Video-Assisted Thoracoscopic Procedures

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Prior to Procedure

- Review imaging studies (chest CT, PET scan) to confirm location and planned approach.
- If a lung resection is planned, then pulmonary function tests should be performed and reviewed to ensure adequate postoperative lung function.
- Lung isolation will be required to allow unilateral collapse. This is accomplished with a bronchial blocker or double-lumen endotracheal tube. Adequate positioning should be confirmed with flexible bronchoscopy.
- While not always indicated, bronchoscopy to ascertain bronchial anatomy is important for central lung lesions.

Preference Card

- Silk ties
- 0 polypropylene suture to secure chest tubes
- 0, 1-0, 2-0, 3-0, and 4-0 polyglactin sutures, to, respectively, re-approximate ribs, muscle, subcutaneous tissue, and skin, as needed
- Bupivicaine 0.5% with epinephrine, for local analgesia via intercostal muscle injection
- Chest drainage system
- Chest tube, 28 French
- Kittner dissector sponge
- Electrocautery with an extended protected tip
- Endoscopic vessel sealing device, electrothermal, ultrasound, or other, useful also for dividing thin lung tissue
- Surgical clips small, medium, and large
- 0- and 30-degree, 5 and10 mm scopes
- Army/Navy retractors
- Ring forceps, long Kelly clamps, endoscopic graspers, non-disposable trocars
- Endoscopy ring forceps, endoscopic Harken dissector
- Endoscopic GIA stapler. Vascular 30 mm, normal tissue and thick tissue 30, 45, and 60 mm
- Small would protector/soft tissue retractor
- Disposable trocars, 5 mm, 12 mm, and 15 mm for thoracoscopy with CO2 insufflation
- Endoscopic specimen bags
- 4 × 4 sponge on a sponge stick for direct pressure if bleeding is encountered

Patient Positioning/Operating Room Setup

- VATS – lung resection – posterior mediastinal mass (Fig. 9.1)
  - The patient is placed in full lateral decubitus position.
  - The position is secured on a bean bag with padding to avoid compression injury (this includes axillary roll, floating arm board, elbow pads, and pillows between the legs and ankles).
  - The point of flexion for the operating table is placed at the level of the xiphoid. The table is flexed as much as possible, so the lower chest is the highest point, and the iliac crest does not obstruct movements of the camera and instruments.
  - The arms should be directed cephalad to allow room for the surgeon.
  - The surgeon stands at the patient's front.
- Thoracoscopy – thymectomy – anterior mediastinal mass
  - Supine, arms out on arm boards. Head of bed elevated
  - IV bag transversely behind the back at the level of the xiphoid to arch the spine

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R. J. Rosenthal et al. (eds.), *Mental Conditioning to Perform Common Operations in General Surgery Training*,
https://doi.org/10.1007/978-3-319-91164-9_9

