

# Emergency Department Thoracotomy

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# Background

- ▶ Thoracic trauma is one of the leading causes of death worldwide in all age groups and accounts for 25-50% of all traumatic injuries.
- ▶ EDT introduced in 1900
- ▶ Intense debate
- ▶ It is drastic ,last effort to save life

# Background...Cont'd

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

- ▶ Remains controversial , survival rate up to 60% others have argued that EDT is futile and expensive procedure that put the health care providers at risk

# Definitions

## ► **Emergency Department Thoracotomy (EDT):**

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

## ► **Urgent Thoracotomy:**

Thoracotomy performed in the operating theatre.

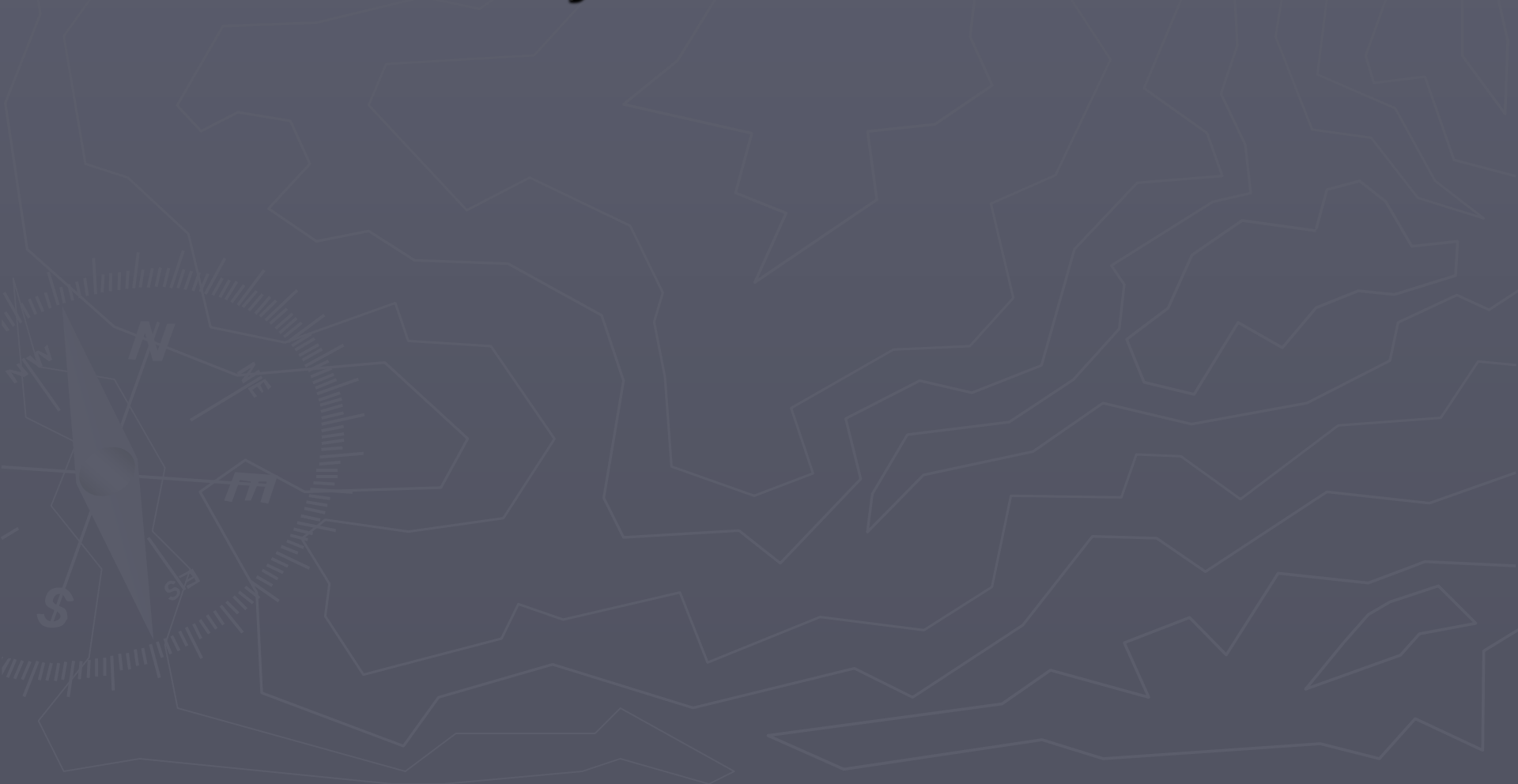
# Signs Of Life (SOL)

