

McCraw and Arnold's Atlas of Muscle and Musculocutaneous Flaps



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Global-HELP
Publication

PECTORALIS MYOCUTANEOUS FLAP

ANATOMICAL CONSIDERATIONS

See Pectoralis muscle.

USES

The pectoralis major myocutaneous flap is almost always designed as a "paddle." The term "paddle" was coined to denote the cutaneous segment which is supplied more by an extension of the muscle fascia, rather than by direct attachment to the muscle itself. A "cookie cutter" segment of skin which is directly attached to a muscle is usually termed a skin "island." This term must also be contrasted with the term "pure island flap" which refers to the isolated or "dangling" supplying vessels rather than to the design of the cutaneous segment.

The pectoralis "paddle" finds its primary applications in intraoral and pharyngeal defects which warrant a major chest flap rather than a smaller local flap. Although it is possible for the pectoralis muscle to carry all of the skin of the breast area, the resulting skin-grafted donor site is comparable to the radical mastectomy deformity. For this reason every attempt should be made to close the donor site primarily without any distortion of the nipple or breast. When a large myocutaneous flap is required for major chest wall or sternal problems, the esthetic deformity is a secondary consideration. However, this considerable donor site deformity does encourage us to choose a skin-grafted pectoralis muscle flap rather than a pectoralis musculocutaneous flap for adjacent chest wall defects.

REGIONAL FLAP COMPARISONS

Even though the medially based deltopectoral flap is just as useful for surface problems of the neck, the pectoralis "paddle" is preferred for intraoral or pharyngeal problems because of its reliability and versatility. "Free" jejunal transfers offer an excellent substitute for oral mucosa and appear to provide better swallowing in the replacement of the cervical esophagus. Unfortunately, the potential for abdominal donor site morbidity and mortality has tempered its use, probably unfairly. The "what if you lost the flap" mentality also presents a psychological road block which necessitates a justification for using the jejunal "free" flap. Now that the survivability of this "free" flap is comparable to the pectoralis "paddle" transfer, the magnitude of certain

defects provides adequate justification for its routine consideration. For example, if the "free" jejunal flap can not only replace the cervical esophagus but also provide normal swallowing and prevent a laryngectomy, it is almost illogical to ask where the flap came from. In the case of smaller, non-crippling intraoral defects, the pectoralis "paddle" probably is still the standard against which other flaps are judged. The pectoralis myocutaneous "paddle" also supplies muscle coverage to the vascular structures of the neck, which may be lifesaving in the case of a major wound breakdown or an infection. The superior flap mobility for temporal and cheek reconstructions is comparable to the latissimus dorsi myocutaneous flap. Both of these flaps can provide massive amounts of skin, but the compound latissimus dorsi flap is usually preferred for very large defects because a skin-grafted donor site is better placed on the back rather than on the anterior chest. For extremely large defects it is preferable to skin graft the transposed pectoralis or latissimus muscle flap and to leave the donor site skin intact. One advantage of the pectoralis "paddle" is that the muscle can be employed to carry the fourth rib as a vascularized unit for mandibular reconstruction. The vertical trapezius "island" myocutaneous flap covers areas of the posterior neck and occiput which are not reached by the pectoralis "paddle," but it is seldom used for intraoral defects because of its lack of proximity and its troublesome donor site closure. The horizontal trapezius myocutaneous flap is more accessible for anterior and lateral neck coverage, and it gives a better color match than any of the other locally available myocutaneous flaps. When compared to the excellent color match of the horizontal trapezius myocutaneous flap, transferred back skin is too dark and anterior chest skin is too pale. While the sternocleidomastoid myocutaneous flap is acceptable for certain small areas of intraoral coverage, it results in a significant neck deformity and a worrisome vertical closure in the line of the carotid vessels.

