Malignant Hyperthermia Association of the United States and the North American Malignant Hyperthermia Registry of MHAUS

Volume 22, Number 2
Spring 2004

The Communicator

New Genetic Test For Diagnosing Malignant Hyperthermia To Be Introduced

It is with great pleasure that MHAUS announces an agreement has been reached to work with the molecular genetic diagnostic testing laboratory at the University of Pittsburgh to introduce a clinical diagnostic test for malignant hyperthemia.

The MHAUS Board of Directors has been pursuing a genetic test for MH to help patients more easily identify their susceptibility and spent several months in 2003 looking for a laboratory that could assist in this endeavor.

"Not only is this laboratory experienced in clinical molecular genetic diagnostic testing," says Dr. Henry Rosenberg, President of MHAUS, "but the director, Jeffrey A. Kant, MD, PhD, is well known for his expertise and leadership in this area."

The lab currently tests for seventeen different disorders including a number which involve DNA sequencing. In addition, there is a superb center for genetic counseling (the Center for Clinical Genetics) at the University of Pittsburgh Medical Center.

"In a site visit that Sheila (Dr. Sheila Muldoon, MHAUS Vice President of Scientific Development) and I conducted, the Dean of the medical school, Dr. Arthur S. Levine, expressed his strong support," Dr. Rosenberg adds.

The next step in this project is to negotiate the details then continue the process of establishing the mutation panel that was agreed upon based on information produced at the September 2002 Genetics of MH meeting. (See *The Communicator*, Volume 21, Number 2, Spring 2003.)

Next, the biopsy center directors and Hotline Consultants will convene at the end of June with board members, the laboratory group, the MHAUS staff, as well as Professional Advisory Council members who have experience in this area, to discuss the mechanics of patient referral and genetic counseling.

At the meeting, the goal will be to work out a number of particulars, including how the inner workings will proceed, costs, legal issues and logistics of using the Web to input and access the data.

In an editorial in *Anesthesiology,* 2004; 100(2):212-214, coauthors Dr. Rosenberg, Dr. Muldoon and Dr. Thomas Nelson pointed out that the caffeine-halothane contracture test currently used to determine susceptibility has a high sensitivity and specificity. However, this test has many drawbacks including the fact that fresh muscle must be biopsied at one of only 6 centers in the United States. Therefore, a less-invasive, highly sensitive and specific diagnostic test has been sought for many years. Findings in recent years on the genetics front have bolstered hope that this goal might finally be in reach.

"I anticipate that molecular genetic testing for MH will assist many families in determining susceptibility to MH," Dr. Rosenberg adds. "The test will also help investigators understand which signs and symptoms result from MH and which are unrelated. This information will improve our understanding of the MH syndrome immensely. However, it is important to remember that this is a first step in formulating a highly accurate, universally applicable, minimally invasive test for MH susceptibility. MHAUS is prepared to do whatever is necessary to make that goal a reality."

In This Issue:

Genetics Lab Named	1
MH Awareness Month	2-3
One Family's Gift	4
Registry News	5
Award in New Zealand	6
New Sterile Water Info	7
Hotline Activity	8-10
Membership Info	11
Happenings	12

The Communicator is published four times each year by the Malignant Hyperthermia Association of the United States (MHAUS) and is made possible by a generous grant from Procter & Gamble Pharmaceuticals, manufacturers of Dantrium. *The Communicator* is intended to serve the information needs of MH-susceptible families, health care professionals, and others with an interest in MH.

EDITOR
Katherine O. Riess

Editorial Advisory Panel
Scott Schulman, M.D.
Henry Rosenberg, M.D.
Barbara Brandom, M.D.
Cynthia Wong, M.D.
Lena Sun, M.D.
Ronald J. Ziegler
Ingrid Skillings

FOR MHAUS
Henry Rosenberg, M.D.
President

Sheila Muldoon, M.D.
Vice President, Scientific Development

Stanley Caroff, M.D.
Vice President -- Director of NMSIS

Christina Duetsch, MS, RN, CS-P
Vice President -- Assoc. Dir. of NMSIS

Ingrid Skillings
Vice President -- Patient Affairs

Ronald J. Ziegler
Secretary

John L. Blair
Treasurer

Dianne Daugherty
Executive Director

Gloria Artist
Hotline Coordinator

Josephine Nichols
Business Manager

Cynthia L. Solyian
Administrative Coordinator

Fay Kellogg
Office Assistant

Malignant Hyperthermia (MH) is an inherited muscle disorder which, when triggered by potent inhalation anesthetics and succinylcholine, may cause a life-threatening crisis. The incidence of MH is low, but, if untreated, the mortality rate is high. Since the advent of the antidote drug, dantrolene sodium, and with greater awareness of the syndrome, the mortality rate has decreased.

Great advances in our understanding of MH have been made since it was first recognized in the early 1960s, but the nature of the fundamental defect(s) is still unknown.

MHAUS advocates that all surgical patients undergoing general anesthesia should receive continuous temperature monitoring, that adequate supplies of dantrolene be stocked near the OR and that thorough family histories be obtained.

Copyright 2004 by MHAUS

C.A.R.E.: Girl Scouts Project Makes a Difference One Bead At A Time

Projects both large and small are underway to raise public awareness of MH this Spring.