Increased EDT Survival rates are associated with signs of life in the E D, including the followings

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

# Best Survival Rate

- EDT for stab injuries who arrived with SOL



# Factors associated with increased survival rate

- ▶ High blood pressure
- ▶ High respiratory rate
- ▶ High GCS





# Low Survival Rates

- ▶ Multitrauma
- ▶ No SOL in the field
- ▶ Blunt trauma due to conditions like cardiac contusion , aortic rupture cardiac rupture

# GSW injuries survival rate

- ▶ USUALLY are un able to seal spontaneously because of the large nature of the missile injury pattern



# EDT - Accepted Indications

## ► Penetrating Thoracic Trauma :

- Traumatic arrest with previously witnessed cardiac activity
- Patient with < 5 mins of CPR on arrival
- Patient in extremis (BP <60 not responding to fluid resuscitation) on arrival to ED
- Witnessed cardiac arrest in the ED

## ► Blunt Thoracic Trauma :

- Witnessed cardiac arrest in the ED .
- Patients age and co-morbidity needs to be taken into account when making a decision to undertake an EDT
- Rapid exsanguinations from chest tube (>1500ml)

# **EDT - Relative Indications**

## **Penetrating Thoracic Trauma**

- ▶ Traumatic arrest without previously witnessed cardiac activity

## **Penetrating Non-Thoracic Trauma :**

- ▶ Traumatic arrest with previously witnessed cardiac activity

## **Blunt Thoracic Trauma:**

- ▶ Traumatic arrest with previously witnessed cardiac activity



# EDT - Contraindications

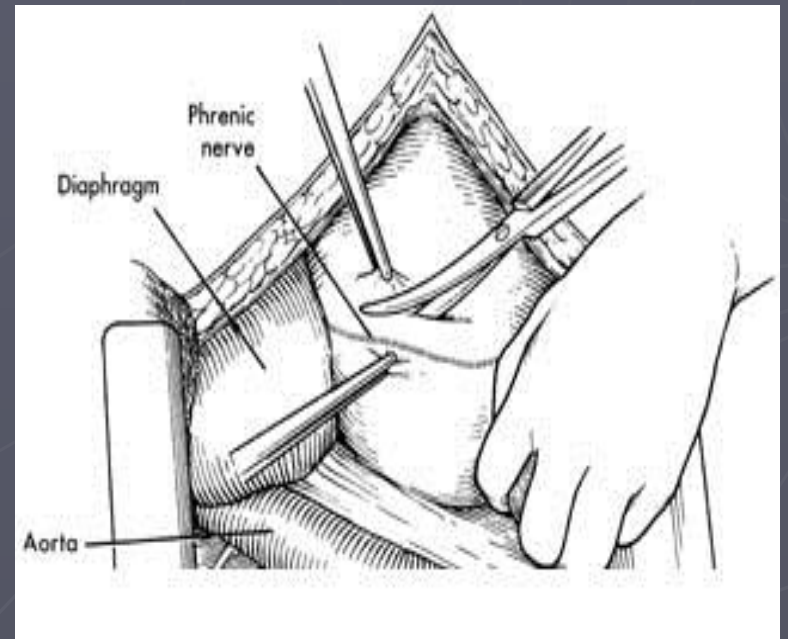
- **Blunt Trauma:**

- ▶ Blunt thoracic injuries with no witnessed cardiac activity
- ▶ Multiple blunt trauma
- ▶ Severe head injury
- ▶ Non traumatic arrest
- ▶ Improperly trained team
- ▶ Insufficient equipments

## Prospective multi centre study

- ▶ EDT doesnot yield survival if the follwoings are noted
- ▶ Blunt trauma with more than 10 minutes CPR in prehospital without response
- ▶ Pentrating trauma with more than 15 CPR with no rspnse
- ▶ Asystole without cardiac tamponade

# The EDT Procedure





# Aims of an EDT

Resuscitation of a patient in extremis with a penetrating injury by:

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








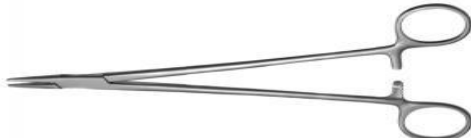
# Equipment

- ▶ **Personal protective equipment and *preparation***
- ▶ Gloves
- ▶ Sterile gloves
- ▶ Gown
- ▶ Face shield
- ▶ Povidone iodine (Betadine)
- ▶ Sterile drapes



