NORTHERN TRAUMA NETWORK NTN	Traumatic Cardiac Arrest Protocol
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VERSION NUMBER/DATE	1.0 / June 2017
REVIEW DATE	**01/06/2019**
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Traumatic Cardiac Arrest Protocol

Major Trauma continues to be the leading worldwide cause of death in young adults. Mortality remains high but there are reports of good neurological outcomes from traumatic cardiac arrest following introduction of treatment algorithms and use of clamshell thoracotomy. Rapid, effective intervention is required to address potential reversible causes of traumatic cardiac arrest. The aim was to develop a simple algorithm to manage the major trauma patient in actual or imminent cardiac arrest that could be utilised by services in the North East of England. Current ILCOR guidelines do not contain a standard algorithm for management of traumatic cardiac arrest. It was decided to split the algorithm into 2 sections; penetrating and blunt trauma.

A review of recent literature on traumatic cardiac arrest protocols. Traumatic cardiac arrest algorithms were reviewed from Lockey et al[(1)] and Sherren et al[(2)] and adaptations made to fit our current practice and geographical constraints. The protocol was aimed to be utilised in a pre-hospital setting with a physician-paramedic Helicopter Emergency Medical Service and in Major Trauma Centre/Trauma Unit Emergency Department.

The algorithm developed addresses the need for potential reversible causes of traumatic cardiac arrest. This includes immediate control of external haemorrhage, IV/IO access and blood transfusion, optimising oxygenation, bilateral chest decompression to exclude tension pneumothorax and resuscitative thoracotomy to treat cardiac tamponade and its cause. The algorithm also stipulates time guidelines and the introduction that these interventions need to be undertaken simultaneously with no external cardiac compressions.

The suggested algorithm is designed for a highly trained physician-led pre hospital team and in hospital emergency department Trauma Team. It aims to identify the early recognition of patients who fit these criteria and maximise the number of neurologically intact survivors in out-of-hospital TCA.

1. Introduction

Survival rates following traumatic cardiac arrest (TCA) are known to be poor but resuscitation is not universally futile.[2] There are distinct differences in the pathophysiology between medical cardiac arrests and TCA. Traumatic pathologies associated with an improved chance of successful resuscitation include hypoxia, tension pneumothorax and cardiac tamponade.[1] http://www.scancrit.com/wp-content/uploads/2013/06/fce6ef85d6fc2085d9077346e87caf1a.pngLockey et al[1] recently published an algorithm for traumatic cardiac arrest in *Resuscitation*, June 2013. It suggests incorporating resuscitative on-scene thoracotomy into our algorithms for traumatic cardiac arrest. It is a consequence of the very same group's previously published data on prehospital clamshell thoracotomies in patients with cardiac arrest due to penetrating chest injuries.[3]

In the emergency department it has been demonstrated that if blunt trauma patients have had more than 5 min of CPR or penetrating trauma patients have had mote than 15 min, resuscitative thoracotomy is likely to be futile.[4] Peri-arrest is imminent cardiac arrest in these patients. These patients should too be entered into the algorithm for targeted interventions. Often after intubation, and therefore planning and preparation pre intubation are vital.

Clinical care of patients suffering medical cardiac arrest follow national guidelines. A definitive evidence-base for many interventions does not exist, and this is unlikely to change due to practical difficulties in devising ethically sound randomised, controlled and blinded studies. Current guidelines apply irrespective of the presumed cause of cardiac arrest: emphasis is on immediate and minimally interrupted cardiac compressions, and once effective CPR and monitoring is established, the final bullet point in the "during CPR" box is "correct reversible causes".

There is some evidence that this process improves outcomes in some cases of cardiac arrest, for example Ventricular Fibrillation due to myocardial infarction. The pathophysiology of traumatic cardiac arrest is different and the Resuscitation Council guidelines address this in the "4 H's and 4 T's". It is reasonable to assume the following "H's" and "T's" apply to traumatic cardiac arrest: Hypovolaemia, Hypoxia, Tension Pneumothorax and Cardiac Tamponade. Massive head injury is not listed as if this is the cause of cardiac arrest it is generally accepted to be incompatible with successful resuscitation.

