

Thoracic Injuries

Introduction

About 15% of war injuries involve the torso. Those injuries involving the vasculature of the mediastinum (heart, great vessels, and pulmonary hilum) are generally fatal on the battlefield. The vast majority of injuries of the lung parenchyma are managed by the insertion of a chest tube and local wound care. Although penetrating injuries are more common, blunt chest trauma does occur and may result in disruption of the thoracic contents and injury to the chest wall itself. Blast injuries can result in the rupture of air-filled structures (the lung), as well as penetrating injuries from fragments.

The immediate recognition and treatment of tension pneumothorax is an important lifesaving intervention in the treatment of chest injuries in combat. Distended neck veins, tracheal shift, decreased breath sounds, hyperresonance in the affected hemithorax, and hypotension are the cardinal signs, BUT may not be readily evident in the presence of other injuries/hypotension/hypovolemia. Immediate decompression is lifesaving.

The protection afforded by body armor greatly reduces the incidence of thoracic injuries, compared with extremity or head/neck injuries. Unfortunately, not all individuals have such protection; some tactical situations limit the use of body armor and some service members sustain chest injuries despite protection. Furthermore, military surgeons routinely treat injured civilians who generally have no such protection.

Anatomical Considerations

- Superior border of the thorax is at the level of the clavicles anteriorly and the junction of the C7–T1 vertebral bodies posteriorly. The thoracic inlet at that level contains major arteries (common carotids and vertebrals), veins (anterior and internal jugulars), trachea, esophagus, and spinal cord.
- Within or traversing the thoracic cavity itself are the heart; the great vessels (aortic arch, innominate/right subclavian/common carotid, left common carotid, left subclavian, and descending aorta); veins (superior and inferior vena cava, azygous vein, and brachiocephalic vein); and pulmonary arteries and veins (distal trachea, main stem bronchi, lungs, and esophagus).
- The inferior border is bounded by the diaphragm, attached anteriorly at the T6 level and gradually sloping posteriorly to the T12 level.

Penetrating thoracic injuries below the T4 level (nipple line) mandate evaluation for abdominal injuries due to the variable position of the diaphragm during the respiratory cycle (Fig. 16-1).

Evaluation and Diagnosis

Knowledge of the mechanism of injury (eg, blast, fragment) may increase the index of suspicion for a particular injury. A complete and accurate diagnosis is often not possible due to limited diagnostic tools. Nonetheless, injuries to the chest can profoundly affect breathing and circulation, and a complete and rapid assessment of each injury is mandatory.

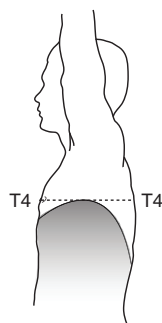


Fig. 16-1. Diaphragm level.

- If the casualty is able to talk without hoarseness or stridor, there is reasonable assurance that the airway is intact.

Life-Threatening Injuries

Injuries requiring urgent intervention include tension pneumothorax, massive hemothorax, cardiac tamponade, and open pneumothorax. Flail chest is not immediately life-threatening in most cases, but can present with a severe associated lung injury.

- **Tension pneumothorax.**
 - A patient with a known chest injury presenting with a patent airway and difficulty breathing has a tension pneumothorax until proven otherwise. It requires rapid decompression and the insertion of a chest tube. Needle decompression alone is insufficient.
- **Massive hemothorax.**
 - The return of blood on chest tube placement may indicate a significant intrathoracic injury. Generally, the **immediate return of 1,500 mL of blood mandates thoracotomy**. When initial blood loss is <1,500 mL, but bleeding continues such that ongoing blood transfusions are required and all other sources of hemorrhage are eliminated, then thoracotomy may be indicated. Needle decompression will not identify hemothorax.
 - Casualties with massive thoracic hemorrhage require damage control resuscitation and rapid surgical intervention (see Chapter 12, Damage Control Surgery).
 - Chest tube output is not always reliable because tubes may kink or become occluded from clot. In the setting of persistent hypotension after chest tube placement for hemothorax, you should not hesitate to place a second chest tube (in addition to evaluating for other sources of bleeding, such as intrapericardial, intraabdominal, or in the contralateral pleural space).
- **Cardiac tamponade.**
 - Distended neck veins (may be absent with significant blood loss) in the presence of clear breath sounds and hypotension indicate the possibility of life-threatening cardiac tamponade.