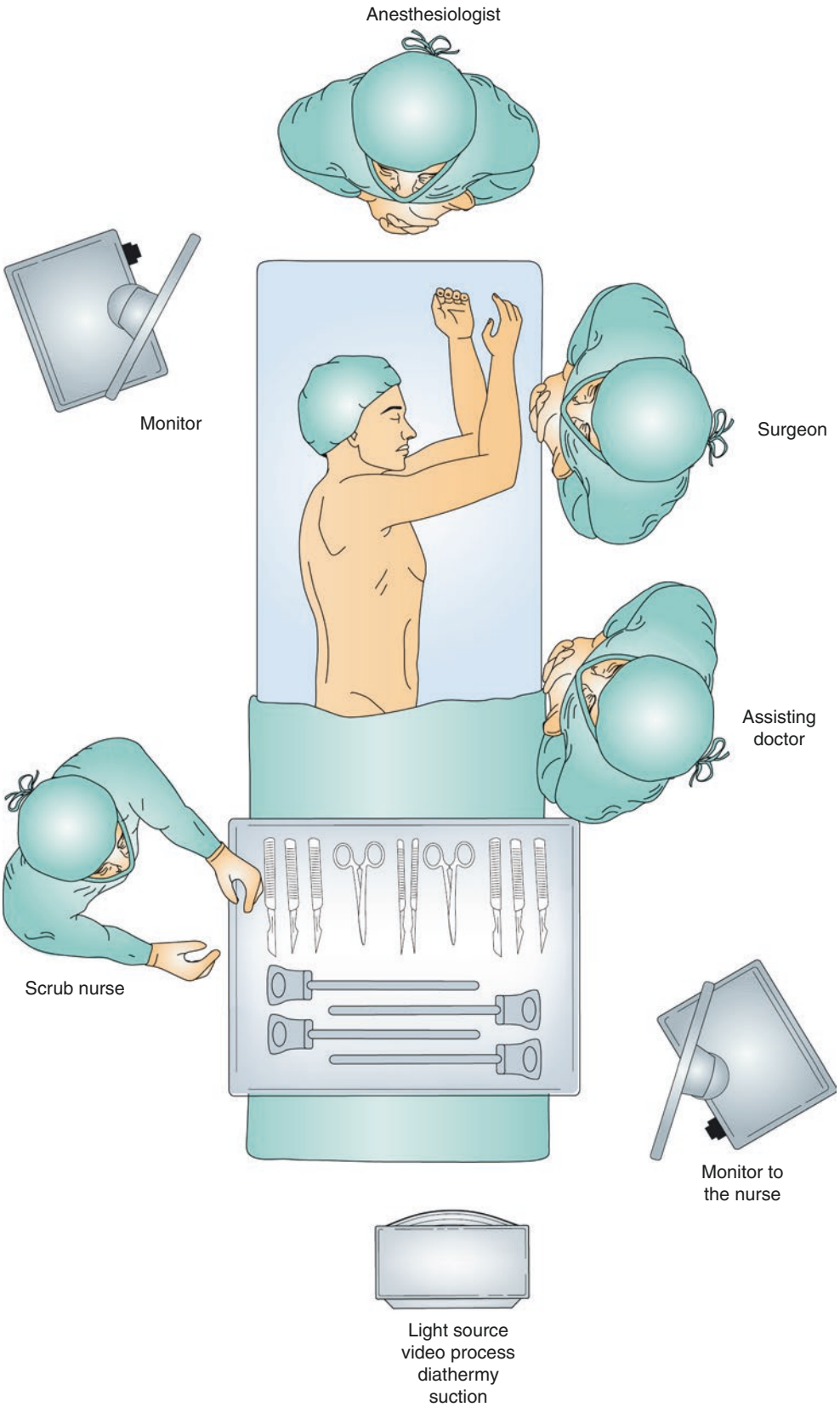

Fig. 9.1 Operating room setup and patient positioning

Nodal Points

General Principles

- The main difference between thoracoscopy and laparoscopy is that the chest is a rigid box. The abdominal wall is pliable and does not limit instrument mobility and angulation. The chest wall greatly limits instrument mobility so that adjustments need to be made for camera angles and in particular passage and placement of staplers.

Trocar and Access Incision Placement

- This can vary depending upon the type of procedure (biopsy, wedge, lobectomy, thymectomy) and location of the mass/tissue of interest.
- VATS – lung resection – posterior mediastinal mass (Fig. 9.2)

