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Surgical Technique

Muscle sparing lateral thoracotomy: the standard incision for thoracic procedures

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Abstract

Lateral thoracotomy is a versatile approach with many variations and is currently the most widely used incision in thoracic surgery. In the current article we are presenting the muscle-sparing lateral thoracotomy in the lateral decubitus position which we consider to be the "standard" for lateral thoracotomies. Indications, surgical technique and pitfalls are described alongside our experience with thoracic drainage.

Although there is no consensus regarding the name of this incision, some authors call it "axillary thoracotomy" while others call it a "modified lateral thoracotomy", they all agree on one aspect – the importance of muscle sparing – which makes it the go-to thoracotomy for both small and large procedures involving the lung.

Lateral muscle sparing thoracotomy allows for good exposure of the pulmonary hilum, fissures, apex and diaphragm. The approach is easy and quick to perform while at the same time ensuring faster postoperative recovery by sparing the latissimus dorsi muscle, better cosmetics and lower postoperative pain score when compared to the posterolateral or classical lateral thoracotomies.

Keywords: lateral thoracotomy, muscle sparring, thoracic incisions, standard procedure

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Introduction

Lateral thoracotomy and its variations are the most widely used incisions in thoracic surgery while providing access to all structures of the interested hemithorax and part of the mediastinum. This approach offers great exposure for performing both limited procedures such as wedge resections and apical bullectomy but also oesophagostomy and extended pulmonary resections like intrapericardial pneumonectomy or sleeve lobectomies (1-3). Several authors also consider it to be an excellent thoracic incision for single lung transplantation (4).

The patient is placed in a true lateral decubitus position with a roll beneath his contralateral hemithorax in order to open the interested intercostal spaces (Figure 1). The homolateral arm is supported at right angle to the ether screen. The contralateral leg is flexed and the homolateral leg is straight. The patient is tightly secured with a pelvic strap to the operating table. The head is supported with a roll so that the cervical spine is in neutral position. An additional stand is placed anterior, at the level of the lower half of the sternum, to prevent patient shifting during surgery.

Figure 1. The position of the patient on the operating table

Discussion

The presented incision is a muscle-sparing lateral thoracotomy in which the skin incision is made on a horizontal line parallel to the underlying intercostal space and extending from the anterior margin of the latissimus dorsi muscle towards the submammary groove – lateral margin of the pectoral muscle (5, 6).

An important landmark for establishing the site of incision is the mammary areola which corresponds to the 4th intercostal space in men. In case of a standard lobectomy, the incision would measure between 15 and 20 cm long and is performed in the 5th intercostal space which allows for good exposure of the pulmonary hilum, fissures, apex and diaphragm (Figure 2).

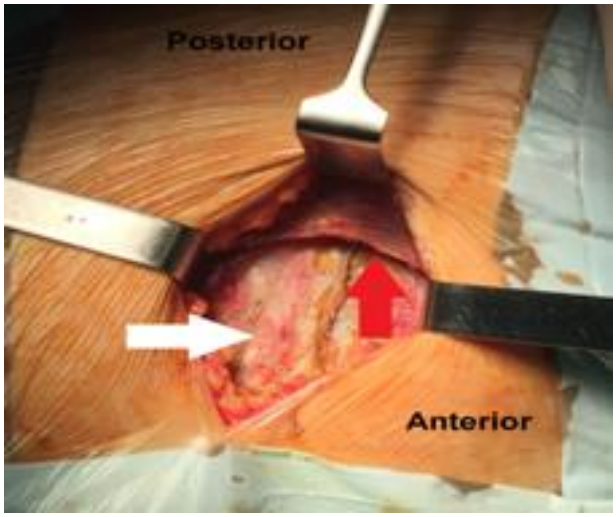

Figure 2. Thoracotomy for lobectomy (red arrow – latissimus dorsi muscle visible in incision; white arrow – the plane of serratus anterior muscle)

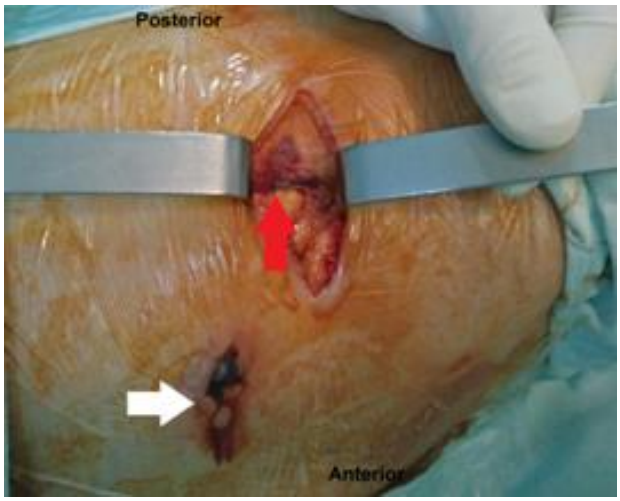

Figure 3. Thoracotomy for video assisted wedge resection (red arrow – latissimus dorsi muscle visible in the incision; white arrow – port used for camera)

For large tumours or carinal approach, the incision can be extended anteriorly through the submammary fold and further to the back towards the tip of the scapula, while for wedge resections (Figure 3),

pneumothorax or uniportal VATS a 5cm incision is satisfactory.

