MALIGNANT HYPERTHERMIA: MOCK DRILL EXPERIENCE

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Learning Objectives

- Define Malignant Hyperthermia (MH)
- List the signs and symptoms of MH
- Describe the diagnosis and treatment of MH
- Describe the role of perioperative team members in a MH crisis
- Identify professional resources for MH patients and healthcare providers

Average 10.3 years operating room (OR) experience

Patient Scenario

Imagine that you are a surgical team member assessing your first patient of the day. You help the patient to the OR and onto the table. Standard monitors are applied, and you note that this is the 20-year-old patient's first surgery. He receives routine induction medications and intubation is uneventful. The patient is placed on air and oxygen at 50% flow for each, with an inhalational agent. Within minutes, the anesthesia provider notes muscle rigidity in the patient and an increase in exhaled carbon dioxide, heart rate, and blood pressure. The provider suspects malignant hyperthermia. As a vital part of the team, what will you do to help? What is the best plan of action? How can you help save this patient's life?

Mock Drill

- Staff attended a pre-drill information meeting
- MHAUS video shown
- Pre-test
- Q&A session
- 1 week later, staff attended a slide lecture and performed a bedside drill with the MH cart in PACU

Staff Comments Prior To MH Drill

- What's my role?
- Thought it was in the Omnicell
- How do I mix it?
- It's not premixed?
- Lost, clueless, and incompetent!
- Everyone was "very worried" (including 2 MDs and 2 CRNAs)

Malignant Hyperthermia - Characteristics

- An inherited disorder of skeletal muscle triggered in most instances by inhalation agents and/or succinylcholine, resulting in hypermetabolism, skeletal muscle damage, hyperthermia, and death if untreated.
- Underlying physiologic mechanism – abnormal handling of intracellular calcium levels

Source: Malignant Hyperthermia Association of the United States www.mhaus.org

Clinical Signs of MH

- Muscle rigidity (Masseter's sign)
- Increased CO2 production
- Rhabdomyolysis
- Marked temperature elevation
- Tachycardia
- Tachypnea
- Acidosis (respiratory/metabolic)
- Hyperkalemia

Treatment/Management of MH

- Discontinue inhalation agents, succinylcholine
- Hyperventilate with 100% 0xygen
- Bicarbonate 1-2mg/kg as needed
- Summon additional staff
- Contact MH hotline
- Dantrolene 2.5mg/kg push
- Cool patient: gastric lavage, surface, wound
- Treat arrhythmias
- Blood gases, electrolytes, coagulation studies

Treatment/Management (cont'd)

After crisis is controlled:

- Dantrolene 1mg/kg every 4-6 hours for 24-48hrs
- Closely monitor for return of symptoms
- Follow electrolytes, blood gases, CK, core temp, urine output/color, coagulation studies
- Monitor for signs of myoglobinuria and rhabdomyolysis and begin treatments to prevent renal failure

Doctors Memorial MH Preparedness

- Recommendation to purchase a dedicated MH cart made by safety team during annual review
- Skeptical of the necessity of moving
- Dantrium, sterile water in bottom drawer of crash cart (prior year's recommendations to standardize crash carts was accepted)
- No supplies in cart, only dantrolene and sterile water

Discovered During Mock Drill

- Added insulin to OR refrigerator
- Blood draw equipment
- Changed “slip tip” syringes to luer-lock
- Added ice packs
- Added supply of insulin syringes
- Patient care ice machines offer a limited supply
- Need a portable phone in PACU area
- Need accepting hospital’s phone numbers on cart

Post-Drill Comments

- Transfer procedure severely lacking
- Fluid dates
- “Opening the cart really opened the conversation”
- “More practical”
- Ice machine?
- Portable phone
- Don’t send back expired product!
- **Assign responsibilities**

Pre/post Evaluations

- Continuing education test used as a pre-test to assess knowledge and pique interest
- Pre-test average: 55%
- Post-test average: 91%