- This diagnosis must be suspected in any hypotensive patient with an injury to the chest.
- Judicious fluid resuscitation may temporarily stabilize a patient in tamponade.
- Perform an ultrasound if time permits and/or if the diagnosis is unclear.
 - ◆ If **positive**, proceed to the OR. For a stable patient, perform a subxiphoid pericardial window, with conversion to sternotomy if any blood is present in the pericardial space. For a patient with instability and isolated chest trauma, sternotomy or left anterolateral thoracotomy is appropriate (see below). With combined abdominal and chest trauma and instability/hypotension, a pericardial window can be performed in combination with exploratory laparotomy (with the addition of a sternotomy if blood is encountered in the pericardial space).
 - ◆ A **negative** ultrasound but persistent clinical suspicion for tamponade mandates either repeat ultrasound or pericardial window, depending on the level of clinical suspicion.
- Pericardiocentesis is not recommended for cardiac trauma.
- **Open pneumothorax occurs when a defect in the chest wall is sufficiently large to impair effective air exchange (generally larger than 2/3 the tracheal diameter).** It is treated by placing a chest tube through a separate incision and sealing the hole. Alternatives include one-way valve chest dressings or a square piece of plastic dressing taped to the chest on three sides as a “flap valve.”
- **Flail chest** (entire segment of the chest wall floating due to fractures of a block of ribs, with at least two fractures on each rib) is commonly associated with pulmonary contusion under the flail segment. Patients with flail chest should be monitored closely for respiratory distress. Pain control is essential and may require intercostal nerve blocks or epidural catheters to optimize pulmonary mechanics. Patients with evidence of respiratory distress, poor or marginal oxygenation or ventilation should be intubated and mechanically ventilated prior to air evacuation. If an ipsilateral chest tube is not already in place, one should be placed before transport.

Surgical Management

Most penetrating chest injuries reaching medical attention are adequately treated with tube thoracostomy (chest tube) alone.

Tube Thoracostomy (Chest Tube)

- Indications.
 - Known or suspected pneumothorax.
 - Hemothorax.
- Procedure (Fig. 16-2).
 - In cases of tension pneumothorax, **immediate decompression with a large bore needle may be lifesaving**. An IV catheter (14 gauge, 3.25 inches in length) is inserted in the mid-clavicular line in the second interspace (approximately 2 fingerbreadths below the clavicle on the adult male). **Do not place medial to the nipple to avoid cardiac or vascular injury**. Entry is confirmed by the sound of air passing through the catheter, if a pneumothorax was actually present. **Needle decompression is a temporizing measure**, and is always followed by the immediate insertion of a chest tube (regardless of whether needle compression results in a rush of air or clinical improvement).
 - Although some providers advocate placing the patient's ipsilateral arm above the head to increase the room between ribs for chest tube placement, this is not mandatory, and is generally not practical for a combat injured patient. Instead, the arm can be placed at the patient's side on a rolled sheet/towel, in an extended position at the elbow, but slightly flexed at the shoulder to allow adequate chest wall access.
 - If time allows, prep the anterior and lateral chest on the affected side.
 - Identify the incision site along the anterior axillary line, at approximately the 5th or 6th rib. This is at nipple level in males and at the inframammary crease in women. If rib levels are difficult to determine, err on the high side to avoid abdominal entry.
 - Inject a local anesthetic at the skin and muscle level in an awake patient, if conditions allow.

