

# McCraw and Arnold's Atlas of Muscle and Musculocutaneous Flaps



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Global-HELP  
Publication

# SERRATUS ANTERIOR

## ANATOMICAL CONSIDERATIONS

### *Surface Markings*

Only the anterior border of the serratus anterior muscle can be palpated as it passes from the lower aspect of the anterior axillary line to the medial border of the scapula. The posterior border of the muscle is covered by the larger latissimus muscle and is not palpable. The average size of the serratus anterior muscle is ten by twenty centimeters.

### *Origin and Insertion*

The serratus anterior muscle originates from the anterior surface of the seventh through the tenth ribs and inserts on the costal surface of the vertebral border of the scapula.

### *Adjacent Muscles*

The multipinnate origin of the muscle lies just inferior and lateral to the pectoralis major muscle. In its course toward the scapula the serratus anterior muscle is covered by the latissimus dorsi muscle. The bulk of the serratus anterior muscle is located between the latissimus dorsi and the pectoralis major muscles, where the muscle resides in the hollow between the anterior and posterior axillary folds. In the axillary hollow, the upper part of the serratus anterior muscle is surrounded by the musculature of the shoulder girdle.

### *Vascular Pattern*

The serratus anterior muscle is supplied by two proximal, dominant pedicles which arise in the axilla. The lateral thoracic artery is visible on the lateral surface of the muscle. A branch of the thoracodorsal artery enters the posterior aspect of the serratus muscle before it terminates in the latissimus dorsi muscle. The thoracodorsal branch is the more dominant of the two vessels and consistently arises three to six centimeters cephalad to the vascular leash of the latissimus dorsi muscle.

### *Motor Nerve*

Long thoracic nerve.

### *Sensory Nerve*

Intercostal and long thoracic nerves.

## USES

The serratus anterior can be used as a muscle, musculocutaneous, or osteomyocutaneous flap. The muscle flap alone is applicable to chest wall reconstructions

which lie within the twenty centimeter arc around the vascular axis in the axilla. The muscle is most often used to vascularize an autogenous rib graft or to cover a foreign body placement such as Prolene® mesh. It can be transposed intrathoracically to reach most areas of the tracheobronchial tree and the heart. Its most common intrathoracic application is in the reinforcement of secondary airway closures such as a bronchopleural fistula, but it also can be used for primary reconstructions of the trachea and the bronchi.

The serratus anterior muscle can also be used to carry its overlying skin as a musculocutaneous flap. This composite flap is most commonly employed in conjunction with the pectoralis major muscle. In this application both of these muscles are elevated with a large amount of skin from the anterior and lateral chest and moved centrally. As an osteomyocutaneous flap, the primary applications have been as “free” microvascular transfers. The serratus anterior muscle is recognized as one of the most versatile “free” tissue donor sites because of its advantageous features of size and vascular capabilities. Its versatility is expanded by the direct attachment of the muscle to both the underlying ribs and the overlying skin.

## REGIONAL FLAP COMPARISONS

Although the serratus anterior muscle is not as large as either the pectoralis major or the latissimus dorsi muscles, it has a similar, robust blood supply and is ideally suited for both intrathoracic and extrathoracic uses. For this reason, it is primarily compared to the latissimus and pectoralis muscles for intrathoracic and extrathoracic reconstructions. The serratus anterior is distinguished from these other two muscles by being more difficult to dissect and by having a more limited arc of rotation. The left pectoralis major muscle is more often used as a reinforcing layer for the ventricular myocardium because it is more accessible. The latissimus muscle is larger but it is usually transected by the standard posterolateral thoracotomy. It is unusual to employ the serratus anterior as a myocutaneous flap since skin is seldom needed in the common chest wall and intrathoracic applications of the muscle flap. The direct adherence of the serratus anterior muscle to the underlying intercostal muscle provides a unique rib-carrying capability which is not offered by the pectoralis major or the latissimus dorsi muscle flaps.

## DISADVANTAGES

The primary disadvantage of transposing the entire serratus anterior muscle is the resulting winging of the scapula. The muscle is important for scapular stabilization in overhead arm movements such as the tennis serve. This unique muscular function alone limits the elective application of the serratus anterior muscle flap in certain individuals. It is also less anatomically distinct and more difficult to dissect than either the pectoralis major or the latissimus dorsi muscles. For reasons of convenience the serratus anterior muscle flap is generally not used if one of the other major chest wall muscles is available.

