



## Title CSOP Traumatic Cardiac Arrest

Version No: 3.4

Effective date: 21/06/2023

### APPROVALS

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Next Review Date:	June 2025		

### HISTORY

Effective Date	Version No.	Summary of Amendment
22/10/12	2.0	
21/11/14	3.0	Addition of TCA in pregnancy. Extension thoracotomy time from 10 to 15 minutes loss of vital signs.
14/08/15	3.1	Reviewed
13/12/15	3.2	Amendment in section 3.5 to 15 mins
April 2020	3.3	References amended, Addition of description of current evidence for ultrasound use, PLE description extended, addition of communication with relatives
Oct 2022	3.4	References amended, addition of notes to use of blood products as per CSOP 34 and latest thoracotomy guidance as per CSOP 35.



## Title CSOP Traumatic Cardiac Arrest

Version No: 3.4

Effective date: 21/06/2023

### REFERENCES

Document Reference Number	Document Title
1	ERC Guidelines for Resuscitation 2015: Section 4 Cardiac Arrest in Special Circumstances. Resuscitation 2015; 95:148-201
2	Lockey D, Crewdson K, Davies G. Traumatic cardiac arrest: who are the survivors? Ann Emerg Med 2006;48:240–4.
3	Association of Ambulance Chief Executives. Clinical practice Guidelines (JRCALC) 2013. Traumatic cardiac arrest. Page 36.
4	Lockey DJ, Lyon RM, Davies GE. Development of a simple algorithm to guide the effective management of traumatic cardiac arrest. Resuscitation 2013;84:738-42.
5	Einav S, Kaufman N, Sela HY. Maternal cardiac arrest and perimortem caesarean delivery: evidence of expert-based? Resuscitation 2013; 83(10):1191-1200.
6	Ann Surg. 2015 Sep;262(3):512-8; discussion 516-8. FAST ultrasound examination as a predictor of outcomes after resuscitative thoracotomy: a prospective evaluation. Inaba K1, Chouliaras K, Zakaluzny S, Swadron S, Mailhot T, Seif D, Teixeira P, Sivrikoz E, Ives C, Barmparas G, Koronakis N, Demetriades D.
7.	<a href="https://www.resus.org.uk/resuscitation-guidelines/prehospital-resuscitation/">https://www.resus.org.uk/resuscitation-guidelines/prehospital-resuscitation/</a>
8.	Consensus Statement 2018. Management of traumatic cardiac Arrest <a href="https://fphc.rcsed.ac.uk/media/2577/tca-submission-oct-2018.pdf">https://fphc.rcsed.ac.uk/media/2577/tca-submission-oct-2018.pdf</a>
9.	JRCALC Guidelines March 2016
10	JRCALC Clinical Guideline Updates Bundle No. 9 – Publication date: October 2022



## Title CSOP Traumatic Cardiac Arrest

Version No: 3.4

Effective date: 21/06/2023

11	European Resuscitation Council Guidelines 2021: Cardiac arrest in special circumstances. Resuscitation 2021: 161, 152-219
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### 1. Purpose

This CSOP provides guidance on the management of pre-hospital traumatic cardiac arrest and read in conjunction with CSOP 35 & 17.

### 2. Definitions/Acronyms:

Abbreviations	Definitions
TCA	Traumatic cardiac arrest
MTC	Major trauma centre
PLE	Pronounce life extinct
ROLE	Recognition of life extinct
ROSC	Return of spontaneous circulation
PRF	Patient Report Form
IV/IO	Intravenous/intraosseous
EtCO <sub>2</sub>	End tidal carbon dioxide
RTC	Road traffic collision
ALS	Advanced life support
ECG	Electrocardiograph
PEA	Pulseless Electrical Activity
CPR	Cardiac Pulmonary Resuscitation



**Title CSOP Traumatic Cardiac Arrest**

Version No: 3.4

Effective date: 21/06/2023

**3. Scope**

**3.1 Introduction**

Traumatic cardiac arrest (TCA) carries a high mortality with survival rates of 0-17%. In survivors, where data is available, neurological outcome is good in only 1.6%.<sup>1</sup>

In a retrospective UK pre-hospital study with a doctor-paramedic model, the overall survival rates to hospital discharge were 7.5% (17% in patients with a hypoxic cause, 7.9% in penetrating trauma and 3.3% in blunt polytrauma patients).<sup>2</sup>

However, resuscitation is not futile in TCA, with a trend of increased survivors in more recent research compared to research often cited from 15 years previously.