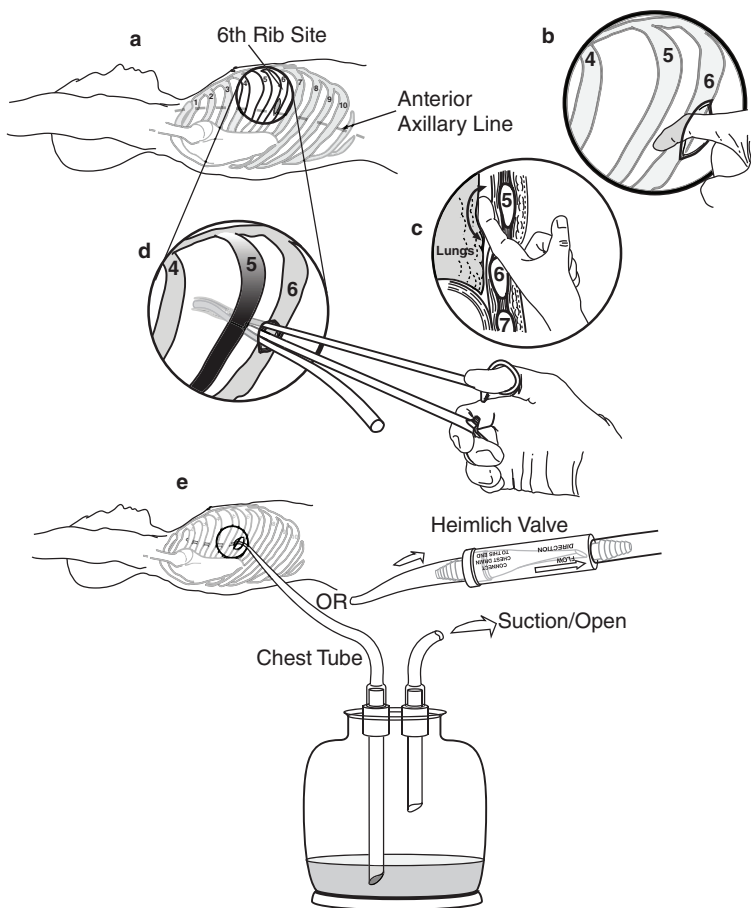


Fig. 16-2. Procedure for tube thoracostomy. Numbers indicate rib sites.

- Make a transverse incision, 3–4 cm in length, along and centered over the rib, carrying it down to the bone (Fig. 16-2a).
- Insert a curved clamp in the incision, and spread several times with a clamp to bluntly mobilize overlying chest wall muscle. Then direct a clamp over the top of the rib, and push into the chest through the pleura. A distinct pop is encountered when entering the chest, and a moderate

amount of force is necessary to achieve this entry. A rush of air or blood out of the chest will confirm a pneumothorax or hemothorax, respectively. Insertion depth of the tip of the clamp should be limited by the surgeon's hand to only 3 or 4 cm to make sure that the clamp does not travel deeper into the chest, resulting in damage to underlying structures.

- Spread the clamp gently with the tips at the level of the ribs and remove. The operator's finger is then inserted to confirm entry (Fig. 16-2b,c).
- Insert a chest tube (24–36 Fr gauge) into the hole, directing it posteriorly and apically. All chest tube side holes must be in the pleural space (ie, not just below skin level).
- Attach a chest tube to a Heimlich valve, standardized closed drainage system, or bottles. In a resource-constrained environment, a cutoff glove with a slit in the end or a Penrose drain may be attached to the end of the chest tube (Fig. 16-2e). Although these are only temporizing measures for chest tube drainage, they should serve as a one-way valve to prevent tension pneumothorax.
- Secure the tube with sutures, if possible, and dress to prevent contamination.

Resuscitative Thoracotomy

● Indications

- Penetrating injury and loss of vital signs after arrival to facility (or within minutes of arrival) with ongoing CPR.
- Patient with penetrating injury in extremis (**signs of life but impending loss of vital signs**).
- **No role in blunt trauma or with isolated head injury.**
- **Only appropriate in a facility with bona fide surgical capability (Role 2 or above)**, and must always be preceded by careful consideration of available resources and the effects of this resource-intensive procedure on the care of other casualties (or the risk of injury to assistants). Generally **not appropriate in a mass casualty scenario**.
- Should be accompanied by endotracheal intubation, initiation of damage control resuscitation, placement of an oro/naso-gastric tube, and adequate IV or IO access.