Staff Assignments

- MHAUS Mock drill kit contains 12 assignment cards
- DMH reduced assignments to 4
- Circulating nurse
- Dantrolene nurse
- Medication nurse
- Cooling nurse

Circulating Nurse

- Calls for help (911 & MHAUS hotline)
- Notifies other anesthesia providers
- Assists surgeon to close/pack for transfer
- Delegates

Dantrolene Nurse

- Obtain MH and/or crash cart
- Start mixing dantrolene
- Organize your assistants
- Organize empty vials to accurately record dose
- Send dantrolene vials with patient during transfer

Dantrolene Facts

- Dantrolene (Dantrium©, Revonto©) acts directly on skeletal muscle, suppressing the release of calcium ion from the sarcoplasmic reticulum that activates the catabolic processes associated with MH
- Ryanodex© - a unique injectable formulation of dantrolene sodium that reduces the time to administer a therapeutic dose (www.ryanodex.com)
- Each facility should have 36 vials on hand (treatment may continue up to 36 hours after crisis) with accompanying supply of preservative-free sterile water
- 60mL sterile water per vial
- Shake until clear: 2–4 minutes
- Rapid IV push once diluted
- 2.5mg/kg initial dose

Medication Nurse

- Focuses on assisting anesthesia provider in treating hyperkalemia, acidosis, arrhythmias
- Be prepared to give:
  - Sodium Bicarbonate
  - Dextrose
  - Calcium chloride
  - Regular insulin
  - Lidocaine
  - Amiodarone

Medication Nurse (cont'd)

- Record keeper
  - Focus on:
    - Time medications are administered
    - Dose
    - Patient response
    - Nursing interventions
    - Cooling measures

Cooling Nurse

- Discontinue warming blanket
- Retrieve esophageal temp probe and provide to anesthesia
- gather cooling supplies
- Retrieve supply of ice/delegate
- Cold IV fluids
- Cool patient skin surfaces by applying ice packs to groin, axillae and head
- Be prepared to lavage stomach, bladder, and rectum with cold saline
- Provide cold sterile saline for lavage of open cavity if requested by surgeon

What's My Job?

- All four are important and stressful
- Trust your team
- Be familiar with all four assignments
- Employees recruited from ancillary departments work directly under one of the designated nurse positions

Transfer Protocol

- At the discretion of anesthesia provider
- Signs of stability:
  - EtCO2 is declining
  - Stable heart rate/no dysrhythmias
  - Dantrolene administration in progress
  - Temperature normal or consistently declining
  - Muscle rigidity resolving

DMH CART CONTENTS

MH Prep: Medications

- Dantrolene – 36 vials (20mg each)
- Sterile water (preservative free – 36vials x 50mL)
- Sodium Bicarb 8.4% (50mL x 5)
- Regular Insulin
- Dextrose 50% (50mL x 2)
- Calcium Chloride 10% - 2 PFS
- Lidocaine 2% - 3 PFS
- Amiodarone 150mg – 2 vials

Auxiliary Medications

Dantrolene Drawer

MH Prep: Supplies

- 60 mL syringes
- Temp probes
- 3 liters of cold IV fluids

Supply Drawers

MH Prep: Equipment

- 60mL syringes x 5
- IV catheters
- NG tubes (appropriate for patient population)
- Toomy irrigation syringes (60mL x 2) for NG irrigation
- Core temp probe
- CVP kits
- Transducer kits for arterial and central venous cannulation

MH Prep: Nursing Supplies

- 3000mL cold saline
- Sterile drape (for rapid drape of wound)
- Urine meter
- Irrigation tray with piston syringe
- Bags for ice
- Urine analysis strips
- 3mL syringes/blood tubes for lab analysis

Staff Resources

- Malignant Hyperthermia association of the United States (MHAUS)
- Not-for-profit organization of over 2,000 members (MH susceptible patients and their families, medical professionals, corporations)
- Mission – to promote optimum care and scientific understanding of MH and related disorders
- 1-800-644-9737 or 1-800-MH-Hyper
- www.mhaus.org

Questions?