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CASE REPORT ARTICLE

MALIGNANT HYPERTHERMIA: PROPOSING A CARE PROTOCOL FOR SURGICAL CENTERS

HIPERTERMIA MALIGNA: PROPOSTA DE UM PROTOCOLO ASSISTENCIAL PARA O CENTRO CIRÚRGICO

HIPERTERMIA MALIGNA: PROPUESTA DE UN PROTOCOLO ASISTENCIAL PARA EL CENTRO QUIRÚRGICO

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ABSTRACT

***Objective*:** to develop a care protocol for treating patients with malignant hyperthermia. ***Methods*:** reporting experiences in order to show the construction of the treatment protocol for malignant hyperthermia in surgical centers. The protocol was designed by surgical center nurses and happened in two distinct phases. The first consisted of searching for literature for the theoretical foundation in the LILACS, MEDLINE, and SCOPUS databases, using the keywords *Medical Subject Headings* (MeSH): *Malignant Hyperthermia; Anesthesia; Postanesthesia Nursing; and Guidelines*. The second phase involved meeting with nurses, discussing the literature we reviewed, and constructing the protocol. ***Results*:** we constructed a care protocol for malignant hyperthermia in a table format, with activities to be performed separated by professional category. ***Conclusion*:** with the protocol we developed, we hope to build the capacity of nursing teams with respect to this theme and training this care flow. ***Descriptors*:** Malignant Hyperthermia; Nursing; Clinical Protocols.

RESUMO

***Objetivo*:** desenvolver um protocolo assistencial para atendimento de pacientes com hipertermia maligna. ***Método*:** relato de experiência, com intuito de demonstrar a construção do protocolo de atendimento para hipertermia maligna no centro cirúrgico. O protocolo foi construído por enfermeiras do centro cirúrgico e constituiu-se de duas fases, a primeira consistiu em uma busca na literatura para embasamento teórico nas bases LILACS, MEDLINE, SCOPUS, com os descritores do *Medical Subject Headings* (MeSH): *Malignant Hyperthermia; Anesthesia; Postanesthesia Nursing; e Guidelines*. A segunda fase foi realizada por meio de encontros entre os enfermeiros, discussão da literatura levantada e construção do protocolo. ***Resultados*: foi** construído um protocolo de atendimento para hipertermia maligna em formato tabela e realizada a separação das atividades por categoria profissional. ***Conclusão*:** com o protocolo elaborado, pretende-se desenvolver a capacitação da equipe de enfermagem para a temática e o treinamento deste fluxo de atendimento. ***Descritores*:** Hipertermia Maligna; Enfermagem; Protocolos Clínicos.

RESUMEN

Objetivo: desarrollar un protocolo asistencial para el cuidado de pacientes con hipertermia maligna. ***Método:*** relato de experiencias con el fin de demostrar la construcción del protocolo de atención para la hipertermia maligna en el centro quirúrgico. El protocolo fue elaborado por enfermeros del centro quirúrgico y constó de dos fases, la primera consistió en una búsqueda bibliográfica para base teórica en los bancos de datos LILACS, MEDLINE, SCOPUS, con los descriptores del Medical Subject Headings (MeSH): *Malignant Hyperthermia; Anesthesia; Postanesthesia Nursing; y Guidelines*. La segunda fase se llevó a cabo a través de reuniones entre los enfermeros, discusión de la literatura encontrada y construcción del protocolo. ***Resultados:*** fue elaborado un protocolo de atención para la hipertermia maligna en forma de tabla y se separaron las actividades por categoría profesional. ***Conclusión:*** con el protocolo elaborado, pretendemos desarrollar la capacitación del equipo de enfermería para la temática y el entrenamiento de este flujo de servicio. ***Descriptores:*** Hipertermia Maligna; Enfermería; Protocolos Clínicos.