○ **Procedure**

- ◆ With the patient supine and the ipsilateral arm flexed at the shoulder to expose the chest wall, make an incision in the left inframammary fold starting at the lateral border of the sternum and extending to the table. Following the line of the ribs, the incision should be curved in a cephalad direction in its posterior extent (Fig. 16-3).



Fig. 16-3. Incision for resuscitative thoracotomy.

- ◆ The procedure should be abandoned upon discovery of devastating injuries to the heart and great vessels.
- ◆ An immediate right chest thoracostomy should be performed concurrently. If bleeding is identified from the right chest, a rapid extension through the sternum with a Lebsche knife or sternal saw should ensue, thus performing a "clamshell" thoracotomy. The clamshell approach will provide wide access to the mediastinum and both pleural spaces. In the course of this procedure, both internal mammary arteries are divided, which will be a significant source of bleeding that must be controlled with clips, ties, or suture. Bleeding may not be immediately evident, but may be profuse after restoration of arterial perfusion.
- Quick identification and treatment of a penetrating cardiac injury probably provides the highest chance of salvage. After thoracotomy, place a large rib-spreading retractor, pack the lung posteriorly, and open the pericardium to assess the heart. Use an anterior longitudinal incision in the pericardium to avoid phrenic nerve injury. The phrenic nerve may be difficult to identify during a resuscitative thoracotomy, but generally runs 1–3 cm anterior to the hilum of the lung and is always accompanied by blood vessels (which are often more visible than the adjacent nerve).

- **Priorities after thoracotomy are to control bleeding and restore central perfusion.**
 - ◆ Lacerations in the heart and/or great vessels should be temporarily occluded.
 - ◇ Temporary occlusion of cardiac injuries can be achieved with fingers, Foley catheters with 30-mL balloons, or any other sterile device of opportunity. A finger is usually sufficient, and less traumatic.
 - ◇ Temporary occlusion of the great vessels can be addressed with side-biting clamps or manual pressure.
 - ◆ If there is no blood in the pericardium or obvious cardiac injury but cardiac activity appears reduced (or if the heart is fibrillating), two-handed open cardiac massage can be instituted to facilitate resuscitation. If there is cardiac standstill, it is unlikely that the patient has a survivable injury.
 - ◆ The hilum of the lung should be cross-clamped en masse for suspected air embolism or major pulmonary hilar injuries.
 - ◆ In the case of penetrating injury and suspected uncontrolled bleeding below the diaphragm, the distal thoracic aorta should be cross-clamped. Clamping the aorta is facilitated by placing an orogastric tube to palpate and avoid clamping the adjacent esophagus, and by sharply or bluntly opening the mediastinal pleural anterior and posterior to the distal thoracic aorta just above the diaphragm to allow secure placement of an atraumatic vascular clamp. This temporizing measure will allow for resuscitation (including open cardiac massage if necessary) until definitive control of bleeding via laparotomy or other appropriate measures. Once bleeding is controlled, you must be prepared for transient acidosis, hyperkalemia, and significant hemodynamic shifts after clamp removal.
 - ◆ If unable to restore cardiac function rapidly, abandon the operation.
- With successful restoration of cardiac function, injuries should be more definitively repaired in the OR.

Subxiphoid Pericardial Window

Subxiphoid pericardial window should not be attempted in an unstable patient. Unstable patients with penetrating injuries suspicious for cardiac injury should undergo immediate median sternotomy/anterolateral thoracotomy.

Procedure

- With the patient supine, make a 4–5 cm longitudinal midline incision just on and below the xiphoid process through the skin and fascia. The xiphoid process can then be grasped/lifted with a Kocher clamp to access the pericardium, or it can be excised (with a heavy scissor or with electrocautery).
- Bluntly dissect superiorly toward the heart, exposing the phrenopericardial membrane below the heart.
- Sharply incise pericardium with care to avoid the heart, opening the pericardial sac, and exposing the underlying beating heart.
- Presence of pericardial blood mandates sternotomy to assess/repair cardiac injury.

