Review Article

Approaches to the thoracic cavities

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Abstract: In the past, posterolateral thoracotomy was utilized as the usual incision for pediatric patients. Nevertheless, in children, most thoracotomic operations could be performed through a muscle sparing lateral thoracotomy. The video-assisted thoracic surgery (VATS) is progressively more used since most procedures can be tailored to VATS. On the contrary, median sternotomy has a partial role and consent the access to both lungs and mediastinal structures.

Keywords: Thoracotomy; video-assisted thoracic surgery (VATS); lung cancer; children; pediatrics

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Introduction

In the past, the posterolateral thoracotomy was utilized as the usual incision in pediatric patients. Nevertheless, in children, most thoracotomic operations could be performed through a muscle sparing lateral thoracotomy. The video-assisted thoracic surgery (VATS) is progressively more used since most procedures can be tailored to VATS. On the contrary, median sternotomy has a partial role and consent the access to both lungs and mediastinal structures (1).

Thoracotomic incisions

Posterolateral thoracotomy

The posterolateral thoracotomy provides excellent access to:

- ❖ Lung;
- ❖ Oesophagus;
- ❖ Mediastinum;
- ❖ Descending aorta;
- ❖ Diaphragm.

The standard incision extends:

- ❖ From the anterior axillary line;
- ❖ To a point midway between the vertebral border of the scapula and the spine (level of the fourth thoracic vertebra);
- ❖ The incision may be extended anteriorly or posteriorly.

Steps:

- ❖ Division of the trapezius muscles and latissimus dorsi;
- ❖ Elevation and anterior retraction of the serratus anterior muscle;
- ❖ Division of the serratus anterior muscle origins from the underlying ribs;
- ❖ Preservation of the neurovascular bundle to avoid the winging of the scapula;
- ❖ Thorax is opened through the bed of the fifth intercostal space;
- ❖ Identification of the parietal pleura.

If an extrapleural approach is intended, the pleura is gently separated from the inside of the chest wall using small damp gauze or can also be opened through the bed of a rib. The posterior periosteum can be opened to gain entry to the thoracic cavity. In the case of complexity, broader access could be achieved removing the whole bone or excising a segment of the posterior rib (*Figure 1*).

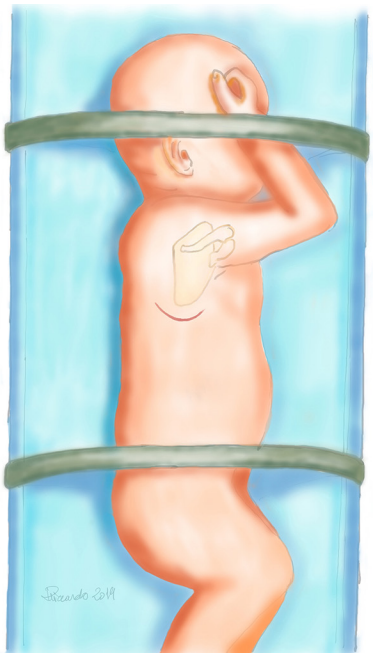

Figure 1 Posterolateral thoracotomy.

Figure 2 Lateral thoracotomy.

Lateral and auscultatory triangle muscle-sparing thoracotomies

The general principle of muscle-sparing thoracotomies is retraction rather than the division of the chest wall muscles.

The skin incision runs:

- From the anterior axillary line;
- To a point midway between the vertebral border of the scapula and the spine, at the level of the fourth thoracic vertebra.

Steps:

- Undermine the anterior and anteroinferior edges of the wound;
- Exposition of the latissimus dorsi and serratus anterior muscles;
- Definition of the anterior boundary of the latissimus dorsi muscle;
- Posterior retraction of the muscle to expose the serratus anterior.

Further retraction of the latissimus dorsi to delineate the posterior border of the serratus anterior (*Figure 2*) (2-4).

The muscle-sparing technique can also be used to enter the chest through the triangle of auscultation (trapezius superiorly, the posterior border of latissimus dorsi inferiorly, and the vertebral border of the scapula laterally).

The skin incision for auscultatory triangle muscle-sparing thoracotomies:

- Slightly more posteriorly than for a lateral thoracotomy (5).

The lateral incision offers a little less exposure than the usual posterolateral thoracotomy but is quite acceptable if completed with the proper mobilization of the latissimus dorsi and complete exposure of the intercostal space (*Figure 3*) (4).

Muscle sparing posterolateral thoracotomy

The skin incision is the same as posterolateral thoracotomy. The anterior margin is generally found between the posterior axillary fold and the anterior superior iliac spine, although the latissimus dorsi inserts on the posterior aspect of the iliac crest.

