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Malignant Hyperthermia

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What is your topic?

Malignant Hyperthermia- Malignant hyperthermia is a rare, life-threatening disorder triggered by the use of volatile anesthetics agents such as succinylcholine (Yang et al., 2020)



The picture above describes the step by step management for a patient with MH based on the MHAUS guidelines (Normandin & Benotti, 2018)

Why Malignant Hyperthermia?

-Malignant hyperthermia is estimated to occur in between 1:10,000 and 1:150,000 anesthetic cases (Hopkins et al., 2021).

- Malignant hyperthermia is estimated to have a fatality rate of 9.5% (Yang et al., 2021).

- MH commonly occurs when an individual is having their initial contact with anesthetic agents (Ravaei et al., 2020).

Pathophysiology of Malignant Hyperthermia

- Malignant Hyperthermia is due to an uncontrolled amount of calcium released from the sarcoplasmic reticulum into the myoplasm (Ravaei et al., 2020). The uncontrolled release of calcium can be due to potent inhalation agent, a stressor such as heat and exercise, succinylcholine (muscle relaxant), or a genetic mutation to the ryanodine receptor (Ravaei et al., 2020).

- The Ryanodine receptors (RyR1) function to regulate the amount of calcium being released into the sarcoplasmic reticulum. When there is a genetic mutation in RyR1 an excessive amount of calcium is released (Chen et al., 2017). The large amount of intracellular calcium leads to the myocyte reaching threshold quicker and maintain a contractile state for a prolonged period. Prolonged muscle contraction leads to muscle rigidity which is detrimental to an individual. Muscle rigidity increases carbon dioxide production, body temperature, oxygen requirements and exhaust ATP stores (Yang et al., 2020)

Signs and Symptoms

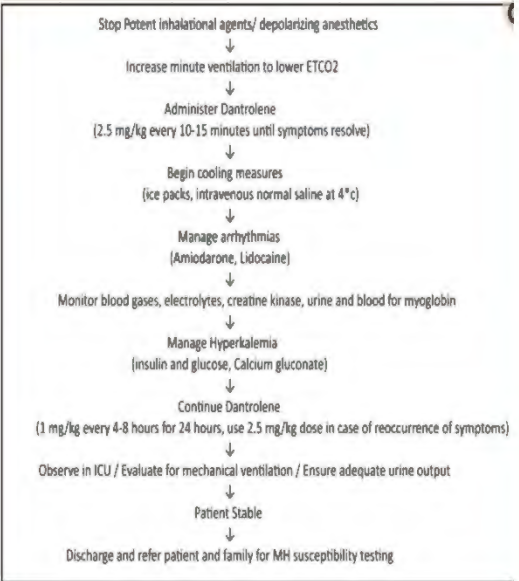
- A patient Malignant hyperthermia presents with multiple signs and symptoms
- Hyperthermia, excessive sweating, mottled skin (Mayo Clinic, 2021).
- Muscle Rigidity, excessive bleeding, tachycardia, masseter spasm (Cornelius et al., 2020)
- Abnormal Laboratory findings include elevated myoglobin, calcium, potassium, creatine phosphokinase and serum myoglobin. (Sinha et al., 2017)

Order and percentage of appearance of the clinical symptoms during 255 malignant hyperthermia (MH) events			
Clinical symptom	Median of appearance number	Range of appearance number	Percentage of patients (%)
Masseter spasm	1.00	1.00-4.00	26.7
Hypercarbia	2.00	1.00-8.00	92.2
Sinus tachycardia	2.00	1.00-7.00	72.9
Generalized muscle rigidity	2.00	1.00-6.00	40.8
Tachypnea	2.00	1.00-6.00	27.1
Cyanosis	2.00	1.00-7.00	9.4
Skin mottling	2.00	1.00-7.00	6.3
Rapidly increasing temperature	3.00	1.00-7.00	64.7
Elevated temperature	3.00	1.00-8.00	52.2
Sweating	4.00	1.00-8.00	17.6
Ventricular tachycardia	4.00	1.00-7.00	3.5
Cola-colored urine	5.00	2.00-9.00	13.7
Ventricular fibrillation	5.50	1.00-8.00	2.4
Excessive bleeding	6.00	4.00-8.00	2.7

The picture above displays all the clinical symptoms of MH and the percent of patients who present with that specific symptom (Yang et al., 2020)

Nursing Care and Management

- Treatment of MH includes two steps
- Step 1: Immediate treatment
 - Step 1 involves stopping all triggering agents. If possible, the surgery she be stopped, if this is not possible then the procedure continue with the use of non-triggering anesthetics.
 - Call for help and administer IV Dantrolene 2.5 mg/kg rapidly (Cornelius et al., 2020)
- Step 2: The second step involves symptomatic treatment. Hyperkalemia should be treated with calcium chloride, calcium gluconate or sodium bicarbonate (Yang, 2020). Hyperthermia is treated with administration of 2,000 ml of cold crystalloid fluids (4 degrees Celsius), if possible, the patient's body should be packed with ice packs or cooling pads
- Step 2: The second step involves symptomatic treatment. Hyperkalemia should be treated with calcium chloride, calcium gluconate or sodium bicarbonate (Yang, 2020). Hyperthermia is treated with administration of 2,000 ml of cold crystalloid fluids (4 degrees Celsius), if possible, the patient's body should be packed with ice packs or cooling pads



The picture above describes the treatment process for MH (Yang et al., 2020)

Conclusion and Implications

- Malignant Hyperthermia is a rare disorder that can turn fatal if not recognized in a timely manner by a provider (Cornelius et al., 2020)
- There are currently only two diagnostic methods used for MH, more research is needed to expand diagnostic methods and validity (Yang, 2020)
- Anesthetic education on malignant hyperthermia should center around skills that will better prepare the anesthetist to provide adequate care to a patient experienced MH (Kleidon, 2020).
- Dantrolene is currently the only acute treatment for MH; the use of dantrolene is a poor long treatment as it can lead to kidney and liver toxicity.

Significance of Pathophysiology

- Due to the severity of MH it is pertinent that health care providers recognize the initial signs and symptoms and treat the patient appropriately (Miyazaki et al., 2021).
- If not recognized immediately a patient can develop irreversible kidney, liver and brain damage.

Case Study

- Case study outlines a 24-year old male who presented to the Ohio State University to receive dental treatment (Cornelius et al., 2020)
- Pt received 200mg of Succinylcholine, 150 mg of propofol and 2% sevoflurane
- 15 minutes into the patients arrival his heart rate increased from 82 to 123 bpm and his temperature increased to 38.9 (was 35. initially).
- Clinicians noted the patients and diagnosed the patient with MH
- Help was called in and interventions such as administration of dantrolene, placement of ice packs around the individuals groin, axilla, neck and chest area.
- Paramedics were called and the patient was transferred to the emergency department and eventually spent 4 days in the intensive care department.
- 3 days later the patient was discharged from the hospital and made a complete recovery.

References