Median Sternotomy

- Indications.
 - Suspected cardiac injury.
 - Positive pericardiocentesis/subxiphoid pericardial window.
 - Suspected injury to the great vessels in the chest.
 - Sternotomy does not afford adequate access to the left subclavian artery or descending thoracic aorta (both better accessed via left thoracotomy).
 - Suspected distal tracheal injury.
- Procedure.
 - In the supine position, make a midline skin incision from the sternal notch to just below the xiphoid.
 - Score the sternum with Bovie from the mid-portion of the sternal notch to the xiphoid to aid in creating a midline sternotomy.
 - Through blunt dissection, develop a substernal plane such that a finger can hook under the sternal notch superiorly, and under the xiphoid inferiorly.

- Divide the sternum in the midline with a sternal saw or Lebsche knife. Bone wax or Gelfoam can be used to decrease bleeding on the cut edges of the marrow, and cautery should be used to control bleeding from the sternal periosteal edges.
- Separate the halves of the sternum using a chest retractor.
- Once the retractor is placed, divide the thymic remnant and mediastinal fat down to the shiny whitish pericardium, from the level of the diaphragm up to the innominate vein, which runs transversely at the superior border of the sternotomy field. This structure must be carefully preserved to avoid significant bleeding. For great vessel access, isolating the innominate vein with a vessel loop will aid in exposure.
- Elevate the pericardium with forceps, make a small rent in it, then open the rest in the midline over a finger. Begin caudally, teeing off the pericardium along the diaphragm on both sides. Superiorly, open up to the pericardial reflection along the front of the ascending aorta.
- Place stay sutures (“pericardials”) along the edge of either side of the pericardium, which should be snapped to the drapes or skin outside the incision under a fair bit of tension. Usually 2 or 3 on either side are adequate, and any suture (3-0 or bigger) will work fine.
- **Pericardial sutures are critical for exposure;** they will keep the ventilating lungs out of your field, and will help retract the heart/great vessels closer to you.

In general, exposure to the heart and great vessels is best achieved through a median sternotomy. For proximal left subclavian artery injuries, additional exposure (trap door) may be necessary.

- See below for the management of injuries within the pericardium.
- Prior to closing the sternum, place one or two mediastinal tubes for drainage, exiting through a midline stab wound inferior to the mediastinal skin incision.
- A sternotomy is closed with a series of interrupted wire sutures directly through the halves of the sternum,

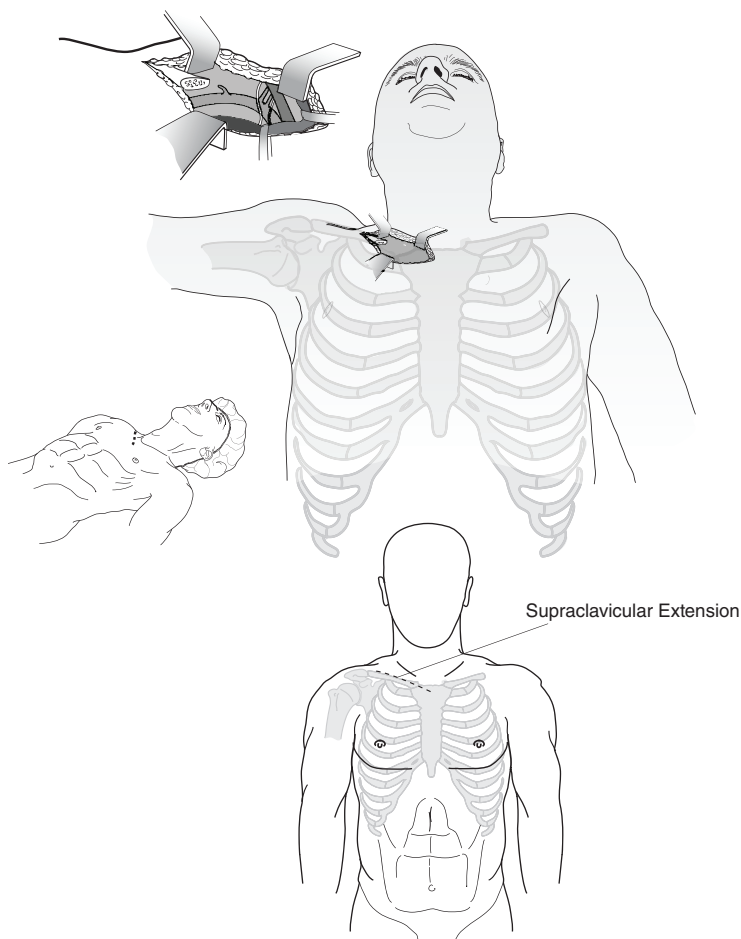


Fig. 16-4. Supraclavicular approach.