DISADVANTAGES

The pectoralis major is an esthetically important muscle, and its total loss is highly visible. The frequent undesirability of the pectoralis "paddle" donor site is rationalized against the even worse donor site deformities of the forehead and deltopectoral flaps. The passivity and sufferability of head and neck cancer patients also serve to distract our attention away from the pectoralis

“paddle” donor site. These combined deformities of visible ribs, distorted nipple position, and the loss of the anterior axillary fold contour would be viewed more critically by a small-breasted twenty-year-old female without a cancer of the mouth. To lessen the donor site deformity, the muscle should be elevated as a pure “island” flap, and the contour of the anterior axillary fold should be left undisturbed. Although all of the skin directly attached to the pectoralis muscle can routinely be expected to survive, the pectoralis “paddle” will not survive without adequate attachments to the muscle and the muscular fascia. These limitations of flap design ultimately determine the size and the location of a viable pectoralis “paddle.” The pectoralis “paddle” is a moderately “cold sensitive” flap which should be protected during elevation and inset.

ADVANTAGES

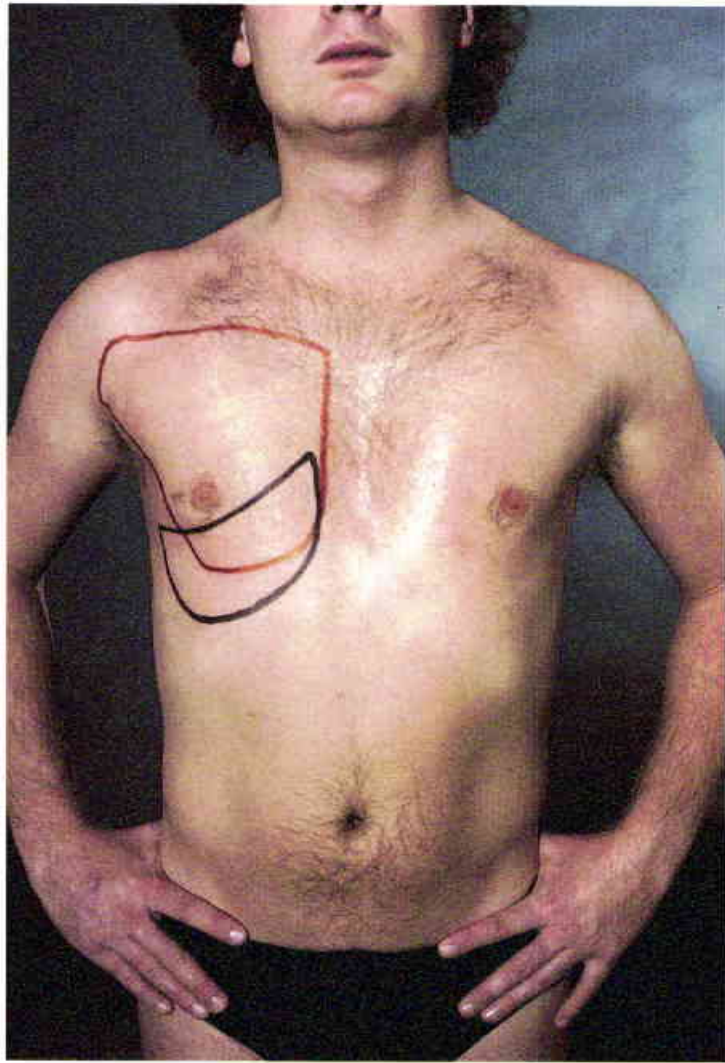
The broad arc of rotation of the pectoralis “paddle” extends for a distance of twenty centimeters from the center of the clavicle. This distance can be accurately measured to predict the proper preoperative location of the “paddle.” The cutaneous segment can be centered over the inframammary fold or extended onto the lateral chest wall or sternum. This versatility of flap design facilitates a primary closure of the donor site without distortion of the nipple. The lower chest wall skin is usually less hairy than back or upper chest wall skin, which is advantageous for intraoral or pharyngeal lining.

