Grady Memorial Hospital
Trauma Service Guidelines

Resuscitative Thoracotomy in the Marcus Trauma Center

BACKGROUND
- While the technique of resuscitative thoracotomy (RT) is fairly standard, the indications for performing a thoracotomy are somewhat controversial.
- Overall survival of patients undergoing RT for penetrating wounds is about 15%, with isolated cardiac stab wounds having the highest survival rate (~35%).
- Blunt trauma survival rates are significantly lower, ranging between 0 and 2.5%.
- The primary aims of RT include the release of cardiac tamponade, control of hemorrhage, and providing access for internal cardiac massage.
- Patients undergoing cardiopulmonary resuscitation (CPR) on arrival to the hospital should be stratified based on injury, presenting physiology and transport time to determine the utility of RT.
- Closed chest CPR and ACLS has not been shown to be of any benefit in exsanguinated patients.

INDICATIONS
- **Penetrating Thoracic or Non-thoracic Injury**
  - Witnessed traumatic arrest with previous cardiac activity
  - Narrow complex PEA or perfusing rhythm (i.e. pulseless ventricular tachycardia, tachyarrhythmias)
- **Blunt Thoracic Injury**
  - Presence of a pulse or perfusing rhythm on arrival to ED with rapid deterioration to narrow complex PEA

CONTRAINDICATIONS
- Patients that present in asystole regardless of mechanism should not undergo RT
- Patients with blunt mechanism of injury and wide complex PEA should not undergo RT

CLINICAL PRACTICE GUIDELINES
I. Preparation
   a. All equipment required for performing a resuscitative thoracotomy must be readily available prior to starting the procedure. This includes full barrier precautions and a thoracotomy tray.
   b. Patients undergoing RT should be intubated immediately and a nasogastric tube placed by the physician securing the airway.
   c. Large bore central venous access should be established and uncrossmatched blood should be ordered and immediately available.
   d. Open cardiac defibrillator paddles should be opened and present in the Trauma resuscitation room.
   e. The patient is positioned supine with the arm extended or raised behind their head.
II. Technique
   a. A supine anterolateral thoracotomy is the accepted approach.
   b. A left sided approach is used in all patients in traumatic arrest and with injuries to the left chest.
   c. Patients who have profound hypotension and right-sided injuries should have their right chest opened simultaneously.
   d. After rapid skin preparation a skin incision is made in the 5th intercostal space (infra-mammary fold in females), curving from the border of the sternum to the mid-axillary line following the patient’s ribs. This is continued down through subcutaneous tissues to reach the intercostal muscles.
   e. Enter the chest bluntly with a finger through the intercostal muscles. The opening is extended with a combination of heavy scissors and blunt dissection, taking care not to lacerate the lung.
   f. Insert the rib spreader between the ribs and open.
   g. If the thoracotomy has to be extended to the other side of the chest, repeat these steps on the opposite side. A Gigli saw or Lebske knife is used to divide the sternum and the rib spreader is moved to the midline to open the chest at the sternum.
   h. Note that division of the sternum results in transection of the internal mammary arteries. These will start to bleed once blood pressure is restored and will need to be ligated.
   i. After performing the thoracotomy and pericardotomy (see below), the patient’s intrinsic cardiac activity is evaluated. Patients in asystole without cardiac tamponade are declared dead. Patients with a cardiac wound, tamponade, and associated asystole are aggressively treated (See Appendix I).5

III. Relief of Tamponade
   a. The pericardium is opened longitudinally to avoid damage to the phrenic nerve, which runs along its lateral border.
   b. Make a small incision in the pericardium with a scalpel and then extend the incision with scissors up to the root of the aorta.
   c. Evacuate any blood and clot from the pericardial cavity.

IV. Aortic Cross-clamping
   a. Cross-clamping of the descending thoracic aorta redistributes blood flow to the coronary vessels, lungs and brain, and reduces exsanguination from lower torso injuries.
   b. Cross-clamping is done ideally at the level of the diaphragm.
   c. The lung is retracted anteriorly and the mediastinal pleura incised.
   d. Blunt dissection is used to separate the aorta from the esophagus and pre-vertebral fascia.
   e. This dissection should be sufficient enough to place a clamp across the aorta while taking care to avoid avulsing aortic branches supplying the cord and thorax.

V. Definitive Management
   a. Once control is achieved and cardiac activity restored, the patient is transferred rapidly to the operating room for definitive management.

REFERENCES
APPENDIX I

Methods for Controlling Hemorrhage

- Cardiac wounds should be controlled initially with direct finger pressure. Large wounds may be controlled temporarily by the insertion of a Foley catheter with the balloon inflated.
- Satinsky clamps can be placed across wounds of the atria to control hemorrhage.
- Take care not to miss posterior cardiac wounds. Examination of the posterior surface of the heart requires displacing it anteriorly, which may obstruct venous inflow.
- Cardiac wounds can be directly sutured using a 3-0 non-absorbable suture. Note that with wounds in the region of the coronary vessels, mattress sutures are used to avoid obstructing coronary flow.
- Massive hemorrhage from the lung or pulmonary hilum can be temporarily controlled with finger pressure at the pulmonary hilum. This may be augmented by placement of a Satinsky clamp across the hilum.
- Lesser hemorrhage from the lung parenchyma can be controlled with a temporary clamp.
- Small aortic injuries can be sutured directly using non-absorbable suture. Larger injuries, especially to the arch may require temporary digital occlusion and cardiac bypass.
- Following hemostatic repair, if the patient remains in asystole, bimanual internal massage of the heart is initiated; this is done with a hinged clapping motion of the hands, sequentially closing from palms to fingers.
- Intracardiac epinephrine may be injected directly into the left ventricle; the heart is elevated slightly to expose the posterior left ventricle, and care is taken to avoid the circumflex coronary during injection. The heart is then massaged to increase coronary perfusion.
- After allowing time for vasopressors to circulate, the heart is defibrillated (30 J) using internal paddles. Following several minutes of such treatment, as well as generalized resuscitation, cardiac activity should be reassessed.

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