Trauma Service Guidelines

Title: Emergency Department Thoracotomy Guideline


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See Also: TRM08.12 Traumatic Cardiac Arrest Guideline; TRM08.16 Trauma OPSTAT; TRM08.01 Massive Blood Transfusion Guideline

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Background

Thoracic trauma is one of the leading causes of death worldwide in all age groups, and accounts for 20-50% of all traumatic injuries. Most thoracic injuries can be managed conservatively but a small group will require a thoracotomy as part of their initial resuscitation. 1-5

Rapid response times and improved paramedical treatment at the scene have resulted in increasing numbers of patients arriving in the Emergency Department in extremis. Salvage of this group of patients requires immediate control of haemorrhage, and resuscitation. This is achieved by focusing on correction of reversible causes of shock, namely, haemorrhage, obstruction (due to tension pneumothorax or pericardial tamponade) and hypoxia. 1, 4, 6

Survival rates following Emergency Department Thoracotomy (EDT) for all patients with penetrating thoracic trauma are 9-12% and up to 38% in those with signs of life; whereas for all patients with blunt trauma survival rates are 1-2% and up to 5% in those with signs of life. 2-10

Definitions:

Emergency Department Thoracotomy (EDT) 5, 7, 8

Occurring in the emergency department as an integral part of the initial resuscitation process immediately after presentation.

Urgent Thoracotomy 5, 7, 8

Thoracotomy performed in the operating theatre.

Signs of Life 1, 6, 9

- Pupillary response to light
- Respiratory effort
- Cardiac activity/contractility on eFAST
- Spontaneous movement
- Palpable pulse

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Aims of the Emergency Department Thoracotomy

Primary Aim
- Alleviate cardiac tamponade which is causing refractory obstructive shock.

In the presence of senior surgical staff, secondary aims to consider are:
- Haemorrhage control
- Performing open cardiac massage
- Cross clamping the descending thoracic aorta to prevent exsanguination from catastrophic intra-abdominal bleeding.

Indications for Pericardial Decompression via Emergency Department Thoracotomy in either Blunt and/or Penetrating Trauma

- Profound refractory shock with SBP < 70mmHg despite bilateral chest decompression and aggressive 1:1:1 blood product resuscitation
- Cardiac Tamponade on eFAST
- Cardiac Activity on eFAST

OR
- Witnessed cardiac arrest in ED or Pre-hospital Arrest (< 10 mins) in the in an undifferentiated trauma patient
- Cardiac Tamponade on eFAST

The Massive Blood Transfusion Guideline should be activated and the MEP pack retrieved and a TRAUMA OPSTAT activated to notify theatre that an urgent surgical case may be on their way for definitive management once the EDT is complete.

Contraindications for Pericardial Decompression via Emergency Department Thoracotomy:

- Pre-hospital CPR of > 10 minutes in the context of traumatic arrest Injuries that are not compatible with life (including non-survivable head injuries)
- No return of spontaneous circulation (ROSC) after 10 minutes in the context of traumatic arrest
- Lack of training in the procedure
- The patient’s age and pre-existing co-morbidities mean that successful resuscitation is highly unlikely

Urgent Thoracotomy

Time critical patients who are NOT in extremis and who do not meet the indications above are best managed in the operating room by the thoracic team. The patients can have safe rapid transport to theatre by the Trauma OPSTAT.

If the thoracic team is delayed and not immediately available in theatre at the time of the patient’s arrival, the thoracotomy should be commenced by the general surgeon.

The approach should be as outlined below using the left lateral thoracotomy (which can then be extended/converted to clamshell).

Methods and Equipment

The left anterolateral approach is frequently utilised (see Figure 1) for EDT due to the advantages of:
- rapid access with simple instrumentation in the supine patient
- easy extension to the contra lateral hemi-thorax (clamshell)
The right anterolateral approach may be selected in cases where there is a penetrating injury to the right side of the chest.

**How to** 10, 14, 19

Although surgical draping is not essential, large, waterproof, disposable sterile paper drapes are included in the Emergency Department Thoracotomy (EDT) tray. The patient is positioned supine with both arms abducted at right angles, and the left side of the chest and hip partly elevated (folded towels, pillow or sandbags).