A slightly longer skin incision is required to realize an adequate muscle flap. The subcutaneous attachments of the latissimus dorsi are prepared. The entire anterior border is freed inferiorly toward the iliac crest and superiorly into the axilla. The profound margin of the latissimus dorsi is released. The muscle is retracted posteriorly, exposing the serratus anterior that is dissected by dividing the fascia along the posterior margin up to the tip of the scapula, down to the lowest attachment on the anterior aspect of the sixth rib. The profound element of the serratus is mobilized, retracting the muscle forward.

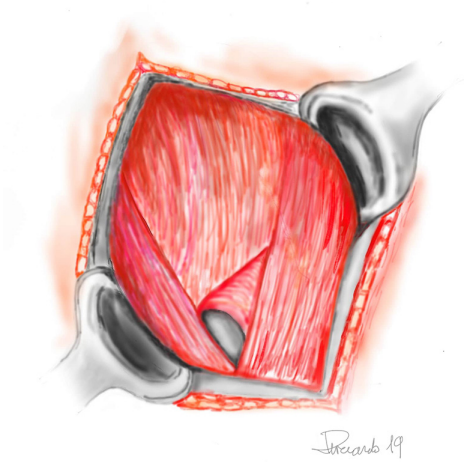

Figure 3 Lateral thoracotomy in the auscultatory triangle.

Figure 4 Transaxillary thoracotomy.

The bones are viewed for choosing the entry level into the pleura (6,7).

Transaxillary thoracotomy

The skin incision could be vertical or horizontal. To expose the serratus anterior, the subcutaneous tissue and fascia are divided. Tissue planes are developed between the superficial fascia. The muscle layers should be taken care to avoid the long thoracic and the intercostobrachial nerves. Latissimus dorsi is retracted posteriorly, elevating the serratus anterior muscle, and exposing the desired rib space. The third intercostal space is best suited for operations on the patent ductus arteriosus, sympathetic chain, and apical lung lesions. The fourth space is used for biopsy of mediastinal lesions, upper lobectomy pleurodesis, and wedge resection (*Figure 4*) (6-8).

Table 1 VATS procedures described in children [modified from Engum SA (9)]

Cyst excision
Decortication
Excision of the mediastinal mass
Ligation of ductus arteriosus
Ligation of the thoracic duct
Lobectomy
Lung biopsy
Mediastinal biopsy
Pericardial window
Pleurectomy
Plication of diaphragm
Repair of a diaphragmatic hernia
Repair of oesophageal atresia
Repair of tracheoesophageal fistula
Resection of foregut duplication
Resection of sequestration
Sympathectomy
Thymectomy

VATS, video-assisted thoracic surgery.

Minimally-invasive thoracic surgery approaches

Minimal access thoracic surgery carries with it several concerns, including aesthetic considerations, control of vascular structures, and adequate workspace. Advances in new generation products including shorter instruments, high-resolution cameras, improved linear staplers and endoclip, energy devices, have further popularized VATS in children. The breadth of minimally invasive indication was shown in *Table 1*. The most common indications include pleural debridement for empyema, the mediastinal

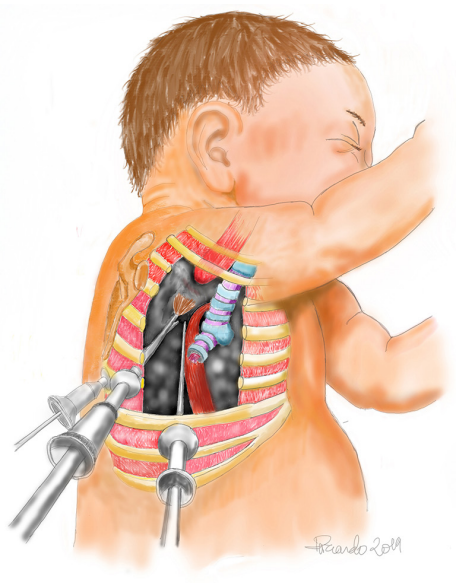

Figure 5 VATS approach in oesophageal atresia. VATS, video-assisted thoracic surgery.

lesions biopsy and excision of duplication or bronchogenic cysts. The VATS is useful for other pleural disorders, such as chylothorax and spontaneous pneumothorax. Latest developments are being created to performing anatomic lobectomies, repair of oesophageal atresia and diaphragmatic hernias (*Figure 5*). The role of the robot in pediatric thoracoscopy is still in the preliminary stages of definition (9,10).

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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