## ADVANTAGES

When compared to the latissimus dorsi muscle, the smaller size of the serratus anterior muscle is an advantage in reinforcing a tracheal or bronchial stump. A very large and bulky muscle flap is more a disadvantage than an advantage in this application. The distinct advantage of the serratus muscle is found in situations involving intrathoracic defects following a thoracotomy. The latissimus muscle is usually divided in a standard posterolateral thoracotomy and cannot be transposed as a complete muscle, while the serratus anterior muscle is not divided. The dominant vasculature is found high in the axilla, which facilitates the use of this muscle for both intrathoracic and extrathoracic problems of the upper chest.

## COMPLICATIONS, PITFALLS, AND DONOR SITE

The complications involved with this muscle are much the same as its two extrathoracic neighbors, the pectoralis and latissimus muscles. The two dominant vessels of the serratus muscle can be difficult to dissect in their high axillary location, but this feature does allow the muscle to reach most of the superior intrathoracic structures. This excursion of the muscle flap, however, must be facilitated by a second thoracotomy in the region of the dominant vessels. Adequate exposure through retraction of the latissimus dorsi and the pectoralis major muscles is required for the safe removal of the muscle from its origination on the chest wall and its attachment to the scapula. Since this is a dissection over a large area, hematoma and seroma collections must be avoided by meticulous hemostasis and adequate suction drainage.

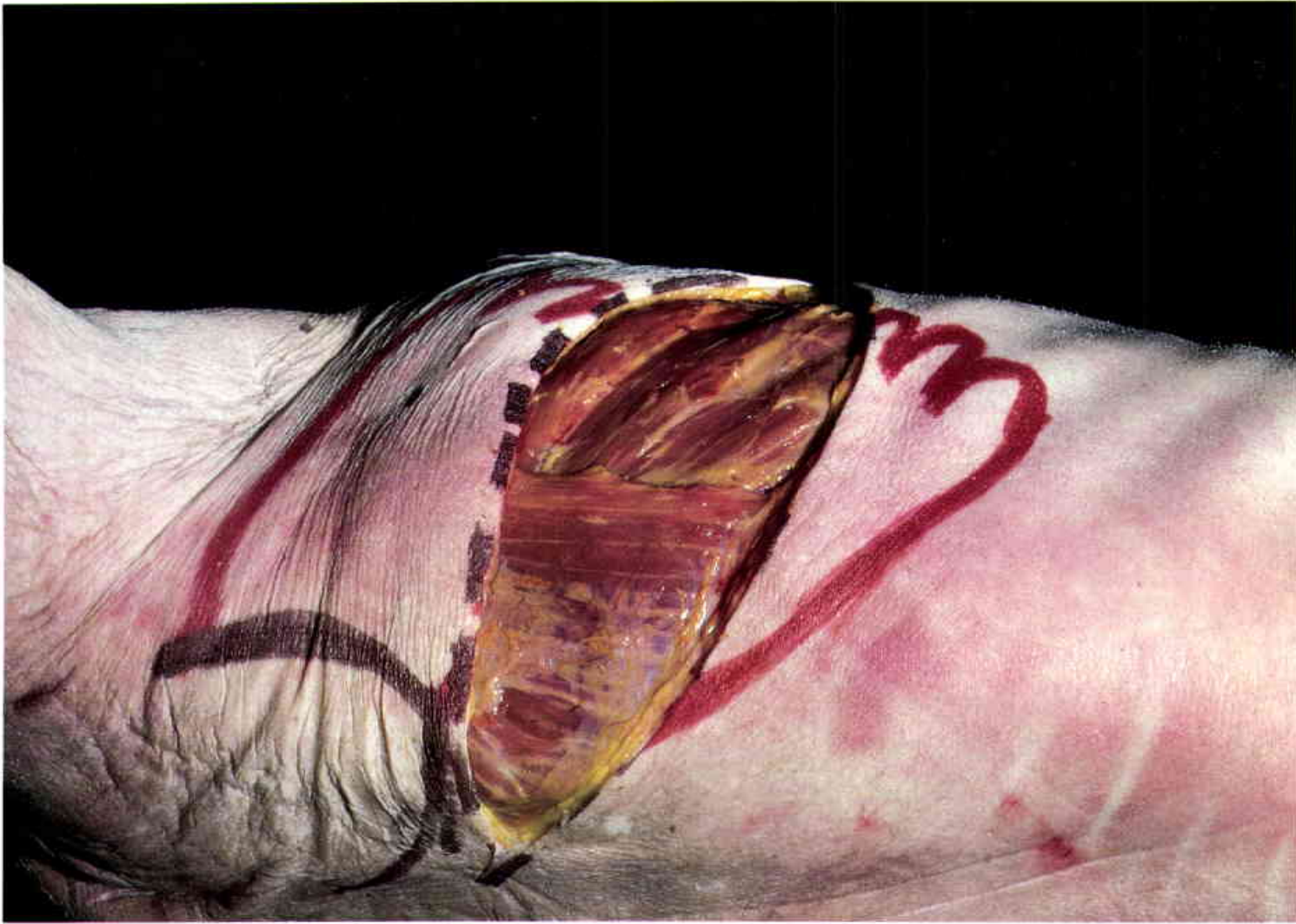
The donor site is not a significant problem unless a full-thickness chest wall defect is created in the process of elevating an osteomyocutaneous flap. This defect is correctable by the transposition of the latissimus dorsi muscle and should not present a problem with appropriate planning. Winging of the scapula is usually not noticed by the patient, but it can create a problem in the athletic person. Winging of the scapula is a particular concern in elective "free" flap applications when compared to the relative merits of the other available donor sites. For intrathoracic applications this minor functional "trade off" is an inconsequential consideration when compared to the benefits of this muscle flap. Given the choice between the correction of a difficult or life-threatening intrathoracic problem and this functional deficit, the decision is an easy one.