Publicist Al Rothstein and Patient Liaison Chair Ingrid Skillings sent letters to all the state governors to ask them to proclaim the month of March as MH Awareness month. As of press time, four states have made it official, 13 have said they will also follow suit.

In gearing up for a public awareness campaign in March, C.A.R.E. (Creating Art for Recognition and Education) was launched.

Troopmates Stacey Skillings and Laurel Anderson demonstrate their bead projects to promote awareness of MH.

C.A.R.E. was the brainchild of Stacey Megan Skillings, an MH-susceptible 11 year old from Eagan, Minnesota. Members of the Junior Girl Scout Troop 1713 from Eagan, Minnesota launched this campaign in November 2003 when they tackled their "A Healthier You" patch.

When Stacey, a member of Troop 1713, heard the troop needed to get involved on a national level, she discussed the options with her mom who contacted the office of the Malignant Hyperthermia Association of the United States.

Through the collaboration of MHAUS and Al Rothstein Media Services, it was determined that the girls had two options to help in the education of physicians and patients. The girls made get well cards and beaded items, which will be distributed through the office and biopsy centers to patients who have experienced the effects of an MH episode.

Stacey received news coverage from television and newspaper, spreading the word about MH. She also appeared on the morning news in Minneapolis with Hotline Consultant Dr. Kumar Belani. Most recently, Stacey's Letter to the Editor was published in January by the St. Paul, Minnesota Pioneer Press (see the side bar on page 3).

"Stacey's example has received media coverage in her hometown, and we would like

continued on next page...

The Malignant Hyperthermia Association of the United States is a not-for-profit organization dedicated to reducing the morbidity and mortality of malignant hyperthermia and other heat-related disorders by: improving medical care related to MH; providing support information for patients; and improving the scientific understanding and research related to MH and other kinds of heat-related syndromes.

For more information or for materials on malignant hyperthermia or MHAUS' programs, call 607-674-7901; write MHAUS, 11 East State St., PO Box 1069, Sherburne, NY 13460; or visit us on the Internet at www.mhaus.org.

adults and young people in other cities to get involved in making the beaded crafts," says Al Rothstein Media Services. "It is a focus of MH Awareness Month in March and a major step in educating the public."

Malignant Hyperthermia Awareness Month will educate those who may not know they are susceptible to MH about the signs and what to do about it. In order to have March declared "Malignant Hyperthermia Awareness Month" we are attempting to get a Governor's Proclamation in your state. We have already had success. Some states do require an in-state resident to apply and we will continue working with patients to get this done.

YOU TOO CAN HELP!

We are asking families of those who are MH susceptible to designate one night in March as a "crafts" night, in which children, teenagers, and even adults in those families create crafts like beaded bookmarks, key-chains and strands of DNA.

Ingrid Skillings and her daughter Stacey have created a simple "how-to" instruction kit. Al Rothstein will then also attempt to get the news media in your area to cover your crafts-making event, allowing you to tell the public why it is important to be aware of MH and what to do about it.

"Our goal is to get media coverage for those MH awareness efforts," Al says. "For those who don't want to have the craft parties, we are lining up media coverage for them to simply tell their stories and advise the public on the signs of MH, or maybe tell how a family member has had an unusual reaction to anesthesia and what to do about it."

You can then send your beaded items to the MHAUS office in Sherburne, NY, and they will be mailed all over the world, wherever the art is needed, to help spread the word of the organization's ability to educate both patients and physicians. MHAUS will also hand out these items at both the national and international meetings attended by representatives of the association.

For more information on how to get involved, please contact the office or visit the Web site where more info on this campaign will be available shortly. You may also contact Al Rothstein toll free at (866) 636-3342 or mhaus@rothsteinmedia.com.

Troop 1713 from Eagan, Minnesota. From left to right: Katie Peterson, Meghan Gloede, Alexa Rarick, Morgan Swalve, Jamie Baier, Lianne Garlough, Stacey Megan Skillings, Laurel Anderson, and Kristin Byrne.

The following Letter To The Editor was published in the South Suburban City Edition of the St. Paul Pioneer Press in Minnesota on Sunday, January 18, 2004 and is reprinted here with their kind permission.

Stay Healthy: Find Out If Someone You Know Has A Medical Reaction To Anesthesia

I am an 11-year-old girl who is lucky to live in the community of Eagan. That's because when people need help, my friends always seem to pitch in.

A few years ago, my brother almost died because he has Malignant Hyperthermia. It is not something that many people know about, but if you have it, you might be allergic to something called anesthesia. That means you could have a reaction if the doctor were operating on you, like my brother did.

I am lucky because recently my Girl Scout troop here in Eagan needed to earn a patch towards our Bronze Award, "A Healthier You." Luckily, I was hosting the meeting. It said the troop needed to help a health organization, then it popped into my head -- we would help MH. So it was decided that we would create bookmarks, bracelets, rings and DNA strands. I hope that if you have a family member who has had a bad reaction during an operation that you will find out if they might have MH.

I got tested and found out that I have it, too. At least now I know to tell my doctor and friends, so the same thing won't happen to somebody else. Please don't let it happen to you, either.

Stacey Megan Skillings
Eagan, Minnesota

One Mother's Gift To Us All

Every single month for the last nineteen years, Mrs. Anna Wolfenbarger has made a donation to MHAUS in memory of her son, the Reverend Floyd I. Wolfenbarger, who died during a malignant hyperthemia crisis in 1985.