The management of TCA should focus on the likely mechanism of arrest and address the reversible causes in order of priority. Not all patients will need all interventions.

Reversible cause	Intervention
Hypoxia	Intubation, 100% oxygen & ventilation
Hypovolaemia	External haemorrhage control, splintage & intravascular fluids (including blood). As per CSOP 035 thoracotomy may be indicated if within 5mins.
Tension pneumothorax	Bilateral thoracostomies. Document if lung was up or down.
Cardiac tamponade	. In traumatic arrest where cardiac tamponade is thought to be the most likely cause a resuscitative thoracotomy should be considered, within 15mins. In line with new CSOP 035

There are no reliable predictors of survival for TCA based on clinical findings e.g. pupil reactivity.



## Title CSOP Traumatic Cardiac Arrest

Version No: 3.4

Effective date: 21/06/2023

### 3.2 Injuries incompatible with life

Before starting or during resuscitation, a clinician should decide whether attempted CPR is appropriate for the individual in the current circumstances.

The following injuries are unequivocally associated with death in all age groups:

- massive cranial and cerebral destruction
- hemi-corporectomy
- massive truncal injury including decapitation
- incineration with >95% burns
- Decomposition / putrefaction
- Foetal Macertion
- Rigor Mortis\* & Hypostasis

Special care should be taken with rigor mortis. There may be other situations (e.g. following ingestion of certain drugs) that may cause a patient to have abnormal rigidity in the moments directly after a cardiac arrest.

**As per JRCALC guidelines, resuscitation should not be started in these patients and the recognition of life extinct (ROLE) procedures should be followed at scene.**<sup>9</sup>

Preservation of forensic evidence should not prevent a clinician accessing the patient to confirm death. Limit the number of people accessing the body to avoid disrupting the scene.

Further details regarding documented do-not-attempt cardiopulmonary resuscitation (DNACPR) decision or advance decision to refuse treatment (ADRT) for cardiac arrest patients is available in TAAS Policy OSOP 007 ROLE.

### 3.3 Presumed Medical Cause

There are a small group of patients (generally elderly) who have a primary medical cardiac arrest which causes them to have a RTC or fall from height. The history of mechanism (e.g. car was seen to veer off the road with no obvious reason, minor damage to the vehicle or no injuries on clinical examination) may point to a potential medical cause.

Comotio cordis is a cardiac arrest caused by a blunt impact to the chest wall over the heart. A blow to the chest during the vulnerable phase of the cardiac cycle may cause malignant arrhythmias: commonly ventricular fibrillation. Comotio cordis occurs mostly during sports and victims are usually young males (mean age 14 years). The overall survival rate is 15%, but 25% if resuscitation is started within three minutes.<sup>1</sup>



## Title CSOP Traumatic Cardiac Arrest

Version No: 3.4

Effective date: 21/06/2023

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**These patients should receive full ALS resuscitation as for medical cardiac arrests. Do not forget to check a blood glucose level.**

The use of Adrenaline is currently recommended in the medical cause cardiac arrest ALS algorithm, but due to the different pathophysiology of TCA, there is little evidence to support its use for TCA.

### 3.4 Peri-arrest patient with trauma

Victims of major trauma can present in a peri-arrest state. Cardiovascular instability, including bradycardia, profound hypotension or rapidly decreasing blood pressure, loss of peripheral pulses, together with a deteriorating conscious level should immediately alert the emergency care provider of imminent cardiac arrest. Rapid, targeted interventions aimed at correcting reversible causes can prevent cardiac arrest. In cases where the patient is still self-ventilating, early drug-assisted tracheal intubation may be warranted.[7]

### 3.5 Hypoxic TRCA

Hypoxic causes include drowning, hanging, electrocution, traumatic asphyxia, high cervical spine injury with loss of ventilation, smoke inhalation and burns, or head injury with loss of airway.