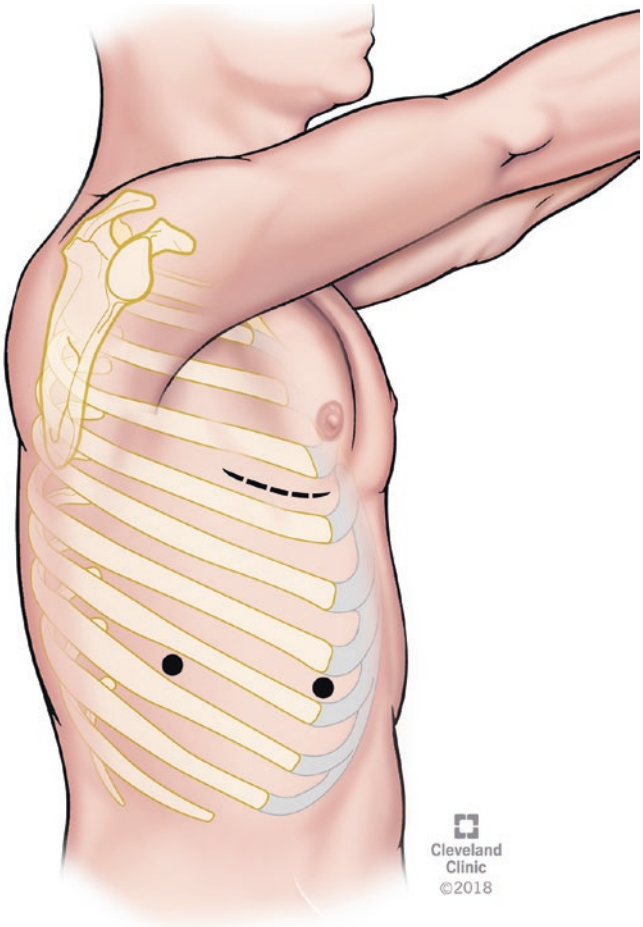

Fig. 9.2 VATS port and access incision placement. (Reprinted with permission, Cleveland Clinic Center for Medical Art & Photography © 2018. All Rights Reserved)

  - Create the camera incision in line with the anterior superior iliac spine, about one handbreadth above the costal margin. This will usually place it in the seventh intercostal space and high enough to prevent the diaphragm from getting in the way. The chest tube will be placed through this hole at the end of the procedure to ensure the patient will not lay on it after surgery.
  - Using the lung as a guide, through the scope and with manual palpation, locate the interspace that will allow direct access to the major fissure (usually the fourth or fifth interspace).
  - A 4–5 cm skin incision is made laterally over the interspace. Raise small adipocutaneous flaps on the surface of the muscle to allow cephalad and caudad separation of the latissimus dorsi muscle fibers. (Sometimes the muscle can just be pulled posteriorly.) Separate the serratus anterior muscle fibers. Enter the chest under camera guidance. Extend the intercostal incision enough to allow specimen removal.
  - A soft tissue retractor makes passing instruments through the access incision easier.
  - In most cases these two incisions are adequate. Occasionally a third incision in the posterior axillary line, eighth interspace is necessary for retraction or for the best angle to pass and position the stapler.
  - Instruments for traction can be passed through the camera port also.
  - In general try to divide most or all of the artery branches first to avoid engorgement of the lobe with blood. If not possible try to plan to divide the artery branches soon after the veins.
- Thoracoscopy – thymectomy – anterior mediastinal mass (Fig. 9.3)
  - Disposable trocars, 2–5 mm, 1–15 mm.
  - Trocars are placed between the mid- and anterior axillary lines, in the fifth, sixth, and seventh interspaces. The large trocar is placed in the middle. CO2 is insufflated. 6–8 mmHg is usually adequate. Too much pressure leads to hypotension.
  - A camera holder attached to the bed is very useful.
  - It is imperative to maintain sufficient distance between the working ports to avoid instrument crowding.
  - Most work can be done with an endoscopic grasper and vascular sealing device.

Identification of the Affected Pulmonary Area and Resection

- Nodules on the lung surface can often be visually identified. Others can be palpated through the access incision. Correlation with the CT scan is key here.

