Operative Approaches to the Thorax

5

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5.1 Introduction

The wide range of neonatal and pediatric chest pathology requires various approaches to manage these lesions surgically. Over the last 20 years there has been a huge shift in the approach to these lesions, with many now being addressed thoracoscopically. However, the use of this technique for more advanced procedures and for some tumors or masses is not widespread, and many of these lesions are approached using a standard open incision.

Depending on the type and location of the lesion, the approach and incision may vary widely. Lung lesions are usually approached *via* a lateral or posterolateral incision, as are several anterior and posterior mediastinal lesions. Some anterior mediastinal lesions are amenable to an anterior thoracotomy or Chamberlain procedure. Large anterior mediastinal masses may require a median sternotomy.

Mediastinoscopy can also give access to the anterior mediastinum, primarily for diagnostic procedures. However, this is a difficult skill to master safely, especially in the pediatric patient and, in most cases, thoracoscopy is a better and safer surgical approach. The pediatric surgeon should be familiar with all of these approaches and be able to choose and use the most appropriate incision for any particular lesion (Table 5.1).

Table 5.1 Traditional standard approaches to access the thoracic cavity

Lateral thoracotomy
Posterolateral thoracotomy
Anterior thoracotomy
Chamberlin procedure
Muscle-sparing procedures
Medianstinoscopy
Median sternotomy

5.2 Lateral or Posterolateral Thoracotomy

The most common and versatile incision is the posterolateral thoracotomy incision. It gives wide access to the entire chest cavity for pulmonary and extrapulmonary lesions. The advantages and disadvantages of this approach are listed in Table 5.2, but this incision is the choice for lung resections.

The patient is positioned in a lateral decubitus position and padded appropriately. In general, the surgeon stands at the back of the

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Table 5.2 Lateral or posterolateral thoracotomy

Advantages	Disavantages
Wide access to chest cavity	Difficult to access apex of chest
Easy access to anterior and posterior mediastinum and hilar structures	Division of large chest wall muscles
Can enter at variable interspaces	Painful
	Limited access between ribs

patient with the assistant at the front of the patient. This is reversed if the lesion is located in the posterior mediastinum.

The incision can start anywhere form the middle to anterior axillary line and then extends 1–2 cm below the tip of the scapula and then gradually curves upwards behind the scapula (Fig. 5.1). Dissection is then carried down through the subcutaneous tissue until the latissmus dorsi muscle is reached. The anterior border of the muscle crosses near the anterior third of the incision. In most cases, this muscle is then divided to provide access to the serratus anterior muscle and the appropriate interspace. The muscle should be divided as inferiorly as possible to preserve the innervation to the majority of the muscle. An alternative is to mobilize the anterior border of the latissimus dorsi muscle and retract it posteriorly to expose the serratus anterior muscle. The posterior border of the serratus anterior muscle is then easily visualized. The serratus anterior muscle can be divided, again inferiorly as possible, as necessary to expose the desired intercostal space. It may also be mobilized along its posterior border to allow for anterior retraction, again avoiding the division of the muscle (Fig. 5.2) This total muscle-sparing technique decreases the pain and recovery associated with formal thoracotomy, as well as the long-term morbidity of scoliosis, chest-wall deformity, and shoulder-girdle weakness, which are the comorbidities of this approach.

Once the rib cage is reached, the appropriate interspace is chosen. For most lung resections, this is the fourth or fifth interspace. If the lesion is in the apex of the chest or in the base, the interspace can be adjusted accordingly. Cautery is then used to score the periosteum longitudinally, in the middle, along the length of the lower rib. The periosteum is then stripped off the top half of the rib, thereby releasing the intercostal muscle from the rib. The pleura is then opened on the top of the rib and the incision extended along the top of the rib.

The interspace is then slowly widened and a chest retractor inserted. Attachments between the intercostal muscle and the lower rib are slowly released anteriorly and posteriorly as the space is gradually widened.