**These patients should receive early intubation with a cuffed endotracheal tube, 100% oxygen and full ALS resuscitation including CPR.**

Drowned patients following a diving emergency may also require bilateral thoracostomies to exclude tension pneumothorax from barotrauma (please refer to CSOP 08: Diving Emergencies). Give IV fluids as hypovolaemia may have occurred from the effects of hydrostatic pressure on the body from the water following prolonged immersion.

### 3.6 – Patients with Cardiac Tamponade as presumed mechanism of arrest

Patients where the diagnosis of cardiac tamponade, as presumed cause of cardiac arrest, whether due to blunt or penetrating injury should be considered for resuscitative thoracotomy CSOP35. This should be done within 15mins with an understanding that outcomes drop significantly with every 1min delay to the procedure.



## Title CSOP Traumatic Cardiac Arrest

Version No: 3.4

Effective date: 21/06/2023

For other patients with penetrating injury to the neck, central/lower abdomen, flanks or limbs the following interventions should be performed:

<C>	Tourniquet application or Celox + direct pressure*
A	Intubation & 100% oxygen
c	Spinal immobilization is not necessary
B	Ventilation with EtCO <sub>2</sub> monitoring
C	Wide-bore IV or IO access with administration of 2 litres IV fluids*, Blood products & Tranexamic acid administration
C	Control of external haemorrhage with direct pressure

\*(CSOP22: External Haemorrhage Control).

### 3.7 Blunt Polytrauma

TRCA from blunt polytrauma requires multiple interventions performed simultaneously. This includes:

<C>	Tourniquet application or Celox + direct pressure
A	Intubation & 100% oxygen
c	Spinal immobilization is unproven in blunt TRCA <sup>1</sup>
B	Bilateral thoracostomies Ventilation with EtCO <sub>2</sub> monitoring
C	Wide-bore IV or IO access with administration of 2 litres IV fluids or blood products* & Tranexamic acid administration



**Title CSOP Traumatic Cardiac Arrest**

Version No: 3.4

Effective date: 21/06/2023

C	Control of external haemorrhage with direct pressure, splintage of pelvis and pulling limbs out to length with manual traction of fractures/KTD application
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\*For IO access, the humerus of an uninjured arm is the preferred site due to a potential pelvic fracture in a TRCA blunt polytrauma patient.

Large volume of IV fluids may be needed to achieve ROSC, a mix of blood products and crystalloid is acceptable if necessary. In some instances a second blood carrying resource may be sent to aid resuscitation, primarily if the patient cannot be transported to hospital

**3.7 ALS Resuscitation**

A definitive airway should be provided in all patients. An endotracheal tube is the gold standard especially in patients who may have a chest injury with high inflation pressures or an ‘open chest’ from thoracostomy or thoracotomy. Where intubation is impossible an LMA should be used, as per failed airway protocols (please refer to CSOP 13).

EtCO<sub>2</sub> should be measured in all patients and is a useful indicator of cardiac output.

Depending on the cause of the TCA, chest compressions may provide some blood flow during cardiac arrest and should be continued while the history and mechanism of injury are established.<sup>4</sup> Chest compressions are unlikely to be effective in hypovolaemia, tension pneumothorax or cardiac tamponade. Chest compressions should not delay the treatment of any of these reversible causes and therefore in a small team it may only be possible to commence this after attention to the reversible pathology.

**ROSC**

It is useful to note which intervention may have resulted in ROSC to determine the likely cause of arrest. Ensure all other reversible causes are rapidly addressed and transfer by land to the nearest MTC with a pre-alert message.

Spinal immobilization should be performed for blunt TRCA patients with ROSC.

**General principles**

The focus of post-ROSC management is directed at optimising perfusion of the brain and heart using the ABCDE approach, whilst considering the overall trauma care and transfer to definitive care.





## Title CSOP Traumatic Cardiac Arrest

Version No: 3.4

Effective date: 21/06/2023

### Use of Ultrasound

Ultrasound devices and their use by trained operators may add information to the clinical decision making process.

#### 3.8 Pronouncing Life Extinct (PLE)

In the literature, the maximum CPR time associated with a favourable outcome is 16 minutes.<sup>1</sup> If there is no response within 30minutes<sup>10</sup>, despite the above measures, the patient should be pronounced dead.