**1**

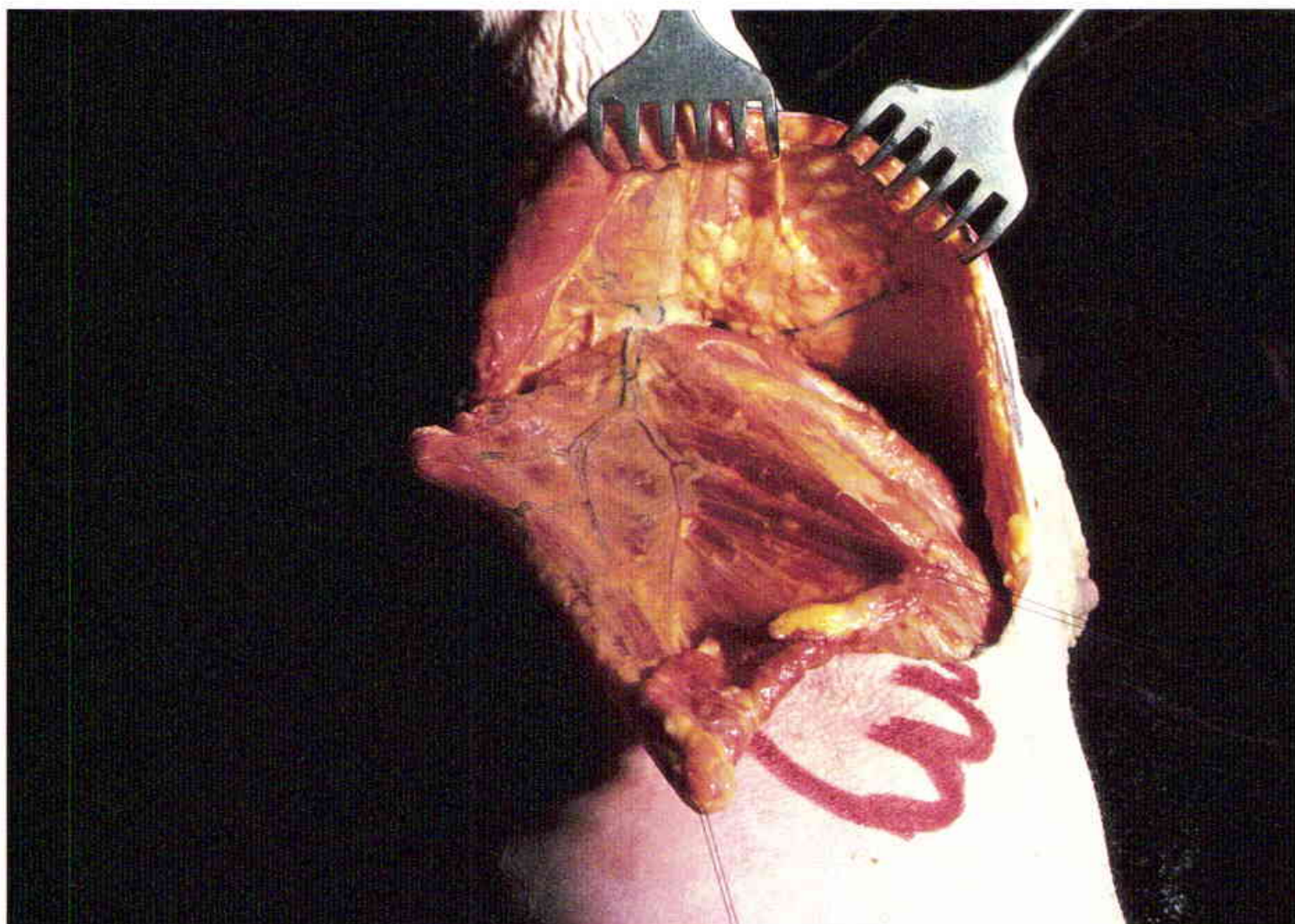
The general anatomical location of the serratus anterior muscle is depicted on the back. The scapula is outlined in black.