COMPLICATIONS, PITFALLS, AND DONOR SITE

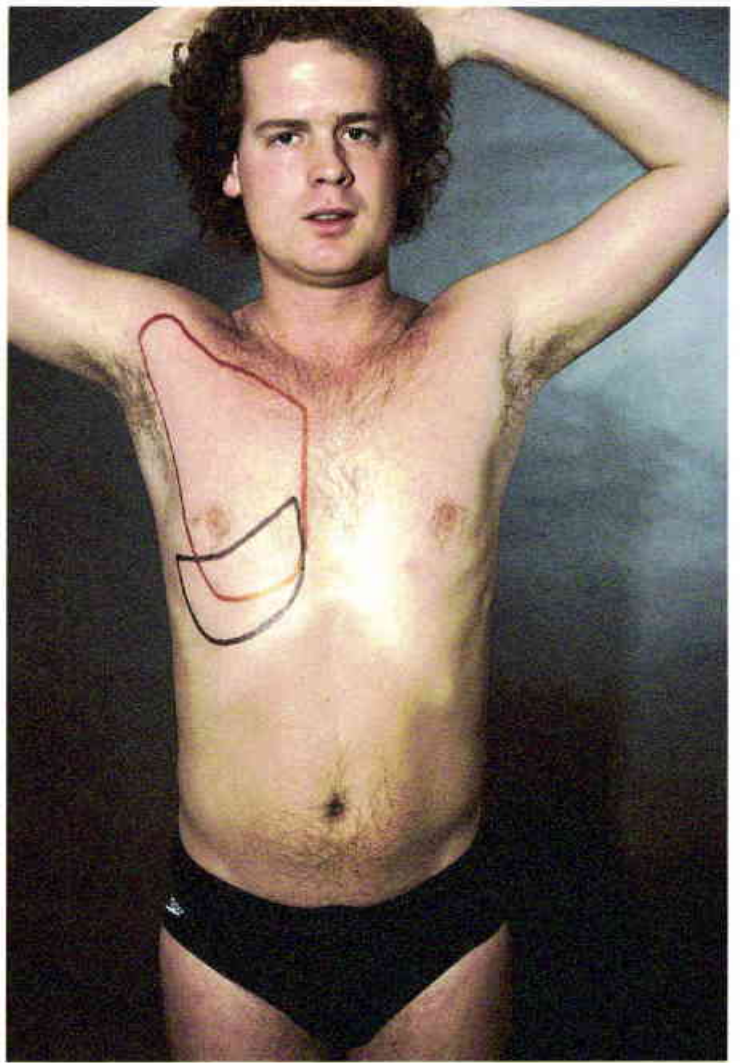
The primary pitfalls are related to inadequate identification of the thoracoacromial vessels on the undersur-

face of the muscle. When one is elevating this muscle, the vessels will initially be seen at a point approximately eight centimeters below the mid clavicle. The vessels pass near the coracoid process and are densely adherent to the undersurface of the muscle and surrounded by areolar tissue. If the thoracoacromial vessels are approached from the anterior surface of the muscle near the clavicle, they can be injured in this “blind” dissection. The upward rotation of the flap can be improved either by creating a pure “island” flap or by partially dividing the humeral insertion. The lateral portion of the humeral insertion should be left intact to maintain the contour of the anterior axillary fold. When the muscle is passed over the clavicle, it should be appropriately thinned so that an unsightly bulge is not created. If bulk is a problem in using this muscle, the muscle can be denervated at the time of the flap elevation. In executing the rotation of the flap, it is possible to twist the pedicle into a 360 degree arc and occlude the blood flow. This should not happen if the proper orientation is maintained. The muscle is useful to recreate the bulk of an excised sternocleidomastoid muscle, but it may also form a “band” as it transverse the neck. If a “band” is created, it can be divided after a few weeks even though the thoracoacromial vessels may be included as part of the “band.” If a skin graft is used for the donor site, the resulting appearance is as bad as the radical mastectomy deformity.

