Thoracic Incisions

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TABRIZ

- Selection of the appropriate approach for thoracic procedures is critical to undertaking safe, effective operations.

- Incorrect incision choice with resultant inadequate exposure may lead to an unnecessary or difficult, ineffective operation or even fatal intraoperative complications.

- (CT) scans: potential intraoperative anatomic issues can be contemplated in advance, so that the planning phase can include alternative incisions .
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- This is especially true in the era of minimally invasive operation, when a secondary or tertiary incision may be necessary if the goals of the operation cannot be met using a minimally invasive approach. Additionally, some operations will require two incisions to achieve repair or resection safely.

Positioning and Prophylaxis

- Most general thoracic surgical procedures: lateral decubitus position.
- Positioning injuries:
- 1- nerve stretching or compression at pressure points .
- 2-Pressure points should be padded about the elbows using foam pads.
- 3- “axillary” roll should be placed under the dependent chest wall to take pressure off the shoulder and brachial plexus.
- 4- One or two pillows should be placed between the legs. The dependent tibial tuberosity and lateral malleolus should be padded .

maneuvers to hold the patient:

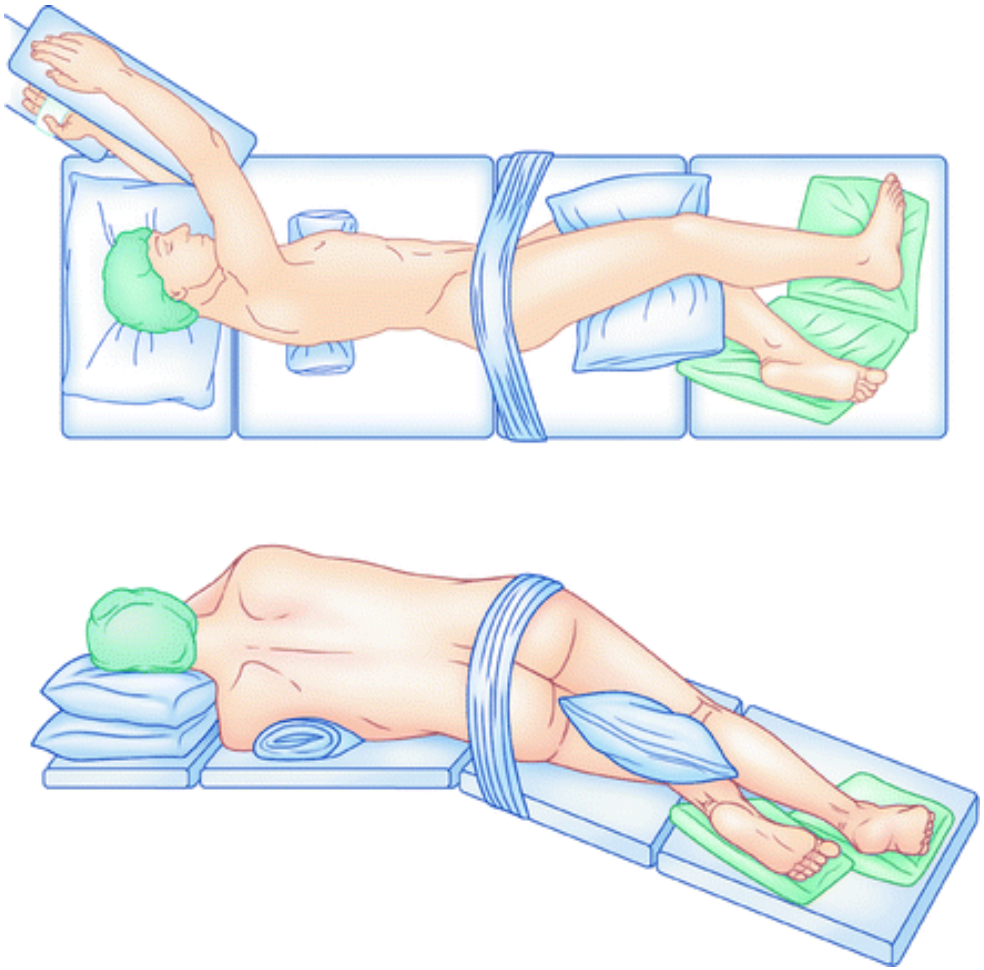
- placing a sandbag under the operating table mattress, rolled sheets front and back, and bean bags.
- Two straps of 3-in adhesive tape placed over surgical towels at the hip and the calf are used as well.
- The dependent arm is flexed at the elbow and padded.
- The superior arm can be flexed similarly and appropriately padded, obtaining the so-called praying position, or it can be extended on a padded Mayo stand or arm holder .