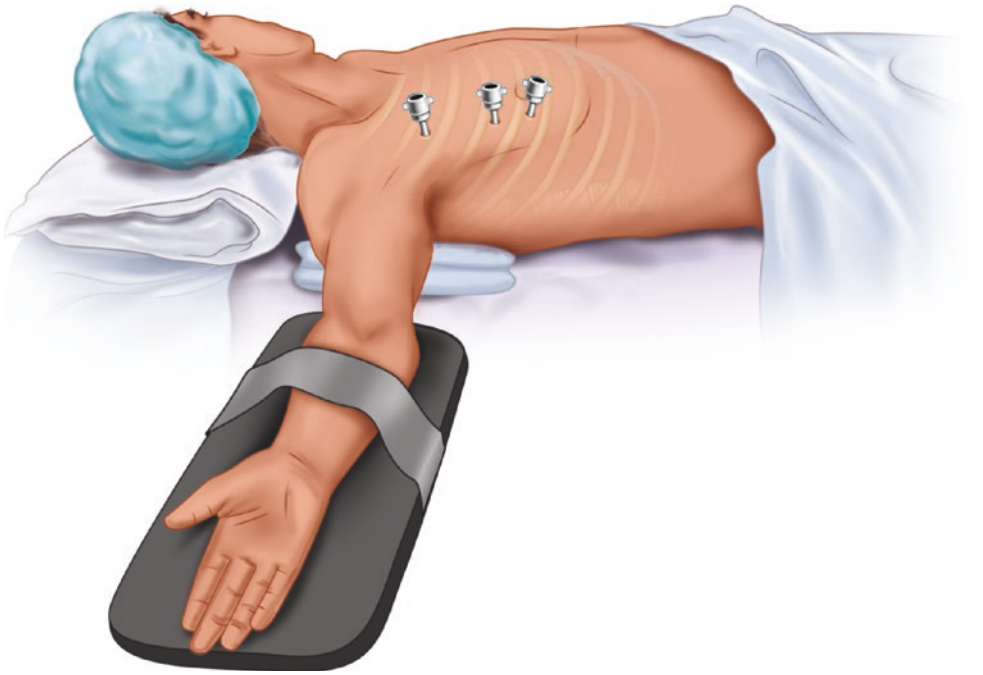

Fig. 9.3 Thoracoscopic port placement

- Nodules that might not be palpable can be localized in advance with CT-guided injection with methylene blue and wire localization. If wire localization is used, cut the wire at the skin prior to prepping to ensure it will not dislodge when the lung is collapsed.
- Small nodules can be grasped directly with a ring forceps or lung clamp. For larger nodules, a linear clamp is placed deep to the nodule to ensure a 1 cm margin.
- In the case of some deep nodules, wedge resection may not be possible, and diagnostic lobectomy or segmentectomy may need to be performed.

Specimen Removal

- To prevent tumor implantation in the chest wall, all specimens are placed in a disposable endo bag and brought out through the access incision or the trocar incision.
- The wound protector may inhibit removal of larger specimens and should be removed prior to extraction.

Intercostal Nerve Block

- Intercostal nerve blocks are performed under direct vision via the thoracoscope.
- Blocks are placed extending from one interspace above the access incision to one interspace below the chest tube incision.
- Blocks are also placed in the latissimus dorsi and serratus anterior and skin.

Chest Tube Placement and Wound Closure

- A single chest tube is inserted through the inferior incision and positioned postero-superiorly under visual guidance either through the access incision or next to the chest tube in the camera incision.
- The lung is reinflated under visual guidance. This is particularly important in right upper lobectomy, to ensure the middle lobe does not twist creating torsion.
- Split muscle layers in the access incision can be loosely reapproximated.

Chest X-Ray

- The postoperative chest X-ray is reviewed to assess for pneumothorax and documentation of chest tube placement.
- Most patients are placed on water seal in the PACU. Suction is only necessary if there is a large pneumothorax or increasing subcutaneous emphysema.
- Some pneumothoraxes are anatomic (the lung is not shaped to fill the space). These will not get better with increased suction.

Access Reader Checklist Appendix

☑ READER CHECKLIST
Video Assisted Thoracoscopic Procedures

☑ PREFERENCE CARD

►**Instruments**
__Silk ties
__0 Polypropylene suture to secure chest tube
__0, 1-0, 2-0, 3-0, 4-0 Polyglactin sutures, to respective re-approximate ribs, muscle, subcutaneous tissue and skin, as needed
__Bupivicaine 0.5% with epinephrine, for local analgesia via intercostal muscle injection
__Chest drainage system
__Chest tube, 28 French
__Kittner dissector sponge
__Electrocautery with an extended protected tip
__Endoscopic vessel sealing device; electrothermal, ultrasound or other, useful also for dividing thin lung tissue
__Surgical clips small, medium and large
__0 and 30-degree, 5 and 10-mm scopes
__Army/navy retractors
__Ring forceps, long Kelly clamps, endoscopic graspers, non-disposable trocars
__Endoscopy ring forceps, Endoscopic Harkin dissector
__Endoscopic GIA stapler. vascular 30 mm, normal tissue and thick tissue 30, 45 and 60 mm
__Small would protector/soft tissue retractor
__Disposable trocars, 5 mm, 12 mm, 15 mm for thoracscopy with CO2 insufflation

►**Instruments**
__Endoscopic specimen bags
__4x4 sponge on sponge stick for direct pressure, if bleeding encountered

☑ PATIENT POSITIONING/ OPERATING ROOM SETUP

►**VATS - Lung Resection – Posterior Mediastinal Mass**
__Patient is placed in full lateral decubitus position.
__Position is secured on a bean-bag with padding to avoid compression injury (this includes: axillary roll, floating arm board, elbow pads and pillows between the legs and ankles)
__Point of flexion for operating table placed at level of xiphoid
__Table flexed as much as possible so lower chest is highest point and iliac crest does not obstruct movements of camera and instruments
__Arms should be directed cephalad to allow room for surgeon
__Surgeon stands at patient's front

