

Trauma Service Guidelines

Title: Emergency Department Thoracotomy 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.^{1,2} Most thoracic injuries can be managed conservatively but a small group will require a thoracotomy as part of their initial resuscitation.

Rapid response times and improved paramedical treatment at the scene have resulted in increasing numbers of patients arriving in the emergency department in extremis.^{1,3,4} Salvage of this group of patients requires immediate control of haemorrhage and resuscitation.

Survival rates following Emergency Department Thoracotomy (EDT) for penetrating thoracic trauma are 9-12% (up to 38% with signs of life); whereas for blunt trauma survival rates are 1-2% regardless of clinical signs.²⁻⁹

Definitions:

Emergency Department Thoracotomy (EDT)

Occurring in the emergency department as an integral part of the initial resuscitation process immediately after presentation.⁸

Urgent Thoracotomy^{1,4,8}

Thoracotomy performed in the operating theatre.

Signs of Life^{1,7,8,10,11}

- Pupillary response to light
- Respiratory effort
- Cardiac activity on the ECG
- Spontaneous movement
- Palpable pulse

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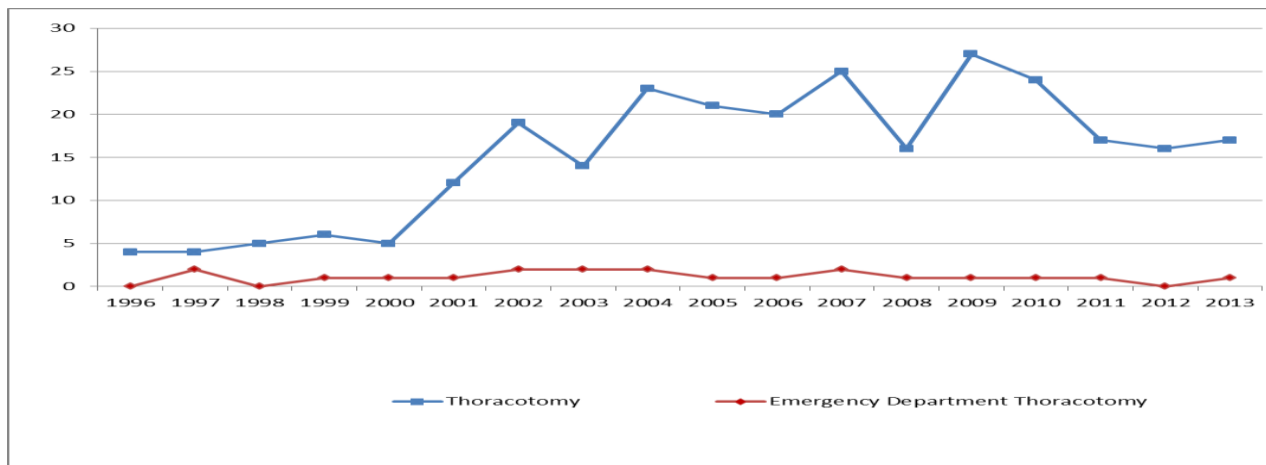
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RMH Experience

The Royal Melbourne Hospital has conducted 294 thoracotomies in patients with multiple trauma since 1996, of these 20 were EDT's (6.8%).¹²

The overall death rate for thoracotomies (emergency and urgent) in the major trauma population at RMH is 6%, and for those conducted in the ED the death rate is 61% with only 2 survivors in this small group.¹²



Aims of an Emergency Department Thoracotomy

Resuscitation of a patient in extremis with a penetrating injury by:^{1, 3, 7-11, 13}

- Release cardiac tamponade
- Control haemorrhage
- Perform open cardiac massage
- Cross clamp the descending thoracic aorta
- Control air embolism

Indications for Emergency Department Thoracotomy

Penetrating trauma

- Presents to ED with no signs of life (SOL) and pre hospital CPR time <10mins^{14, 15}
- Witnessed cardiac arrest in the ED^{1, 3, 7, 8, 10, 13}
- Patient in extremis (BP<60 not responding to fluid resuscitation) on arrival in ED^{1, 4, 6, 7, 9, 13}

Blunt Trauma

- Presents to ED with no SOL and pre hospital CPR time <5mins^{14, 15}
- Witnessed cardiac arrest in the ED^{3-5, 7, 9-11, 14}

Patients age and comorbidity needs to be taken into account when making a decision to undertake an EDT^{5, 10, 14}

It is recommended that all urgent thoracotomies are performed, where possible in the operating theatre by the cardiothoracic team (those patient's NOT in extremis, who are NOT time critical and can make it to the operating theatre ie Trauma OPSTAT's).

