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This guideline is intended for the immediate management of patients presenting to the Emergency Department with penetrating chest trauma who are in cardiac arrest. It defines the indications, contra-indications and practical procedure for performing an emergency thoracotomy in the Emergency Department for both cardiac arrest and patients who are peri-arrest

It is expected that a thoracotomy will only rarely be performed in the ED as the majority of patients will have been in cardiac arrest for too long for the procedure to be effective and patients with signs of life will go to theatre. The success rate of emergency thoracotomy for a patient with no vital signs on arrival to the ED is 1%.

The primary objectives of ED thoracotomy are to (a) release pericardial tamponade; (b) control cardiac haemorrhage; (c) control intra-thoracic bleeding; (d) perform open cardiac massage; and (f) temporarily occlude the descending thoracic aorta.

Indications for ED thoracotomy

Penetrating trauma (eg stabbing or GSW or other penetrating foreign body)

to thorax or upper abdomen

AND

Patient is in cardiac arrest

AND

Patient has had a definite cardiac output within the last 15 minutes eg signs of life, palpable carotid pulse or cardiac activity seen on ultrasound

Blunt chest trauma is unlikely to produce an isolated single system injury that will respond to the interventions performed at thoracotomy. ED thoracotomy for traumatic cardiac arrest following blunt trauma has a very poor prognosis. It should therefore only be **considered** if pericardial tamponade has been confirmed by ultrasound or CT scan; the patient has been witnessed to arrest by the trauma team; and there are no other obvious irreversible causes of cardiac arrest.

Contraindications to performing ED thoracotomy

- Patient has signs of life and is not about to arrest – patient should be considered for rapid CT or moved immediately to theatre. However if patient loses cardiac output in the Emergency Department then the patient should not be moved and an immediate thoracotomy should be performed in the resuscitation room.
- Patient has had loss of cardiac output for greater than 15 minutes – evidence in the literature points to procedure being unsalvageable after this time. This information may be obtained from the ambulance crew in the time of 999 call or time of arrival at scene. Where doubt exists regarding the exact time but it is thought to be around 15 minutes it may be in the patients best interests to perform an Emergency Department thoracotomy.

Pre-arrival preparation

If the Emergency Department receives an alert message from the ambulance service of an incoming patient with penetrating trauma who is peri-arrest or in cardiac arrest the following should be prepared:

- Activate a Trauma Alert
- Activate 'Massive Haemorrhage Protocol'

- Fast bleep the Cardiothoracic Registrar/Consultant to the Emergency Department (Trauma Units/LEH's should contact the Surgical Registrar)
- Identify equipment for emergency thoracotomy including scalpels, spencer wells forceps, sterile paramedic shears, thoracotomy pack, sterile gauze swabs.
- Brief team for potential ED resuscitative thoracotomy and assign roles
- Prepare the rapid infuser (if available).
- Identify the location of the O negative blood

Emergency Department thoracotomy procedure

The decision to perform ED thoracotomy will be led by the Trauma Team Leader and the procedure will be executed without delay. Departments should identify in their local protocols who will perform the procedure and who will take over the role of TTL if the most senior ED person is involved in performing the thoracotomy.

It is recognized that **external chest compressions are not effective** for patients in traumatic cardiac arrest due to cardiac tamponade (an obstructed heart) or hypovolaemia (an empty heart) and obstruct access to the chest for emergency procedures.

Unlike a medical arrest, the **administration of inotropes and vasopressors (eg adrenaline) is contraindicated** in the hypovolaemic patient who is already maximally vasoconstricted. Inotropes may be required after control of haemorrhage if ROSC is achieved.

Whilst the thoracotomy is being performed the following simultaneous actions will occur:

- the Anaesthetist will intubate the patient and provide positive pressure ventilation with 100% oxygen.
- wide bore IV or IO access will be obtained with the infusion of O negative blood stat.

A clam shell technique will be used to open the chest to allow full exposure.

Skin preparation will not routinely be undertaken for the patient in cardiac arrest.

Bilateral thoracostomies will be performed in the 5th intercostal space just anterior to the mid-axillary line. The first thoracostomy will be performed on the side of the penetrating injury. If ROSC occurs following thoracostomy there is no need to continue to thoracotomy and it is likely the patient had a tension pneumothorax.

If ROSC does not occur, the thoracostomies will be joined by a scalpel incision through the skin, with scalpel and paramedic shears used to cut through the intercostal muscles. The sternum can be divided with sterile paramedic shears or the gigli saw in the thoracotomy pack.

The pericardium will be opened longitudinally on every patient to exclude an occult tamponade.

Bimanual internal cardiac compressions should be undertaken on patients with no cardiac activity.