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INTRODUCTION

Malignant hyperthermia (MH) is a rare but fatal syndrome that occurss in genetically predisposed patients who have been exposed to triggering agents that are used to induce general anesthesia. It happens during or immediately after the administration of general anesthesia with certain inhaled anesthetics or neuromuscular blocking agents.[1,2] Incidences are described in different ways. A North American study reports an incidence of 1 in 3,000 to 1 in 50,000 surgical procedures, more of which affected children than adults.[3] In New York, a study reports 73 diagnosed cases between 2001 and 2005.[4] In Brazil, there is no current data concerning incidence, but it has been estimated that in 2009 around 1 in 50,000 episodes occurred in patients under general anesthesia, which is how many would be expected with 77 reported cases during this period.[5]

The first documented case of MH was reported in 1960. The case involved a 21-year-old patient who had a medical history of raised temperatures in anesthesia-related complications. The patient became hypertensive and tachycardic, with an elevated body temperature after ten minutes under halothane anesthesia. The anesthetist immediately stopped the anesthesia, and the patient was covered with ice in order to lower the body temperature, having survived the episode.[6]

Clinical signs that may indicate the onset of MH are described as: unexplained tachyarrhythmia (for example, ventricular extrasystoles, ventricular tachycardia) that occur in 96% of those with MH; tachypnea in 85%; and acidosis in response to an increase in glycogenesis in 80%. This event produces abnormal quantities of lactic acid, carbon dioxide (CO_2) and heat; sustained muscle group contracture brings about a higher use of available adenosine triphosphate (ATP) and oxygen; and overall stiffness is one of the first signs of MH, something which is present in approximately 80% of patients, especially in the presence of muscle relaxants. The masseter muscle is one of the most commonly and prominently-involved muscle groups.[3,7]

In cases in which the patient already has a diagnosis, or high risk has been identified preoperatively, material to treat MH and resuscitation equipment should be available. In the case of an immediate MH diagnosis, three liters of refrigerated saline solution and ice should be immediately procured in order to cool down the patient both intravenously and using ice compresses in the axillary, inguinal, and cephalic regions, in an attempt to reduce the rapid increase in body temperature. Urine output should be carefully monitored by means of catheterization. Teams should proceed with periodic venous blood withdrawals to control and replenish electrolytes. Vital signals should be monitored regularly. The medication Dantrolene® will probably be recommended by the anesthetist, and nurses should prepare this medication according to the manufacturer's recommendations.[3,7,8]

Nurses should be aware that there is a direct correlation between an episode of MH and treatment opportunities. Thus, any delay in the early recognition and prompt treatment of an episode of MH can result in patients' sudden death due to cardiac arrest, brain injury, multiple organ failure, and disseminated intravascular coagulation (DIC).[2,7,9]

Currently, with well-trained staff, early diagnosis, and quickly-deployed treatment, the rate of mortality has been around 5% since 2007; meanwhile, data from 1970 reported an 80% mortality rate.[3] We recommend that hospitals have care protocols for this type of event.

Competence in surgical center staff involves a combination of efficient decision making during the perioperative period, satisfactory performance, and effective communication between professionals, as well as technical skill.[6] It would be useful to understand the competency of surgical center nurses beyond just organizational duties, and to look once more at the relationship between these practices and patient safety.[10]

The *Association of periOperative Registered Nurses* (AORN) recommends that nursing staff and other professionals on the premises that may involved in the response to a MH crisis should receive training and go through a validation of relevant skills.[9] The *American Association of Nurse Anesthetists* (AANA) also recommends that certified nurse anesthetists maintain their skills through continuing education geared towards the treatment of MH.[11]

OBJECTIVE

- To develop a care protocol for treating patients with malignant hyperthermia.

METHOD

This is a descriptive, analytic study, like an experience report, that shows the construction of the treatment protocol for malignant hyperthermia in surgical centers.

The protocol was built in two phases. The first involved searching for literature relevant to the subject. We consulted the LILACS, MEDLINE, and SCOPUS databases using the keywords from *Medical Subject Headings* (MeSH): *Malignant Hyperthermia; Anesthesia; Postanesthesia Nursing; and Guidelines*. We searched for publications from the last five years in Portuguese and English that concerned care processes for MH patients in surgical centers.

The second phase consisted of discussing the relevant literature and constructing the protocol, a process involving three surgical center nurses, and later, an anesthesiologist. In this phase, we determined that the format for the protocol would be a table, taking into consideration the staff's care components and the care activity of each professional (anesthesiologist, nurse, and nurse technician), the activation of support services, the implementation of care during the perioperative period, and the availability of materials necessary for care. After constructing the protocol we discussed it with an anesthesiologist who had experience with MH, the dosage of proposed drugs, and the role of anesthesiologists.

RESULTS AND DISCUSSION

The protocol seen in Figure 1 was built to guide surgical center staff in caring for patients who develop MH during surgery.