"It's a faithful thing for me," she says, "to try and give the little bit I can."

It was May and Floyd went into the hospital in Little Rock, Arkansas, where he lived with his wife and daughter and was pastor of the Russellville Free Will Baptist Church. Scheduled for gastric bypass surgery, Floyd had no prior history of surgeries or anesthesia complications. He was 36 years old at the time.

Anna, who lives in western Ohio, received a phone call from Floyd's wife that he had come through the surgery and that he "was coming along fine."

About a week later, however, Floyd experienced strong pain in the night. He was still in the hospital recovering so his doctor took him back into surgery the next morning to determine the problem. The surgical team found a pinhole leaking infection near his surgery site. They fixed the hole and sent him on to the recovery room.

"Floyd's wife called me later that night and told me there was a problem," Anna recalls.

By 5 pm that night, Floyd had a temperature elevation that eventually climbed to 108°. The doctors administered two courses of dantrolene and used ice to try to bring Floyd's fever down, but the treatment was ineffective. He became semi-comatose and unresponsive. He died early the next morning at 7:42 am.

Anna knows the hospital did what it could, but continues to wonder in her heart if the outcome could have been different if the doctors had diagnosed the symptoms sooner.

They brought Floyd home to Ohio to bury him. Soon after, the family received word that MH had caused Floyd's death and a form to help them notify their relatives. Anna copied the form and sent it to everyone on both sides of the family. But as she and her husband thought more about it, they came to the conclusion that it probably came from her husband's side of the family since his sister had also died of similar complications during surgery and his younger brother had also had a probable episode.

"When we looked back at our family (history), it seemed as though it had to be related," she says. While most of their relatives had thought it was the gastric surgery that had taken Floyd's life, the family accepted the connection and have since all taken precautions when they need medical care.

One cousin needed breast surgery, she told her doctor's and they took precautions. And in 1990, Anna needed a heart bypass. She made sure her doctors and anesthesiologist knew ahead of time and they took precautions as well.

"They pre-dosed me with dantrolene," Anna says. "He told me it could take a little longer to come out of the anesthesia and that I might experience a small loss of memory, but I had no problems."

Her family finds that dentists are a little more reluctant to treat MH-susceptibles, but that the regular doctors seem to understand how to be prepared.

"One of my grandaughters was refused treatment (by a dentist) yet my daughter had her wisdom teeth removed with no problem." Anna feels that there doesn't need to be a problem for susceptibles as long as doctors, and dentists, know to do the right things.

At the time of Floyd's episode, Anna was working as a receptionist in a doctor's office. The doctor helped her get more information about the syndrome and put her in touch with

MHAUS recognizes the generous support of

Makers of

Dantrium® IV
(dantrolene sodium for injection)

To order Dantrium® IV, call 1-800-836-0658

MHAUS. She bought materials and gave them to her family members and their doctors to help them all better understand MH.

It was at this time Anna started her monthly contributions in Floyd's name.

"I try to send a little extra around Christmas and in February, Floyd's birthday month."

Most recently, she contacted MHAUS again for the latest information on MH and Pregnancy for her granddaughter who is expecting a baby.

Meanwhile, Floyd's daughter has grown up and is a mother of four. She had no complications. She, too, just talked with her doctors to let them know of her susceptibility and all is fine.

"I am just thankful," she says, "that doctors are aware of it, but I still read and hear about a lot of places that aren't aware."

When Anna passes away, she wants all her friends and family to make donations to MHAUS "so that this work can go on."

Her faith is an unwavering, empowering force that has kept her family strong and it is her faith that allows Anna to educate those around her about malignant hyperthermia.

"I just try and spread the word when the opportunity comes up."

We at MHAUS are grateful for caring people like Anna. Without such support, MHAUS would not be where it is today. Every gift counts and there is no gift that is too small. Thank you to all who have remembered MHAUS with their giving.

Looking for a way to make your gift last?

Lifetime Memberships to MHAUS are now available for a one-time cost of $500 or more. MHAUS Lifetime members receive a special membership card, no renewal notices, an uninterrupted subscription to *The Communicator*, and special acknowledgement in the MHAUS Contributor List each year.

An Update from the North American MH Registry

The North American Malignant Hyperthermia Registry is useful for investigation of clinical problems related to increased metabolism and muscle injury during anesthesia, as well as other problems that may be related to malignant hyperthermia susceptibility. Malignant Hyperthermia (MH) is a rare event. Therefore, when a serious metabolic or musculoskeletal complication that may be MH occurs, the Registry would like to record that event.

As part of the conversion to a platform that supports Web-based communication, the five Registry forms were redesigned. The Adverse Metabolic/Musculoskeletal Reaction to Anesthesia (AMRA) Report is the means by which this can be done. An AMRA is a confidential report of anesthesia complicated by hypercarbia, metabolic acidosis, fever and/or muscle injury.

In October 2003 the Registry database was exhibited at the American Association of Anesthesiologists yearly meeting.

Attendees at the meeting provided beta testing for data entry into the AMRA. Positive aspects were the use of buttons, the color of the format and the font of the text. A negative aspect was the length of the form. With uninterrupted attention and the information requested at hand, the AMRA can be filled out in 15 minutes.