Prophylaxis for deep venous thrombosis:

- 1- special elastic hose
- 2- sequential compression device—is implemented prior to induction of anesthesia
- 3-The perioperative use of prophylactic heparin or low-molecular-weight heparin should be routine.

administration of prophylactic perioperative antibiotics

- most major general thoracic surgical procedures, the is indicated to minimize wound infection.
- reductions in the incidence of wound infections, although several did not reach significance.[1]
- Antibiotic prophylaxis should be given prior to skin incision and redosed as necessary to maintain adequate levels throughout the operation.
- ***Staphylococcus aureus*** is a major nosocomial pathogen and colonizes the nares of up to 30% of the population.
- Preoperative treatment of patients who are carriers with 5 days of twice daily intranasal mupirocin has been shown to decrease S. aureus infections in carriers.[1]
- A retrospective series with sequential groups of patients undergoing Ivor Lewis esophagectomy suggests that mupirocin may help decrease infectious complications and length of stay in this group



Posterolateral Thoracotomy

- -super exposure for most general thoracic procedures.

- The main disadvantages: time expended - if a muscle flap is required for a complication such as a bronchopleural fistula previously transected latissimus is often unsatisfactory.
- The electrosurgical unit is used for hemostasis and musculofascial dissection.
- The lower portion of the trapezius muscle is

The desired interspace :***large Richardson*** or ***scapula retractor*** beneath the scapula

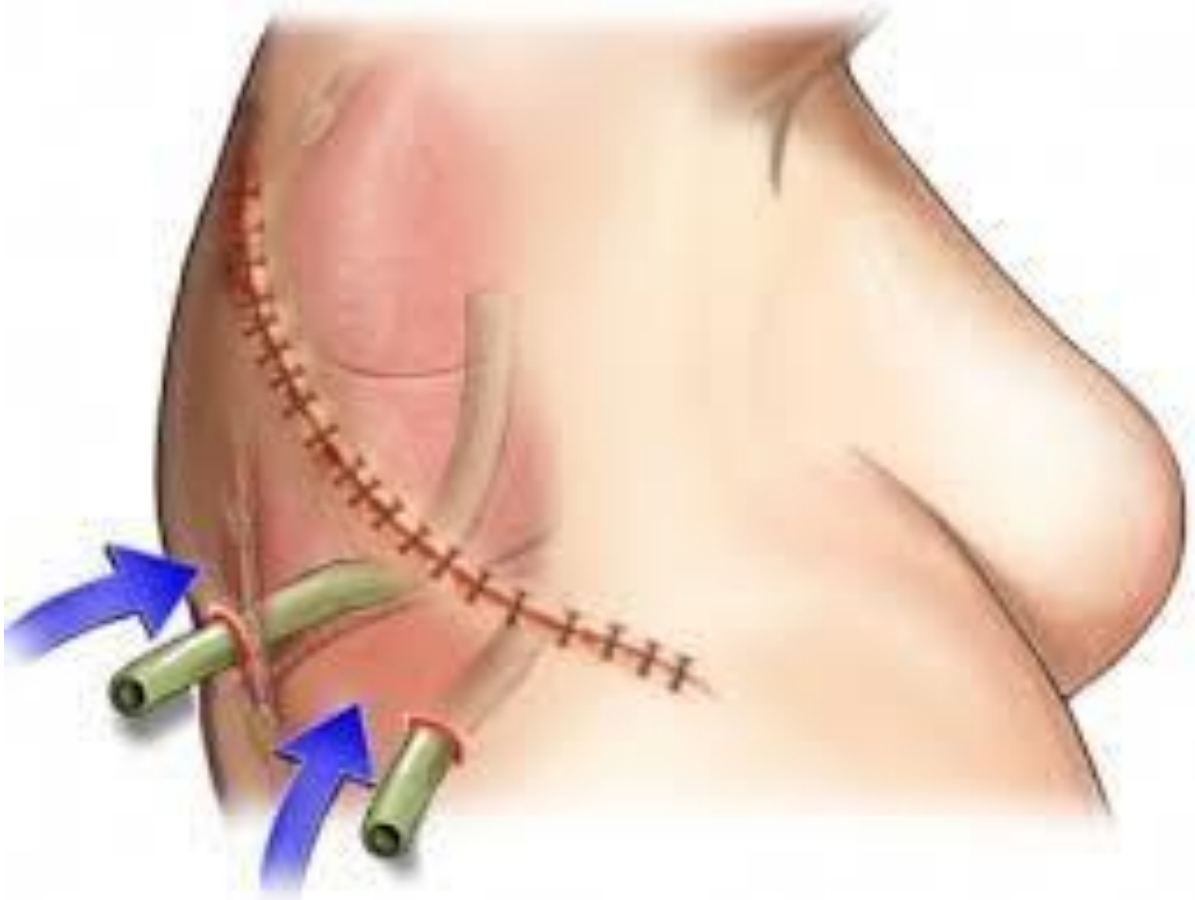
- Sometimes, the first rib is obscured to easy palpation
- Rib sectioning at or anterior to the costovertebral angle is rarely necessary

