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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's or obs as deaths in these patients are notifiable and require further action by the specialists.	C.Leech
June 2023	Incorporates ERC 2021 guidelines and APLS 2021 for TRCA	C Leech

Purpose

This document contains a guide for rapidly and simultaneously addressing all relevant reversible causes of traumatic cardiac arrest.

Scope of document

This guide is for receiving hospitals within the West Midlands Trauma Network.

Refer to the “Major Trauma in Pregnancy guideline” if the patient is pregnant.

Introduction

Traumatic cardiac arrest (TCA) carries a high mortality. The most common causes of death are from haemorrhage and traumatic brain injury. Survival rates depend on the mechanism of arrest and ranges from 1.6% to 32%. In survivors, the neurological outcome appears to be much better than in other causes of cardiac arrest. The reversible causes of TCA are uncontrolled haemorrhage (48%), tension pneumothorax (13%), asphyxia (13%), and pericardial tamponade (10%).

The priorities in the Emergency Department are to rapidly and simultaneously address all reversible causes of traumatic cardiac arrest. Briefing of the trauma team members to undertake specific procedures in the resuscitation and 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.

The management of a Paediatric patient (under 16 years) follows the same principles as the management of an adult in TCA.

Principles

1. Definitions

VF = ventricular fibrillation
VT = ventricular tachycardia
ALS = advanced life support
MTP = massive transfusion protocol
CT = computed tomography
IV = intravenous
IO = intraosseous
TCA = traumatic cardiac arrest
ROSC = return of spontaneous circulation

2. 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 e.g., hanging, drowning, burns, cervical spine injury, traumatic asphyxia or isolated head/cervical spine injury

- c) cardiac cause of arrest e.g. electrocution
- d) 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)
- e) blunt polytrauma
- f) penetrating trauma

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

For e) blunt polytrauma or f) penetrating trauma, the following interventions should be performed simultaneously (see Appendix 1)

2.1 <C> Catastrophic Haemorrhage

Activate the Massive Haemorrhage Protocol (MHP/ Code Red protocol).

Give balanced resuscitation with O negative blood/FFP via the Belmont rapid infuser & correct hypocalcaemia.

Catastrophic limb haemorrhage should be treated with the application of a commercial tourniquet above the injury and tightened until the bleeding stops. Haemostatic topical agents are indicated when the patient has catastrophic life-threatening external haemorrhage which is not controllable by any other means. Scalp wounds may require temporary sutures for haemorrhage control.

2.2 Airway

- Secure the airway with an endotracheal tube.
- 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

2.3 Breathing

Ventilate with 100% O₂.

In the presence of blunt or penetrating torso trauma perform bilateral thoracostomies to decompress the chest and exclude tension pneumothoraces.

For other patients, perform lung ultrasound to confirm lung sliding and exclude pneumothorax.

2.4 Circulation

Obtain wide bore IV access immediately.

If IV access proves difficult, move swiftly onto intraosseous access or a subclavian trauma line (if a trained operator is available). For IO access choose an uninjured limb and a humeral insertion site.

Apply a pelvic splint and re-align limb fractures.

Fully expose the patient and look for any external haemorrhage which can be controlled (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.

In penetrating chest trauma, perform a resuscitative thoracotomy if there were vital signs <15 minutes ago (see EMERGENCY DEPARTMENT THORACOTOMY GUIDELINE).

In blunt chest trauma, when a pericardial tamponade has already been diagnosed by ultrasound or CT, perform a resuscitative thoracotomy if there were vital signs <15 minutes ago (see EMERGENCY DEPARTMENT THORACOTOMY GUIDELINE).

Perform bedside ultrasound to assess whether there is any cardiac activity or cardiac tamponade. Profoundly hypovolaemic patients may have no palpable carotid pulse but have weak cardiac activity and need more blood product resuscitation and haemorrhage control.

Perform a FAST ultrasound to exclude massive abdominal or pelvic haemorrhage.

Do not routinely give adrenaline or other vasoconstrictors to a patient with suspected hypovolaemia as this may worsen intracellular hypoxia and increase bleeding.

3. 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 unlikely to be effective in the presence of an empty heart from hypovolaemia or where tension pneumothorax or cardiac tamponade are left untreated. Reversible causes should be addressed as the priority and then chest compressions can be resumed.

Ultrasound for cardiac activity is beneficial to establish a 'no flow' state requiring CPR versus 'low flow' states from hypovolaemia (which requires volume replacement).

Traumatic injury is not a contraindication for mechanical CPR but should be used with caution, particularly if there is chest wall injury

4. Paediatric traumatic cardiac arrest

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

5. Termination of Resuscitation

If after treating all reversible causes, there is no return of spontaneous circulation after 20 minutes of loss of vital signs, and no detectable cardiac activity on ultrasound if the patient is in PEA, resuscitation should be stopped and death confirmed. If injuries incompatible with life are identified during the resuscitation then it is 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.

Involvement in a traumatic cardiac arrest may be distressing. Staff members should be offered a hot debrief and signposted to pastoral support and counselling services within the trust.

6. Return of Spontaneous Circulation after TCA

Trauma teams should have a forward plan for what the management will be if a ROSC is achieved. This includes invasive blood pressure monitoring, blood pressure management, radiological imaging, damage control surgery (theatre and surgeon available in advance) or interventional radiology, and addressing coagulopathy and anticoagulation.

References

European Resuscitation Council Guidelines 2021: Cardiac arrest in special circumstances. Resuscitation 2021;161:152-219. Accessed at <https://cprguidelines.eu/>

Resuscitation Council UK. Special circumstances guideline. May 2021. Accessed at <https://www.resus.org.uk/library/2021-resuscitation-guidelines/special-circumstances-guidelines>

Resuscitation Council UK. Paediatric Advanced Life Support Guidelines. May 2021. Accessed at <https://www.resus.org.uk/library/2021-resuscitation-guidelines/paediatric-advanced-life-support-guidelines>

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

Appendix 1: ERC 2021 guidelines

**TRAUMATIC CARDIAC ARREST/
PERI-ARREST ALGORITHM**