Methods and Equipment ^{1,3}

The approach

The EDT incision is determined by the anticipated injury. The left anterolateral approach (see fig 1) is frequently utilised for EDT due to the advantages of

- rapid access with simple instrumentation in the supine patient,
- easy extension to the contra lateral hemi thorax.
- cross-clamping of the aorta
- open cardiac massage

The anterolateral approach is regarded as the initial approach due to its limited access to heart, lungs and great vessels.

The right anterolateral approach may be selected in cases where the injury is to the right side of the chest

How to

Although surgical draping is not essential, large, waterproof, disposable sterile-papered drapes are included in the EDT tray. The patient 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).

The skin incision should be below the nipple, in the infra-mammary fold and should target the fifth intercostal space (see figure 1.0), extending through the soft tissues of the chest wall. Entry into 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 general minimal.

Once the incision is completed and the pleural cavity exposed a suitable retractor 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.

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

Procedures

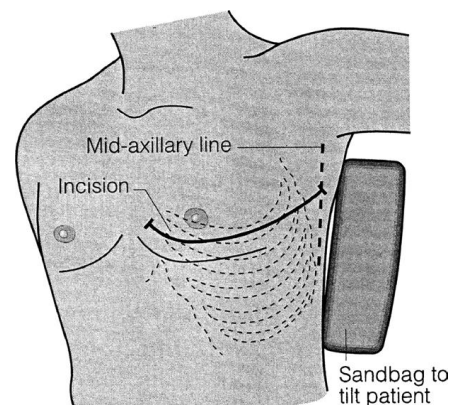
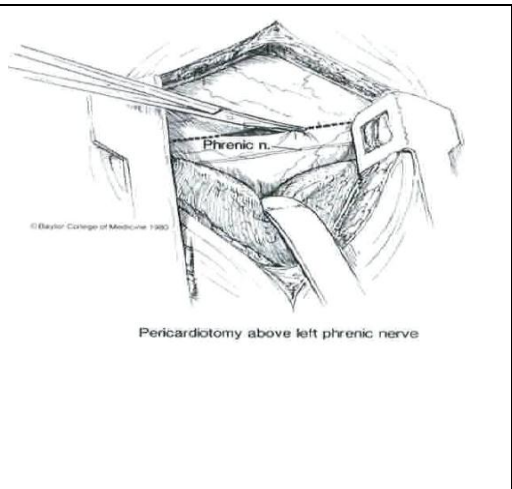


Figure 1.0 Left Anterolateral Thoracotomy (Hunt 2006)

Pericardotomy



The pericardotomy should be made with scissors at least 1 cm 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 formed before defibrillation.

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

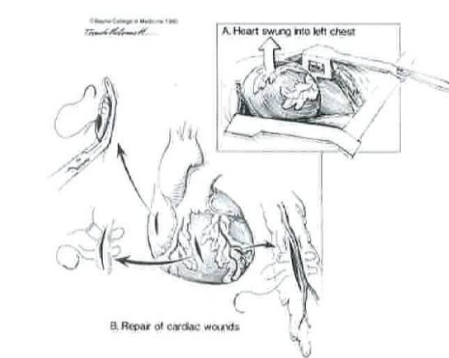
Cross Clamping the Aorta



Rationale for clamping the descending thoracic aorta is to reduce sub-diaphragmatic blood loss if that is a problem, and hence retain the limited blood volume to the myocardium and brain.