approximately 2 cm from the edge, or around the sternum through the costal interspaces. Large, permanent sutures can be used if wire is unavailable.

- In a damage control setting (unstable patient, ongoing resuscitation), temporary chest closure is appropriate. A laparotomy pad (or negative pressure dressing) can be placed beneath the edges of both sides of the sternum (to

avoid laceration of the heart from movement). An occlusive adherent dressing is then placed, and the chest tubes are placed to suction and evacuate any residual bleeding.

Other Approaches

● **Supraclavicular** (Fig. 16-4).

- Indication.
 - ◆ Mid- to distal subclavian artery injury.
- Procedure.
 - ◆ Make an incision 2 cm above and parallel to the clavicle, beginning at the sternal notch and extending laterally 8 cm. The subclavian vein will be anterior and caudal to the artery.
 - ◆ For complex injuries, division of the clavicle (with a Gigli saw) or removal of part of the clavicle may facilitate additional exposure.

● **Trap door** (Fig. 16-5).

- Indication.
 - ◆ Proximal left subclavian artery injury.
- Procedure.
 - ◆ Perform a left supraclavicular approach as previously described.
 - ◆ Perform a partial median sternotomy to the 4th intercostal space.
 - ◆ At the 4th intercostal interspace, incise the skin laterally in the submammary fold to the anterior axillary line.
 - ◆ Divide the sternum laterally with sternal saw or a Lebsche knife, be prepared to divide and control the left internal mammary vessels, and continue in the 4th intercostal space to the anterior axillary line.
 - ◆ It may be necessary to either divide or remove a section of the clavicle to gain adequate exposure of the proximal left subclavian artery.
 - ◆ Approach distal left subclavian artery injuries through a supraclavicular incision.

● **Thoracoabdominal.**

- Indication.
 - ◆ Combined thoracic and abdominal injuries.
- Procedure.

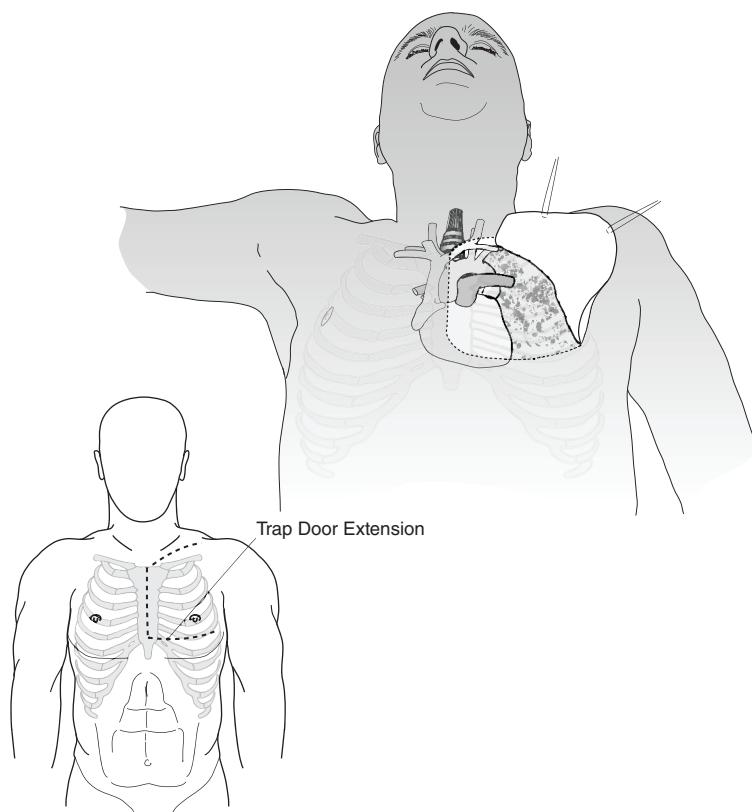


Fig. 16-5. Trap door procedure.