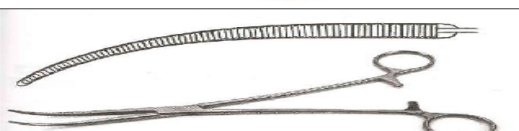


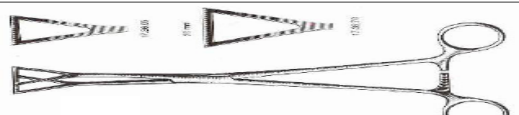




# To enter the chest cavity

- ▶ Scalpel, No. 10 or No. 20 blade
- ▶ Mayo scissors (alternatively, Metzenbaum scissors)
- ▶ Rib spreaders (eg, Finochietto)
- ▶ Trauma shears or saw (eg, Gigli)

# EDT Tray ... Cont'd

INSTRUMENT	No	NAME	USE
	1	B.P. Handle No 4 Long	Deep wounds
	2	DeBakey dissectors Long 25cm	Atraumatic
	2	DeBakey dissectors Long 20cm	
	1	Gillies dissectors- toothed	Used mainly to grip skin
	2	Yankeur sucker	
	1	Metzenbaum Scissor 20cm	Cutting delicate tissue
	1	Metzenbaum Scissor 23cm	
	1	Mayo Scissor-Curved	Cut sutures etc
	1	Vascular Needle Holder-Long 25cm	
	1	Ryder Vascular Needle Holder	
	1	Mayo Hegar Needle Holder	

# EDT Tray

INSTRUMENT	No	NAME	USE
	2	Rampley sponge holders	Attach prep foam for skin prep
	6	Curved Artery Forceps	
	6	Roberts artery forceps	Longer Tissue forceps clamp bleeding vessels
	1	Aortic Curved Clamp- Large	
	1	Aortic Curved Clamp- Medium	
	1	Satinsky Clamp-Large	Vascular clamp
	2	Duvals Lung Tissue Forceps	Tissue forceps used on lung
	1	Allison Lung Retractor	Other name is Lung spade
	2	Durham Barr Retractors	
	5	Towel Clips	
	1	Gigli saw + 2 handles	Cut through ribs and sternotomy if required

# To control hemorrhage and repair injury

- ▶ Tissue/tooth forceps
- ▶ Satinsky vascular clamps (large and small)
- ▶ Long and short needle holders (eg, Hegar)
- ▶ Nonabsorbable sutures (silk), 2-0 or larger, on large round-body needle
- ▶ Cardiovascular Ethibond sutures, 3-0
- ▶ Teflon pledgets
- ▶ Suture scissors
- ▶ Kelly clamp

- ▶ Skin stapler
- ▶ High-volume suction device
- ▶ Laparotomy packs
- ▶ Tonsil clamps
- ▶ Aortic clamp instrument
- ▶ Foley catheter, 20F with 30-mL balloon
- ▶ Laparotomy pads
- ▶ Teflon patches
- ▶ Internal defibrillator

# Approach

- A supine anterolateral thoracotomy
- Raise the patient left arm above the head
- left sided approach is used in all patients and with injuries to the left chest
- Patients who are not arrested but with profound hypotension and right sided injuries have their right chest opened first.



- Prepare the patient left and right side with iodine
- Drape the area with sterile towels
- Airway control for all , if the thoracic organs are suspected do selective right main bronchus by pushing the tube to 30 cm