When the procedure is completed the ribs are re-approximated with 1–3 pericostal sutures which encircle the ribs and pull them back together. The fascia on the lower border of the intercostal muscle is then re-approximated to the periosteum of the rib using a running absorbable suture. The rest of the incision is closed in the appropriate layers.

As mentioned above, this incision is excellent for lung resections, decortications and pleurectomies, anterior and posterior mediastinal masses, and posterior procedures such as tracheoesophageal atresia repair or foregut duplications, and ligation of patent ductus arteriosus.

Some authors have advocated an axillary thoracotomy. In this case, the incision runs in the mid-axillary line longitudinally, but the mobilization and division of muscle is similar to the posterolateral incision. Some authors believe a longitudinal incision in the axilla is more cosmetically pleasing than the transverse one.

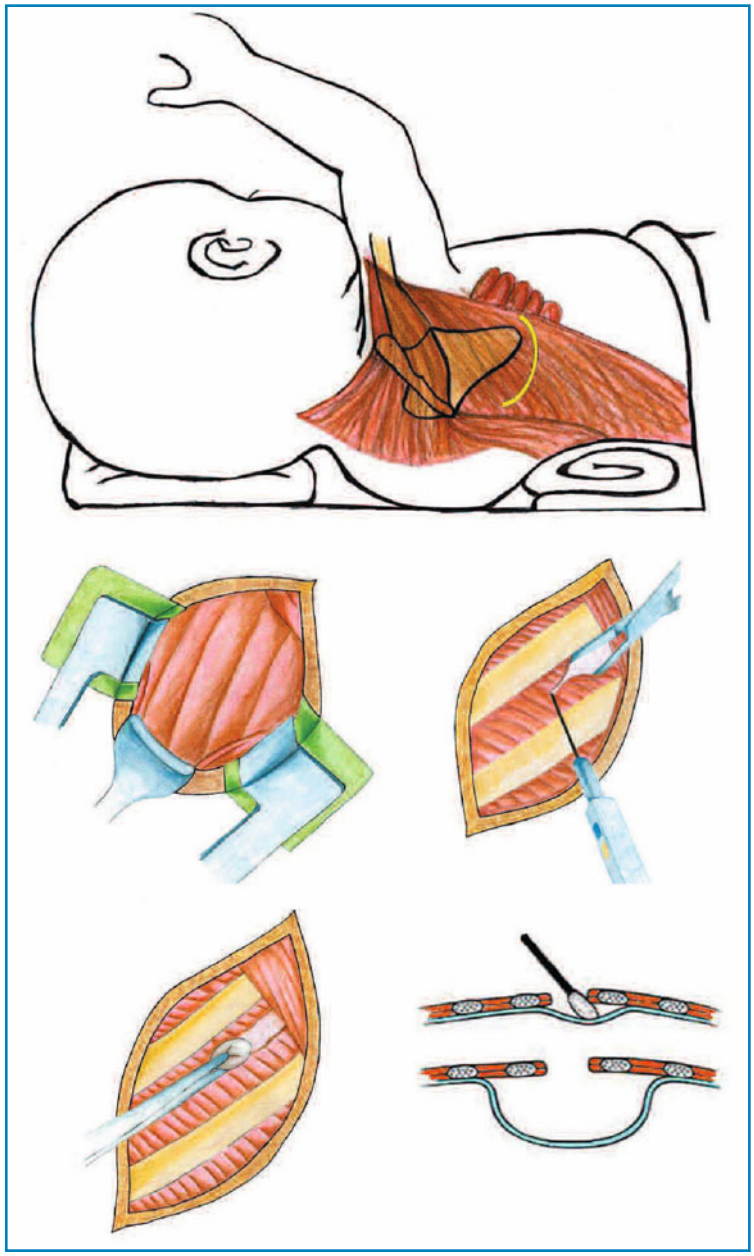

Fig. 5.1 Posterolateral thoracotomy

5.3 Anterior Thoracotomy (Chamberlain Procedure)

This incision is used primarily to biopsy anterior mediastinal masses. It is also used if an aortopexy is needed. The advantages and disadvantages are listed in Table 5.3. The patient is kept in the supine position. The chosen side may be elevated slightly with a roll under the back and shoulder if desired. The incision is made just lateral to the sternum, extending laterally to approximately the mid-clavicle. This is done over the third-to-fifth interspace (depending on the site of the mass (Fig. 5.3). The pectoralis muscle is divided. Then the intercostal muscle can be stripped off the lower rib as described above. If the lesion is in

