Malignant Hyperthermia

1. EMERGENCY THERAPY FOR THE ACUTE MALIGNANT HYPERTHERMIA (MH) CRISIS

CAUTION: This protocol may not apply to every patient and may require modification depending on the specific needs of each patient.

A) ACUTE TREATMENT

1) Look for signs and symptoms of an acute MH reaction:
   hypercarbia
   tachypnoea
   tachycardia
   cardiac arrhythmias
   rigidity
   cyanosis/mottling
   unstable/increasing blood pressure
   fever
   respiratory and metabolic acidosis
   myoglobinuria

2) Call for help! Immediately discontinue all volatile inhalation anaesthetics and succinylcholine. Hyperventilate with 100% oxygen at high gas flows, at least 10 L/min. A clean circuit should be used if possible, without delaying other important treatment.

3) Immediately begin dantrolene sodium 2.5 mg/kg. Rapidly administer the initial bolus intravenously with supplemental increments up to 10 mg/kg total. A central venous line is preferred in order to avoid peripheral venous thrombosis. Each vial of dantrolene contains 20 mg dantrolene and 3 g mannitol. One vial should be mixed with 60 mL of sterile water for injection (USP). Continue to administer dantrolene until signs of MH (e.g. hypercarbia, rigidity, tachycardia and fever) are controlled. Occasionally more than 10 mg/kg dantrolene total dose may be needed, but clinical reassessment is suggested.

4) Administer bicarbonate to correct metabolic acidosis as guided by blood gas analysis. In the absence of blood gas analysis, 1–2 mEq/kg should be administered.

5) Arrhythmias will usually respond to treatment of acidosis and hyperkalaemia. If they persist or are life-threatening, standard anti-arrhythmic agents may be used. If dantrolene has been administered, do not use calcium channel blockers as they can interact to produce fatal hyperkalaemia and cardiovascular collapse.

6) Determine, monitor and treat end tidal CO_2, arterial, central or femoral venous blood gases, serum potassium, calcium, CK, serum and urine myoglobin, blood cultures, thyroid function studies, clotting studies and urine output. Respiratory and renal failure and disseminated intravascular coagulation may need appropriate supportive measures.

7) Hyperkalaemia is common and should be treated with hyperventilation, bicarbonate, intravenous glucose and insulin (e.g. 10 units regular insulin in 50 mL 50% glucose titrated to potassium level). Life-threatening arrhythmias from hyperkalemia should be treated with IV calcium (10 to 30 mg/kg of IV calcium chloride).

8) Ensure urine output of greater than 2 mL/kg/hr by hydration and/or administration of mannitol or furosemide. Remember that each vial of dantrolene contains 3 grams of mannitol. Consider central venous or pulmonary arterial monitoring because fluid shifts may result in haemodynamic instability.

B) POST CRISIS MANAGEMENT

1) Observe the patient in an Intensive Care Unit setting for at least 24 hours. Recrudescence of an MH reaction may occur and require further therapy.

2) Administer bolus doses of dantrolene 1 mg/kg IV every 6 hours for 24 to 48 hours after the crisis. After that, oral dantrolene 1 mg/kg every 6 hours may be used for 24 hours as necessary.

3) Follow (e.g. every 6 hours) and treat ABG, serum CK, potassium and calcium, urine and serum myoglobin, and clotting studies until they return to normal values. Central temperature (e.g. axillary, rectal, oesophageal) should be continuously monitored until stable.

4) Counsel the patient and family regarding MH and further precautions. MH susceptibility is inherited in an autosomal dominant fashion. For additional information on MH, refer the patient to the Malignant Hyperthermia Unit.

5) Further consultation on MH is avilable at most university-based anaesthesia departments, or the nearest clinical unit specializing in malignant hyperthermia.

2. ELECTIVE MANAGEMENT OF MALIGNANT HYPERTHERMIA SUSCEPTIBLE PATIENTS

All Departments of Anaesthesia should have a hospital policy and procedures manual for MH cases.

A) PREOPERATIVE

1) Premedication is optional. Preoperative dantrolene is rarely needed. Other premedication, as for a non-MH susceptible patient, can be used as indicated.

2) Lab tests–baseline serum CK may be useful.

3) Equipment—clean, vapour-free anaesthetic machine, MH cart. If a dedicated MH anaesthesia machine is not available, remove vapourizers (or empty them and tape the dial in the off position), then flush on high flow oxygen for at least 10 minutes, and change circuit and absorbers.

4) Drugs — do not use succinylcholine or potent inhalation agents. Have sufficient dantrolene (36 vials per adult) and other resuscitation drugs on hand.

B) INTRAOPERATIVE

1) Continuous temperature monitoring with axillary temperature probe if possible, otherwise rectal or oesophageal temperature probes.

2) Large bore IV cannula.

3) Standard monitoring including end tidal CO_2.

C) POST OPERATIVE

1) Inpatient — Temperature and heart rate every 1 hour for 4 hours and then every 4 hours for 24 hours.

2) Outpatient — Discharge of ambulatory care patients may be possible (after 4 hours) providing all discharge criteria are met. The patients should be given written instructions that include guidelines for monitoring temperature at home, recognizing the signs of an MH reaction and the emergency contact number from the anaesthesia department.

MH EMERGENCY HOTLINE

1 800 MH HYPER or 1-800-644-9737

Malignant Hyperthermia Investigation Unit • 200 Elizabeth Street, EN3-323 • Toronto, ON • M5G 2C4
Phone: 416-340-3128 Fax: 416-340-4960