Malignant hyperthermia (MH) is an inherited disorder of skeletal muscle that is triggered by the potent inhalational anesthetic agents and succinylcholine. The triggering agents cause a disorder in the transport of calcium by skeletal muscle cells so that the muscle cells attempt to contract continuously. The continual muscle cell contraction causes, among other things, an extreme amount of heat to develop in the muscles. Death and serious morbidity from MH is caused primarily by the inability of a person to dissipate the extreme heat generated by the constant muscle contraction. In the last few years, there have been deaths from MH of young, healthy patients having elective surgical procedures at both hospitals and ASCs.

The key to preventing death and serious morbidity from MH at your ASC is to be prepared. If given early and in appropriate doses, dantrolene sodium can be used to treat and prevent the progression of MH.

At our ASC, we have an MH kit with drugs and supplies used to treat MH. We have annual drills to improve our competency in recognizing and treating MH. We have the MHAUS “Emergency Therapy for MH” poster in our ASC to guide us in treating MH appropriately. We are also aware that every patient who is presumptively diagnosed with MH at an ASC will require transfer to a Receiving Health Care Facility (RHCF) for continuing care.

By Keith Metz, MD
Dr. Metz is the medical director of Great Lakes Surgical Center in Southfield, Michigan. He is a member of the panel that developed the MH transfer guidelines and serves on the Board of the Ambulatory Surgery Foundation.

Keith Metz, MD, and Michael Policastro, MD, discussing the new MH patient transfer protocol at ASCs 2010.

The advice and opinions expressed in this article are solely those of the author and do not represent official ASC Association policy or opinion in any way.
Malignant Hypertension:
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To help ASCs prepare to transfer MH patients to an RHCF safely and expeditiously, “Transfer Plans for Suspected MH Patients” was developed. The new guidelines were developed jointly by the Ambulatory Surgery Foundation and the Malignant Hyperthermia Association of the United States (MHAUS). MHAUS is a not-for-profit organization dedicated to the control of MH and MH-like conditions. MHAUS developed and promulgated standardized treatment guidelines for MH patients. The association also funds and facilitates MH research and provides a 24/7 emergency expert consultation telephone service for acute MH emergencies (1-800-MH-HYPER).

“Transfer Plans for Suspected MH Patients” was developed over the last 12 months by a panel that included leading academic experts in MH, anesthesiologists, certified registered nurse anesthetists (CRNA), nurses, ASC administrators, emergency room (ER) physicians and emergency medical technicians (EMT) (see the box at right). The Ambulatory Surgery Foundation, MHAUS and the Society for Ambulatory Anesthesia (SAMBA) also provided input. After the initial guidelines were developed, public comment was solicited and reviewed. Revisions were made. After final legal review and approval, the final “Transfer Plans for Suspected MH Patients” was released in May 2010.

The greatest difficulty posed to the panel developing the transfer guidelines was the significant diversity in the several thousand ASCs in the US. Some ASCs can look across their parking lot at a tertiary care hospital; others are in remote locations hundreds of miles from a tertiary care facility. Some have sophisticated laboratories and treatment modalities available; others don’t. Some may have only one or two clinicians on-site; others may have dozens. No particular configuration of an ASC is better or worse. Each meets the needs of its particular patients and community safely and effectively.

The conclusion of the panel was that it is not possible to recommend specific guidelines that will serve the transfer needs of all ASCs. Instead, the panel recommended a list of potential clinical problems and therapeutic intervention capabilities for consideration during the transfer of an MH patient from an ASC to an RHCF. The panel members agreed that the specific characteristics of each patient and his or her needs should dictate care, choice of RHCF and transport decisions. Those decisions must be made by the clinicians on-site at each ASC, acting in the best interests of the patient.
RECOGNITION OF MH AND INITIAL TREATMENT

Any patient who receives any of the potent inhalational anesthetic agents (halothane, isoflurane, desflurane and sevoflurane) or succinylcholine can develop MH anytime during surgery or in an ASC’s post-anesthesia care unit (PACU). In most circumstances, patients with a personal history of MH should not receive care requiring triggering agents at an ASC.