2. Explanation of Algorithm:

The aim of the algorithm is to rapidly identify and correct reversible causes of TCA. Transport of TCA patients with ongoing CPR is futile and either they need to have key interventions done at scene in a pre-hospital setting or transported rapidly to definitive in hospital Emergency Department Trauma Team for surgical intervention.

Identify/Rule out Medical Causes of Cardiac Arrest

Penetrating:

(a) Identify penetrating injury to anterior/posterior chest or epigastrium area.

Rapid examination to above areas to identify potential penetrating wounds. Ensure examination of patients back.

(b) Diagnosis of traumatic cardiac arrest

Rapid clinical assessment identified over 10 seconds. Agonal, abnormal or absent respiration and absence of a central pulse should immediately follow the algorithm if deemed to be traumatic in nature.

(c) No external Cardiac compressions to be performed and BLS/ALS algorithms to be commenced only when reversible causes treated.

Given the high incidence of hypovolaemia, hypoxia and obstructive shock prior to TCA, the role of adrenaline and chest compressions are limited. The current guidelines have the emphasis on early chest compressions: in the case of hypovolaemia this will lead to compression of an empty heart and is not expected to deliver effective circulation. Tamponade and tension pneumothorax will prevent effective cardiac compression. *When resources allow, simultaneous CPR should be delivered, however there is no role for isolated CPR – this will not reverse the underlying condition.*

(d) Simultaneous Interventions to be performed as reversible causes are ruled out – using HOTT pneumonic.

Hypovolaemia *should be managed with control of active external haemorrhage. Direct pressure to bleeding wounds, use of haemostatic agents, application of tourniquets and splintage of pelvis/limb fractures.*
IV access or IO access should be obtained expeditiously to allow rapid transfusion of blood products for volume resuscitation.

Oxygenation *with endotracheal intubation and positive pressure ventilation should be achieved as early as possible to correct airway obstruction and hypoxia and prevent traumatic asphyxia. It is key to ensure etCO2 is attached and monitor. It has been shown that an etCO2 <= 1.3kPa has limited survival and cessation of resuscitation should be considered.*

Tension pneumothorax *should be excluded by rapid bilateral chest decompression. Ideally by simple thoracostomy which is routinely used in a pre hospital setting. This has shown to be more effective than cannula decompression which are more prone to kinking or blockage.*[5,6]

Cardiac ***Tamponade*** *should be excluded when ROSC is not successful and the algorithm indicates moving onto Immediate Clamshell Thoracotomy.*[2,7]

Where release of cardiac tamponade does not result in ROSC patients may benefit from internal cardiac massage.[7]

(e) ROSC

If ROSC achieved in a pre-hospital setting immediate transfer to a definitive Major Trauma Centre with activation of Code Red Protocol is indicated. Ensure a pre alert to the receiving hospital is given.

If in hospital, immediate transfer for haemorrhage control with appropriate surgical teams/interventional radiology and activation of major haemorrhage protocol.

Blunt:

(f) Proceed with above simultaneous intervention

(g) Additional interventions

Follow ALS algorithm to include CPR and adrenaline administration. 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 are established. These are indicated in blunt trauma which may be partially effective while reversible pathology is addressed.[8]

ECG monitoring and appropriate defibrillation used as indicated. Defibrillation pads to be placed in the normal chest position, which will aid rhythm monitoring. They can be used as defibrillation pads whilst chest open or closed.

Bedside ultrasound can be used, typically in a hospital emergency department setting. This can help establish whether a pericardial effusion is present. In blunt trauma it is a helpful tool to accumulate evidence before moving onto a clamshell thoracotomy.

(h) Continue with algorithm

The algorithm presents a standardised simple approach to traumatic cardiac arrest which can be used in a pre hospital and hospital setting. This has specifically been adapted for Major Trauma Centres, Trauma Units and Pre Hospital physician led emergency medical services.

References:

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