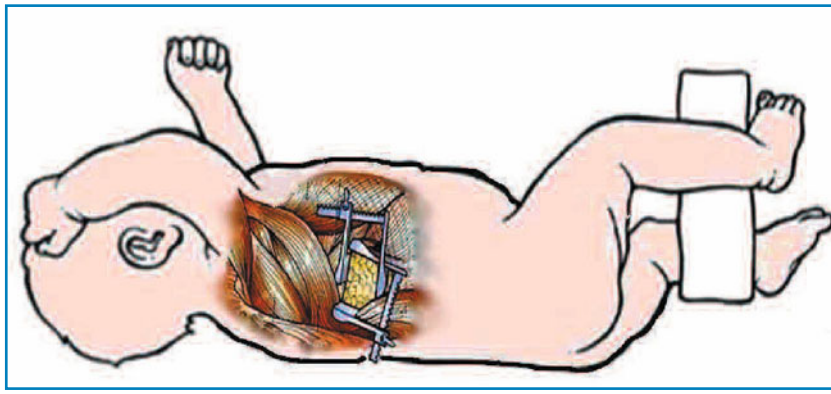

Fig. 5.2 Muscle-sparing thoracotomy

Table 5.3 Anterior thoracotomy (Chamberlain procedure)

Advantages	Disavantages
Limited incision	Limited exposure
Avoids complete division of muscle	Limited access
Access via interspace	
Decreased pain	
Access directly over pathology	

Table 5.4 Mediansternotomy

Advantages	Disavantages
Access to both chest cavities	Limited access to posterior mediastinum and lung surface
Less pain	Possibility of sternal non-union
Avoids bilateral procedures	lnjury to heart
? Quicker recovery	

the anterior mediastinum, an extraperitoneal approach can be used. If the lesion is in the pulmonary parenchyma or intra-pleural region, the pleura can be opened. The incision is closed in layers and in general a chest tube is not necessary after this approach.

5.4 Median Sternotomy

A median sternotomy is most often associated with open-heart procedures, but occasionally it is used in pediatric surgery for large anterior mediastinal tumors.

The advantages and disadvantages are listed in Table 5.4.

The patient is placed supine on the table. Occasionally a roll is placed in-between the shoulder blades to hyper-extend the chest. The incision extends in the midline from the sternal notch to the tip of the xiphoid process (Fig. 5.4). In general, cautery is used to separate the precoralis muscles in the midline and score the periosteum of the sternum. A combination of sharp and blunt dissection is then used to create a space at the top of the sternal notch, where the intraclavicular ligament is divided. A plane is then created behind the manubrium. This ma-