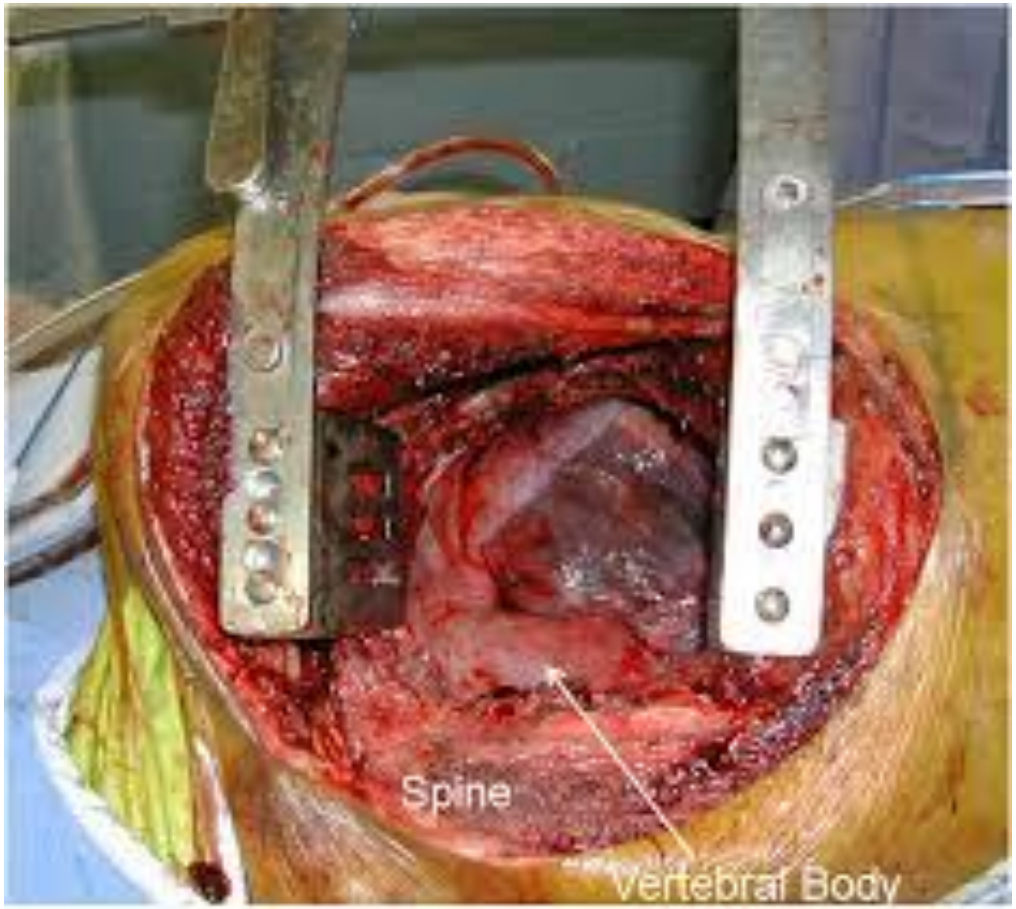
- Typically only a small portion of subperiosteal rib needs to be resected to prevent overriding of the cut ends.

- Although some recommend division and ligation of the neurovascular bundle, it is not necessary.