Determining whether or not a patient is at risk for MH, however, can be difficult. A clear indicator would be that the patient has experienced MH in the past. But patients who have not experienced MH in the past, may be still be at risk. The most highly regarded medical test for MH requires a costly muscle biopsy that results in the patient’s relative disability for between two and seven days. MHAUS does not recommend that test as a screening tool for the general population. Instead, MHAUS recommends that, in most cases, evaluation of a patient’s susceptibility to MH depends on a careful review of both the patient’s and his or her family members’ medical history. In line with this recommendation, many ASCs ask their patients to indicate if anyone in their family has ever experienced serious complications or died during or immediately following surgery. If so, the ASCs then ask those patients to provide more information, including a more complete description of their family member’s surgical experience.

Usually, the patient who develops MH in your ASC will be a child or adolescent without any history of MH. It is mandatory to have trained anesthesia providers (anesthesiologists or CRNAs) on-site at your ASC whenever triggering anesthetic agents are used. Anesthesia providers are specifically trained to recognize and treat MH. They are likely to be the clinicians who recognize and make the presumptive diagnosis of MH, coordinate treatment at your ASC and facilitate transport to an RHCF.

If an anesthesia provider makes the presumptive diagnosis of MH at your ASC, it is an immediate, life-threatening emergency. Other clinical activities will need to be delayed until the MH patient is stabilized (ongoing procedures should be completed, but no additional procedures should be started until the MH patient is stabilized or transferred out of your facility). The anesthesia providers will immediately discontinue use of the triggering agents and begin treatment with dantrolene sodium. If you use any triggering agents in your ASC, you must stock at least 36 vials of dantrolene sodium in your ASC at all times. Treatment will be guided by the MHAUS “Emergency Therapy for MH” protocol. It will take most or all of your clinical personnel to treat the MH patient and facilitate his or her transfer to an RHCF. One person should immediately contact the MHAUS Hotline (1-800-MH-HYPER) for guidance. Another person should initiate an “Emergent MH Transfer Plan” for the patient.

TRANSFER CONSIDERATIONS AND CAPABILITIES

Every patient with a presumptive diagnosis of MH will require transfer to an RHCF with sophisticated diagnostic and therapeutic capabilities. Some of the capabilities required at the RHCF may include critical care for pediatrics or adults, mechanical ventilation, continuous temperature and cardiopulmonary monitoring, sophisticated laboratory studies, administration of therapeutic options and antidote, non-invasive or invasive cooling, continuous sedation and hemodialysis. An ASC should consider the availability of these capabilities at the RHCF. An ASC should also consider the availability of specialist consultant services at the RHCF, including anesthesia, critical care, hematology, surgery, nephrology, neurology and medical toxicology.

As mentioned previously, no one specific set of transfer guidelines would be sufficient at all ASCs. The most important consideration will always be the best interests of the patient. Decisions about what is in the best interest of the patient can only be made on-site by the clinicians treating the patient.

The clinicians caring for the MH patient must consider what is ideal and what is possible in determining the appropriate RHCF. The Centers for Medicare and Medicaid Services and various ASC accreditation organizations require every ASC to have a pre-existing transfer agreement in place with a local hospital. Surgeons may want the patient transferred to a facility where they have clinical privileges. They may also want to consider transferring the patient to a tertiary pediatric facility nearby. The clinician may or may not be able to select a specific RHCF for the transfer of an MH patient, even if that facility may be a more appropriate choice.

An ASC should also consider the capabilities of the Transport Team (TT) for an MH patient. Transport scenarios may include ground or air transport depending on the location of the ASC and the RHCF, the clinical situation and the anticipated transport time. Each state and most localities have different requirements for staff, training and equipment for an emergency TT. Some may use a public emergency medical service (EMS), while some may use a private EMS. Although users can assume that the members of the TT will provide skilled care, the specific skills and training of the team members will vary widely.

When possible, it is desirable that the TT have the following capabilities:

- ventilatory support
- cardiopulmonary and temperature monitoring
- fluid resuscitation
- medication administration capabilities that include IV dantrolene sodium
- non-depolarizing muscle relaxants
- sedatives/hypnotics
- analgesics/opioids
■ medications to treat hyperkalemia
■ advanced cardiac life support medications

It is also preferable that the TT is capable of communicating with the RHCF, the MHAUS Hotline or both.

