Otterbein University
Digital Commons @ Otterbein

Nursing Student Class Projects (Formerly MSN) | Student Research & Creative Work

Summer 2015

Malignant Hyperthermia: A Clinical Crisis

Eric Reing
Otterbein University, eric.reing@otterbein.edu

Follow this and additional works at: https://digitalcommons.otterbein.edu/stu_msn

 Part of the Medical Pathology Commons, Musculoskeletal Diseases Commons, Nursing Commons, and the Pathological Conditions, Signs and Symptoms Commons

Recommended Citation

Reing, Eric, "Malignant Hyperthermia: A Clinical Crisis" (2015). *Nursing Student Class Projects (Formerly MSN)*. 83.
https://digitalcommons.otterbein.edu/stu_msn/83

This Project is brought to you for free and open access by the Student Research & Creative Work at Digital Commons @ Otterbein. It has been accepted for inclusion in Nursing Student Class Projects (Formerly MSN) by an authorized administrator of Digital Commons @ Otterbein. For more information, please contact digitalcommons07@otterbein.edu.

Malignant Hyperthermia: A Clinical Crisis

Eric Reing, ,BSN-RN, CCRN
Otterbein University, Westerville, Ohio

Introduction

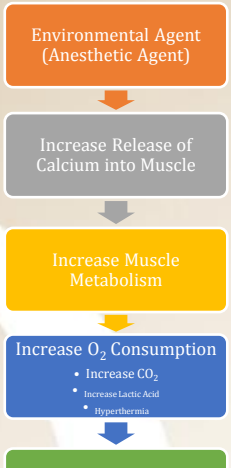
Malignant hyperthermia, though uncommon, is a serious and life threatening condition. Malignant hyperthermia is an autosomal dominant disorder that affects skeletal muscle. It can be caused by various general anesthetic agents like succinylcholine and several inhaled anesthetics. Malignant hyperthermia is a relevant topic to certified registered nurse anesthetists due to the potentially fatal result if not recognized and treated promptly. In understanding the pathophysiology, risk factors, signs and symptoms, epidemiology, and current treatments the health care provider can help to prevent complications due to this disorder (Nagelhout, 2014).

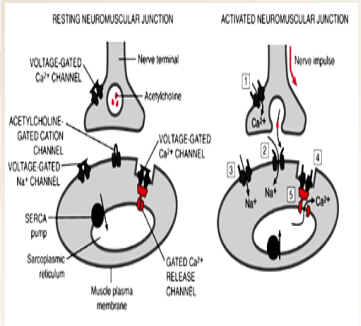
Signs and Symptoms

Malignant hyperthermia has a wide range of manifestations in a patient. It can be very acute with sudden and apparent muscle rigidity post anesthetic or the process can occur gradually and not show signs or symptoms until several hours post procedure. Besides the variety of timing, malignant hyperthermia also varies in severity from mild complications to full systemic complications that can result in patient death. Typically, malignant hyperthermia begins when a genetically susceptible individual undergoes anesthesia, usually succinylcholine, desflurane, or sevoflurane. The best initial indicator of malignant hyperthermia is a rise in end tidal carbon dioxide unrelated to how well the patient is ventilating. Other important signs are tachycardia, tachypnea, arrythmias, and labile blood pressure. Muscle rigidity occurs seventy five percent of the time with malignant hyperthermia. Although hyperthermia is in the name of this complication, it is often a late sign. Decreased SaO_2 is observed and dark colored urine from myoglobinuria can be noted. Laboratory findings consistent with an malignant hyperthermia diagnosis are an elevated CO_2, base deficit, pH<7.25, serum K greater than 6meq/l, creatine kinase greater than 20,000 units/ml, serum myogolbin greater than 170mcg/L, and urine myoglobin greater than 60mcg/L (Mitchell-Brown, 2013).

Pathophysiological Process

Malignant hyperthermia is an autosomal dominant disorder with variable penetrance. It is a genetic disorder of the skeletal muscle affecting a mutation of the ryanodine receptor. This receptor is found on the endoplasmic reticulum and is the major calcium release channel of skeletal muscles. Individuals with malignant hyperthermia have an environmental agent, usually succinylcholine or other inhaled anesthetics, that triggers the inappropriate release of calcium into skeletal muscles. This increase in intracellular calcium causes muscle contraction. With the increase in calcium, muscles attempt to normalize the calcium with mechanisms that require energy which can increase "muscle metabolism two to three fold"(Nagelhout, p 830, 2014). When the overactive muscle metabolism oxygen consumption is increased, ATP is depleted, and carbon dioxide is increased. This nefarious cycle leads to lactic acid production and subsequently acidosis, hyperthermia, and cell destruction. With myocyte failure, potassium, myoglobin, and creatine kinase leak into the circulation. The fact that skeletal muscle accounts for forty to fifty percent of our body mass explains the often devastating systemic effects malignant hyperthermia can have on patients (Brislin, 2013).