# In both cases it may become necessary to extend the incision across the sternum.

# Skin incision is made in the 4th intercostal space above the fifth rib , from sternal border to the mid axillary line.

# Stop ventilation momentarily when you enter the pleural cavity to allow the lung to collapse

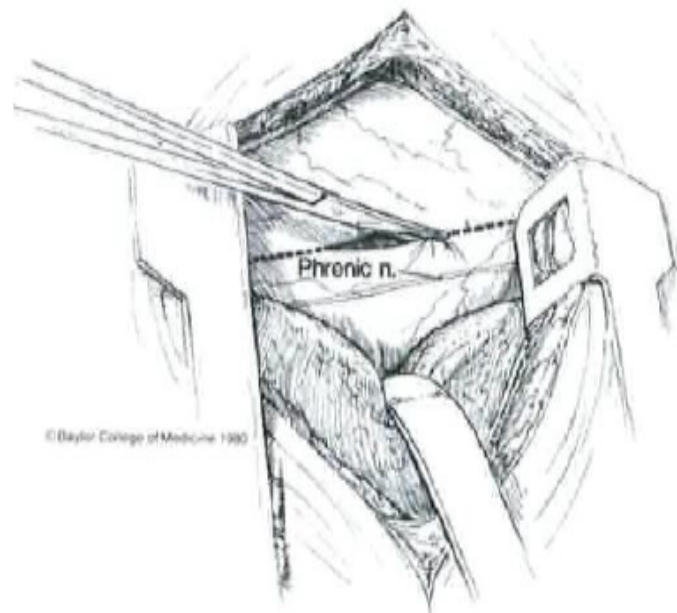
# The rib spreader should be placed with the handle downward to allow for extension

# Relief of Tamponade :

- The pericardium is opened longitudinally to avoid damage to the phrenic nerve,
- the pericardium should always be opened to assess for retro cardiac blood.
- The operator can use his fingers to dissect after the initial incision
- If cardiac lacerations are seen , digital occlusion, interrupted sutures, or clamps (satinsky) to repair

# EDT - Operative Technique

## Pericardotomy



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Pericardiotomy above left phrenic nerve

The pericardiotomy 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.

# Control of Hemorrhage :

- **Cardiac wounds :**

- ▶ controlled initially with direct finger pressure.
- ▶ sutured using non-absorbable 3/0 sutures
- ▶ mattress sutures are used to avoid obstructing coronary flow

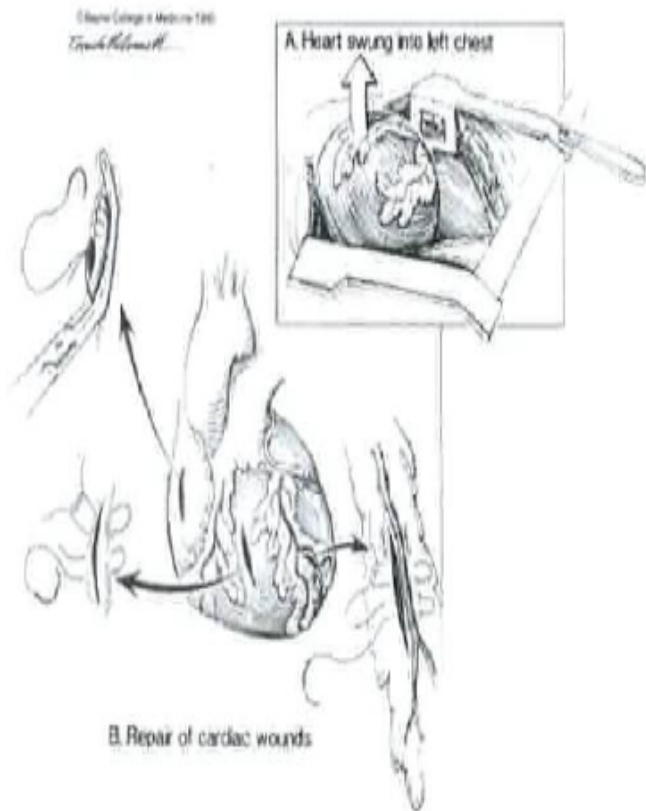
- **Pulmonary & Hilar injuries.**

- ▶ temporarily controlled with finger pressure at the pulmonary hilum.

