NORTHERN TRAUMA NETWORK NTN	Thoracotomy
AUTHOR	Laura Duffy
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RELATED INFORMATION	Emergency thoracotomy: how to do it. Emergency Med J 2005; 22:22-24 Emergency Thoracotomy in thoracic trauma – a review. Injury, Int J Care Injured 2006; 37: 1-19

Background

Patients who lose their vital signs on scene through penetrating trauma have a desperately poor outcome. Transportation to hospital, while administering cardiopulmonary resuscitation is pointless; blood flow through the heart is either obstructed or the heart is simply empty through hypovolaemia.

If the patient is to have any chance, surgical intervention should be immediate.

It is vital to understand that prehospital/hospital thoracotomy does not aim to address all the possible lesions that can lead to cardiac arrest through penetrating chest trauma. Even in Emergency Departments the provision of an all "encompassing cardiothoracic response" is an impossibility – most departments do not have a cardiothoracic department on which to draw. It follows that the majority of emergency room thoracotomies are carried out by non-cardiothoracic surgeons and can only reasonably expect to address a limited number of problems.

Thoracotomy aims to address one specific group of patients, those with a simple cardiac wound leading to tamponade and cardiac arrest. It does not aim to address more complicated wounds that have produced hypovolaemic arrest. In the majority of cases of cardiac tamponade the blood in the pericardium has clotted so needle pericardiocentesis is useless.

Formal thoracotomy and pericardotomy is essential. Patients will also require “quality massage” to ensure return of spontaneous cardiac activity. The type of thoracotomy performed aims to provide maximal exposure to facilitate identification of anatomy. Only a minimal amount of surgical equipment is required; scalpel, Gigli saw and Spencer Wells forceps.

This operational guideline should be read in conjunction with the guideline on penetrating thoracic trauma.

Indications

Penetrating injury to the chest or upper abdomen resulting in cardiac arrest or an agonal state.

Process

1. MAKE THE DECISION

The decision to undertake an open thoracotomy should be made within 10–15 seconds of arrival and establishing that the patient has no signs of life. This is a clinical diagnosis and should not require monitoring. Begin opening the chest immediately while the paramedic undertakes intubation and IV cannulation if required.

2. BILATERAL THORACOSOTOMY

Undertake bilateral thoracostomies in the midaxillary line 4^{th} or 5^{th} intercostal space using a No 22 scalpel and a pair of Spencer Wells.

3. JOIN THE THORACOSTOMIES

Make a skin incision between the thoracostomies. The first incision should aim to get through all skin layers to fat / chest wall.

Using a pair of Tuff Cut Shears extend the thoracostomy wounds on both sides through the sternum. It may be possible to cut through the sternum with the shears. If not the sternum must now be breached with a Gigli saw. Pass the Spencer Wells behind the sternum grab the Gigli wire and pull it behind the sternum. Attach the wire to Gigli handles and saw. It should take little more the 2 or 3 pulls.

4. EXTEND THE EXCISION POSTERIORLY

Before opening the chest up extend the incision in the intercostal space posteriorly to the posterior axillary line. This will allow you to open the chest fully in a clamshell, maximising the exposure and identification of anatomy.

5. OPEN THE CHEST

Lift the chest open wide. Use suction if necessary to help clear the field and help identify anatomy. Identify the heart. If tamponade is present the pericardium will look tense. Using two clips raise a tent of pericardium on the anterior surface of the heart and cut a small vertical hole. Extend the hole vertically with scissors; try not to tear it. Remove blood clots with your hands. The heart may fibrillate or beat spontaneously as this happens.

6. START HEART MASSAGE

If the heart makes no spontaneous movement try flicking it with your finger. If no movement occurs begin massage. Take great care to do this properly. Do not let anyone else perform the massage at this stage, it is essential to get blood moving through the coronary arteries and for the myocardium to be perfused – focus on the quality of massage you are providing. Get an assistant to compress the descending aorta on the spinal column.. This will raise root pressure and enhance coronary blood flow. Use a two handed technique and ensure the heart is flat in its bed and not kinked on its vascular pedicle (ie delivered or partially delivered through the wound to the pericardium.)

7. START ALS

By this time IV access should have been established. Load the heart with volume you will feel whether it feels empty or not. If myocardial activity is sluggish despite adequate filling then 1 mg of intracardiac adrenaline should be delivered to the right ventricle. Massage and repeated doses should be continued until myocardial activity is good. If the procedure is successful the internal mammary arteries may now bleed and require clipping.

8. ENSURE ANAESTHESIA

Anaesthetise the patient as required.

Cardiac Wounds

Small wounds (approximately 1cm) can be left if there is little blood loss, however if they bleed significantly they should be sutured. Be careful not plug the hole with a finger as this may simply extend the wound. Wounds adjacent to coronary arteries should be treated with caution. If the artery is distal then it (and the distal myocardium) can be sacrificed if necessary otherwise either a mattress suture should be used or the wound occluded with a finger. Consider suturing all other wounds. Wounds should be stitched with interrupted 1/0 silk.

Ventricular Fibrillation

Should this occur close the chest, apply paddles / electrodes to chest wall as normal and defibrillate. Ensure there is no blood pools / fluids that may arc.

Triage

All patients who have undergone thoracotomy should be triaged to the nearest Major Trauma Center with an appropriate pre alert. Hypothermia may well prevent you from restarting the heart in the prehospital setting. If despite maximal resuscitation the situation appears hopeless then life may be pronounced extinct at the scene. It is vital to document on the ambulance crews paperwork that thoracotomy has been performed.

Key points to success:

1. Rapid access - < 1 minute to pericardial sack
2. Extending the thoracotomy wound to the posterior axillary line to promote clamshell opening.
3. 2 handed massage quality massage
4. Aortic occlusion against the spinal column

Common Reasons for Failure:

1. Anterior location of wound preventing adequate access.
2. Single-handed, poor quality, intermittent massage
3. Failure to occlude aorta.
4. Kinking of heart anteriorly (delivering it through pericardial wound) impairing vascular filling