- The intercostal muscle incision down to the parietal pleura is made carefully in the lower portion of the interspace to avoid injury to the neurovascular bundle.
- If a pedicled intercostal flap may be useful, it is created at this time.

- If the lung does not move freely, the surgeon must anticipate a significant number of adhesions and the need to divide them with care, particularly when the operation is a repeat thoracotomy.




Spine
Vertebral Body

- tube to be used depends on the preference of the operating surgeon, the size of the patient, and the nature of the particular operation.

- it is not necessary to use tubes larger than 28 Fr

- 24-Fr posterior and 20-Fr anterior tube are used .
- Patients requiring chest tube drainage for purulent collections, blood, or fibrinous material may require larger drainage tubes to prevent clogging.
- The chest tubes are secured at the skin with a heavy nonabsorbable suture (e.g., No. 1 polypropylene) and connected to an appropriate chest drainage system

- Postoperative pain is generally managed using patient-controlled continuous epidural analgesia (PCEA) for posterolateral and axillary thoracotomy patients. The epidural catheter is placed prior to induction so that test dosing can be used to confirm proper placement and function. A bolus can then be given prior to emergence to minimize immediate postoperative

- In situations where PCEA is contraindicated or unavailable, a paravertebral catheter (PARA) with a continuous infusion of fentanyl (5 μg/mL) with bupivacaine 0.1% has been useful.[5] Drug concentrations can be varied if side effects such as drowsiness and nausea occur. In the event that PCEA or PARA is not feasible, an intercostal nerve block with a long-acting local anesthetic such as 0.5% bupivacaine with epinephrine is placed prior to chest wall closure. The intravascular injection of such compounds can have dire cardiovascular consequences and should be avoided.[8] The blocks should include at least two interspaces above and two below the thoracotomy as well as the chest tube insertion interspace(s). The subpleural injections are given at least 8 cm off the midline to avoid a subdural injection, which would produce spinal anesthesia. Intravenous patient-controlled analgesia is used to complement the rib block.
- Pericostal sutures, usually three, of heavy absorbable material, such as No. 2 polyglycolic acid, are then placed. The rib spaces are reapproximated to their original position but not overcorrected, even if a rib is resected (Figs. 25-3B and 25-4B). Intracostal (also called transcostal) suture placement through holes drilled in the lower rib may minimize intercostal nerve injury and decrease postoperative pain.[6,20] Each of the two musculofascial planes is closed with running suture of a similar material, usually size 1 or 0; the subcutaneous tissues are closed with a size 2-0 running suture of the same material and the skin with the surgeon's preferred material.