# EDT -

## Operative Technique *...Cont'd*

### Repair of the heart



Digital occlusion of the laceration

Satinsky clamp for atrial wounds

Interrupted sutures

# Control of Hemorrhage:

*Cont'd*

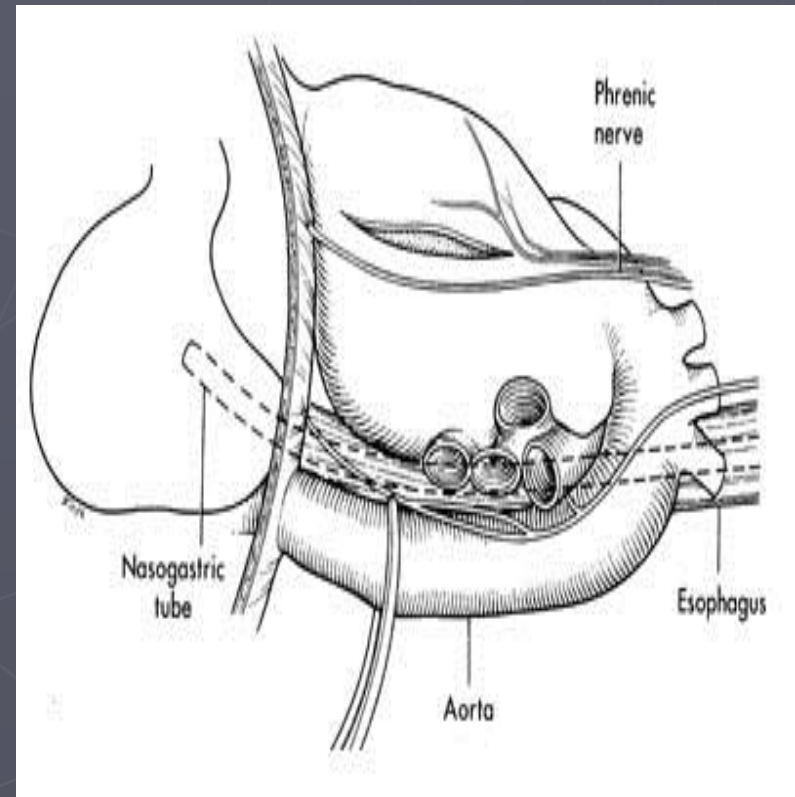
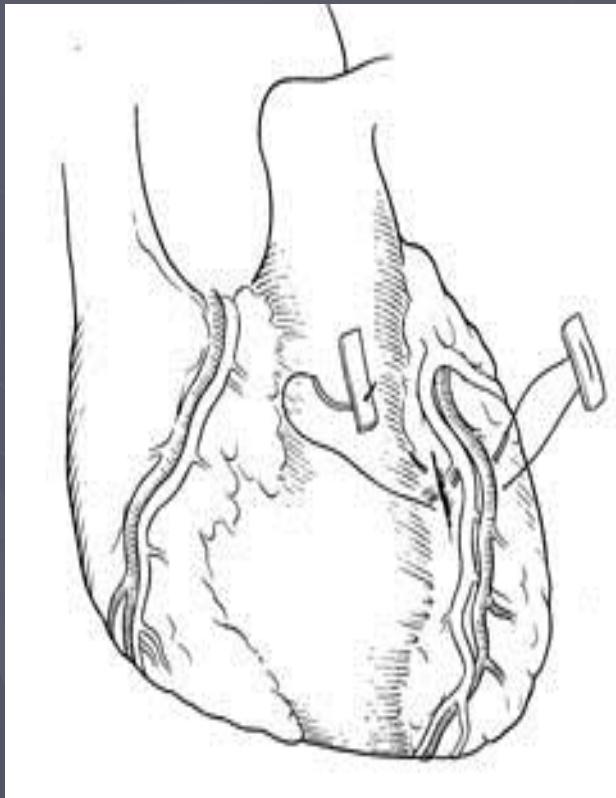
- **Pulmonary & Hilar injuries :** *(Cont'd)*
  - ▶ This may be augmented by placement of a Satinsky clamp across the hilum
  - ▶ Lesser haemorrhage from the lung parenchymas can be controlled with a temporary clamp
- **Great vessel injuries :**
  - ▶ Small aortic injuries can be sutured directly using the 3/0
  - ▶ Larger injuries, especially to the arch may require temporary digital occlusion and institution of cardiac bypass.

# Aortic cross-clamping :

- ▶ The rationale for clamping the aorta is to redistribute blood flow to the coronary vessels, lungs and brain,
- ▶ Clamp time should ideally be 30 minutes or less.
- ▶ Cross-clamping is done ideally distal to the level of the diaphragm, to maximise spinal cord perfusion
- ▶ Near the level of the diaphragm to control bleeding in abdominal vascular injuries .