Nurse Technician	Anesthetist	Nurse
Get help in providing the resources necessary for care	Monitor the patient, administer supplementary medication	**Prepare and administer the Dantrolene**
Call engineering to change the trachea and soda lime anesthesia equipment	Begin monitoring core temperature	**-Dantrolene IV, 36 vials -2160 ml of sterile water to reconstitute the Dantrolene - 36 Transofix spikes to use in the Dantrolene reconstitution**
Provide materials for laboratory exam collection (biochemical, coagulation, emergency kit)	Hyperventilate the patient with 100% oxygen.	**Mix: Use 60 ml of distilled water for every one vial of Dantrolene. (each vial contains 20 mg of the drug and 3 g of mannitol)**
Prepare materials for arterial puncture, central puncture, nasogastric tube, and indwelling catheter	-Insert nasogastric tube -Collect lab exams	**Administer: 2,5 mg Dantrolene/kg IV. _____Kg x 2,5 mg = _____mg**
Administer chilled saline (1000 ml x 3 or 4) IV and cover the patient with ice packs for cooling (until temperature reaches 38 °C)	Monitor vital signs every 15 minutes for 1 to 2 hours	**Repeating as many times as necessary in order to control clinical signs (10 mg/Kg)**
Make notes about complications, medications, and conduct	Evaluate exam results **Correct electrolyte disorders***	**Keep Dantrolene IV for at least 24 hours after controlling the episode. (aproximately 1 mg/kg every 6 hours) Report the case: Brazilian Registry of Malignant Hyperthermia Information and Guidance Phone: (48) 331-9169 / 234-3014 - Fax: (48) 234-3014 E-mail: registrohm@hu.usfc.br (Professor. Maria Anita E. B. Batti);**

If in doubt about how to proceed, call **Malignant Hyperthermia Hotline - Information and Guidance during Malignant Hyperthermia crises - 24 hours/day, Tel: (11) 5575-9873 São Paulo Hospital.**

***Infusion suggestion:**

1 to 2 mEq/Kg bicarbonate. _____Kg x 1 mEq = _____mEq

0,15 UI/Kg regular insulin. ____Kg x 0,15 UI = _____UI

2mg/Kg $CaCl_2$. _____Kg x 2mg = _____mg $CaCl_2$

Figure 1. Care protocol for patients in malignant hyperthermia crises. São Paulo – SP, 2013.

According to the literature researched, the care plan for MH should include assigning responsibilities to each team member. The tasks should be simultaneously performed during the stressful, high-risk situation, while the patient is clinically decompensated. Carrying out simultaneous actions during an episode of MH is beyond the ability of a single team member. In most cases, there needs to be a nurse, an anesthetist, nurse technicians, other care providers (for example, messagers and someone to help with transportation), and a surgeon to manage the tasks.[1,3,6,7]

With these simultaneous patient care actions in mind, we built this protocol as a table, organized by professional category and featuring a description below of the actions to be taken during the treatment, since this data would not be well-suited to a flowchart.

Our goal is to clearly display each action by professional category, in keeping with our hospital's guidelines. In addition to care activities, information about the mandatory reporting of HM incidents and a phone number to contact the Support Center were included in the protocol. Our intention was to encourage the professional who will guide the

treatment and guarantee quick information access.

CONCLUSION

It is expected that during surgery, surgical center professionals are able to quickly recognize the clinical manifestations of an MH crisis and begin the steps necessary for care.[3,9] Anesthesiologists are responsible for diagnosing and immediately recognizing the crisis, but staff should alert to the signals presented by patients, the flow of service, and the location of emergency materials so as to ensure quick and effective care.[7,8]

In this protocol, each member's activities were defined according to the routine in our hospital, but they can be adapted to the situation in another hospital. It is vital that institutions that serve patients with predisposing conditions or who could be exposed to factors that trigger these crises (for example, surgical centers, emergency rooms, interventional radiology departments, intensive care units) be prepared for this type of care.

This study contributes to the targeting of MH care and may be used as a guide for surgical center professionals. Thus, the study permits systematized care that begins immediately, ensuring the survival of patients who have MH episodes. At the same time, we recommend other studies on the subject, since there are so few to be found on the subject, and since in nursing practice, we noticed a lack of knowledge about proper care for this particular context.

The creation of this MH protocol brought about the need for staff training in order to orient, update, and simulate the care in the event of MH, following the steps in the protocol. We hope to further develop this study later this year.

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