Successful management of malignant hyperthermia depends upon early diagnosis and treatment; onset can be within minutes of induction or may be insidious. The standard operating procedure below is intended to ease the burden of managing this rare but life threatening emergency.

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### 1 Recognition
- Unexplained increase in ETCO₂ **AND**
- Unexplained tachycardia **AND**
- Unexplained increase in oxygen requirement
- (Previous uneventful anaesthesia does **not** rule out MH)
- Temperature changes are a late sign

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### 2 Immediate management
- **STOP** all trigger agents
- **CALL FOR HELP.** Allocate specific tasks (action plan in MH kit)
- Install clean breathing system and **HYPERVENTILATE** with 100% O₂ high flow
- Maintain anaesthesia with intravenous agent
- **ABANDON/FINISH** surgery as soon as possible
- Muscle relaxation with non-depolarising neuromuscular blocking drug

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### 3 Monitoring & treatment
- Give **Dantrolene**
- Initiate active **cooling** avoiding vasoconstriction
- **TREAT:**
  - **Hyperkalaemia:** calcium chloride, glucose/insulin, NaHCO₃
  - **Arrhythmias:** magnesium/amiodarone/metoprolol **AVOID** calcium channel blockers – interaction with dantrolene
  - **Metabolic acidosis:** hyperventilate, NaHCO₃
  - **Myoglobinæmia:** forced alkaline diuresis (mannitol/furosemide + NaHCO₃) may require renal replacement therapy later
  - **DIC:** FFP, cryoprecipitate, platelets
- Check plasma CK as soon as able
- **For Paediatric Doses see Section 6**

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### 4 Follow-up
- **Continuous monitoring**
  - Core & peripheral temperature
  - ETCO₂
  - SpO₂
  - ECG
  - Invasive blood pressure
  - CVP
- **Repeated bloods**
  - ABG
  - U&E (potassium)
  - FBC (haematocrit/platelets)
  - Coagulation
- **DANTROLENE**
  - 2.5mg/kg immediate iv bolus. Repeat 1mg/kg boluses as required to max 10mg/kg
  - **For a 70kg adult**
    - **Initial bolus:** 9 vials dantrolene 20mg (each vial mixed with 60ml sterile water)
    - Further boluses of 4 vials dantrolene 20mg repeated up to 7 times
  - **For Dantrolene Doses in Paediatric patients see Section 5**

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**The UK MH Investigation Unit, Academic Unit of Anaesthesia, Clinical Sciences Building, St James’s University Hospital Trust, Leeds LS9 7TF. Direct line: 0113 206 5270. Fax: 0113 206 4140. Emergency Hotline: 07947 609601 (usually available outside office hours). Alternatively, contact Prof Hopkins or Dr Halsall through hospital switchboard: 0113 243 3144.**
Paediatric Administration of Dantrolene

- Mix 20mg (one vial) of Dantrolene with 60ml of sterile water to make a Dantrolene solution of 1mg in 3ml.
- Give an initial bolus of 7.5ml/kg of the Dantrolene solution (=2.5mg/kg)
- Repeat further doses of 3 ml/kg (=1mg/kg) up to a maximum of 30ml/kg in total of Dantrolene.
- For a 10kg infant: Give an initial bolus of 75mls (2.5mg/kg) of Dantrolene solution followed by 30ml (1mg/kg) boluses as required up to a maximum of 300mls (10mg/kg) of Dantrolene solution in total.
- Remember to include the Dantrolene solution administration in the overall fluid bolus totals i.e. 300ml of Dantrolene Solution in a 10kg child = 30ml/kg of fluid.

Paediatric Administration of Supportive Therapy

MAINTENANCE OF ANAESTHESIA:
- Benzodiazepine and Opioid. Propofol TIVA is contraindicated in Critically Ill Children.

ARRHYTHMIAS:
- Magnesium: 0.2 mmol/kg (50mg/kg). Give slowly by IV injection not >10mg/kg/min
- Amiodarone: 5mg/kg over 20 minutes then 300micrograms/kg/hour. Max 1.2g in 24 hours
- Esmolol: Loading dose of 500mcg/kg over 1 min then an infusion of 50mcg/kg/min over 4 mins
  Re-load with 500mcg/kg if inadequate response and increase infusion by 50mcg/kg/min
  Repeat until effective or a maximum infusion of 200mcg/kg/min is reached.
- AVOID calcium channel blockers they interact with Dantrolene

HYPERKALAEMIA: Calcium Gluconate 10%: 0.5ml/kg to a maximum of 20ml
  10% Dextrose (5ml/kg) + Insulin (0.1 Units/kg) over 20 minutes.
  Monitor Blood Sugar.

ACIDOSIS: Correct with SODIUM BICARBONATE 0.5-1.0 mmol/kg
  (0.5-1.0 ml of 8.4% NaHCO3/ kg).

URINE OUTPUT: Need to maintain urine output at least 2 ml/kg/hr If required use:
  MANNITOL 0.5 - 1.0 g/kg (2.5 – 5 ml/kg of 20% solution) and/or
  FRUSEMIDE 1 mg/kg IV

DIC:
- FFP 10ml/kg
- Cryoprecipitate 5ml/kg body weight up to 30kg
  5 units at a time are issued to children >30kg
- Platelets
  <30kg 10ml/kg
  >30kg one pool of donors

Drug doses references from the BNF for children. The drugs advised are for the initial management of MH. For ongoing and definitive treatment please contact your regional Paediatric Intensive Care Unit.
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