It is difficult to condense the many questions that may arise in describing a case of MH. Three of the five forms are available for patients to describe their family history and anesthetic experience.

It is the plan of the Registry that patients and physicians will eventually be able to enter this information over the Web.

For more information on the North American Malignant Hyperthermia Registry and its activities, call 412-692-5260 or go online to www.mhaus.org.

Dr. Neil Pollock and New Zealand MH Research Team Win Award for Using Method Developed By Yoshi Sei

MHAUS congratulates the New Zealand research team headed by Dr. Neil Pollock for an award it received at the Australia and New Zealand Annual Scientific Meeting in Melbourne, Australia in October of 2003.

The prize was for best New Zealand Presentation for their presentation entitled "Genotype-Phenotype comparison of 5 New Zealand MH-susceptible families."

Dr. Pollock delivered the presentation at the anesthesia meeting. Coauthors were Dr. Aaron Fraser, Dr. Kathryn Stowell, Dr. Rosemary Brown, Brenda Belmont and Robyn Marston. Dr. Pollock described the method of determining functional abnormality in B-lymphocytes associated with a mutation as described by Dr. Yoshi Sei of the Uniformed Services University of the Health Sciences

Dr. Sei developed this method while working on a grant project through MHAUS.

Dr. Pollock reports that Dr. Stowell is utilizing this method at the local university in New Zealand and that they hope to demonstrate functional adnormalities in all the mutations identified in New Zealand.

In the abstract, the investigators said the genotype-phenotype concordance was investigated in 5 New Zealand MHS families with point mutations in *RYR*1.

The aim of the study was to compare DNA analysis with IVCT (*in vitro* contracture test) results in patients who had undergone both types of testing in New Zealand. Both IVCT and DNA testing was performed on 180 patients. Patients with an MHN result and a negative DNA test showed (89/89) concordance. A second group of twenty-two patients with an MHE (equivocal) result also had a negative DNA test, (22/22). In the third group only 51 out of 69 MHS patients had a positive DNA test. This meant there were 18 discordant individuals, all from one very large family.

Possible reasons for the discordance are incorrect sampling, inaccurate family line, or false positive test results but the majority had strong contractures ruling out the possibility of false positive results. Analysis for this is currently in progress.

From The Mailbag: One Patient's Story

From time to time, we receive letters from people who are grateful for the work MHAUS does. Below is an email from a patient about his family's experiences with MH.

Dear Folks,

I have to start by saying that visiting your site has given me more information in 10 minutes than in the 29 years since I tested positive for MH.

In the 1970s, my brother Terry, a then very fit British Royal Marine Commando, suffered an MH reaction which he ultimately survived after treatment guided by Professor Ellis. I believe Terry (may have been) the first survivor?

I was tested at Leeds by Professor Ellis in 1974. Since then, aware of the MH, I have had several knee operations with no problem. I have always been active (in) sports, soccer, rugby and cricket. And then in 1992 to keep fit, I took up cycling to work, about a 14-mile round trip daily. After a short break of 2 days from cycling, I was crippled by cramps in my thighs, which after a few days, subsided.

A few weeks later, after more cycling, I was admitted to hospital with severe muscle pain in my thighs. Although their was very little stiffness in my muscles, the pain was ghastly. My CK level was measured at >33,000 and a muscle biopsy revealed my quadriceps were "necrotic mush" according to my doctor. I was hospitalized for 3 weeks. I have since suffered bouts of cramps in many parts of my body. My underlying CK now runs at around 1000-2000 elevating when I go "belly up." The trigger for these episodes is difficult to pin-point.

I have just read your article in *The Communicator*, Volume 18 #3, Summer 2000 regarding exercise and MH with great interest and your message board has people similar to me…

Once again, many thanks for your website which I will visit again.

Tom Underwood, Fareham, Hampshire, United Kingdom

Consultants Discuss ISMP Advice Concerning Sterile Water

MHAUS sponsors a group discussion list that allows Hotline Consultants to review literature, highlight new findings, and keep in touch on other pertinent information as it relates to MH.

In November and December of 2003, a topic was raised that elicited many interesting suggestions - the danger of giving sterile water intravenously and how to avoid this.

Sterile water is often used in hospital pharmacies to prepare various intravenous (IV) infusions. Anesthesia care providers also use sterile water in their MH kits in the event they need to reconstitute dantrolene sodium.

But in some instances, these sterile water bags (which physically resemble the IV fluid bags) are finding their way into nurses supply cabinets and sometimes onto IV poles. If accidentally given intravenously, sterile water can cause hemolysis, a potentially dangerous condition where red blood cells are destroyed and can result in death.

The Institute for Safe Medical Practices, an organization that works closely with healthcare practitioners, institutions, regulatory agencies, professional organizations and the pharmaceutical industry to provide education about adverse drug events and their prevention, recommends that hospitals ensure that sterile water is not stocked or ordered in patient care areas without special precautions in order to avoid accidentally giving sterile water instead of IV fluids. Usually, Dextrose 5% in water or saline solutions containing sodium and chloride are used for IV solutions.

The clear fluid bags are easy to confuse, especially, the ISMP says, in an emergency situation. They suggest that 50mL vials of sterile water be stocked instead of clear bags in the MH kits to help avoid confusion and possible patient harm.

