Malignant Hyperthermia

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**Excitation-contraction Coupling Process**

1. Acetylcholine binds to postjunctional nicotinic acetylcholine receptors (nAChR) located on the sarcoplasmic reticulum (sarcoplasmic reticulum (SR)) (Mullins, 2018, p. 583).
2. RyR1 gene encodes the channel that releases Ca$^{2+}$ from the SR.
3. Ca$^{2+}$ influx occurs through the transverse tubule (t-tubule) system (Mullins, 2018, p. 583).
4. Cardiac muscle is excited with the depolarization of the sarcolemma and the action potential travels down the transverse tubule (t-tubule) system, which closes RyR1 channels (Mullins, 2018, p. 583).
5. Voltage-gated calcium (Ca$^{2+}$) currents in the t-tubules undergo a conformational change due to depolarization. Ca$^{2+}$ channels open the transverse tubule (t-tubule) system (Mullins, 2018, p. 583).
6. Increased intracellular Ca$^{2+}$ causes abnormal skeletal muscle contraction, initiating a self-sustaining contracture (Rosenberg et al., 2015, p. 4).
7. Muscle contraction increases oxygen consumption and intracellular Ca$^{2+}$ content.
8. Calcium influx continues, causing the release of additional intracellular Ca$^{2+}$ stores.
9. An influx of extracellular Ca$^{2+}$ through Ca$^{2+}$ channels and intracellular release of Ca$^{2+}$ from the sarcoplasmic reticulum (SR) (Mullins, 2018, p. 583).
10. RyR1 gene encodes the channel that releases Ca$^{2+}$ from the SR.
11. Calcium release increases the affinity of the T-tubule volume sensor.

**Signs and Symptoms**

- **Early Symptoms**
  - Tachycardia
  - Hyperpyrexia
  - Hypertension
  - Cardiac dysrhythmias
  - Tachypnea

- **Late Symptoms**
  - Hyperthermia
  - Rhabdomyolysis
  - Acute respiratory distress syndrome (ARDS)
  - Coagulopathy
  - Death

**Implications for Nursing Care**

- **Preoperative Assessment**
  - Discontinue trigger agents
  - Preoperative assessment
  - Cooling measures

- **Intraoperative Monitoring**
  - Monitor for recrudescence (24 hours)
  - Increase oxygenation and hyperventilate
  - Monitor for signs of MH
  - Treat rhythm disturbances
  - Manage an MH crisis

- **Postoperative Management**
  - Discontinue trigger agents
  - Monitor for recrudescence (24 hours)
  - Manage pain
  - Maintain normal core temperature

**References Cited**

- Rosenberg et al., 2015, p. 1
- Rosenberg et al., 2015, p. 10
- Rosenberg et al., 2015, p. 20
- Rosenberg et al., 2015, p. 13

**Current Research**

- Magnesium (Mg$^{2+}$) in MH treatment (Chao, Komer, & Lamont, 2017)
- The role of magnesium in the prevention of MH (Mg$^{2+}$) in MH treatment (Chao, Komer, & Lamont, 2017)
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**Additional Sources**

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