The descending thoracic aorta should be compressed by an assistant to redistribute the reduced circulating volume to the brain and myocardium.

Cardiac wounds should be controlled by gentle digital pressure over a gauze swab (\pm haemostatic gauze) or staples until a cardiothoracic surgeon is available.

Lung bleeding should be controlled by packing or digital pressure (\pm haemostatic gauze) at the pulmonary hilum until a cardiothoracic surgeon is available.

Patients who are peri-arrest with penetrating chest trauma

The following should take place simultaneously:

- Activate Massive Transfusion Protocol
- Intubation by Anaesthetist with muscle relaxant only or no drugs
- Bilateral thoracostomies to exclude tension pneumothorax
- IV or IO access with immediate rapid infusion of warmed O negative blood
- Immediate FAST scan to identify presence of free fluid in the abdominal cavity or the presence of pericardial fluid suggesting cardiac tamponade.
- Immediate Cardiothoracic or Surgical assessment to decide on management plan with Trauma Team Leader
- Involvement of Surgical Registrar or Consultant if abdominal injury also suspected
- Rush patient to theatre for thoracotomy \pm laparotomy.
- If the patient is about to arrest or actually arrests in the ED the patient will have an Emergency Thoracotomy performed in the Resuscitation room to avoid any delays.

Governance

All cases of emergency department resuscitative thoracotomy should be debriefed with the local Major Trauma lead, discussed in local MDT trauma and governance meetings, and reviewed annually at network governance meetings.

Each department should identify the personnel available 24/7 in the Emergency Department who are trained to perform a resuscitative thoracotomy if it is indicated. Commercial cadaveric training courses on resuscitative thoracotomy are available within the trauma network.

References

Soar J, Deakin C, Lockey A, Nolan J, Perkins G. A. Adult Advanced Life Support. 2015. London: Resuscitation Council (UK) [online] available at: <https://www.resus.org.uk/resuscitation-guidelines/adult-advanced-life-support/#reversible>

Royal College of Surgeons of England. Emergency Surgery: Guidance for providers, commissioners and service planners. Standards for unscheduled surgical care. 2011. London: Royal College of Surgeons of England [online] available from: <http://www.rcseng.ac.uk/publications/docs/emergency-surgery-standards-for-unscheduled-care>

Truhlar A, et al., European Resuscitation Council Guidelines for Resuscitation 2015: Section 4. Cardiac arrest in special circumstances. Resuscitation 2015;95:148-201. Available from: <https://ercguidelines.elsevierresource.com/european-resuscitation-council-guidelines-resuscitation-2015-section-4-cardiac-arrest-special#ASPECIALCAUSES>

Moore EE, Knudson MM, Burlew CC, Inaba K, et al. WTA Study Group. Defining the limits of resuscitative emergency department thoracotomy: a contemporary Western Trauma Association perspective. J Trauma 2011 Feb;70(2):334-9.

Seamon MJ, Haut ER, Van Arendonk K, et al. An evidence-based approach to patient selection for emergency department thoracotomy: A practice management guideline from the Eastern Association for the Surgery of Trauma. J Trauma Acute Care Surg 2015 Jul;79(1):159-73.

Seamon MJ, Shiroff AM, Franco M, Stawicki SP, et al. Emergency department thoracotomy for penetrating injuries of the heart and great vessels: an appraisal of 283 consecutive cases from two urban trauma centers. J Trauma 2009;67(6):1250-7; discussion 1257-8.

Edens JW, Beekley AC, Chung KK, et al. Long term outcomes after combat casualty emergency department thoracotomy. J Am Coll Surg 2009;209(2):188-97.

Brown T B, Romanello M, Kilgore M. Cost-utility analysis of emergency department thoracotomy for trauma victims. Journal of Trauma 2007; 62(5): 1180-1185.

Powell DW, Moore EE, Cothren CC, et al. Is emergency department resuscitative thoracotomy futile care for the critically injured patient requiring prehospital cardiopulmonary resuscitation? J Am Coll Surg 2004;199(2):211-5.

Rhee P M, Acosta J, Bridgeman A, Wang D, Jordan M, Rich N. Survival after emergency department thoracotomy: review of published data from the past 25 years. *Journal of the American College of Surgeons* 2000; 190(3): 288-298.

Tyburski JG, Astra L, Wilson RF et al. 'Factors affecting prognosis with penetrating wounds of the heart'. *J Trauma* 2000;48:587-590.

Millham FH, Grendlinger GA. 'Survival determinants in patients undergoing emergency room thoracotomy for penetrating chest injury'. *J Trauma* 1993;34:332.

Boyd M, Vanek VW, Bourguet CC. 'Emergency room resuscitative thoracotomy: when is it indicated?' *J Trauma* 1992;32:77.