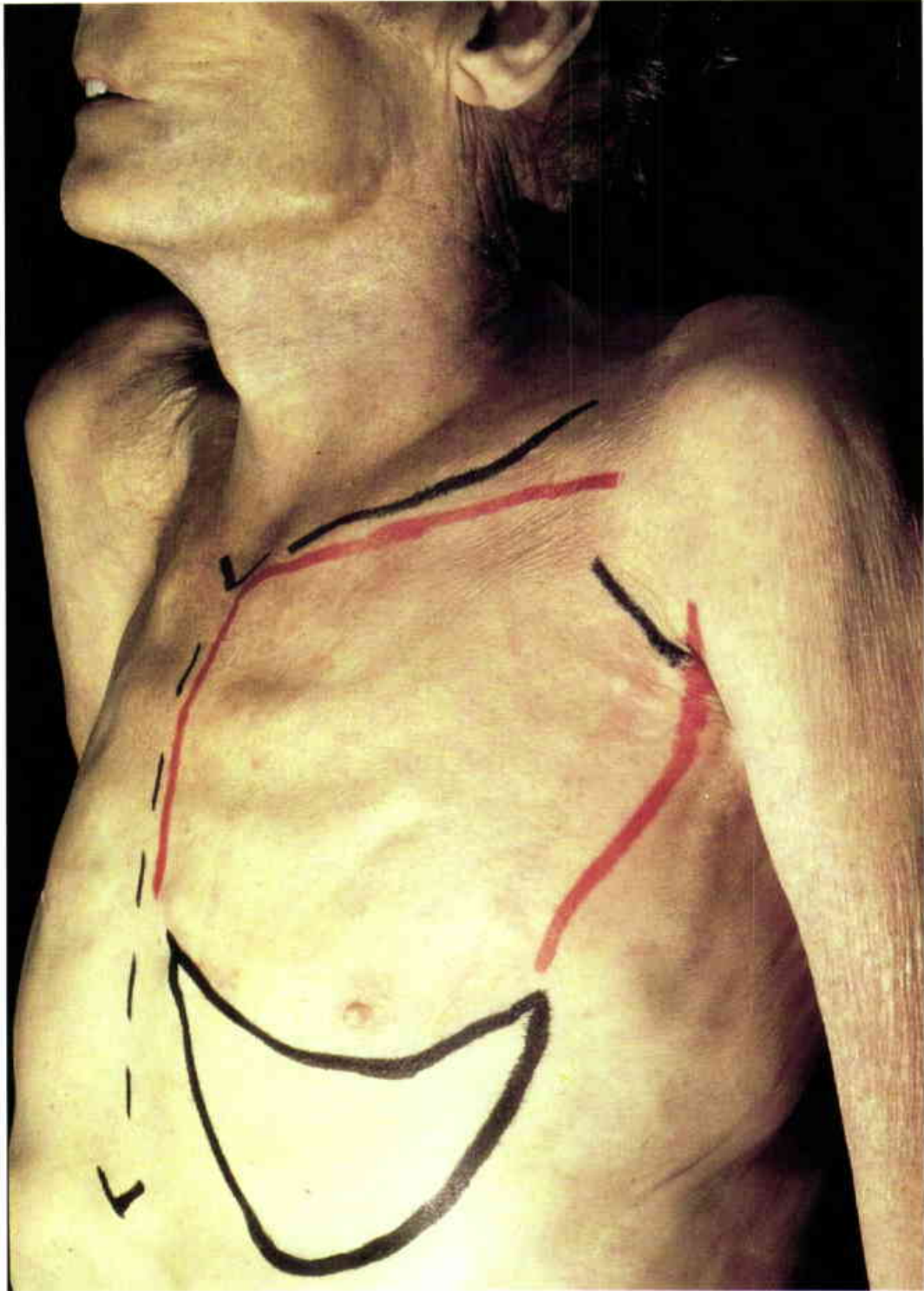
For some reason seroma formation has not been as common as it has been with the latissimus dorsi flap. Neither has the remaining skin of the chest wall necrosed from the loss of the underlying pectoralis perforators. However, if a significant number of internal mammary perforators are removed, the medially based deltopectoral flap is probably converted into a “random” flap, but we have not had the occasion to test this notion.