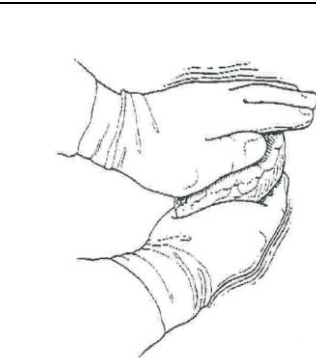
Specific operative approaches

Repair of the heart



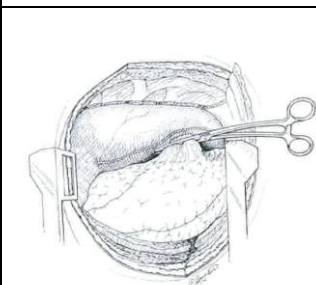
Digital occlusion of the laceration
Satinsky clamp for atrial wounds
Interrupted sutures

Internal (open) Cardiac Massage



2 cupped hands, opposed at the wrist and avoiding thumb pressure.
Internal defibrillation for VF requires energies of 15 to 30 Joule.

Cross Clamp Pulmonary Hilum



Air embolism may result from severe lung trauma where air passages, and pulmonary veins are ruptured in continuity, and air embolism to the coronaries may occur.
Partial or complete rupture of the pulmonary artery or pulmonary vein may also be controlled.

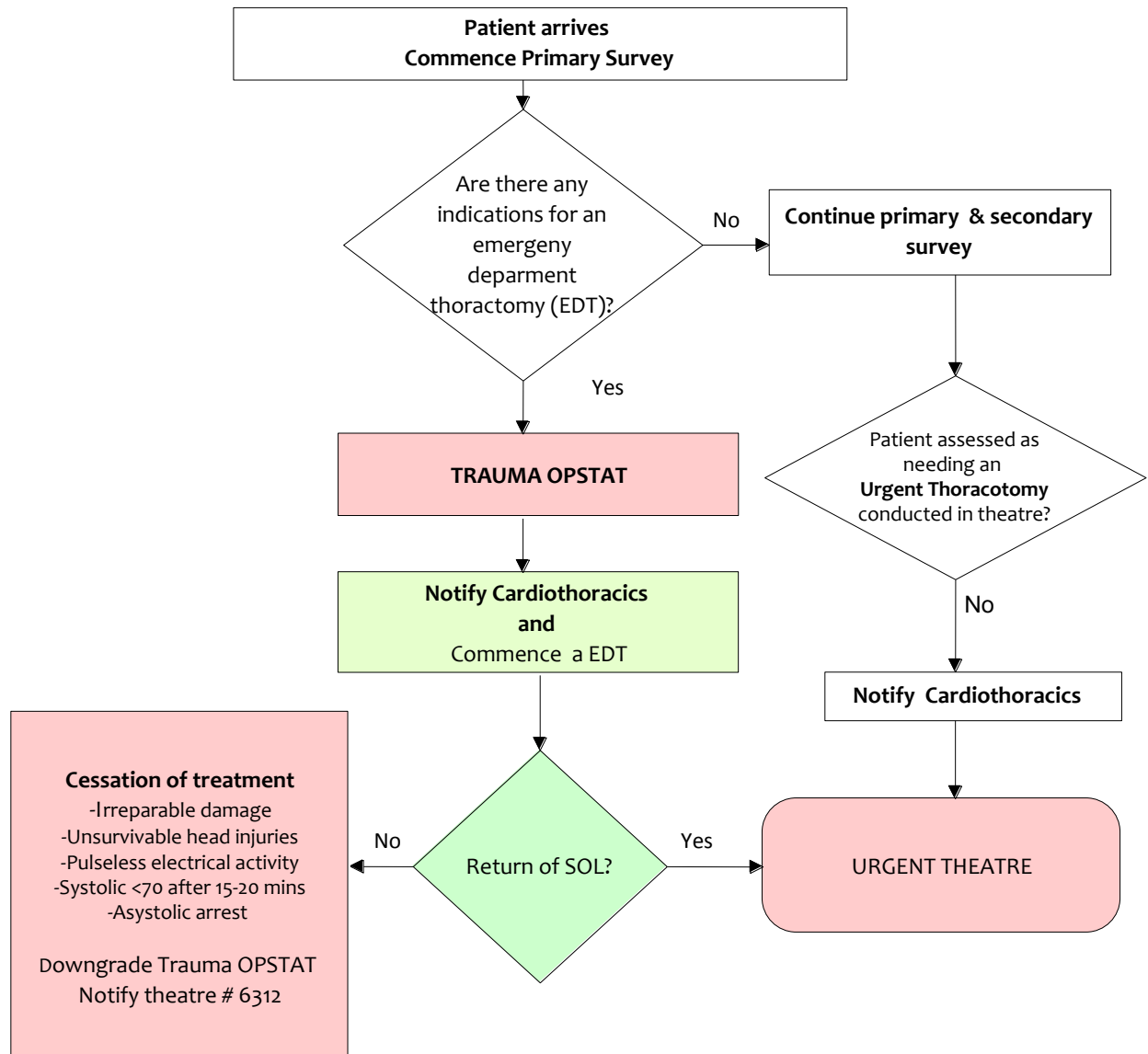
Cessation of Emergency Department Thoracotomy