Axillary Thoracotomy

- The axillary thoracotomy was originally developed for operations on the upper thoracic sympathetic nerve system. It was modified for first rib resection for thoracic outlet syndromes. Some groups refer to it as a lateral thoracotomy to avoid confusion with small, high axillary incisions for first rib resections or apical bleb resections. Other groups refer to it as a minithoracotomy or muscle-sparing thoracotomy, but such nonspecific terminology should be discouraged. This is a good incision for uncomplicated, straightforward pulmonary operations as it provides excellent access to pulmonary vascular structures and the fissure. It is not recommended for sleeve resections or when substantial exposure is needed of the posterior sulcus or diaphragm. This is also the exposure that is easiest to obtain when a minimally invasive lobectomy must be converted to an open thoracotomy. The chief advantages are the speed of opening and closing and the reduced blood loss from minimal muscle transection. As shown in Figure 25-5, the only muscle groups that are actually transected are the intercostals.
- The use of an axillary thoracotomy versus a posterolateral thoracotomy is often dependent on surgeon choice and experience. The axillary thoracotomy is not recommended for the occasional thoracic surgeon or for a difficult operation because the exposure is more limited than that of a posterolateral thoracotomy. Although some report better preservation of muscle strength after axillary thoracotomy than with a posterolateral thoracotomy,[2,11] randomized[2] and comparative[14] studies of patients undergoing posterolateral versus axillary thoracotomy showed no differences in pain scores, functional recovery, or complication rates.
- The classic description of this incision has the patient placed in a lateral decubitus position with the arm abducted at 90 degrees and positioned on an armrest. Abduction or posterior rotation beyond 90 degrees should be avoided to prevent brachial plexus injury. The antecubital fossa over the armrest is padded. We have found that abduction of the arm for a fourth interspace or lower incision is generally not necessary. Upper lobe lesions are best approached through the fourth interspace. Middle and lower lobe lesions are easily handled through the fifth interspace. For operations involving the lower esophagus, we would recommend using the sixth interspace. As this position can place the brachial plexus at increased risk of positioning injury, we prefer to use a prayer position similar to the posterolateral thoracotomy. The skin incision is made over the desired interspace along the course of the rib.
- The latissimus dorsi muscle is elevated bluntly for a short distance and retracted posteriorly, and the serratus anterior muscle is split in the direction of its fibers. The surgeon should not divide the muscle too far posteriorly so as to avoid injuring the long thoracic nerve to the serratus anterior muscle. Once in the subserratal plane, the serratus can be elevated off the chest wall and the intercostal space visualized. The intercostal muscles are divided in a manner much like that described for a posterolateral thoracotomy, and the pleural space is entered. The intercostal muscle incision is carried forward to the anterior curve of the ribs and posteriorly to the level of the paraspinal muscles. A Reinhoff rib spreader is placed between the ribs, and a Balfour with standard or narrow blades is placed in the opposite direction to retract the skin and latissimus dorsi muscle.
- Closure of the axillary thoracotomy is accomplished with three pericostal sutures of No. 2 polyglycolic acid after the placement of one or two chest tubes. Analgesia routines similar to those for posterolateral thoracotomies are used. The serratus anterior muscle is closed with a running absorbable suture, as is the subcutaneous fascial layer. Skin closure technique is again at the surgeon's discretion.
- Variations on this exposure include using a vertical incision placed in the middle of the angle formed by the pectoralis and the latissimus and alternative muscle mobilization (Fig. 25-6). This incision is particularly useful in women, as it avoids a scar leading up to the breast or occasional breast soreness when some breast tissue has been incised.[9] Muscular dissection can be carried out as above. Another variation involves dissecting the latissimus off of the serratus to expose the posterior border of the serratus. The serratus fascia posterior to the muscle is incised and the serratus is retracted anteriorly. If this dissection is used, a submuscular drain should be placed to minimize seroma formation.

Apical Axillary Thoracotomy

Eric Vallières

The apical axillary thoracotomy is a muscle sparing and cosmetically appealing incision.[1] It provides access to the apex of the lung, the upper ribs, and the hemithorax posteriorly. Because of these attributes, it was once, for many, the preferred "minimally invasive" approach for the surgical treatment of recurrent primary spontaneous pneumothoraces or high thoracic sympathectomies.[2,3]

SURGICAL TECHNIQUE

1 Because of the limited exposure provided by apical axillary thoracotomy, double lumen intubation is strongly recommended when working through this incision. The patient is positioned in a lateral decubitus with the ipsilateral axilla exposed. This position can be accomplished by abducting the shoulder at or just above 90 degrees and flexing the elbow at 90 degrees by strapping it on a padded, rigid bar across the head of the table.

2 An alternative approach is to elevate the extended arm at 90 degrees above the head by placing it in a traction-pulley system with a 1-lb weight. The latter option frees up the field anteriorly and potentially offers better access to the incision for the operator situated on the anterior side of the table.

Anterior Thoracotomy

- patient to remain supine, with a resultant improvement in ***cardiopulmonary function***.

- It has been used with decreasing frequency because of improvement of anesthetic techniques and development of video-assisted thoracic surgery (VATS) for lung biopsy.
- incision of choice of some surgeons for open-lung biopsy.

- Ivor Lewis procedure for carcinoma of the esophagus to eliminate the need for repositioning the patient after the intra-abdominal portion of the operation.

- ***disadvantage*** → limited exposure it provides.

- A limited anterior thoracotomy →when open-lung biopsy is needed in the critically ill patient.

- The patient is positioned with a roll under the back and hips to elevate the operated side. The ipsilateral arm is placed under the back, on an elevated arm board, or on an over armrest at the preference of the surgeon.

- An incision →***fourth or fifth***

- In women, the incision →***inframammary***

Thoracoabdominal Incision

- 1-for operations in the lower thorax and upper abdomen.
- 2-for difficult operations involving the lower esophagus and gastroesophagaeal junction .
- 3-for open thoracoabdominal aortic operations.
- At lateral decubitus position .
- A ***seventh- or eighth-interspace incision*** is extended on the same oblique line into the upper quadrant toward the midline.
- A curvilinear or radial ***incision can be made in the diaphragm*** to facilitate exposure

Median Sternotomy

- Median sternotomy is the most common thoracic incision, as it is used in :
- -cardiac operations
- - anterior mediastinal lesions and
- -bilateral procedures, such as the resection of multiple pulmonary lesions
- -repair of postpneumonectomy bronchopleural fistula.
- - exposure of the lower cervical and upper thoracic esophagus and for thymectomy.