Following the incision of the skin and subcutaneous layer, the first muscle we encounter is the latissimus dorsi towards the posterior end of the incision. The anterior margin of the latissimus dorsi is freed from the subcutaneous layer above. The inner side of the latissimus dorsi is freed from the serratus anterior by blunt dissection and the muscle is raised and retracted posteriorly to maximize exposure.

The serratus anterior muscle and its fascia is the next layer visible beneath the latissimus dorsi. We free it anteriorly from the lateral margin of the pectoralis major muscle. In select cases when a larger field of view is required the anterior border of the latissimus dorsi muscle and the lateral margin of the pectoralis major muscle can be partially divided for several centimetres.

This thoracotomy is muscle sparring for two reasons: first, the latissimus dorsi is spared by retracting it posteriorly, second, access to the intercostal plane is performed by dividing the connective tissue between the fibers of the serratus anterior muscle, not the fibers themselves (7).

Incision of the intercostal muscle is performed parallel to the superior margin of the lower rib without the necessity of stripping the rib periosteum. Initially the rib incision should be large enough to allow for a spreader to be inserted. The ribs must be opened gradually as to avoid rib fractures. The rib incision is carried out anteriorly towards the mammary vessels and posteriorly down to the paravertebral muscles with the help of a long tip cautery. The limiting factor in spreading the ribs is the size of the rib incision and not the size of the skin incision which is always smaller for aesthetic reasons (8, 9).

In patients with history of tuberculosis or other non-specific pulmonary infections tight adhesions are to be expected. For these select cases we recommend using the 6th intercostal space for access to the diaphragm and posterior pleural sinus and the 3rd - 4th intercostal space for access to the pleural dome. Although we do not recommend it, a second thoracotomy located two intercostal spaces lower or higher than the first one can be performed by either making a separate skin incision or by freeing and retracting the serratus anterior muscle towards the involved intercostal space (Figure 4).

Figure 4. Double lateral thoracotomy for large pleural tumour

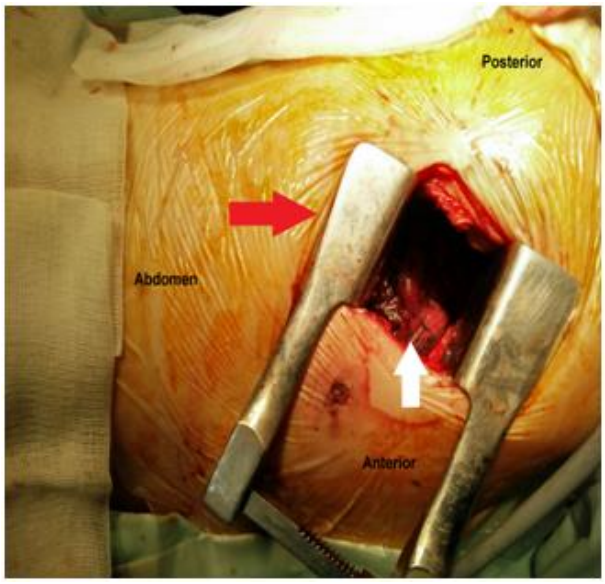

Figure 5. Thoracotomy for open wedge resection (red arrow - Finochietto rib spreader; white arrow deflated lung)

A standard Finochietto rib spreader is placed in the intercostal space with protective gauzes on each rib (Figure 5). A Gosset retractor is used to maximize the field of view on the soft margins of the thoracotomy (the latissimus dorsi and pectoralis major muscles).

Typically, the chest cavity is drained with a single 28-32 French chest tube inserted two spaces bellow the thoracotomy through a separate skin incision located on the middle or posterior axillary line (Figure 6).

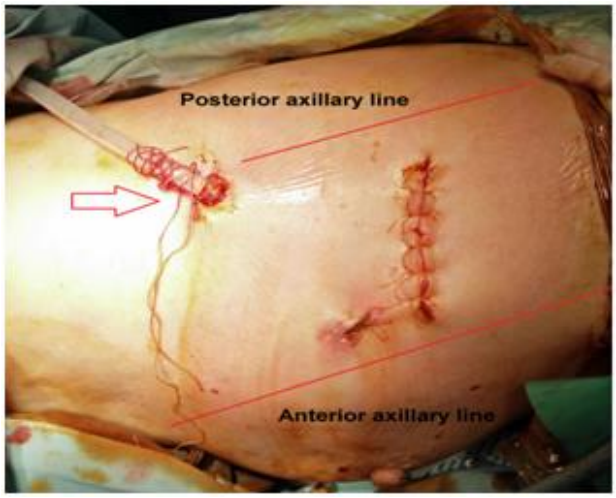

Figure 6. Thoracotomy for pneumothorax (arrow chest drain inserted two spaces bellow the incision, on the posterior axillary line)

The drain is directed towards the apex and is positioned parallel to the paravertebral groove thus allowing for proper air and fluid drainage when the patient is in lying down position.