2

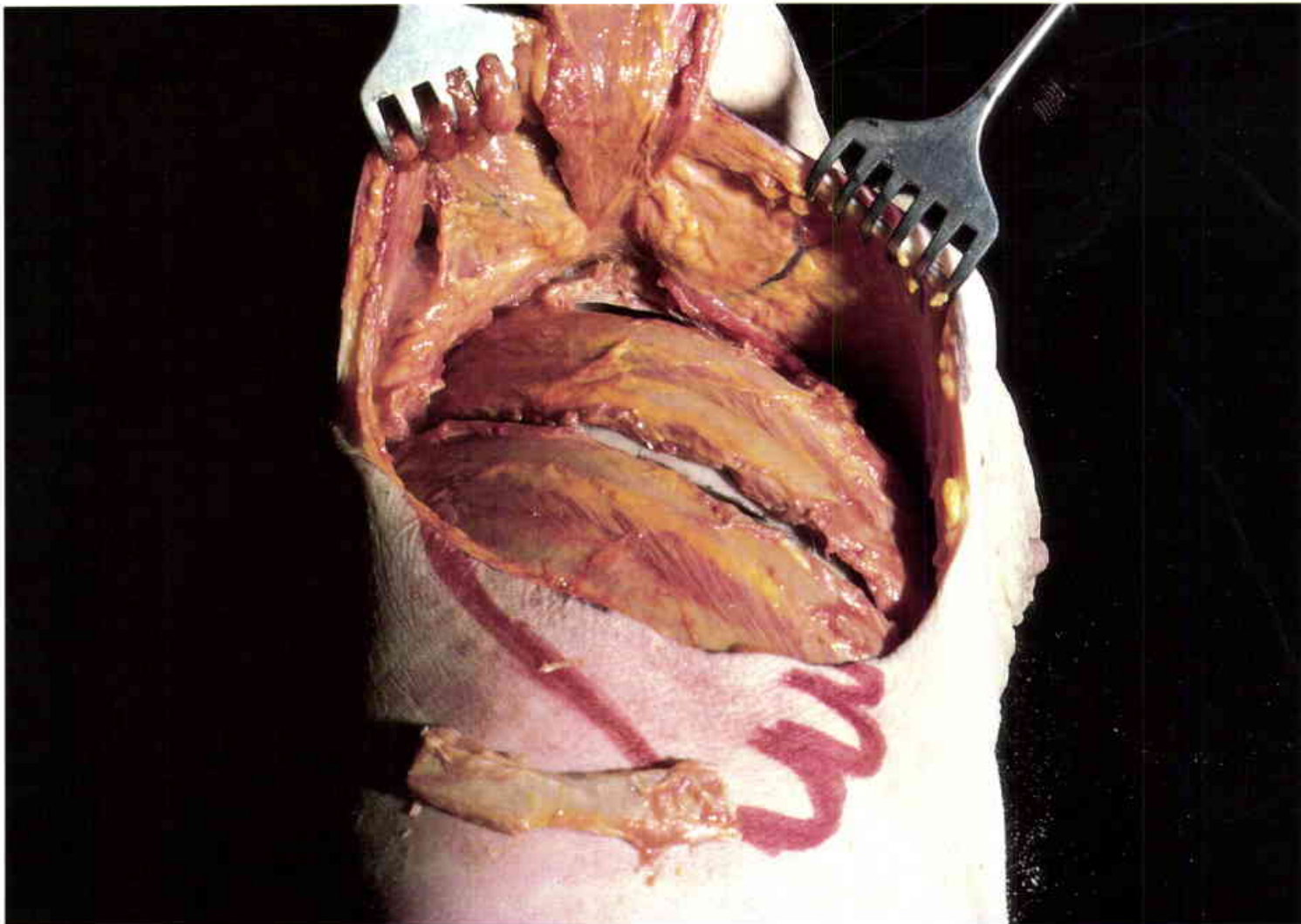
The skin incision is made at the level of a standard thoracotomy exposing the latissimus dorsi muscle posteriorly and the "fingers" of the serratus anterior muscular origin.





