia is inherited in an autosomal dominant pattern,<sup>3,7</sup> which means that an affected person usually inherits the altered gene from a parent who also is at risk for malignant hyperthermia.<sup>7</sup> Carriers of the gene for MH may be unaware they have this risk unless they are aware of whether any of their family members has experienced MH after receiving anesthesia in the past.<sup>3</sup>

If malignant hyperthermia is suspected, it is essential for the nurse to get a thorough history of a patient’s experiences with anesthesia as well as any notable experiences that the patient’s close family members may have had with anesthesia.<sup>8</sup>



## The Malignant Hyperthermia Cart

Health care facilities that use general anesthesia that could trigger MH must have a kit or a cart that contains all of the items needed to manage MH readily available.<sup>1,6,9</sup> A basic MH kit or cart should include the following items<sup>1,6</sup>: Dantrolene, sterile water sufficient to dilute Dantrolene, D50, antiarrhythmics, calcium chloride, sodium bicarbonate, insulin and furosemide.

In addition, the items needed for patient monitoring include EKG, blood pressure, temperature, pulse oximeter and capnograph. It is also helpful to have an ice machine, a refrigerator, cooled intravenous fluids and cool blankets close at hand so these items can be used quickly to help lower the patient’s body temperature.<sup>1,6,9</sup>

To practice how to use the items on the cart efficiently, it can be helpful for facilities to plan annual staff education to refresh their knowledge on MH and the procedures for recognizing and treating MH, and implementing a series of regular, planned mock “MH drills” that involves many health care team members. These drills enable all of the team members to practice providing the urgent care needed for a patient experiencing MH before an emergency arises.<sup>6</sup> Because it can be difficult to dilute Dantrolene, especially on the first attempt at doing so, all staff members should be given an opportunity to practice diluting Dantrolene by using outdated vials of the drug during an MH drill.<sup>6</sup> Staff members should check the MH cart routinely to remove expired supplies and replace them.<sup>1</sup>

The Malignant Hyperthermia Association of the United States (MHAUS) is an organization whose mission is to promote optimum care and scientific understanding of malignant hyperthermia and related disorders. MHAUS offers posters and wallet cards containing concise protocols that can be disseminated to staff or used during a drill or an educational session.<sup>1</sup>

The MH drill could mimic an MH crisis, which would require the staff to call the MH 24-hour hotline (emergencies only): 1-800-644-9737 (United States) or 00+1+303+389+1647 (outside the United States). Also, the drill could incorporate practicing the START emergency therapy for MH Acute Phase Treatment, as recommended by MHAUS.<sup>9</sup>

# MH Drill Protocols

**Get help. Get Dantrolene. Notify surgeon.**

**Inject Dantrolene sodium 2.5 milligrams/kilogram rapidly intravenously through a large-bore IV, if possible.**

**Provide a bicarbonate for metabolic acidosis.**

**Cool the patient.**

**Address dysrhythmias: usually respond to treatment of acidosis and hyperkalemia.**

**Address hyperkalemia.**

**Follow this testing sequence: ETOC2, electrolytes, blood gases, CK, serum myoglobin, core temperature, urine output and color, and coagulation studies.**

## Resources for patients and families affected by malignant hyperthermia

MHAUS has a variety of patient resources that can be accessed online or by attending a support group or meeting.<sup>11</sup> Patients and families who have faced malignant hyperthermia, or who may recently have learned that they carry the gene for MH may find helpful information through this organization<sup>6</sup> and by reading about and connecting with others who have experienced situations with MH. MHAUS manages a registry that keeps records of the family health histories and test results of patients with MH; the organization uses these data to conduct relevant research about malignant hyperthermia.<sup>11</sup>

Today's techno-savvy patients and family members are always looking for reliable sources of medical information online. To help these patients find the type of electronically engaging yet technically sound information they are seeking, nurses might want to suggest that patients and family members view the videos about MH that MHAUS has posted on its website.<sup>12</sup> By watching these videos, patients and their families will learn valuable information; also, it is interesting to note that MHAUS highlights the important role that nurses play in caring for patients with MH.<sup>12</sup>

### REFERENCES

1. Mitchell-Brown F. Malignant hyperthermia: turn down the heat. *Nursing* 2012;42(5):39-44.
2. Kaplow R. Care of postanesthesia patients. *Crit Care Nurse* 2010;30(1):60-62.
3. Malignant Hyperthermia Association of the United States. What is MH? [www.mhaus.org/mhaus-faqs-healthcare-professionals/what-is-malignant-hyperthermia/#.UBGhWTFS](http://www.mhaus.org/mhaus-faqs-healthcare-professionals/what-is-malignant-hyperthermia/#.UBGhWTFS). Accessed July 28, 2012.
4. Rosenberg H, Sambuughin N, Dirksen R. Malignant hyperthermia susceptibility. 2003 Dec 19 (updated 2010 Jan 19). In: Pagon RA, Bird TD, Dolan CR, et al., eds. *GeneReviews* [Internet]. Seattle: University of Washington; 1993-. <http://www.ncbi.nlm.nih.gov/books/NBK1146/>. Accessed July 27, 2012.
5. Medline Plus, U.S. National Library of Medicine, National Institutes of Health. Malignant hyperthermia. [www.nlm.nih.gov/medlineplus/ency/article/00135.htm](http://www.nlm.nih.gov/medlineplus/ency/article/00135.htm). Accessed July 27, 2012.
6. Greco RJ. Malignant hyperthermia: what are the first signs? *The ASF Source*; 2008;Summer:1,10.
7. Genetics Home Reference, a service of the U.S. National Library of Medicine. Malignant hyperthermia. [www.ghr.nlm.nih.gov/condition/malignant-hyperthermia/show/](http://www.ghr.nlm.nih.gov/condition/malignant-hyperthermia/show/). Accessed July 27, 2012.
8. Rosenberg H, Davis M, James D, Pollock N, Stowell K. Malignant hyperthermia. *Orphanet J Rare Dis* 2007;2(1):21.
9. Hutton D. Malignant hyperthermia: part 1. *Plast Surg Nurs* 2011;31(1):23-26.
10. Malignant Hyperthermia Association of the United States. Healthcare Professionals: During an MH Crisis. [www.mhaus.org/healthcare-professionals/#.UBS1EEShDkR](http://www.mhaus.org/healthcare-professionals/#.UBS1EEShDkR). Accessed July 28, 2012.
11. Malignant Hyperthermia Association of the United States. Patients and families. [www.mhaus.org/patients-and-families/#.UBLFqQRaPkR](http://www.mhaus.org/patients-and-families/#.UBLFqQRaPkR). Accessed July 27, 2012.
12. Malignant Hyperthermia Association of the United States. Videos. [www.mhaus.org/videos/#.UBS17UShDkQ](http://www.mhaus.org/videos/#.UBS17UShDkQ). Accessed July 28, 2012.