Exceptions in which it is appropriate to continue resuscitation into the ED include:

- Loss of vital signs during transport to hospital
- Paediatric TRCA
- Pregnant TRCA if palpable uterus above umbilicus
- Scene safety e.g. aggressive relatives or friends of patient
- Isolated drowning with suspected hypothermia

If the patient is confirmed dead the PLE/ROLE time must be noted. Give the time, with your name and contact details to the police officer in charge. Document the police officers surname and collar number on the PRF. Ensure you have the call signs of all ambulance crews involved. When patients have undergone medical interventions all lines and tubes should be left in place. Note any incisions (even for failed procedures) on the PRF.

Transport of a deceased patient is not performed by the air ambulance, except where a land ambulance cannot gain access. Please note that local variances exist regarding the removal of bodies and advice should be taken from ambulance control and/or police.

All cases of sudden death are referred to the Coroner. Ensure you have clearly documented the history, examination, management and times as you may be called to provide a report at a later date.

#### Asystole for more than 30 min

JRCALC Guidelines (2022)<sup>10</sup> state that where a patient has had persistent asystole for more than 30 min, despite ALS, and where drowning, hypothermia, poisoning or overdose, and pregnancy have been excluded, it is appropriate for the resuscitation attempt to be stopped.<sup>(9)</sup>



## Title CSOP Traumatic Cardiac Arrest

Version No: 3.4

Effective date: 21/06/2023

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### Pulseless electrical activity

The decision about when to stop a cardiac arrest where pulseless electrical activity (PEA) persists is less clear and is not currently within JRCALC Guidelines (2016). The reported survival to discharge rate for PEA is very low (one UK registry reported this to be 4.2 %). There is limited evidence to support when one should terminate a PEA cardiac arrest, but the length of time in arrest without life support, the absence of reversible causes and co-morbidities are important factors to consider when making this decision. (9)

### 3.9 TCA In Pregnancy

Bystander confirmation of gestational age or assessment of fundal height should be performed immediately on arrival. Only for female patients with a gravid uterus above the level of the umbilicus or a confirmed gestational age >20 weeks is additional management required.<sup>1</sup> The patient should immediately be tilted >15 degrees on a scoop or have manual displacement of the uterus to the left to reduce aorta-caval compression. A resuscitative hysterotomy is indicated if the patient fails to respond to initial resuscitation (after 4 minutes) with the primary aim of saving the life of the mother by improving cardiac output. If the pre-hospital practitioner is not confident to perform this procedure in the pre-hospital environment, the patient should be rapidly transported to the nearest Emergency Department with senior obstetric staff on site. A clear pre-alert message should communicate the resources required on arrival. Fetal and/or maternal survival have been quoted even when a resuscitative hysterotomy was performed over 30 minutes of arrest, see CSOP 27 Resuscitative Hysterotomy.

### 4.0 Debriefing

Land crews who were involved in the patient care may require a quick 'hot debrief' to provide opportunity for reflection and explain why the management which was performed differs from their traditional ALS teaching. Contact details for further discussions can be provided to avoid delay in clearing from scene. Any team member, regardless of service, is welcome to attend an M&M meeting to discuss the case fully. Members of the public who were witnesses to the incident may also require reassurance.

### 4.1 Communication with relatives & Subsequent Care

Offer relatives the opportunity to be present during the resuscitation attempt, providing their physical presence and behaviour does not interfere with clinical care. Although priorities during the management of a cardiac arrest lie with the patient, it is important to consider the relatives who may also be present. Relatives are also patients in this setting and sensitive treatment of



**Title CSOP Traumatic Cardiac Arrest**

Version No: 3.4

Effective date: 21/06/2023

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relatives may help the mourning process and minimise subsequent grief. Explain to the relatives as soon as possible during the resuscitation, the gravity of the situation and the care that is being administered. If a decision is made to terminate the resuscitation attempt, consider inviting the relative(s) to be with the patient before CPR is stopped (if they are not already present) so that they can spend time with their loved one before they die.

Local ambulance service policies will describe organ donation options, beyond the remit of TAAS.

**End of Document**

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