Rapidly prepping and draping of the entire area is required prior to the skin incision taking place.

The skin incision should be below the nipple, in the infra-mammary fold and should target the fifth intercostal space (see Figure 1), extending through the soft tissues of the chest wall following the curve of the rib. In women the breast should be retracted. If a finger thoracostomy has been performed, the incision should be extended as per the above description.

Entry into the pleural cavity should be on the superior margin of the sixth rib to avoid the intercostal neurovascular bundle. Muscle, periosteum and parietal pleura are divided in one layer with scissors and blunt dissection. Chest wall bleeding is generally minimal.

To spread the ribs once the incision is completed (see Figure 4) and the pleural cavity exposed, a suitable retractor (Finochietto comes assembled on the EDT) should be inserted with the handle pointing towards the axilla. The superior and inferior costal cartilages of the opened interspaces may be incised in order to achieve additional exposure.

*Figure 1 Resuscitative thoracotomy, general technique from Jones & Rivers 2019, Chapter 18 Resuscitative Thoracotomy*. [Custalow CB: Color atlas of emergency department procedures, Philadelphia, 2005, Saunders] 5

![Figures 1-6](image-url)
Procedures

Pericardotomy to relieve cardiac tamponade

The pericardiotomy should be made with scissors at least 1cm anterior to, and parallel to the phrenic nerve.

Any blood and clot should be evacuated.

In the beating heart, digital pressure on bleeding sites should be maintained until the patient is resuscitated.

If the heart is fibrillating, suture control of the bleeding points should be performed before defibrillation.

The pericardium may appear normal despite the presence of tamponade. It must ALWAYS be opened.\(^\text{10}\)

Repair of the heart/ Haemorrhage control

Use Satinsky clamp for atrial wounds

A skin-stapling device can be useful for temporary control of bleeding from the myocardium.

Close pericardium with interrupted sutures

Internal (open) Cardiac Massage

Cardiac massage should begin immediately if there is true cardiac arrest.

This can be done using two hands with a hinged clapping motion i.e. 2 cupped hands, opposed at the wrist and avoiding thumb pressure

Internal cardiac should not be the only indication for EDT as external compressions have been shown to be equally effective

Internal defibrillation for ventricular fibrillation (VF) requires energies of 15 to 30 joules

Post Procedure Care

Once cardiac output has returned the patient requires rapid transport to the operating theatre for definitive care. Hypotensive resuscitation principles (aiming for systolic ~ 90mmHg) should be employed to maintain perfusion, but minimise haemorrhage (see TRM 08.01 Massive Blood Transfusion in Trauma Guidelines ).

Cessation of Resuscitation

Cessation of resuscitation requires careful consideration and the EDT should not be performed where:

- Injuries incompatible with life
- Pulseless electrical activity (PEA)
- Asystolic arrest
Emergency Department Thoracotomy Tray

There are two trays available; one with 2 assembled Finochietto retractors, and one with instruments

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Emergency Department Thoracotomy

If patient is expected with penetrating/blunt chest trauma in extremis notify cardiothoracic team
Retrieve the MEP pack

Patient arrives
Commence Primary Survey

Indications for EDT
BP < 70mmHg despite resus
Cardiac tamponade on eFAST
< 10mins prehospital CPR
Survivable injuries

Are there any indications for Emergency Department Thoracotomy?

Yes

TRAUMA OPSTAT

Perform an Emergency Department Thoracotomy

Cessation of treatment
Injuries incompatible with life
Pulseless electrical activity
Asystolic arrest
Downgrade Trauma
OPSTAT
Notify theatre # 6312

Cessation of treatment
Injuries incompatible with life
Palpable pulse

No

Return of SOL

Yes

URGENT THEATRE

Signs of Life
Pupil response
Respiratory effort
Cardiac activity
Spontaneous Movement
Palpable pulse

No

Continue primary & secondary survey

Patient Requires Urgent Thoracotomy?

Yes

Notify Cardiothoracics

No