3

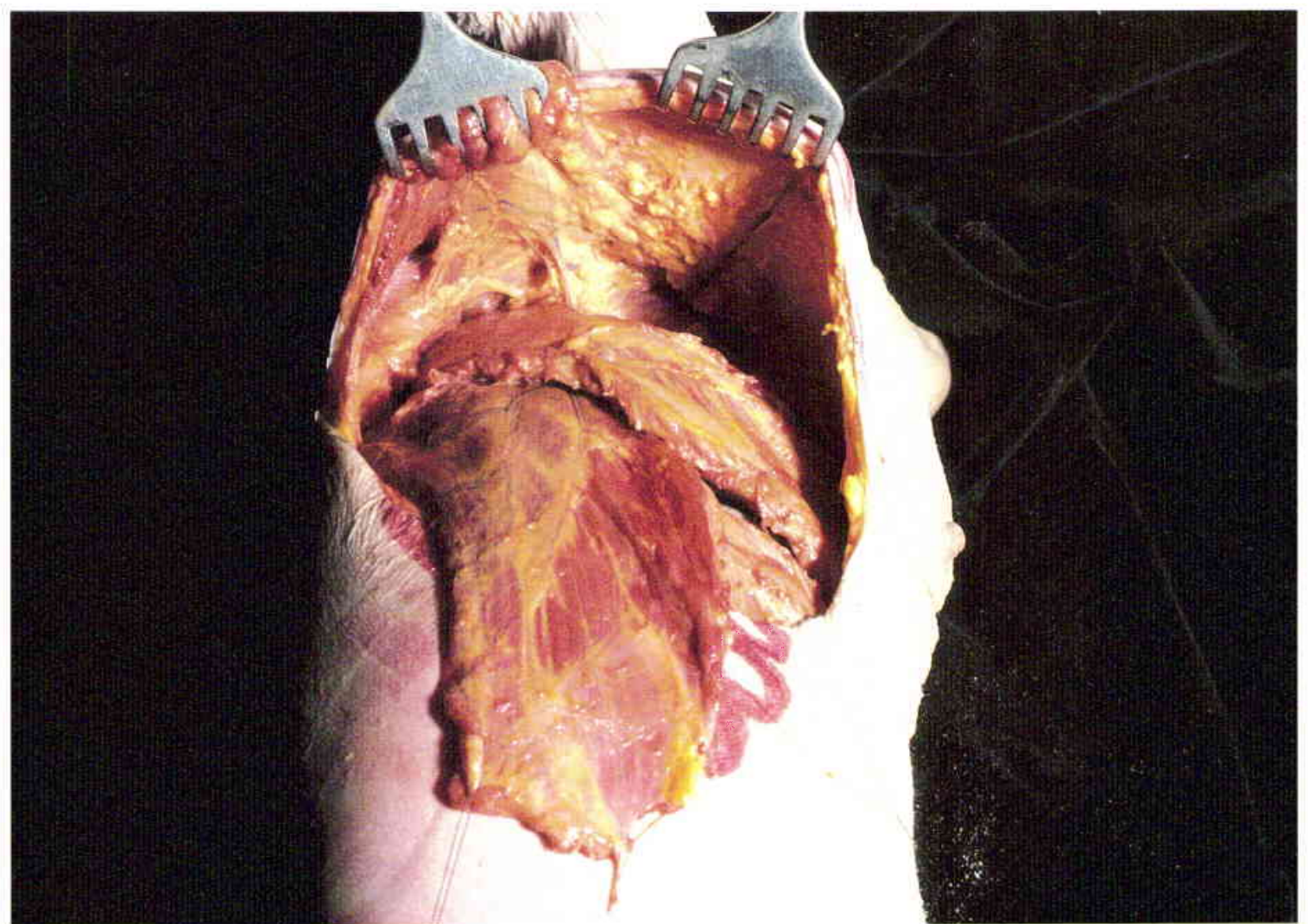
The serratus anterior muscle is exposed by dividing and elevating the latissimus muscle. One can readily appreciate the generous blood supply provided by the subscapular artery.