Dr. Cynthia Wong, a Hotline Consultant from the Northwestern University Feinberg School of Medicine, pointed out in one of the internet discussions on this topic that since the dantrolene requires 60 mL of sterile water to reconstitute, her hospital stocks 1 liter glass vials, which are highly unlikely to become confused with IV bags.

Dr. Michael Adragna, a Hotline Consultant from SUNY, Buffalo, suggested it would help if the sterile water bags were stocked in a different size than the IV fluids and were somehow set apart, perhaps by a colored wrapping.

Dr. Charles Watson, a Hotline Consultant from Bridgeport Hospital in Connecticut, made a compelling point in support of MHAUS advice - dedicate someone specifically to the task of mixing the dantrolene. If that person is prepared and knows their role, the risk for confusion is significantly reduced.

The ISMP has several suggestions to assist hospital staffs, including reminding staff members to not leave opened bags of inhalation water (water sometimes used in humidifiers to humidify gases coming from ventilators) in patient rooms.

For more information on this issue, visit www.ismp.org.

The Lila and Jerry Lewis Memorial Fund

There are many special people who take the time each year to remember their friends and family in a way that keeps MHAUS growing strong. The people below have made gifts during FY 03-04 in memory of Lila and Jerry Lewis. We are most grateful for their support.

Life Benefactors
Dr. Andrew S. Glassman
Marilyn Lewis Glassman
David & Dorothy Glassman
Gregory Lewis Glassman
Jacey Lila Glassman
Steve & Mickey Lewis
Dr. Joseph Sugerman
Bob & Dianne Winters

Sponsors
Gloria Leonard
Lenny Roberts
Mr & Mrs. Karl L. Sussman
Erven & Beatrice Tallman

Donors
Mr. & Mrs. Larry Bloomingfeld
Cindy & Jerry Kay
Sy & Estelle Opper
Mr. & Mrs. Steve Pollack
Bill & Linda Rouse
Stuart & Roberta Schoffman

Friends
Muriel & Mitzi Birnbaum
Mr. & Mrs. Doug Braun
Larry & Shelly Kozak
Dr. & Mrs. Jon Matthews
Lois Soter
George & Miriam Trustman
Mr. & Mrs. Ron Tucker
Jack & Toni White
Ken & Debbie Winters

Act Now! For A Limited Time Only! Until June 30, 2004, new and renewing MHAUS members at the $35 level or higher can receive a copy of the educational MH Grand Rounds Video (a $25 value) for FREE. Call the MHAUS office at 607-674-7901 today for more information!

MH Hotline Activity Summary For July-September 2003

During the months July through September of 2003, 11 Hotline Consultant anesthesiologists received 50 calls – 44 for patient consultations, six for questions or advice about following patients with suspected or proven malignant hyperthermia (MH).

Forty calls came from anesthesiologists, while the remainder of calls came from nurse anesthetists, intensive care physicians, a general surgery resident, a neurosurgeon, a gastroenterology physician, and a post-anesthesia care unit nurse.

No MH Deaths Reported In This Time Period

Twelve consultations involved probable or definite MH episodes. Three episodes involved possible MH. There were no documented deaths or serious sequelae in the patients with suspected MH.

Most of the calls (34) came in the postoperative period. In some, the caller asked for advice concerning appropriate follow-up management of patients with probable or definite MH.

Postoperative Fever & Sepsis

However, the majority of calls in the postoperative period involved patients with fever, but no other signs or symptoms of MH. Most of these patients had complex and severe medical or surgical conditions, and others had concomitant sepsis, a toxic condition resulting from the spread of bacteria into the bloodstream and internal organs. Yet, some were otherwise healthy children who had recently undergone minor surgery.

Although relatively common, postoperative fever (generally defined as a core body temperature greater than 37.5°C, or 100°F) in children is a consistent cause of concern. Surgeons worry about wound infections and anesthesiologists worry about postoperative signs of MH. The fact is, however, that postoperative fever is extremely common in children, and is rarely due to either wound infection or MH.

The precise cause of postoperative fever is unknown, but is theorized to be a transient adjustment of the body temperature "set-point" as a response to the surgical stress. An audit of 150 consecutive pediatric urologic patients revealed that 74% aged less than 1 year and 28% aged greater than 4 years exhibited postoperative fever, none of whom were otherwise clinically ill. Similar incidences have been reported in the pediatric orthopedic, plastic, and tonsillectomy populations.

A study that examined fever patterns in 150 children following inguinal hernia repair demonstrated that one-third of the children had a fever of greater than 37.5°C on the evening of the surgery. No studies in any particular surgical specialty indicate that fever is a marker of a serious clinical entity.

When asked to evaluate a child with postoperative fever, the health care practitioner should review the anesthetic and surgical events as a prelude to determining the cause.

Obvious signs of surgical infection (e.g., redness or discharge at the surgical site) should be sought. The child should be evaluated for concomitant upper respiratory tract illness or middle ear infection that may have been present preoperatively. Abnormal lung sounds should prompt investigation of possible bronchitis or pneumonia.

If the child is ill-appearing, intravenous fluids should be administered and the child evaluated for possible overnight hospital admission.