Cessation of EDT and resuscitation requires careful consideration and should be terminated if 1, 3, 5, 10, 14:

- Irreparable damage
- Massive head injuries
- Pulseless electrical activity (PEA)
- Systolic BP < 70 after 15-20 mins
- Asystolic arrest

Emergency Department Thoracotomy

If patient is expected with penetrating/ blunt chest trauma in extremis notify cardiothoracic team







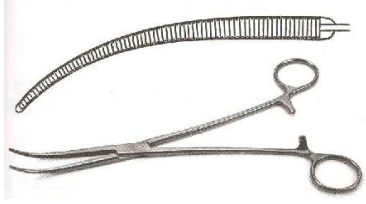




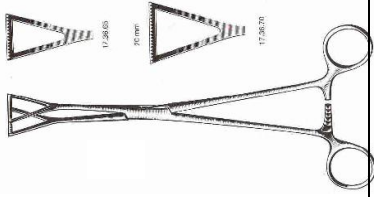



Signs of Life
Pupil response
Respiratory effort
Cardiac activity
Spontaneous Movement
Palpable pulse

Indications for EDT in Penetrating Trauma?
Extremis (BP <60 not responding to fluid resuscitation)
No signs of life and prehospital CPR < 10 mins
Witnessed cardiac arrest in ED

Indications for EDT in Blunt Trauma?
No signs of life and pre hospital CPR < 5mins
Witness cardiac arrest in ED

Equipment: Emergency Department Thoracotomy Tray

IMAGE	No	INSTRUMENT NAME	USE
	2	DeBakey dissectors Long 25cm	Atraumatic
	2	DeBakey dissectors Long 20cm	
	1	Metzenbaum curved Scissor 18cm	Cutting delicate tissue
	1	Metzenbaum Scissor 23cm	
	1	Mayo Scissor-Curved 17.1 cm	Cut sutures etc
	1	Vascular Needle Holder-Long (snowden-pencer)	
	2	Rampley sponge holders	Attach prep foam for skin prep
	6	Curved Artery Forceps	
	2	Roberts artery forceps	Longer Tissue forceps clamp bleeding vessels
	1	Clamp vascular DeBakey aortic large	
	1	Clamp vascular DeBakey aortic med	
	1	Satinsky Clamp-Large	Vascular clamp

	2	Duvals Lung Tissue Forceps large	Tissue forceps used on lung
	2	Durham Barr Retractors	
	1	Gigli saw + 2 handles	Cut through ribs and sternotomy if required
Other equipment on EDT trolley			
Suture		3x 3/0 Prolene round needle 3x 2/0 Ticron 5x 1/0 Prolene	
Pledgets	1	Packet Teflon felt pledgets	
Staplers	1	Skin stapler	
Scalpels	1	Box disposable sterile No 23 scalpel blades	
Catheters	1	14G Foley catheter	
Suction	2	Disposable suction tubing and Yankeur suckers	
Defibrillator paddles	1	Internal defibrillator paddles	
Tegaderm		Large tegaderm	
Drapes		Large disposable drape (3M 6617)	
Tray Number 2.0			
	1	Large Finochietto Retractor Frame (assembled) Includes frame, arm, screw	
	1	Medium Finochietto Retractor Frame (assembled) Includes frame, arm, screw	

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