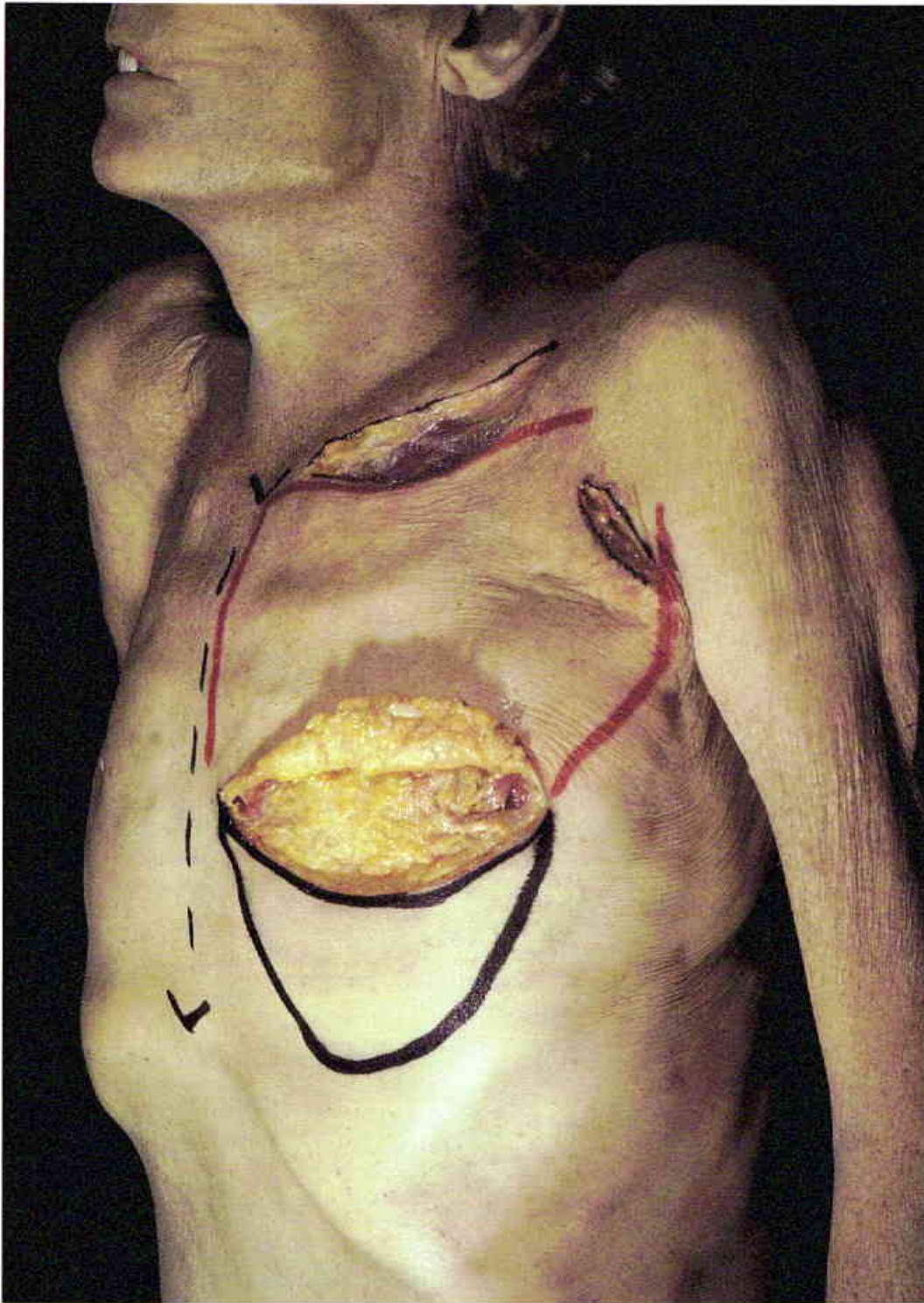
1
Outline of the pectoralis major muscle in red and a pectoralis "paddle" in black.



