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Midlands Trauma Networks
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Version control and record of amendments

Date	Amendment	Lead
October 2018	There has been a published consensus document to say we treat paediatric TRCA in a similar fashion to TRCA using the same principles (reference 5). We have added a sentence about remembering to contact paed or obs as deaths in these patients are notifiable and require further action by the specialists.	C.Leech

1. INTRODUCTION

The mortality from traumatic cardiac arrest (TCA) is high. The most common causes of death are haemorrhage and traumatic brain injury. The ERC treatment algorithm for TCA was developed to prioritise the sequence of life-saving measures. Chest compressions should not delay the treatment of reversible causes. Cardiac arrests of non-traumatic origin leading to a secondary traumatic event should be recognised and treated with standard algorithms.¹

In a retrospective database review, the survival rate of patients whose cardiac arrest was the result of hypoxemia (hanging, drowning, electrocution, burns, traumatic asphyxia) had a survival rate of 17%². In addition, patients who underwent out-of-hospital thoracotomy after penetrating chest trauma had a higher chance of survival (11.8%)².

The priorities in the Emergency Department are to rapidly and simultaneously address all relevant reversible causes of traumatic cardiac arrest. Briefing of the trauma team members to undertake specific procedures in the resuscitation with the equipment being ready is imperative for those trauma patients who are being conveyed to hospital in a state of peri-arrest or cardiac arrest.

2. DEFINITIONS

VF = ventricular fibrillation

VT = ventricular tachycardia

ALS = advanced life support

MTP = massive transfusion protocol

CT = computed tomography

IV = intravenous

IO = intraosseous

TRCA = traumatic cardiac arrest

3. Management of the traumatic cardiac arrest will depend on the likely aetiology.

Patients will fall into one the following groups:

- a) medical cause of arrest (eg the patient had a primary medical event which then caused the traumatic insult)
- b) hypoxic cause of arrest eg hanging, drowning, burns, electrocution, cervical spine injury, traumatic asphyxia or isolated head/cervical spine injury
- c) commotio cordis caused by a blunt impact to the chest wall over the heart during the vulnerable phase of the cardiac cycle (rare and normally resulting in VF)³
- d) blunt polytrauma
- e) penetrating trauma

Patients in groups a), b) or c) should be treated as a medical arrest with full ALS resuscitation. Early intubation with 100% oxygenation and ventilation is essential in group b).

For d) blunt polytrauma or e) penetrating trauma, the following interventions should be performed:

3.1 <C> Catastrophic Haemorrhage

- Activate the Massive Haemorrhage Protocol (MHP/ Code Red protocol).
- Give Group O blood STAT, via rapid infuser (e.g. Belmont)
- Catastrophic limb haemorrhage should be treated with the application of a CAT tourniquet above the injury and tightened until the bleeding stops. Haemostatic agents (eg CELOX gauze) are indicated when the patient has catastrophic life-threatening external haemorrhage which is not controllable by any other means.

3.2 Airway

- Secure the airway with an endotracheal tube.
- Ventilate with 100% O₂.
- Consider a relaxant only intubation if the patient has just arrested since airway reflexes may still be present.
- Use End tidal CO₂ to assess the response to resuscitation and prognosis

3.3 Breathing

- Perform bilateral thoracostomies to decompress the chest and exclude tension pneumothoraces
- In penetrating trauma, perform an emergency thoracotomy if there were vital signs <15 minutes prior to cardiac arrest and there is no return of spontaneous circulation (see EMERGENCY DEPARTMENT THORACOTOMY GUIDELINE)
- In BLUNT chest trauma, in which a pericardial tamponade has already been diagnosed by ultrasound or CT, consider an emergency thoracotomy (see EMERGENCY DEPARTMENT THORACOTOMY GUIDELINE)

3.4 Circulation

- Obtain wide bore IV access immediately
- If IV access proves difficult, move swiftly onto intraosseous access using EZ-IO. (Choose an uninjured limb and a humeral insertion site if a pelvic fracture is suspected). Only attempt central access if there is an appropriately trained operator present
- Apply a pelvic splint and re-align limb fractures.
- Fully expose the patient and look for any external haemorrhage which can be treated (including occipital scalp wounds)
- Check the heart rhythm for shockable VT or VF. This is more likely in the elderly patient in whom the mechanism of injury suggests a relatively low energy transfer.

- Perform a rapid ultrasound to assess whether there is any cardiac activity or cardiac tamponade. Profoundly hypovolaemic patients may have no palpable carotid pulse but weak cardiac activity and need more blood product resuscitation and haemorrhage control.
- Do not routinely give Adrenaline or other vasoconstrictors to a poly-trauma cardiac arrest as this may worsen intracellular hypoxia and increase bleeding.

4. CPR

Depending on the cause of traumatic cardiac arrest chest compressions may provide some blood flow during cardiac arrest and should be continued whilst the history and mechanism of injury is established.⁴

Full ALS including chest compressions should always be performed for patients who have a hypoxic cause of arrest. This includes hanging, drowning, burns, electrocution, traumatic asphyxia, or patients with an isolated head injury or cervical spine injury.

Chest compressions will not be beneficial in the presence of an empty heart from hypovolaemia or where tension pneumothorax or cardiac tamponade exist.⁴

In polytrauma patients, chest compressions are not the priority. Reversible causes should be addressed as the priority and then chest compressions can be resumed.

5. Paediatric traumatic cardiac arrest

Management of a paediatric traumatic arrest should follow the same treatment strategy as for adults.⁵

6. Termination of Resuscitation

Termination of resuscitation should be a senior decision based on response to treatment as assessed clinically, biochemically and in light of the injuries found. In broad terms, if after treating all reversible causes there is no return of spontaneous circulation after 20 minutes of loss of vital signs, resuscitation should be stopped and death confirmed. If injuries incompatible with life are identified during the resuscitation, then it will be appropriate to stop resuscitation before 20 minutes.

Remember to inform the Paediatric Consultant on-call for all deaths in children less than 18 years old or the Obstetric Consultant on-call for any deaths involving pregnant women.

7. References

1. Truhlar A, et al. European Resuscitation Council Guidelines for Resuscitation 2015: Section 4. Cardiac arrest in special circumstances. Resuscitation 2015; 96:148-201.
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5. Rickard, AC, Vassallo J, Nutbeam T, Lyttle M, Maconochie I. K, Enki, DG and Smith JE. Paediatric traumatic cardiac arrest: A Delphi study to establish consensus on definition and management. *Emergency Medicine Journal* 2018;35 (7):434-439