4

The serratus anterior muscle is elevated as an “island” flap and retracted. Thoracotomies have been placed in the second and fifth interspaces. The “second” thoracotomy is created by removing approximately a nine centimeter segment of the second rib near the vascular axis.

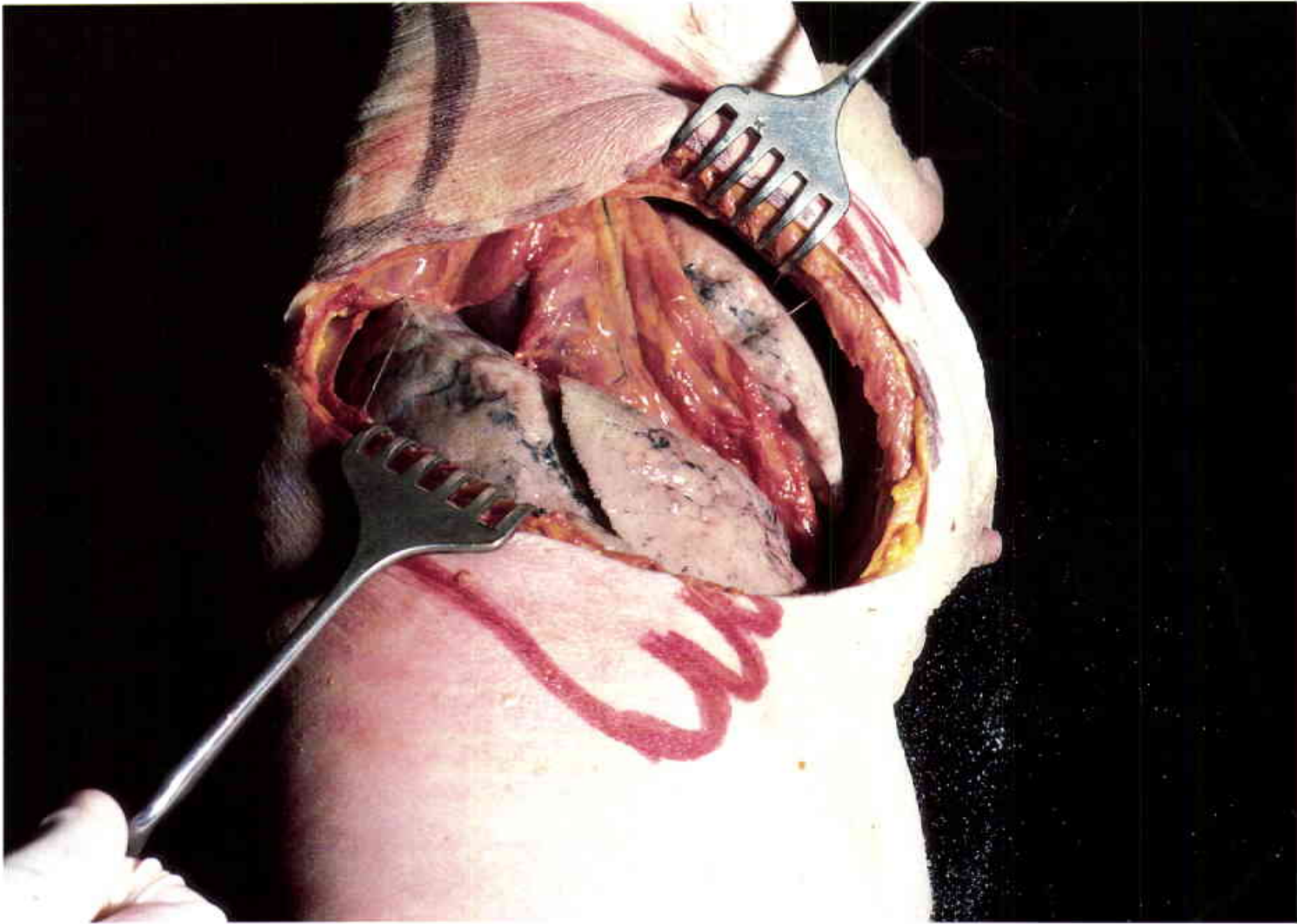




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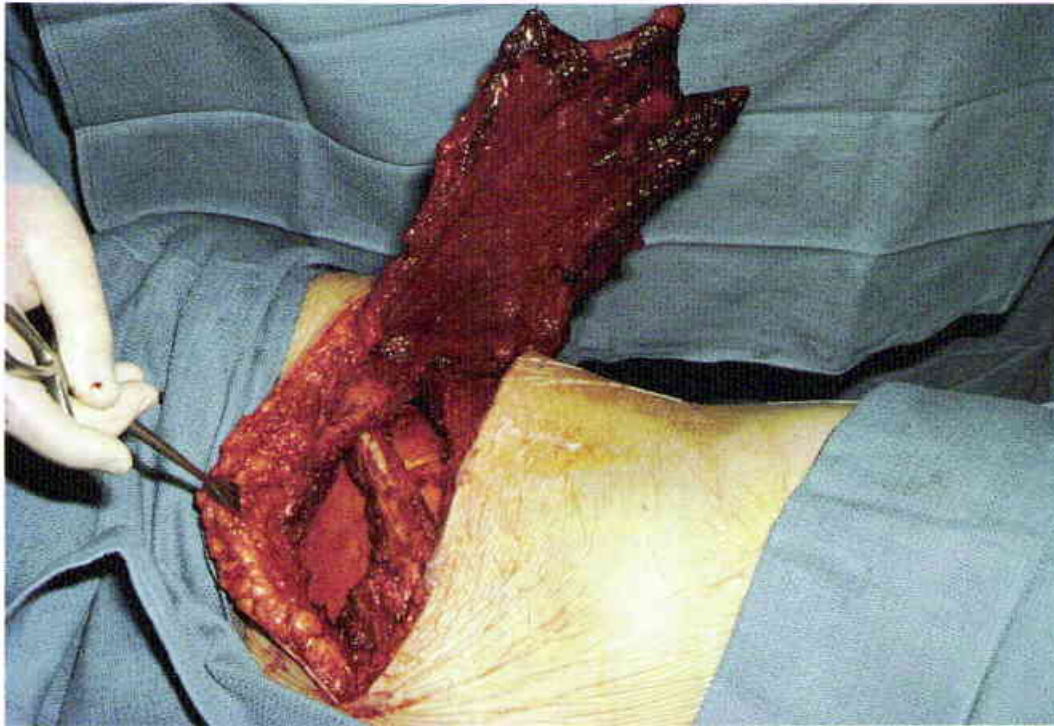