2
Demonstration of the "extensibility" of the chest wall skin which facilitates a primary closure of the donor defect.

**3**

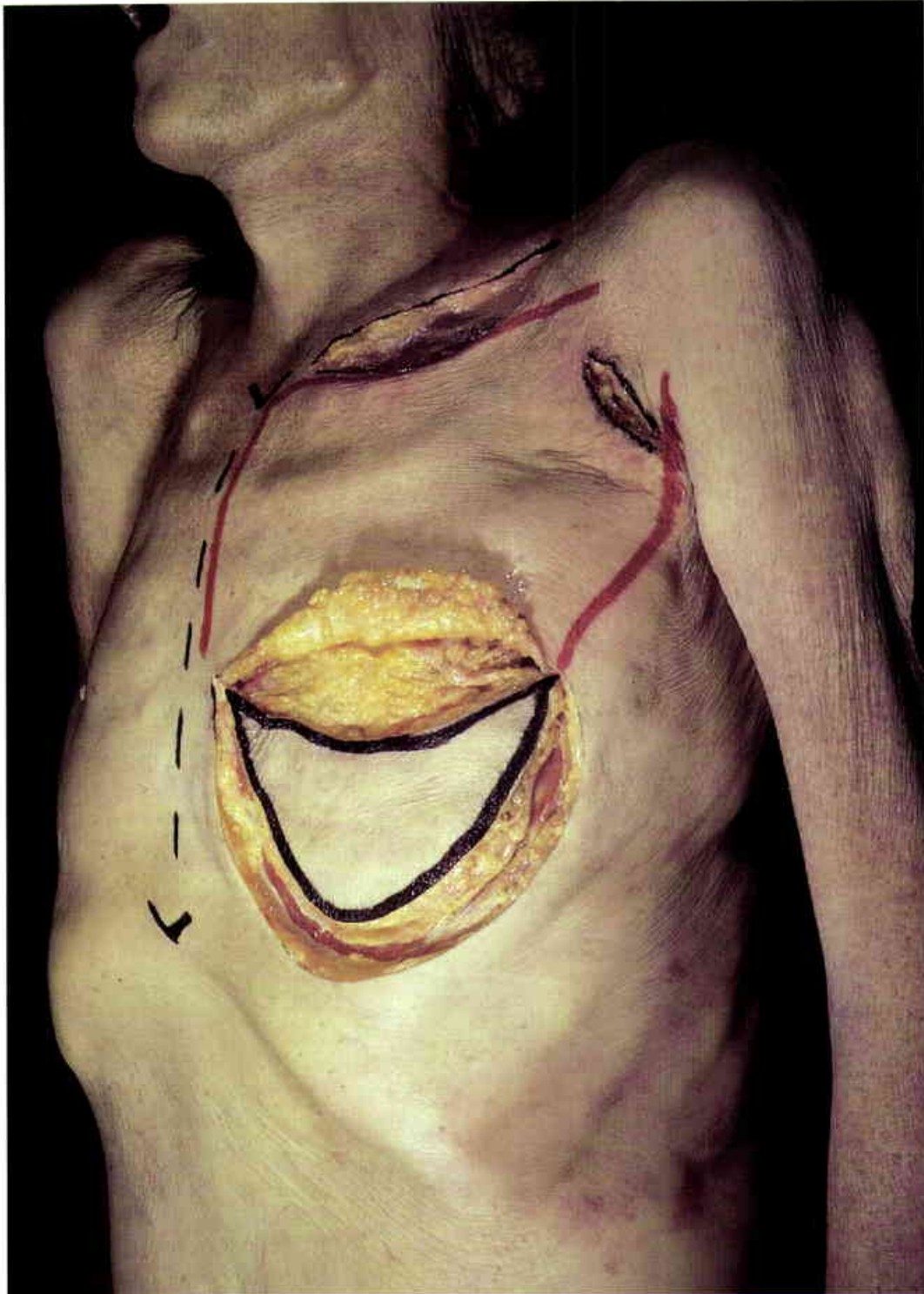
In the cadaver the margins of the pectoralis major muscle are outlined in red. The pectoralis "paddle" is outlined in black. Only the central portion of the muscle is carried with the flap. The portions of the muscle which form the anterior axillary fold and the parasternal prominence are left in place.



