Feeling the Heat! Care of the Patient with Malignant Hyperthermia

[1]Shaylor Klein, MSMEd, DO, [2]Victoria Glascott, MA, DO, [3]Jessica Schumann, DO, FAAEM, and [4]Scott Plasner, DO, FACOEP-D, FACOI, FAAEM

[1]Jefferson Health Northeast EMIM, [2]Jefferson Health Northeast EM, [3]University of Kansas Medical Center CI & EM, [4]Jefferson Health Northeast EMIM

Clinical Case

- A 24-year-old male-to-female transgender patient with no significant medical history presented to the emergency department (ED) from an outpatient surgical center for malignant hyperthermia (MH).
- While undergoing gender affirming surgery, she had a rapidly rising CO_2 (up to 100 mmHg) on end-tidal capnography, hyperthermia (38.8ºC), and tachycardia (HR 108 bpm) without muscular rigidity.
- She had received succinylcholine and sevoflurane.
- She was subsequently intubated, cooling measures initiated, and dantrolene was provided.
- The patient was transferred to the ED via EMS.
- In the ED, she was started on continuous sedation, IV fluids, a cooling device, and administered an additional dose of dantrolene.
- She had medication-resistant hyperkalemia and received emergent dialysis while in the ED
- After admission to the ICU, she was continued on cooling measures and dantrolene for twenty-four hours. She was discharged on hospital day four without complication.
- No definitive testing for MH has been performed.

Physical exam:

T 98.1ºF HR 102 133/59 RR 18 100% intubated Weight: 60 kg

General: intubated, sedated

HEENT: moist mucous membranes, endotracheal tach in oropharynx, PERRL

CARDIOVASCULAR: regular rate and rhythm, normal pulses

LUNGS: clear to auscultation bilaterally without wheezes

ABDOMEN: flat, soft

MSK: soft compartments

SKIN: cap refill <2 seconds. Bilateral breast implants with healing surgical scars to the inframammary folds with staples in place

Pertinent workup (Table 1):

Electrocardiogram: sinus tachycardia, wide QRS, peaked T waves

Initial ABG: pH 7.33, pCO2 47 mmHg, pO2 531 mmHg, and bicarb 25 mmol/L, LA 0.9 mmol/L

Urine myoglobin negative

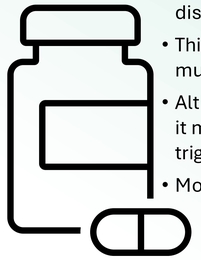
Table 1: Patient laboratory values

Laboratory Component	Initial Patient Value	Peak Patient Value	Reference range and units
Sodium	124		136-145 mmol/L
Potassium	9	9 (day #0)	3.3-4.8 mmol/L
Chloride	96		98-107 mmol/L
CO2	25		21-30 mmol/L
Urea-Nitrogen	13	16 (day #1)	6-20 mg/dL
Creatinine	1.23	1.23 (day #0)	0.5-0.9 mg/dL
Glucose	121		70-100 mg/dL
Creatine kinase	679	8,293 (day #2)	20-180 IU/L
Myoglobin	470	2,800 (day #1)	10-95 ng/mL

Dantrolene formulations

Formulation #1	Formulation #2
Dantrium or Revonto	Ryanodex
20 mg vials that require 60 mL of sterile water	250 mg vials that require 5 mL sterile water

Evidence and Literature Review



- MH is a pharmacologically-induced skeletal muscle disorder that can be fatal if left untreated.
- This typically occurs due to a ryanodine receptor mutation.
- Although this can occur on the first exposure to a drug, it may take up to three anesthetic agent exposures to trigger an event.
- More common in men and children

- Diagnosis depends on an exaggerated hypermetabolic response.
- The gold standard test is an in vitro contracture test with caffeine and halothane.
- **Dantrolene is given as a loading dose of 2.5 mg/kg and then continuing at a dose of 1 mg/kg every 4-8 hours for the next 1-2 days.**
- Continuation of therapy is important as symptom recrudescence can occur.
- Later, patients and their family can undergo genetic counseling and subsequent testing.

Unique Aspects of the Case

Our patient did not have significant tachycardia, fever, or muscular rigidity

These findings were more atypical than classic descriptions

Our patient underwent emergent dialysis for persistent hyperkalemia

Emergent dialysis is rarely indicated in MH

Conclusions

MH is characterized by
1. Hyperthermia (>38.8ºC at a rate of increase by 1-2ºC every five minutes)
2. Hypercarbia ($PaCO_2$ >60 mmHg despite increase in minute ventilation)
3. Tachycardia
4. Rhabdomyolysis
5. Hyperkalemia (K >6 mEq/L)
6. Acidosis (pH <7.25)
7. Muscle rigidity (primarily masseter)

Treatment includes discontinuation of the agent, increasing minute ventilation, contacting the MH Hotline, administering dantrolene, and starting cooling measures

Complications include hyperkalemia, disseminated intravascular coagulation, and end-organ damage

References

Acosta, I., Velasco de Cos, G. & Fernandez, M. (2021). Malignant Hyperthermia Syndrome: A Clinical Case Report. The Journal of the International Federation of Clinical Chemistry and Laboratory Medicine; 32(2): 286-291.

Luong, A., Relli-Dempsey, V., Johnson, E., Price, D., Gable, A., Franzen, M. J. (2024). Turn Up the Heat: A Case Report of Malignant Hyperthermia During Ambulatory Surgery. Cureus; 16(5). DOI: 10.7759/cureus.61365

Rosenberg, H., Davis, M. James, D., Pollock, N. & Stowell, K. (2007). Malignant Hyperthermia. Orphanet Journal of Rare Diseases; 2:21. DOI: 10.1186/1750-1172-2-21

Watt, S. & McAllister, R. (2023). Malignant Hyperthermia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing