Summary of case

A 21-year-old athletic male is currently in the operating room for appendectomy after 2 days of nausea, vomiting and abdominal pain. The patient develops Malignant Hyperthermia (MH) after the start of surgery. End point is patient recovery following cooling measures and administration of Dantrolene.

Progressive Complexity

- Patient has significant cardiac arrhythmias and/or cardiac arrest
- Patient has difficult airway
- Facility depletes stock of Dantrolene

Potential Systems Explored

- Activation of emergency response system
- Accessibility of MH supplies
- Implementation of MH protocol
- Communication between surgery, nursing, and anesthesia

Length

20-25 minutes

Target group

- Multidisciplinary OR team
- Anesthesia Provider (MD and/or CRNA)
- Surgeon
- Surgical Assistant
- Circulating Nurse
- Scrub Tech
- Additional team members: 2nd RN/anesthesia provider to mix Dantrolene; 3rd RN from PACU; Anesthesia Tech; OR Tech/Runner; RT
# Learning Objectives

## General Learning Objectives

- Communicate effectively with patient/family
- Communicate effectively with team using crisis resource management skills
- Demonstrate safety initiatives including medication safety practices
- Demonstrate safety initiatives including workplace safety practices
- Maintain infection control standards

## Scenario Specific Objectives

- Recognize the onset and trigger agents of MH symptoms
- Prioritize care for patient with MH
- Demonstrate proper interventions for treating MH
- Document interventions

## Debriefing Overview

- Review learning objectives
- Review teamwork skills
- Review management of the patient with malignant hypothermia
- Review communication skills including use of SBAR
- What went well?
- What might have been done differently/better?
- Share key assessments and interventions/events
- What was learned that can be taken back to the real workplace?
LEARNER PREPARATION

Pre-session activity

- Review MHAUS website http://about.mhaus.org
- Review MH policy and procedure
- View AORN Malignant Hyperthermia video

Additional Information, Medical History

- Allergies: PCN-anaphylaxis
- Medications: Albuterol prn
- Wt: 70 kg; 154 lbs
- Past Medical History: exercised induced asthma
- Past Surgical History: None
- VS: HR 78; RR 24: BP 115/70; T 37.2 (99F)
- Glucose: 92
- UA: normal
- Electrolytes: normal
- Hgb 14.5
- Hct 42
- WBC: 20.6
- Neutrophils 77.9
- Bands
- Lymphocytes 14.9
- Monocytes 6.7
- Eosinophils 0.3
- Basophils 0.2
- RBCs 4.74
- MCV 88.6
- MCH 30.6
- MCHC 34.5
- RDW 12.9
- Platelets 298,000
- CT of Abdomen and Pelvis with Contrast
- Comparison: None
- Impression: Mildly enlarged right lower quadrant appendix measuring up to 8 mm in diameter with associated enhancement of the appendiceal wall and mild periappendiceal fat stranding, suggestive of early acute appendicitis. There is no evidence of perforation on CT.
- Blood type: O negative

Briefing (patient story)

A 21-year-old male is in the OR for laparoscopic appendectomy. He has had nausea, vomiting and right lower quadrant pain for the past 2 days. Consents have been signed and operative site is initialed by RN, patient and surgeon. Please begin your final verification.
EQUIPMENT PREPARATION

**Equipment**
- MH cart
- Crash cart
- Intubation equipment
- IV fluids/IVPB fluids
- IV supplies
- Desflurane/anesthesia gas
- Arterial line supplies
- Temperature monitor
- Ice
- Cooling blanket
- Saline lavage solution
- Urinary catheter

**Medications**
- Benzodiazepine
- Non-depolarizing agent
- Depolarizing agent
- Anesthesia Induction Agent
- Narcotic (Fentanyl)
- Desflurane/anesthesia gas
- Dantrolene and mixing solution
- Antibiotic