In cases in which air leaks are to be expected we use two chest tubes. The first is a 24 French chest tube inserted two space bellow the thoracotomy through a separate skin incision located on the on the anterior axillary line and positioned anteriorly to the hilum and towards the pleural dome for adequate air drainage.

The second is a 28-32 French chest tube inserted two spaces bellow the thoracotomy through a separate skin incision located on the posterior axillary line. The drain is positioned parallel to the paravertebral groove and closer to the diaphragm in order to drain mostly fluid. The two chest drains will be connected to separate drainage batteries in order to monitor fluid and air leaks individually. Some surgeons prefer to have the chest tubes connected to a 'y' tube connector which is fixed to an appropriate drainage battery. Each chest drain is secured with a size 2 (5.0 metric) stitch while a second untied stitch is inserted to close the orifice after the removal of the tube (10).

The roll beneath the patient must be removed before closure in order to narrow the rib spaces. We reproach the ribs to their initial position, without crushing the intercostal muscles and neurovascular bundle, by using 2 to 4 absorbable sutures passed at equal distance to one another for the entire length of the skin incision. The sutures are size 2 double threads (5.0 metric) passed between the superior margin of the upper rib and inferior margin of the lower rib thus sparring the neurovascular intercostal bundle.

The intercostal muscles are not sutured, instead the serratus anterior muscle is closed with a running suture in order to ensure and airtight barrier (Figure 7).

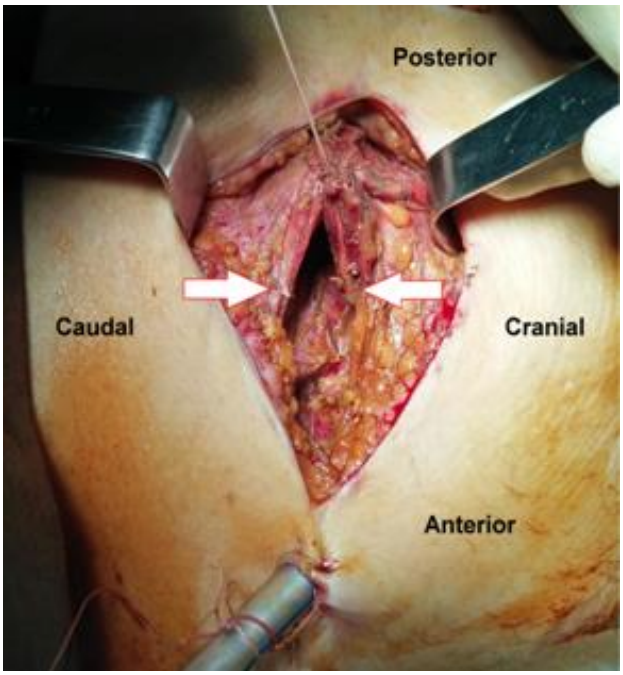

Figure 7. Closure of the thoracotomy – white arrows indicating closure of the serratus anterior muscle with running sutures

The latissimus dorsi is placed back in its anatomic position without the need of suturing. Due to the risk of a postoperative seroma in muscle sparring thoracotomy some authors recommend using Redon drains in the subcutaneous plan. An alternative to using the Redon drain is suturing the subcutaneous plane to the serratus anterior fascia thus disbanding the

space. The closure of the skin incision remains at the surgeons' discretion.

The authors' criteria for removal of chest tubes are: (a) fluid drainage less than 100 ml/24 h, (b) stop of air leak > 24 h, (c) complete pulmonary expansion (non-applicable to pneumonectomy) and (d) absence of residual pleural effusion.

Pitfalls

When freeing the latissimus dorsi muscle one should be careful as extensive and aggressive dissection doesn't facilitate better exposure but increases the risk of damaging the long thoracic nerve.

Real space between the muscle and subcutaneous layer promotes postoperative complications such as seroma, infection or haematoma.

In order to maximize exposure, the Finochietto rib spreader must be placed towards the posterior end of the skin incision, as close as possible to the latissimus dorsi muscle.

We reaffirm the importance of spreading the ribs gradually when performing the thoracotomy in order to avoid fractures. Rib fractures may lead to immediate complications, such as bleeding, or late complications, the persistent nerve palsy (post-thoractomy pain syndrome).

Conclusions

First mentioned by Bethencourt and Holmes in 19887, this muscle-sparing incision allows for most pulmonary resections to be performed in safe conditions. Lateral muscle sparing thoracotomy allows for good exposure of the pulmonary hilum, fissures, apex and diaphragm. The approach is easy and quick to perform while at the same time ensuring faster postoperative recovery by sparing the latissimus dorsi muscle, better cosmetics and lower postoperative pain score when compared to the posterolateral or classical lateral thoracotomies.

Although there is no consensus regarding the name of this incision, some authors call it "axillary thoracotomy"8 while others call it a "modified lateral thoracotomy"9, they all agree on one aspect – the importance of muscle sparing – which makes it the go-to thoracotomy for both small and large procedures involving the lung. As Pr. Gilbert Massard stated ''to be well exposed, it's the half of the success of a surgical procedure''.

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