The primary consideration in selecting a TT must be the best interest of the patient, as determined by the clinicians on-site at the ASC, as it was in the selection of the RHCF. Considerations such as mode of travel, skill of available providers, weather conditions, distance to the RHCF or special patient considerations may be relevant. Transport of the MH patient may require the ASC anesthesia staff to participate and, possibly, to accompany the patient during transport. Transfer should never be delayed pending specific personnel or equipment if, in the judgment of the on-site professionals, emergent transfer is mandatory.

**IMPLEMENTATION OF THE TRANSFER DECISION**

Decisions regarding the choice of TT and RHCF should be made by the clinicians on-site at the ASC. Likewise, the determination of the timing of transport must also be made by the clinicians caring for the patient. It is preferable that the patient not be transferred to an RHCF until he or she is stable. Some key indicators of stability include

■ ETCO2 declining or normal
■ heart rate stable or decreasing
■ no ominous cardiac dysrhythmias
■ IV dantrolene sodium administration has begun
■ temperature declining
■ any muscular rigidity is resolving

Transport time, weather conditions and bed availability at the RHCF and other factors may also be involved.

It will not always be possible for all of the indicators of stability to be present prior to transfer. In some circumstances, few or any of the indicators may be present. For a patient who is deteriorating rapidly, with a short transport time to a sophisticated facility that is prepared to care for him or her, transferring the patient immediately, rather than continuing stabilization at the ASC, may be the wisest course of action. The clinical judgment of the clinicians on-site of the best interests of the patient should always determine the appropriate transfer time and methodology.

**NOTIFICATION AND COMMUNICATION WITH THE RHCF**

Although some factors that are not under the direct control of the ASC are involved in caring for and transferring a MH patient, notification and effective communication with the RHCF is critical and possible. Direct personal communication between the clinicians at the ASC (usually the anesthesiologist) and physicians at the RHCF is strongly recommended. Depending on the best interests of the patient, the MH patient may be treated at the RHCF in the emer-

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gery room, a critical care area or a post-anesthesia care unit by an anesthesiologist. Wherever the MH patient is going to be treated at the RHCF, the ASC physicians should have direct personal communication with the RHCF physicians providing that treatment. The patient’s life may depend on it. The nursing staff caring for the MH patient should provide a clinical report on the patient to the staff at the RHCF that should include

- cardiovascular signs
- temperature monitoring and site
- minute ventilation with ETCO2
- electrolytes (if available)
- IV site
- amount of dantrolene sodium administered
- presence or absence of muscle rigidity
- presence of urinary catheter
- color of urine

HAVE A PLAN

The diagnosis of MH on a patient at your ASC will be life threatening, unexpected, challenging and disruptive to other activities at your ASC. It will never happen at a convenient time or with enough staff. The best thing that an ASC can do to prepare for MH is to plan ahead. You should already have the equipment, drugs and the MHAUS “Emergency Therapy for MH” plan at your ASC. You should have trained anesthesiology providers and staff who have participated in annual MH drills.

The time to consider and plan for the other contingencies is now—well before a patient experiences MH at your ASC. Ask yourself

- What is the best RHCF for an MH patient from your ASC?
- Is it different for an adult or child?
- Is it the same facility with which you have a transfer agreement?
- If you call for emergency transport who will show up?
- What skills, training and equipment will they have?
- Can you get someone else? How? When?

You will not have time to make these decisions once you make a presumptive diagnosis of MH on a patient at your ASC. You and your staff will be busy trying to save the life of the patient.

Now is the time to consider your options regarding the RHCF and the TT. Obtain a copy of “Transfer Plans for Suspected MH Patients” and review it. Make sure your anesthesia providers know what is expected of them in this emergency. Make sure that they are prepared to have direct personal communication with the physicians at the RHCF. Make sure that they are aware that they may be required to participate in the transfer. Patients with MH can be recognized and treated and often recover without any morbidity. To do so will require careful consideration of the best choices for patients at your ASC before any problems occur. Now is the time for those considerations.