Retrieved on July 20, 2015 from www.downstate.edu

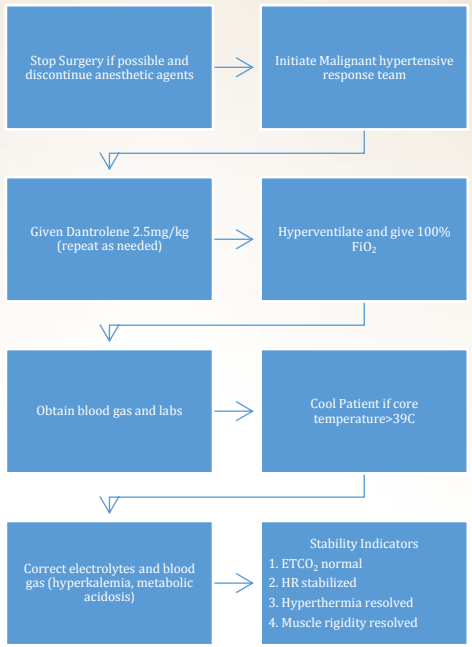
Significance of Pathophysiology

Malignant hyperthermia is a rare disorder and can often have devastating effects. It is often a difficult disease to diagnose due to other diseases with similar symptoms and the fact that malignant hyperthermia can happen at different times during the procedure. Understanding pathophysiology of this disorder can lead to better outcomes and prevent catastrophic events. With early recognition, diagnosis, and treatment with dantrolene sodium the mortality rate of malignant hyperthermia decreased from 80% in the 1970s to less than 5% by 2007(Dirksen, 2013).

Implications on Nursing Care

The understanding of the pathophysiology and signs and symptoms of malignant hyperthermia directly affects nursing care. It is important to understand what population makes up high risk patients. A practitioner, with a good preoperative history, can ascertain if a person is a high risk. Any person with a family history of anesthetic reaction or malignant hyperthermia should be red flagged and suspected of possibly getting malignant hyperthermia with anesthesia. Also, the practitioner knows that the highest rate of malignant hyperthermia occurs amongst younger people with an average age of 18. A practitioner should also know to correctly diagnose and know the steps to handle a malignant hyperthermic crisis. The Malignant Hyperthermia Association of the United States recommends that information on how to handle a crisis be posted in all surgical rooms. The steps include to discontinue anesthetics if possible, hyperventilate with 100% FiO_2, give dantrolene sodium, treat fever aggressively, and correct arrhythmias with treatment of acidosis and electrolyte abnormalities. Dantrolene is an important medication in malignant hyperthermia and has been directly related to the drop in mortality in the last 30 years. Dantrolene relaxes muscles by decreasing calcium produced by sarcoplasmic reticulum which directly reverses the pathophysiologic process of malignant hyperthermia(Donnelly, 1994).

Treatment Pathway



Conclusion

Malignant hyperthermia is a genetically acquired disease that can cause death if not diagnosed and treated early enough. It's detrimental effects depend greatly on the practitioners knowledge and understanding of the pathophysiologic process and the signs and symptoms that manifest with malignant hyperthermia. Once diagnosis is determined treatment should be given immediately to best prevent ill outcomes brought on by malignant hyperthermia.

References

Brislin, R. P., & Theroux, M. C. (2013). Core myopathies and malignant hyperthermia susceptibility: A review. *Pediatric Anesthesia*, *23*(9), 834-841. doi:10.1111/pan.12175

Dirksen, S. H., Van Wicklin, S. A., Mashman, D. L., Neiderer, P., & Merritt, D. R. (2013). Developing Effective Drills in Preparation for a Malignant Hyperthermia Crisis. *AORN Journal*, 97(3), 330 352. doi:10.1016/j.aorn.2012.12.009

Donnelly, A. J. (1994). Malignant hyperthermia. Epidemiology, pathophysiology, treatment. *AORN Journal*, *59*(2), 393.

Mitchell-Brown, F. (2012). Malignant hyperthermia: Turn down the heat. *Nursing*, *42*(5), 38-45. doi:10.1097/01.NURSE.0000413609.98565.96

Nagelhout, J. J., & Plaus, K. L. (2014). Nurse anesthesia (5th ed.) . St. Louis, MO: Elsevier Inc.

Additional Sources

Barnes, C., Stowell, K. M., Bulger, T., Langton, E., & Pollock, N. (2015). Safe duration of postoperative monitoring for malignant hyperthermia patients administered non triggering anesthesia: an update. *Anaesthesia And Intensive Care*, 43(1), 98-104.

Herlich, A. (2013). Perioperative temperature elevation: not all hyperthermia is malignant hyperthermia. *Paediatric Anaesthesia*, 23(9), 842-850. doi:10.1111/pan.12244

Heytens, L., Forget, P., Scholtès, J. L., & Veyckemans, F. (2015). The changing face of malignant hyperthermia: less fulminant, more insidious. Anaesthesia *& Intensive Care*, 43(4), 506-511.

Plurad, D., Blaschke, G., Jones, S., & Pfeiffer, J. (2008). A case of malignant hyperthermia in a child encountered during a humanitarian assistance mission to the Philippines. *Military Medicine*, *173*(8), 805-808.

Rosero, E. B., Adesanya, A. O., Timaran, C. H., & Joshi, G. P. (2009). Trends and outcomes of malignant hyperthermia in the United States, 2000 to 2005. *Anesthesiology*, *110*(1), 89-94. doi:10.1097/ALN.0b013e318190bb08

OTTERBEIN UNIVERSITY