- The ***main advantages of median sternotomy*** for general thoracic surgical procedures are its ***speed in opening and closing***, its ***familiarity to many surgeons***, and its ***outstanding exposure for anterior mediastinal lesions.***

- ***major disadvantage*** is: poor exposure of posterior hilar structures, especially those of the left lower lobe.

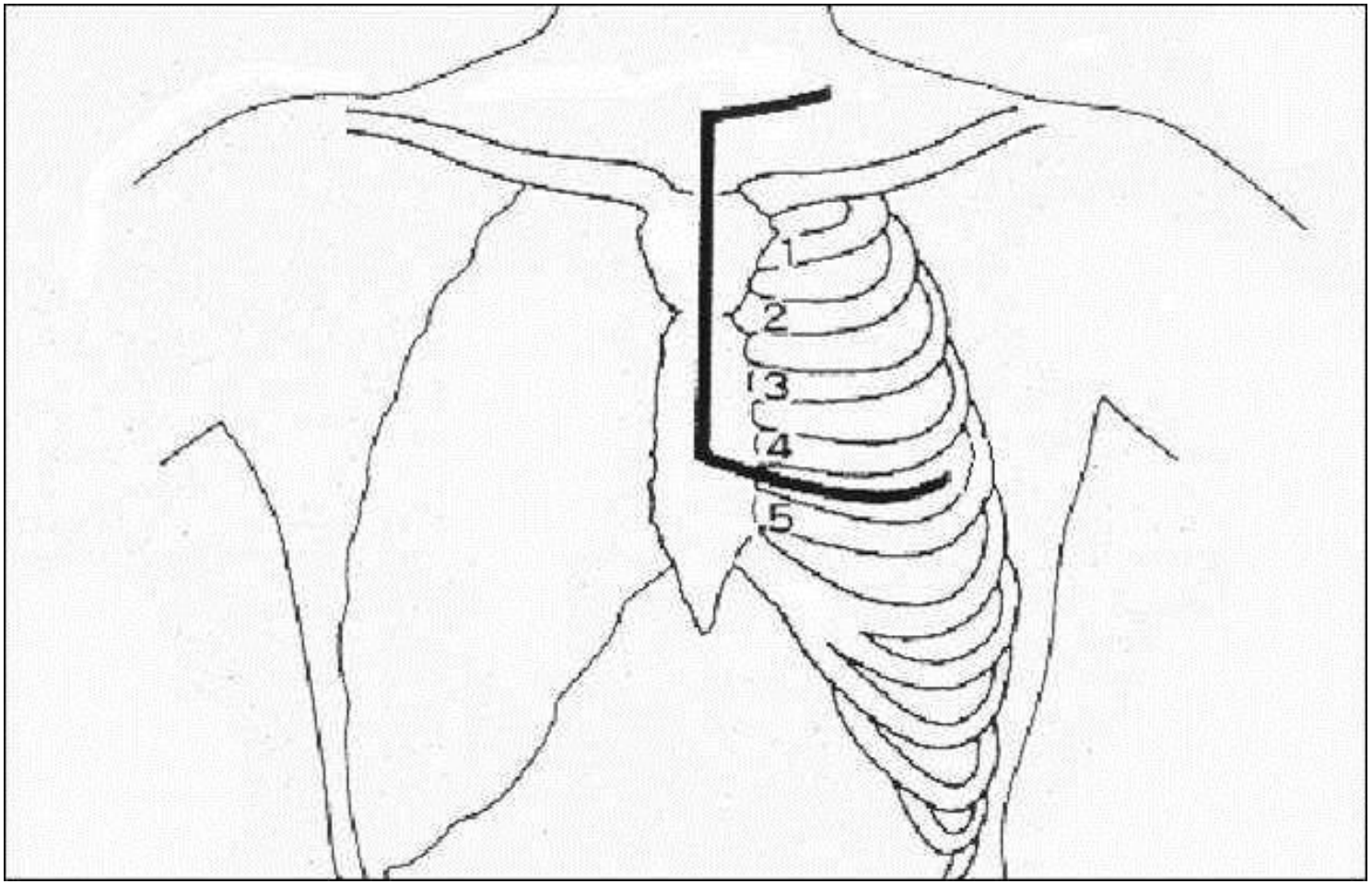
The patient is positioned

- supine, with one or both arms extended, at the preference of the surgeon and the anesthesiologist. Both arms are often placed at the patient's side. Sternotomy patients typically have the arms tucked with padding to protect the ulnar nerve.
- The vertical skin incision is made from just below the suprasternal notch to a point between the xiphoid process and the umbilicus (Fig. 25-8). The pectoral fascia is divided and the periosteum is scored with the electrosurgical unit. The tough interclavicular ligament is completely divided to the top of the manubrium so as to avoid binding of the sternal saw. The xiphoid process is divided or elevated anteriorly to allow blunt dissection of tissues from the posterior sternum with a finger. The sternum is divided with a power saw, from the top down or from the bottom up. The anesthesiologist should cease ventilatory efforts as the sternum is being cut to lessen the chance of injury to the lung. Once the sternum is split, the two edges are gently but firmly retracted, and periosteal bleeding points are controlled with the electrosurgical unit. Marrow bleeding is minimized by rubbing foam cellulose on the marrow, but this is not as necessary as during cardiac surgery, as anticoagulation is usually not used during most general thoracic surgical procedures. A sternal spreader is placed low in the incision to minimize excessive traction on the upper ribs, with attendant occult fracture and neurologic insult. The use of the Lebsche sternal blade should be familiar to the thoracic surgeon, so that sternotomy can be performed if the power saw fails or is unavailable.

- If the pleural space has not been entered, chest tubes or mediastinal drains are passed through separate stab incisions. Sternotomy closure is accomplished with ***five to seven parasternal sutures*** of No. 5 stainless steel wire

Thoracosternotomy (Hemi-Clamshell)

- The hemi-clamshell incision provides outstanding exposure to the apex of the chest and the anterosuperior mediastinum. Large or apical tumors and trauma to the subclavian or P.398