# EDT - Operative Technique

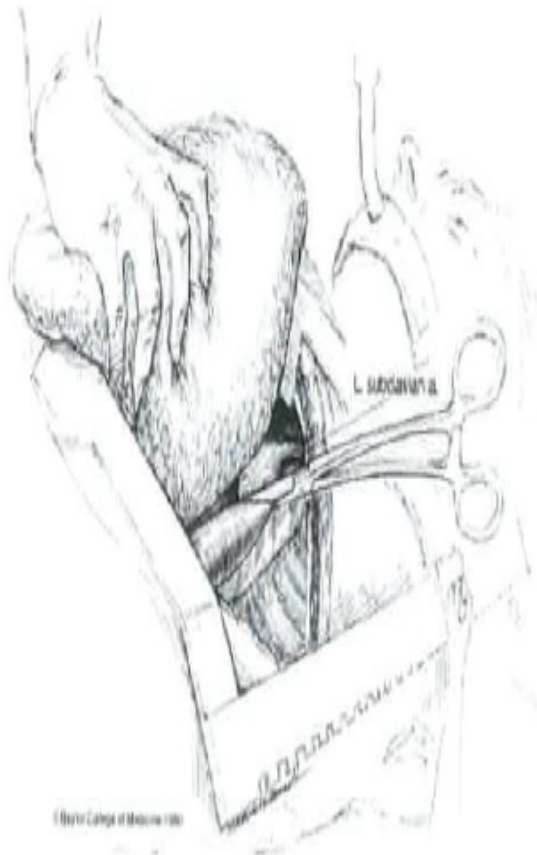


- ▶ Retract the left lung superiorly to expose the aorta , the aorta lies anterior to vertebra wherese the esophagus lies anterior and medial to the aorta
- ▶ The aorta feels rubbery , firm and pulsatile
- ▶ In hypotensive pt NGT inserted to distinguish the esophagus from aorta

# EDT -

## Operative Technique *...Cont'd*

### 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.

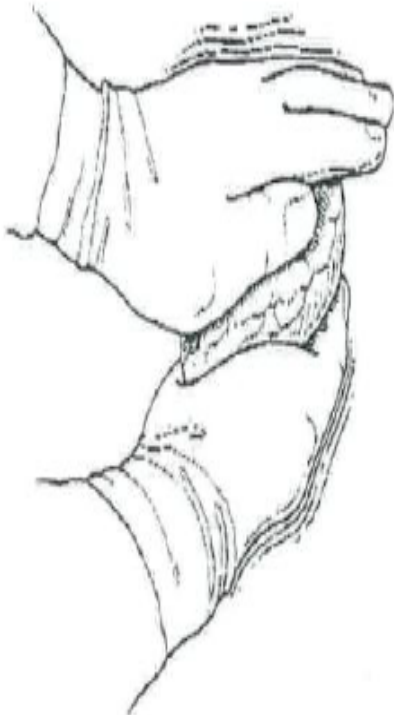
# Internal cardiac massage

- ▶ internal cardiac massage should be started as soon as possible
- ▶ A two-handed technique produces a better cardiac output.
- ▶ Compared with standard CPR ,which delivers up to 20% of the cardiac output , internal CPR produces up to 55% of the body perfusion

# EDT -

## Operative Technique *...Cont'd*

### 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.

- ▶ Internal defibrillation begins at 20 joules and increased to 40- 50 j
- ▶ Avoid touching the coronaries with plades
- ▶ Fluid resuscitation should start after bleeding control , warmed fluid, blood and clotting factors
- ▶ Inotrope support after fluid resus

# Pitfalls

**Anoxic brain death occurs in 50% of survivors**

- ▶ **Peroperative Heart Injury**
- ▶ **Suture Over Coronary Artery**
- ▶ **Peroperative Lung Injury**
- ▶ **Peroperative Oesophageal Injury**
- ▶ **Damage to phrenic nerve**
- ▶ **Damage to esophagus**
- ▶ **Recurrent bleeding from chest wall or mammary artery**

# Pearls

- ▶ Blunt trauma survival rate much lower than penetrating injury
- ▶ Airway control is standard
- ▶ NGT to distinguish the esophagus from aorta
- ▶ Immediate surgical consult



- ▶ Left anterolateral approach when the site of injury is unknown
- ▶ Incision over the 5<sup>th</sup> rib , 4<sup>th</sup> intercostal space
- ▶ Consider potential organs donor rescue after EDT arrest

# SUMMARY

## ► Indications

- Stab wounds
- Deep shock (BP < 70 mmHg)
- Non responder
- Cardiac arrest in the ED
- ≤ 10 min CPR

## ► Emergency procedure – now !

## ► 1 out of 4 can be saved

## ► EDT is part of damage control

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*THANKS ,*  
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