- ◆ The resuscitative thoracotomy can be continued medially and inferiorly across the costal margin into the abdominal midline to complete a thoracoabdominal incision.
- ◆ Alternatively, a separate abdominal incision can be made.
- ◆ With right-sided lower chest injuries, the liver and retrohepatic vena cava can be exposed well using a right thoracoabdominal approach.

Specific Injuries

- **Vascular.**

- Initially, holes in vessels should be controlled with a fingertip if possible. Provisional measures include placing Fogarty or Foley catheters, side-biting clamps, or—in the case of venous injuries—sponge sticks.
- Temporary proximal and distal control may be necessary to allow for resuscitation and restoration of cardiac function.
- If cardiac function cannot be restored within 5 to 10 minutes, the procedure should be abandoned (on-the-table triage) and the patient managed expectantly.
- Repair of vessels should follow the principles detailed in Chapter 25 (Vascular Injuries), with shunting or repair by autogenous or synthetic grafts as indicated.

● **Heart.**

Generally, high-velocity injuries to the heart result in irreparable destruction of the muscle.

- Isolated injuries to the heart should be exposed (after opening the pericardium and placing pericardial stay sutures), and occluded initially by finger pressure. Other temporizing methods include the use of a Foley catheter or skin staples.
- Use pledgeted horizontal mattress sutures (2-0 PROLENE) on a large, tapered needle (MH or SH) for definitive repair. **Care must be taken to avoid additional injury to coronary vessels** or tearing cardiac muscle. Autologous pericardium can be used if commercial pledgets are not available (Fig. 16-6).
- Atrial repairs may include simple ligature, stapled repair, or running closures.
- Temporary inflow occlusion (occluding the superior and inferior vena cava) may prove helpful in repair.
- More complex repairs are impractical without cardiac bypass.

● **Lung.**

- **Tube thoracostomy alone is adequate treatment for most simple lung parenchymal injuries.**
- **Large air leaks not responding to chest tubes** or that do not allow adequate ventilation will require open repair (see section on “Tracheobronchial Tree”).



Fig. 16-6. Repair of penetrating cardiac injury.

- **Posterolateral thoracotomy is preferred for isolated lung injuries, but is only appropriate in a stable patient with adequate resuscitation and no other uncontrolled injuries.** Anterior thoracotomy may also be used, and provides for greater flexibility.
- Control simple bleeding with absorbable suture on a tapered needle. Alternatively, staples (eg, GIA or TA-90) may be used for bleeding lung tears.
- **Tractotomy:** Open any bleeding tracts (through-and-through lung penetrations) with a GIA stapler or between straight vascular clamps and ligate bleeding points.

Do not simply close the entrance and exit points of penetrating tracts in the lung. With positive pressure ventilation, the risk is air embolism. The more central the injury, the higher the risk.

- Resection for bleeding may be indicated with severe parenchymal injury. Anatomical resections are not indicated, and simple stapled wedge excisions are recommended.
- Uncontrolled parenchymal/hilar bleeding, or complex hilar injuries with massive air leak, should be controlled with hilar clamping and subsequent repair. Pneumonectomy is performed as a last resort, because survival with this procedure in the context of traumatic injury is very low.
- **Tracheobronchial tree.**
 - Suspect the diagnosis with massive air leak, frothy hemoptysis, pneumomediastinum, or sudden hypotension/arrest after intubation and initiation of positive pressure ventilation.
 - Confirm by bronchoscopy (if available).
 - Airway control is paramount. If after endotracheal intubation in a patient with a suspected airway injury, there is no large air leak, ventilation appears adequate, and there is no other surgical indication, further intervention should be deferred to a higher level of care where more diagnostic and therapeutic resources are available.
 - Median sternotomy is the best approach for injuries to the mid trachea, with right thoracotomy providing more optimal access to the distal trachea and carina. Injuries to the left mainstem bronchus generally require left thoracotomy for repair.
 - Repair over endotracheal tube with absorbable suture. Bolster with pleural or intercostal muscle flap, especially between the trachea and esophagus.
 - Temporizing measures include:
 - ◆ Single lung ventilation (although double-lumen endotracheal tube placement is not indicated in a combat trauma setting). In some cases, intentional mainstem intubation or the use of a large Fogarty catheter as a “bronchial blocker” may isolate a major ipsilateral airway injury.
 - ◆ Control the airway through the defect (for cervical tracheal injury).