**Room Preparation**
- OR
- Set up for laparoscopic appendectomy

**Simulator Preparation**
- SimMan dressed in hospital gown, ID band and allergy band on
- Surgical site initialed by patient and surgeon
- IVLR in right arm at 125 ml/hr
- IVPB with antibiotic infusing
- Sequential stockings
- ASA standard monitors
### Events / Proposed Correct Treatment

- **MH treatment**
  - Declare MH emergency
  - Turn off all anesthetic agents and N2O and give 100% O2
  - Assign 2 or more individuals to mix Dantrolene
  - Dantrolene 2.5 mg/kg (each vial contains 20 mg of Dantrolene and 3 g Mannitol – the vial must be mixed with 60 ml of sterile water – can give up to 10 mg/kg Dantrolene)
  - Initiate cooling measures (stop cooling measures when core temp is 38° C)
  - Administer HCO3 1-2 mEq/kg initially, then guided by ABG
  - Correct hyperkalemia
  - Treat myocardial arrhythmias
  - Force diuresis if evidence of decreased urine output or myoglobinuria (Mannitol/Furosemide/↑ IV fluids)

- **Perioperative Safety Initiatives**
  - Demonstrate perioperative safety initiatives
  - Communicate effectively with patient
  - Communicate effectively with team
  - Call for help
  - Request MH cart/kit

- **MH Documentation**
  - Electronic Patient Record

- **MH Induction**
  - Benzodiazepine
  - Anesthesia induction agent
  - Narcotic (Fentanyl)
  - Non-depolarizing agent
  - Depolarizing agent
  - Desflurane/anesthesia gas

- **Provide Cooling Measures**
  - Cooling blanket
  - Ice packs
  - Insert NG tube
  - Cold saline lavage
  - Obtain 2nd IV
  - Insert urinary catheter
  - Insert arterial line

- **Call for ICU bed**
**PERIOPERATIVE SCENARIO 4**

**Malignant Hyperthermia**

**Algorithm**

Start:
- HR 78
- RR 24
- BP 115/70
- T 37.2 (99)
- SpO2 99%

**Expected Pathway**

Demonstrate perioperative safety initiatives
Induction/Intubation

Trend over 5 minutes
- HR 110
- RR 14 per ventilator
- B 128/80
- T 38.6 (101.8)
- ETCO2 ↑ 60 and climbing

**Correct Interventions**

- Trend over 5 minutes
  - HR ↓ 96
  - RR managed by anesthesia provider
  - BP ↓ 20/78
  - T ↓ 37.8 (100.2)
  - ETCO2 maintain in 60's once
  - Dantrolene is being given

- Obtain 2nd IV
- Insert urinary catheter
- Insert arterial line
- Dantrolene 2.5mg/kg
- Get labs and ABG and check serum K+

**Delayed/Incorrect Interventions**

- Trend over 5 minutes
  - HR 120
  - RR managed by anesthesia provider
  - BP ↑ 130/86
  - T ↑ 39.2 (102.6)
  - ETCO2 ↑ 80

- Identify change in status
- Stop surgery as soon as feasible
- Call for help and MH cart/kit
- Turn off all anesthetic agents and N2O/give 100% O2
- Cooling measures

**Trend over 5 minutes**

- HR 80
- RR 14 per ventilator
- BP 120/70
- T 37 (98.6)
- ETCO2 drops to 45

**CORRECT INTERVENTIONS**

- Trend over 5 minutes
  - HR ↓ 80
  - RR 14 per ventilator
  - BP ↓ 120/70
  - T ↓ 37 (98.6)
  - ETCO2 drops to 45

**DELAYED/INCORRECT INTERVENTIONS**

- Trend over 5 minutes
  - HR ↓ 120
  - RR 14 per ventilator
  - BP ↓ 120/70
  - T ↑ 37 (98.6)
  - ETCO2 ↓ 80

- Identify change in status
- Stop surgery
- Asystole

- CORRECT INTERVENTIONS
  - Within 5 minutes

- DELAYED/INCORRECT INTERVENTIONS
  - Within 7 minutes