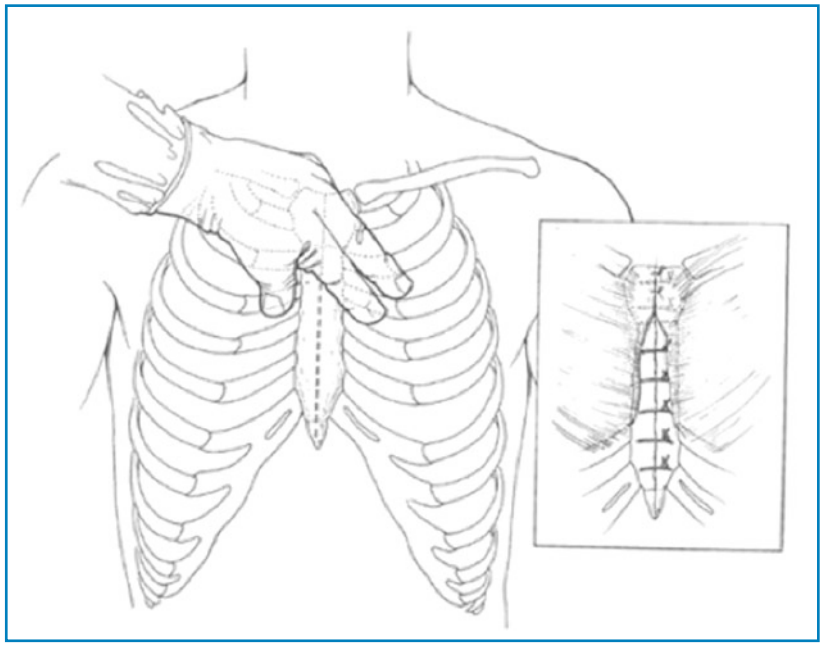

Fig. 5.3 Anterior thoracotomy

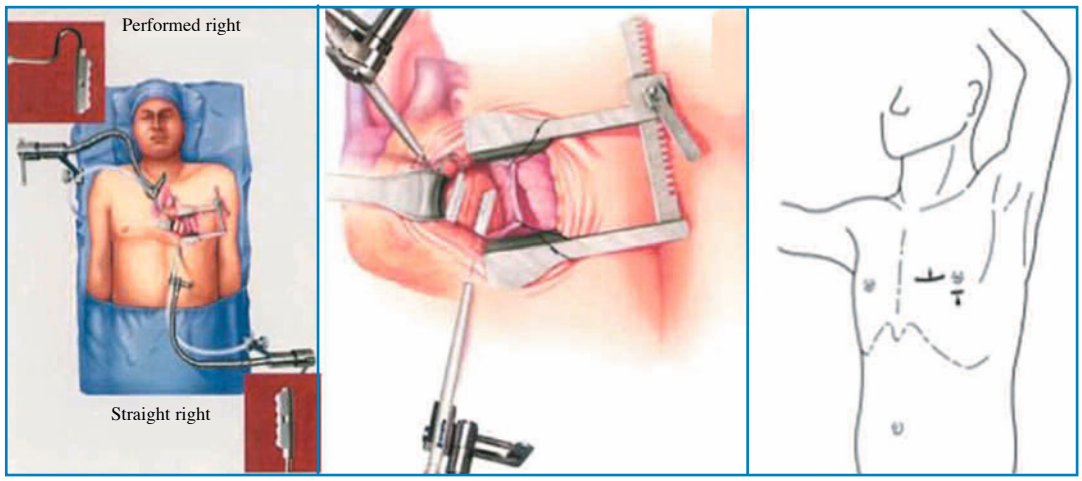

Fig. 5.4 Median sternotomy

neuver helps protect the innominate vein from injury during division of the sternum.

Inferiorly the tip of the xiphoid process is mobilized in a similar fashion and blunt dissection is used to create space behind the sternum. A saw or knife and then be used to split the sternum. There is usually some bleeding from the cut edges of the sternum but this is readily controlled with cautery. Once this is controlled, the sternal spreader is inserted and the edges retracted.

Once the procedure is completed, the edges are allowed to re-approximate. The sternum is then sutured together with sternal wire or a heavy-gauge suture. The rest of the incision is closed in layers.

Suggested Reading

Fry WA (1989) Thoracic incisions. In: Shields T. General Thoracic Surgery. Lea & Febiger, Philadelphia, pp 352–362

Rothenberg SS, Pokorny WJ (1992) Experience with a total muscle sparing approach for thoracotomies in neonates, infants and children. J Ped Surg 27: 1157–1160