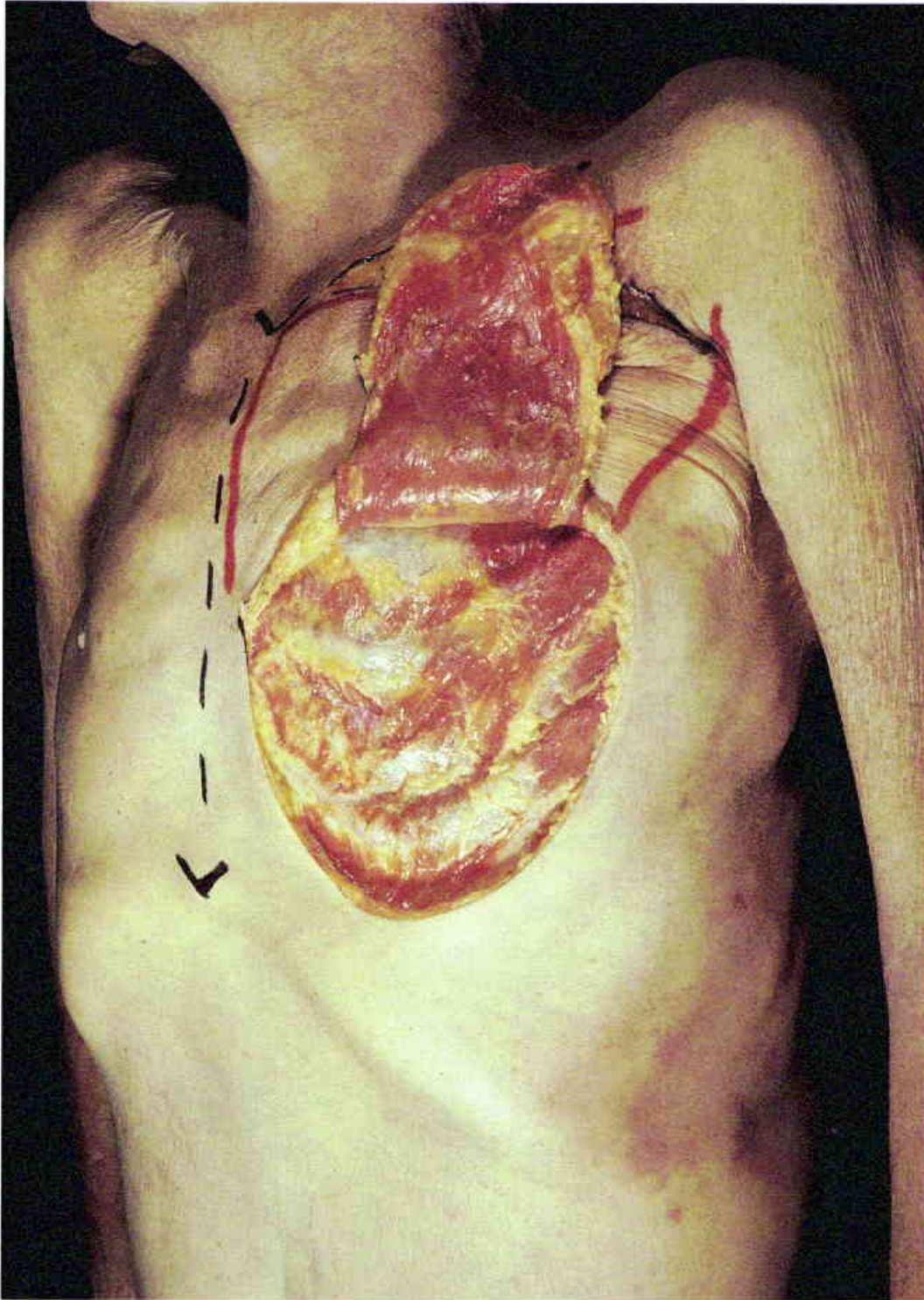
4

The term "paddle" was coined to denote a cutaneous segment which is supplied mostly by an extension of the muscular fascia, rather than through a direct attachment of the muscle itself. The pectoralis "paddle" is attached to the muscle proximally and includes the fascia of the rectus