- innominate vessels are the most common indications (Fig. 25-9A). The incision includes a partial sternotomy and anterior thoracotomy and may include a cervical extension. A second-interspace (instead of a fourth) thoractomy may be used in the resection of apical tumors and anterior spine exposures. The patient is positioned supine. The incision starts at the top of the manubrium and extends inferiorly to fourth intercostal space. The incision is carried laterally in the inframammary fold or the anterior chest wall to the anterior axillary line. The pectoralis muscle is incised along the superior portion of the fifth rib. The mammary vessels are ligated. If needed, a cervical extension along the anterior border of the sternocleidomastoid muscle is made (Fig. 25-9B). The transclavicular approach popularized by Dartevelle[7] included sectioning the medial half of the clavicle. Approaches designed to spare the sternoclavicular joint that remove a portion of the first costal cartilage can provide adequate mobility of vascular structures at the thoracic outlet and obviate the need for clavicular resection.[10,19] This may improve shoulder function over approaches with clavicular resection. The sternum is closed using wire and the intercostal space is closed using No. 2 polyglycolic acid pericostal sutures.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Transverse Thoracosternotomy (Clamshell)

- The transverse thoracosternotomy is often referred to as the clamshell or crossbow incision. Its primary role in recent years has been for bilateral lung transplantation.[16] However, it is an alternative to median sternotomy for bilateral general thoracic surgical procedures such as the resection of bilateral metastatic lesions to the lungs and large anterior mediastinal masses.[3]
- The incision is made over the fourth or fifth interspace, and the sternum is transected with an oscillating saw (Fig. 25-10). Both internal mammary vascular bundles are identified and ligated. Closure is accomplished with pericostal sutures of heavy polyglycolic acid, with a figure-of-eight maneuver about the sternum. Because this incision has a high incidence of poor sternal healing, alternatives have been proposed. In selected cases, bilateral anterolateral thoracotomies may be preferred over a clamshell incision, although this limits access to the mediastinum and access for cardiopulmonary bypass.[13,21] A reinforced sternal closure using principles similar to a Robicsek weave may decrease sternal wound-healing problems. This sternal wiring uses transverse circumsternal wires placed in the interspaces above and below the incised interspaces as reinforcements for the vertical wires.[15]