

SPA Peds crisis checklist scenario – Malignant Hyperthermia

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Scenario Overview

Name of Scenario: A 7 year old undergoing laparoscopic appendectomy who presents with continually increasing end-tidal carbon dioxide shortly after insufflation of the abdomen.

Learning Objectives of Scenario:

Cognitive:

1. Describe the differential diagnosis when a child presents with increasing end-tidal CO₂ during a laparoscopic appendectomy
2. Describe the management of malignant hyperthermia
3. Identify the clinical features of malignant hyperthermia
4. Discuss the management of the patient after successful treatment for malignant hyperthermia

Technical:

1. Demonstrate the preparation and administration of dantrolene
2. Demonstrate the effective use of MHAUS/SPA Guidelines for MH therapy to manage MH in a simulated setting.
3. Demonstrate the appropriate actions during resuscitation of a patient with severe rhabdomyolysis
4. Demonstrate appropriate cardiac resuscitation using PALS guidelines

Behavioral:

1. Recognize when and who to call for help during a critical event in the operating room.
2. Communicate effectively to team members when a code is called. This includes identification of a team leader, assigning roles, and closed-loop communication.
3. Prioritize patient management during distractions by the surgical team.

Patient Description:

History (Medical, Surgical, Social):

SPA-crisis checklist/malignant hyperthermia/TWK

A 7 year old, 25 kg male presents with acute appendicitis. He is allergic to augmentin.

Medications - none

SH: non-contributory

Baseline Vital Signs: 38.7C, HR 118, BP 102/76 RR 26 SpO2 100% 25kg

Baseline Lab Values: WBC – 15.6; Hgb – 14; Plt – 256
Na – 138; K – 3.5; Cl – 100; CO2 – 23; BUN – 13;
CR – 0.81

Target Trainees (Learners): pediatric anesthesia providers

Anticipated Duration:

Scenario Time: 10-15 minutes

Debriefing Time (typically 2-3x scenario length): 30-45 minutes

Scenario Set-up

Pediatric simulation mannequin (high fidelity, low fidelity, or standardized patient)
Room Configuration (set up): operating room set up

Equipment Needed: anesthetic machine, anesthetic drug cart, airway equipment, drugs in syringes and also in drug cart, propofol, rocuronium, epinephrine, hydrocortisone, diphenhydramine, dantrolene, sterile preservative free water, mannitol, lasix, sodium bicarbonate, calcium chloride, calcium gluconate, verapamil, insulin, glucose, Vapor Clean filters

Mannequins/ Task trainers/ Standardized Patients Needed: mannequin or standardized patient to approximate a 7 year old child

Society for Pediatric Anesthesia PediCrisis Manual

<http://www.pedsanesthesia.org/wp-content/uploads/2018/03/SPACriticalEventsChecklists.pdf>

Scenario Logistics

Expected Scenario Flow

The scenario begins with the patient's airway secured, abdomen insufflated and the surgical team performing a laparoscopy.

Learner now enters the room: Anesthesia confederate in the room hands off to a relieving anesthesia provider ('hot seat' anesthesiologist) **just after start of laparoscopy.** (premedication with IV midazolam, smooth RSI with cricoid, rocuronium 1 mg/kg was administered to facilitate endotracheal intubation with size 5.5 cuffed ETT. Antibiotics given. The hot seat anesthesiologist enters the room just as laparoscopy begins.

The confederate anesthesiologist has to quickly run to another building to give a talk to CA-1 residents on how to avoid OR disasters. The surgeon now requests that the hot seat anesthesiologist to relax the patient. With seconds after the confederate anesthesiologist leaves, the child develops tachycardia and increased peak inspiratory pressures. The end tidal CO₂ rises slowly at first. The NIBP decreases significantly. The scenario progresses to rapidly rising end tidal CO₂, desaturation, severe hypotension and finally VF.

The surgeon asks "what is going on, why does the intestine look so mottled?". The hot seat anesthesiologist must think of the differential diagnosis, auscultate for bronchospasm, look for any displacement or obstruction of the endotracheal tube, look for equipment problems and consider malignant hyperthermia. If the hot seat anesthesiologist is struggling to identify the cause, the circulating nurse notes rigidity of the abdomen and points this out to the hot seat anesthesiologist.

The surgeon tries to distract the anesthesiology team by telling them to hurry up because he has a long list of patients for the day.

The scenario may progress to pulseless electrical activity (VF) and resuscitation based on PALS guidelines.

The surgeon asks for a possible differential diagnosis. The hot seat anesthesiologist gives differential diagnosis – eg pneumothorax, equipment issue, CO₂ insufflation, bronchospasm, malpositioned ETT, sepsis and malignant hyperthermia. The surgeon asks about further management – eg further work-up, what to tell family, need for PICU, whether continue with procedure and needed lab work up – CPK, myoglobin, muscle biopsy, genetic workup, etc.

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Expected Interventions of the Participants:

Call for help, expeditiously formulate and run through a differential diagnosis, declare that this is a MH crisis, call for MH cart/dantrolene, appropriately choose a diluent and dose of dantrolene, initiate MHAUS/SPA MH protocol, initiate appropriate PALS protocol. Direct OR responders to perform the following tasks: obtain additional IV access (peripheral and/or central), place an arterial line, place a fole, direct therapy for active cooling, treat rhabdomyolysis, hyperkalemia, metabolic derangements. Direct the surgical team to stop, direct the surgical team to help with the response, discuss whether to continue with the procedure after the patient is stabilized (taking into account acuity of case), post op disposition, continued management for MH recrudescence: frequent ABGs, CPK, myoglobin, dantrolene, post op airway management, counselling and referral for CHCT/genetic workup for MH.

Expected Endpoint of the Scenario:

Recognition and treatment of malignant hyperthermia or patient deterioration

Distracters within Scenario:

Attending surgeon frequently interjecting/distracting the anesthesiologists

Optional Challenges for Higher Level Learners:

If malignant hyperthermia is recognized and treated early, can prompt the learners to deal with VF, further management issues: disposition, to remain intubated or not, should surgery be continued

Roles of Participants/Trainees:

The learner receiving handoff will be in the hot seat. When he/she calls for help, 1 other learner will be called upon to assist.

Roles of Confederates (if applicable): Leave the room after a hurried sign out as his mother is sick in the ED.

Attending surgeon: His/her role is to be disruptive and take away from focusing on the patient

Circulating nurse: Assist in calling for help, getting the MH cart/crash cart, forcing the learners to be specific in their requests

Debriefing Points: As above

Scenario Support Materials, Pre and Post Tests, Evaluations

Reference List:

1. MHAUS. Emergency Therapy for Malignant Hyperthermia, Feb. 2015
2. SPA. Malignant Hyperthermia, 2017
3. <https://www.mhaus.org/testing/introduction-to-mh-testing/testing-for-malignant-hyperthermia-mh-susceptibility-how-do-i-counsel-my-patients/> Sept 7, 2017

Pre-test: None

Post-test: None

Evaluations: standard