Very few cases of MH have been confirmed when the signs and symptoms began later than 2 hours postoperatively. One possible clue that a malignant hyperthermia episode might be occurring is if the child's breathing rate or depth is much higher than

continued...

MHAUS recognizes the generous support of

AstraZeneca
AstraZeneca
A Business Unit of Zeneca Inc.
1800 Concord Pike PO Box 15437
Wilmington DE 19850-5437

DIPRIVAN®
INJECTABLE EMULSION
propofol

In the U.S. and Canada, the MH Hotline is 1-800-MH-HYPER. Outside the U.S., call 1-315-464-7079.

expected for their clinical status. Some medical centers have the capability of measuring end-tidal CO_2 (the amount of exhaled carbon dioxide) noninvasively, and this should be obtained when available to alert the clinician of possible increased CO_2 production.

Myoglobin Can Provide Clue

Another clue to the possible existence of MH is the presence of cola-colored urine. A bedside urine test that is positive for blood may indicate either red cells or myoglobin. The urine should then be sent to the facility's laboratory where a technician can confirm the presence or absence of red blood cells. If red cells are absent the clinician should suspect the leakage of myoglobin, a muscle breakdown product, into the urine, which may herald the presence of MH-related muscle damage.

Arterial blood gas testing in the postoperative period is rarely necessary and should be reserved for those children where the clinician has a high index of suspicion of MH.

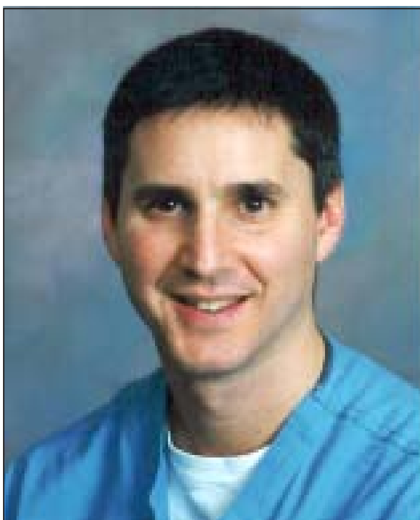
Ronald S. Litman, D.O.

Meet This Issue's Hotline Consultant

The Hotline Activity for this issue was summarized by Ronald S. Litman, D.O. Dr. Litman is Associate Professor of Anesthesiology and Pediatrics at the University of Pennsylvania School of Medicine and Attending Anesthesiologist at The Children's Hospital of Philadelphia in Philadelphia, Pennsylvania.

He joined MHAUS as a Hotline Consultant approximately two years ago.

"It's very rewarding to help other doctors and the patients they are caring for," he says of his work with the Hotline. "Plus, I've become my department's Hotline Consultant and the manager of our MH cart. I've learned a great deal about MH and related disorders since I became a consultant."



Dr. Litman lives with his wife Ruth, their twin sons Alan and Cory and their yellow lab Zoe.

In his spare time, he likes to play squash in the winter and tennis in the summer.

Some Helpful Terms

Creatine kinase

An enzyme found in cells, especially muscle cells. Normal levels are up to about 200iu/L. In cases of muscle membrane breakdown, the enzyme leaks out of the cell. This may occur from any type of muscle trauma, including MH.

After surgery, CK levels may normally rise from 1,000 to 2,000IU/L. When there is severe muscle damage, the level may rise to 10,000 or more. At these levels, the muscle pigment, myoglobin, can be expected to be elevated in the blood as a result of muscle damage. In other words, elevated CK is a marker for leakage of myoglobin from the cell. Elevated levels of myoglobin can lead to temporary or permanent kidney damage.

After an episode of MH, the CK levels may be mildly or dramatically elevated depending in part on the promptness of treatment. In general, peak levels of CK occur about 24 hours after injury and may be elevated for days. Hence in suspected cases of MH, it is important to determine CK levels.

In case of heart muscle damage, CK may be elevated, but this represents a slightly different form of CK. CK from regular muscle is termed CK MM, from heart muscle, CK-MB

Carbon dioxide

Carbon dioxide is a normal by product of respiration and metabolism. The more rapid the metabolism, the more $C0_2$ is produced in a given time. An increase of metabolism may occur from any cause of elevated body temperature, from certain medications and as a consequence of MH.

$C0_2$ levels are measured routinely during anesthesia by measuring the concentration in the exhaled gases. This is usually referred to as end-tidal

continued on next page

more MH-related terms...

CO_2 (i.e. occurring at the end of breath). Normal end-tidal carbon dioxide level is 40mmHg, but changes of CO_2 may also occur from increasing or decreasing ventilation.

Oxygen saturation
The main purpose of the blood is to carry oxygen to the various parts of the body along with nutrients and to remove carbon dioxide and other byproducts of metabolism. The amount of oxygen in a given quantity of blood is not easy to measure, however the saturation level of the hemoglobin in the blood that carries the oxygen can easily be measured with an external probe attached to a "pulse oximeter." Normal oxygen saturation is above 98%. At levels below about 90%, insufficient oxygen is delivered to the blood which may lead to many problems.

Rhabdomyolysis
When muscle is damaged and cells are disrupted, the intracellular constituents begin to leak into the blood stream. This includes creatine kinase, myoglobin and the electrolyte potassium. This is termed rhabdomyolysis. This breakdown may be manifested by muscle pain and in extreme cases dark or cola-colored urine.