►**Thoracoscopy – Thymectomy -- Anterior Mediastinal Mass**
__Supine, arms out on arm boards
__Head of bed elevated
__IV bag transversely behind back at level of xiphoid to arch spine

☑ NODAL POINTS

►**General Principles**
__Main difference between thoracoscopy and laparoscopy is that chest is rigid box
__Abdominal wall is pliable and does not limit instrument mobility and angulation
__Chest wall greatly limits instrument mobility so that adjustments need to be made for camera angles and particularly passage and placement of staplers

►**Trocar and Access Incision Placement**
__Varies depending upon type of procedure (biopsy, wedge, lobectomy, thymectomy) and location of mass/tissue of interest

VATS - Lung Resection – Posterior Mediastinal Mass
__Create camera incision in line with anterior superior iliac spine, about one hand-breadth above costal margin. This will usually place it in 7th intercostal space and high enough to prevent diaphragm from getting in the way. Chest tube will be placed through this hole at end of procedure to ensure patient will not lay on it after surgery
__Using lung as a guide, through scope and with manual palpation, locate interspace that will allow direct access to major fissure, (usually 4th or 5th interspace)
__4-5 cm skin incision is made laterally over interspace
__Raise small adipocutaneous flaps on surface of muscle to allow cephalad and caudad separation of latissimus dorsi muscle fibers. Sometimes muscle can be pulled posteriorly.
__Separate serratus anterior muscle fibers
__Enter chest under camera guidance
__ Extend intercostal incision enough to allow specimen removal
__Soft tissue retractor also facilitates passing instruments through access incision
__In most cases these two incisions are adequate. Occasionally a third incision in posterior axillary line, 8th interspace is necessary for retraction or for best angle to pass and position stapler
__Instruments for traction can be passed through camera port
__In general, try to divide most or all artery branches first to avoid engorgement of lobe with blood. If not possible, plan to divide artery branches soon after veins

Thoracoscopy – Thymectomy – Anterior Mediastinal Mass
__Disposable trocars, 2-5 mm, 1-15 mm
__Trocars are placed between mid and anterior axillary lines in 5th, 6th, and 7th interspaces
__Large trocar is placed in the middle
__CO2 insufflated
__6-8 mmHg usually adequate. Too much pressure leads to hypotension.
__Camera holder attached to bed is very useful.
__It is imperative to maintain sufficient distance between working ports to avoid instrument crowding
__Most work can be done with endoscopic grasper and vascular sealing device

►**Identification of Affected Pulmonary Area and Resection**
__Nodules on lung surface can often be visually identified Others can be palpated through access incision. Correlation with CT scan is key here.
__Nodules that might not be palpable can be localized in advance with CT guided injection with methylene blue and wire localization. If wire localization used, cut wire at skin prior to prepping to ensure it will not dislodge when lung is collapsed
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►**Specimen Removal**
__To prevent tumor implantation in chest wall, all specimens are placed in disposable endo-bag and brought out through access incision or trocar incision
__Wound protector may inhibit removal of larger specimens and should be removed prior to extraction

►**Intercostal Nerve Block**
__Intercostal nerve blocks performed under direct vision via thoracoscope
__Blocks placed extending from one interspace above access incision to 1 interspace below chest tube incision
__Blocks also placed in latissimus dorsi and serratus anterior and skin

►**Chest Tube Placement and Wound Closure**
__Single chest tube inserted through inferior incision and positioned postero-superiorly under visual guidance either through access incision or next to chest tube in camera incision
__Lung re-inflated under visual guidance. This is particularly important in right upper lobectomy to ensure middle lobe does not twist creating torsion
__Split muscle layers in access incision can be loosely reapproximated.

►**Chest X-Ray**
__Postoperative chest x-ray reviewed to assess for pneumothorax and documentation of chest tube placement
__Most patients placed on water seal in PACU. Suction only necessary in cae of large pneumothorax or increasing subcutaneous emphysema.
__Some pneumothoraxes are anatomic (lung is not shaped to fill space). These will not get better with increased suction