- **Esophagus.**

- Isolated thoracic esophageal injuries are exceedingly rare. Esophageal injury will usually be diagnosed incidentally associated with other intrathoracic injuries.
- Diagnostic clues include pain, fever, leukocytosis, cervical emphysema, or chest X-ray evidence of pneumothorax, mediastinal air, or pleural effusion.
- Start IV antibiotics as soon as the diagnosis is suspected. This is an adjunctive measure only. **Drainage and control of contamination of the mediastinum and pleural space are paramount.**
- For stable patients in a forward location, chest tube drainage and a nasogastric tube placed above the level of injury are temporizing measures. Ideally, primary repair is performed within 24 hours of injury. Primary repair can be more challenging (or even impossible) after this interval.

The preferred approach for intrathoracic esophageal injuries in a stable patient is posterolateral thoracotomy: right side for the upper esophagus, and left side for the lower esophagus.

- Locate the injury by mobilizing the esophagus (ideally aided by placement of a nasogastric or orogastric tube). Primarily repair with a single layer or two layers of 3-0 absorbable sutures and buttress with pleural or intercostal muscle flap.
 - Drainage with chest tubes (one apical, one posterior) is recommended.
 - If repair is not feasible or if you are uncomfortable with esophageal mobilization and repair, most patients can be temporized with (1) wide drainage of the pleural space and mediastinum, (2) careful placement of a nasogastric tube, and (3) the initiation of broad spectrum antibiotics and fluid resuscitation. The patient can subsequently be evacuated to a higher level of care.
- **Diaphragm.**
 - All injuries of the diaphragm should be closed. Generally, penetrating injuries to the diaphragm are identified

during exploratory laparotomy. If identified at the time of thoracotomy, you must evaluate for associated intra-abdominal injury.

- ◆ Lacerations should be reapproximated with nonabsorbable 0 or 2-0 running or interrupted sutures.
- If there is significant contamination of the pleural space by associated enteral injuries, copious irrigation and placement of one or more pleural drains is indicated after diaphragm repair.
- **Chest Wall.**
 - Because the intercostal arteries are direct branches of the thoracic aorta or internal mammary artery, chest wall injuries can be associated with major hemorrhage, which may or may not abate with chest tube placement alone.
 - If bleeding exceeds 1.5 L after tube thoracostomy, persists at over 100–200 mL/hour, or is associated with persistent hemodynamic effects, thoracotomy is indicated to address the chest wall bleeding and to assess for underlying pulmonary or major thoracic vascular injury. In practice, it is difficult to discern the exact source of thoracic bleeding (lung versus chest wall versus great vessels, etc) until after thoracotomy.
 - Intercostal arterial bleeding may be controlled with sutures or clips. One option is a figure-of-eight suture around the rib and intercostal bundle, with a blunt needle and suture 2-0 or larger. Temporarily holding ventilation will aid in exposure and repair. In general, separate repair will be needed on both sides of the injured vascular pedicle.
 - Access and visualization to chest wall bleeding may require enlarging an incision, or making a separate counter-incision to improve the angle of approach.
 - If repair of chest wall bleeding is not successful or not possible (eg, chest wall bleeding posterior to hilum, not well visualized without lung isolation), packing the chest will temporize the vast majority of bleeding. This should be followed by temporary chest closure, continued resuscitation, and transfer to a higher level of care once the patient is stable for transport.

**For Clinical Practice Guidelines, go to
http://jts.amedd.army.mil/index.cfm/PI_CPGs/cpgs**