Muscle relaxants
These are drugs that are more properly termed paralyzing agents. There are two classes of muscle relaxants, non-depolarizing and depolarizing agents based on their mode of action. Typical non-depolarizing agents are vecuronium, pancuronium and rocuronium. None are triggers of MH.

However, the one depolarizing agent, succinylcholine is a potent trigger of MH. These agents are administered intravenously and are therefore given by anesthesiologists, emergency room physicians and intensive care physicians

Reversal agents
There are several drugs that can antagonize or "reverse" the effects of other drugs. The drug, Narcan, or naloxone reversed the effect of narcotics (including the analgesia from these agents). Some drugs, neostigmine and pyridostigmine and edrophonium, reverse the effects of the non-depolarizing muscle paralyzing drugs.

General anesthetics
Compounds that produce loss of consciousness, pain relief and amnesia. General anesthetics are either gaseous agents such as halothane, sevoflurane, desflurane (all triggers of MH). Nitrous oxide is often used as an adjunct to these agents. It is not a complete anesthetic, and also not an MH trigger.

There are a variety of agents that are given intravenously that also may produce anesthesia such as the barbiturates (e.g. thiopental), propofol, and ketamine. None are MH triggers.

A variety of other agents are often used during anesthesia such as the narcotics, benzodiazepines (e.g. Valium and Versed) which produce pain relief and sedation.

MH triggers
These are drugs that will lead to the onset of MH. These include all the potent gas anesthetics and succinylcholine.

Local anesthetics
These compounds block transmission of nerve impulses involved in pain sensation. These are the "caine" drugs- novocaine, bupivicaine, lidocaine, mepivicaine. None trigger MH and are safe to use in the MH susceptibles. These drugs are commonly used by dentists, anesthesiologists, pain physicians and surgeons.

Molecular genetics
Genetics is the study of inheritance. Molecular genetics is the study of how changes in DNA structure, such as mutations, affect the function of the genes. Molecular, because the study of DNA entails understanding of molecular or submicroscopic changes

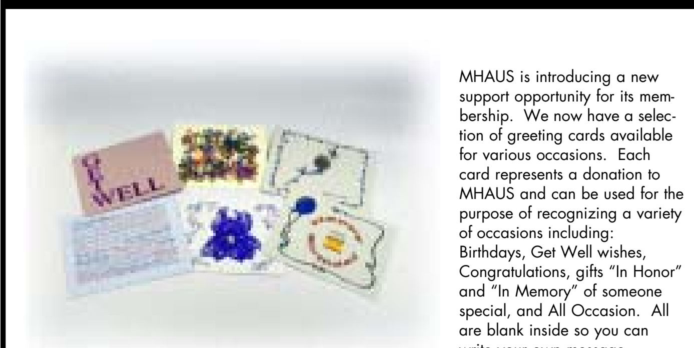
Neurolept malignant syndrome
This is a constellation of signs and symptoms marked by high fever, muscle breakdown, acidosis, muscle rigidity and other signs similar to MH.

However, the syndrome is induced by drugs used in the treatment of major psychiatric disorders. These drugs include thorazine, haloperidol (Haldol), olanzapine and other potent antipsychotic agents.

The syndrome is not inherited and does not predispose to MH. That is, there is no greater frequency of MH in those experiencing NMS nor vice versa. Interestingly, dantrolene is effective in treating NMS. There is no diagnostic test specific for NMS susceptibility.

NEW PROGRAM!

ASSORTED GREETING CARDS



MHAUS is introducing a new support opportunity for its membership. We now have a selection of greeting cards available for various occasions. Each card represents a donation to MHAUS and can be used for the purpose of recognizing a variety of occasions including: Birthdays, Get Well wishes, Congratulations, gifts "In Honor" and "In Memory" of someone special, and All Occasion. All are blank inside so you can write your own message.

The cards can be ordered individually or in a set of 6. The recommended donation is:
$5.00 each for the large cards *(birthday, congratulations and all occasion)*
$3.00 each for the small cards *(get well, In Memory and In Honor of)*
$15.00 for the Sampler Package of 6 cards *(one of each card)*

Description	Size	Cost	Description	Size	Cost
Birthday Card	Large	$5.00	Get Well Card	Invitation size	$3.00
All Occasion Card	Large	$5.00	Gift In Honor of Card	Invitation size	$3.00
Congratulations Card	Large	$5.00	Gift In Memory of Card	Invitation size	$3.00

Combination Package (*1 each of 6 styles*)......$15.00

To order a supply of these cards or for additional information, please contact the MHAUS office:
MHAUS • 11 East State St., PO Box 1069 • Sherburne NY 13460
607 674-7901 • fx 607 674-7910
E-mail: info@mhaus.org • www.mhaus.org

MHAUS accepts payment via credit card, purchase order or check. • Please allow 2-4 weeks for delivery.

For more information, please contact:
Malignant Hyperthermia Association of the United States
11 East State Street • P.O. Box 1069 • Sherburne, NY 13460
Phone: 607-674-7901 • **Web site: www.mhaus.org**

Slide Show or CD-ROM Version of MH Risk Presentation Available

MHAUS offers a Slide Show, or CD-ROM format, with lecture notes on "Managing Malignant Hyperthermia Risk in Today's Surgical Environment." This presentation reviews the risk of MH and assesses current trends in the management of MH in the inpatient and outpatient settings.