The "island" serratus muscle flap is passed into the chest through the second interspace and out of the chest through the fifth interspace to demonstrate the amount of muscle available for intrathoracic transposition.





6

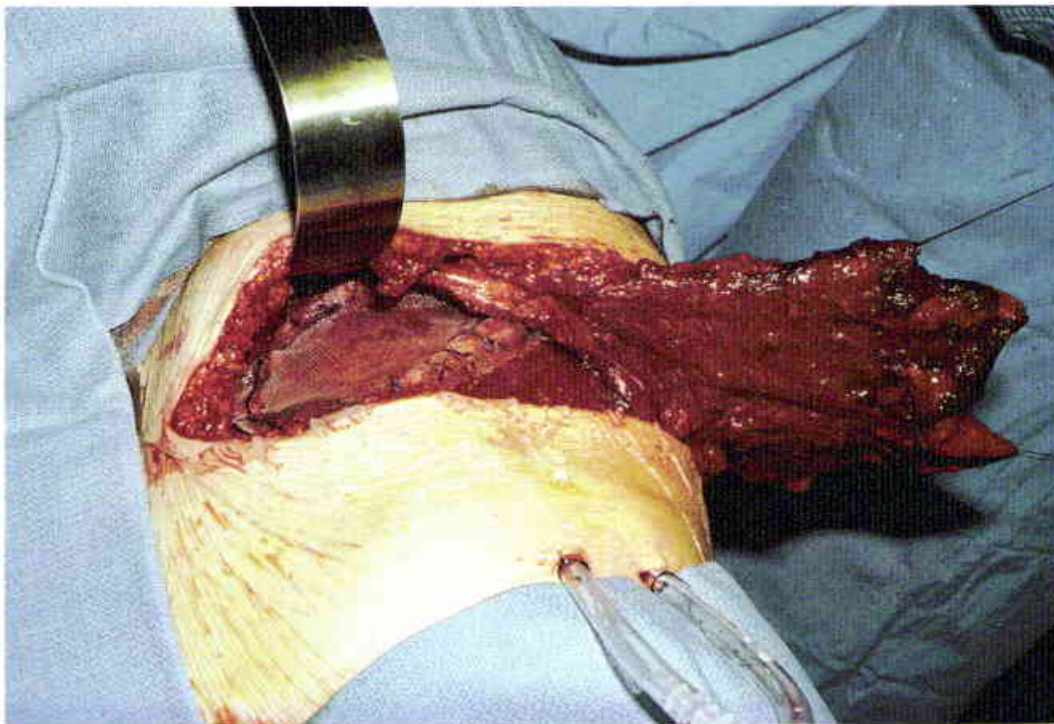
The serratus anterior muscle is then passed into the chest through the new thoracotomy at the level of the second interspace. The flap easily reaches all of the mediastinal structures.