This is a valuable tool to assist in developing standard of care practice guidelines and algorithms to ensure patients at risk will have access to appropriate interventions for treating MH. This program is arranged so that it can also be used as a self-study program to enhance individual knowledge of MH and the risks involved. Two CMEs are available.

Cost is $125 plus $5 for shipping and handling for either the slides or the CD. For both formats, the cost is $135 plus $5 for shipping and handling. Call 607-674-7901 or visit www.mhaus.org to order.

Every MH-Susceptible Should Wear a Medical ID Tag

MHAUS now has help available for the MH-susceptibles who have no insurance, or cannot afford to purchase a medical ID Tag.

The **Sandi Ida Glickstein Fund** was recently established for the purpose of providing free ID Tags for MH-susceptible patients who qualify.

To take advantage of this program, please send us a letter indicating why you would like MHAUS to provide you with a complimentary ID Tag.

The goal of the free ID Tag program is to ensure the safety of all MH-susceptibles during an emergency situtation and to prevent a tragic outcome from MH.

For further information, please contact MHAUS at 11 East State Street, P.O. Box 1069, Sherburne, N.Y. 13460-1069; call 607-674-7901, or visit www.mhaus.org.

Have you visited us lately? Log on to www.mhaus.org and get the latest information on MH, post a note to the message board, order a new program, or just let us know what you think.

Yes! *I want to support MHAUS in its campaign to prevent MH tragedies through better understanding, information and awareness.*

A contribution of: ❑ $35 (Basic) ❑ $50 ❑ $75 ❑ $150 ❑ $250 ❑ $500 (President's Ambassador)
or ❑ (other amount) $ __________ , will help MHAUS serve the entire MH community.

Please print clearly:
Name: ____________________
Address: ____________________
City: __________ State: __________ Zip: __________
Phone: __________ E-mail: __________

❑ I am MH Susceptible ❑ I am a Medical Professional

Please charge my ❑ Visa ❑ Mastercard ❑ Discover ❑ American Express
Name on card: ____________________
Credit Card Number: ____________________
Expiration Date: ____________________

Please clip out this handy coupon or feel free to photocopy if you prefer to keep your issue intact, then mail to: MHAUS, PO Box 1069, Sherburne, NY 13460-1069

MHAUS Happenings, Events, and Notices

Carry the card that cares

Thank you to our many members who are already using the MHAUS affinity credit card offered by MBNA, the only bank whose core business is affinity marketing. This support program, initiated in 1998, provides one more way for our members to help benefit MHAUS while receiving benefits themselves. MHAUS receives royalties from retail transactions.

Through a mutual agreement, MHAUS sends MBNA a random list of names and addresses (no other information is released) for the sole purpose of mailing an invitational letter offering the program. MHAUS does not sell addresses to MBNA nor are any names/addresses released when a member requests us not to do so, and all letters are approved by MHAUS.

Our goal is to provide a credit card program superior to existing premium cards that benefits you. With every purchase, your benefits include the earning of rewards that will give you the flexiblity of selecting travel rewards or merchandise, all in one program. The rewards earn miles toward travel worldwide with no blackout dates. There is no annual fee. The credit line is available up to $100,000 with an introductory 0% APR for one year. Additional benefits are outlined in the letter.

If you have not already received an offer through a special mailing from MBNA, watch for the next invitation to arrive. Or, we would be happy to assist you from the MHAUS office. We invite you to consider participating in this program which benefits all concerned.

❑ **MH now in Espanol!** In order to assist Spanish speaking patients and medical professionals, MHAUS has begun to translate its materials into Spanish. Three brochures, "Drugs, Equipment and Dantrolene," "What Is MH," and "What Is MHAUS?" are available both through the office at 607-674-7901 and online at www.mhaus.org. More translated materials, including Spanish versions of the training manuals, will be available soon so keep checking the Web site for updates.

❑ **THANKS!** MHAUS is grateful for the financial support of the following State Societies of Anesthesiology: **Arkansas, Connecticut, Florida, Idaho, Indiana, Maine, Michigan, New Hampshire,** and **Pennsylvania**. Our grateful appreciation is also expressed to the following state components of the American Society of PeriAnesthesia Nurses: **Arkansas, California, Hawaii, Missouri-Kansas, Nevada, Tennessee, Texas** and **Wisconsin**.

Call the MHAUS office today to find out how your group can help.

❑ **MHAUS exhibited at the Society of Critical Care Medicine** meeting in mid-February in Orlando, Florida. The estimated attendance was more than 5,000. Many of the attendees who visited the MHAUS booth were not aware that our organization even existed and not only had questions about MH treatment and the MH protocol, but were also very interested in information about how to recognize and properly treat neuromalignant syndrome (NMS).

The attendees included physicians, ER physicians, nurses, respiratory therapists, pharmacists and anesthesiologists who were offered educational materials and given Hotline stickers.

"All in all," says Executive Director Dianne Daugherty of the event, "we made the most of this chance to develop a dialogue with an additional specialty area."

MHAUS
11 East State Street
P.O. Box 1069
Sherburne, NY 13460-1069
www.mhaus.org

NONPROFIT
US POSTAGE PAID
PERMIT #10
SHERBURNE, NY 13460