7

This sixty-nine-year-old man presented with a carcinoma of the lung which had invaded the posterior chest wall. A combined resection of the lung and a three rib

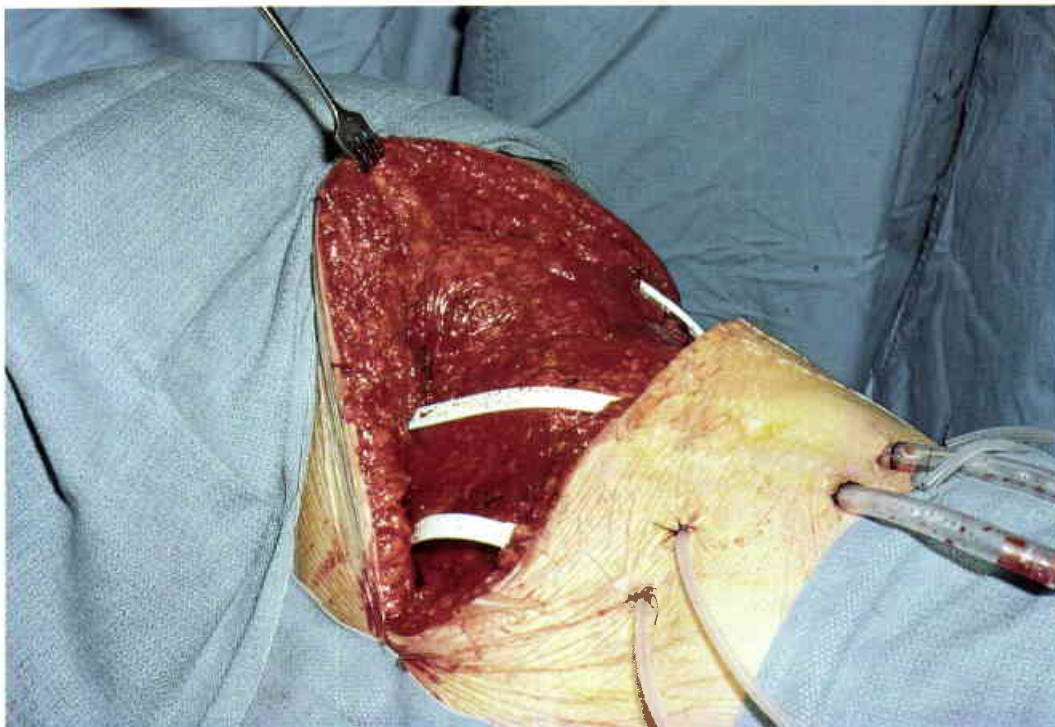
incontinuity chest wall resection has been completed. The serratus anterior muscle is elevated and readied for transposition over the chest wall defect. (Case of P.G. Arnold)



8

The posterior thoracic wall defect has been reconstructed with Prolene<sup>®</sup> mesh. The large serratus muscle is retracted.





9

The serratus muscle flap is transposed over the Prolene® mesh. Multiple drains have been placed. The overlying skin will be closed primarily.



10

Appearance of the patient six months following the surgery.

# SERRATUS

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