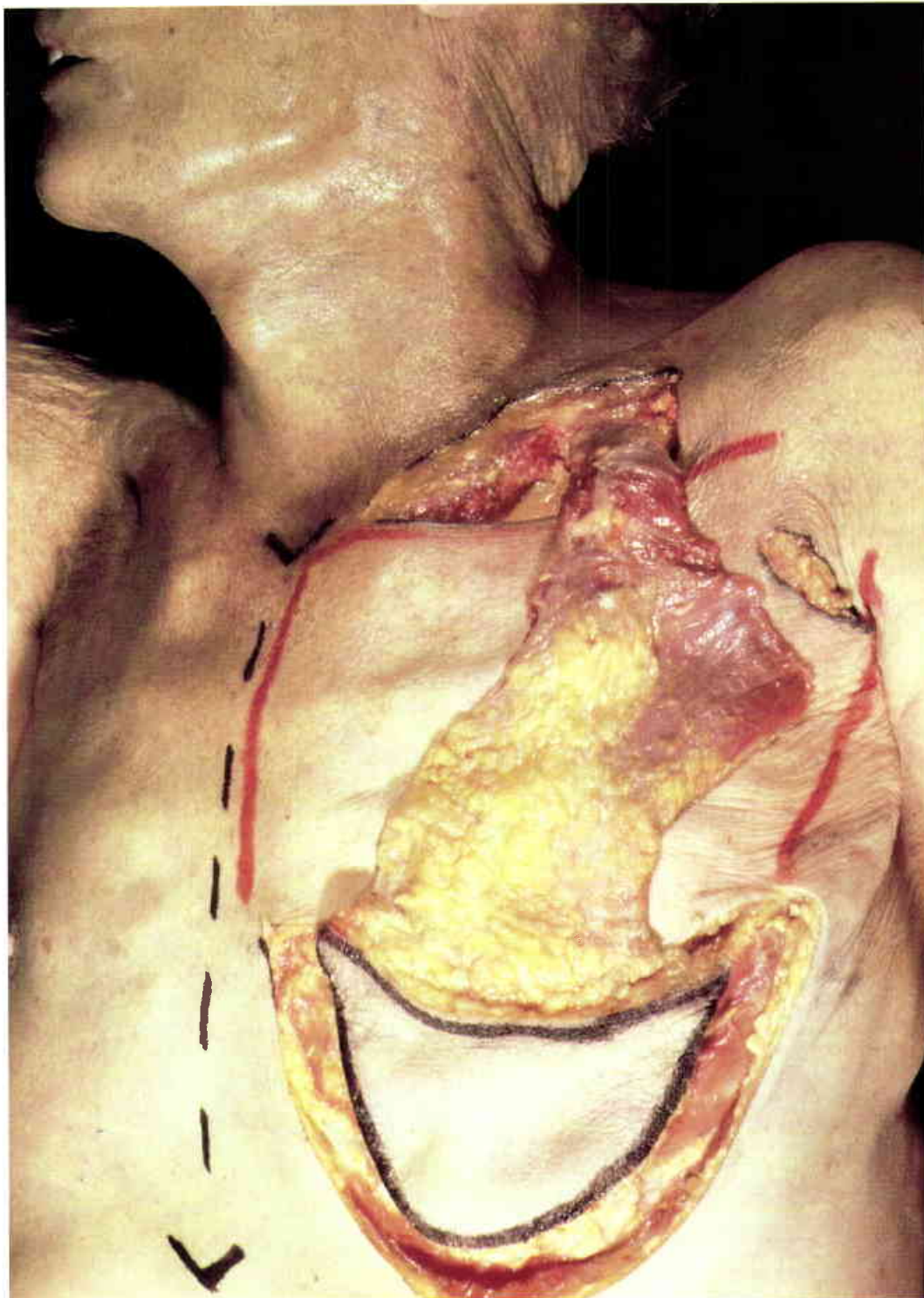
abdominis and serratus anterior muscles on its undersurface. The skin overlying the pectoralis major muscle is elevated above the level of the pectoralis fascia which is left with the muscle. Counterincisions are made as needed for access.

**5**

The fascial attachments of the rectus abdominis and serratus anterior muscles are divided at the distal margin of the skin "paddle." The rectus abdominis fascia extends to the midclavicular line. The serratus anterior fascia is seen lateral to this.

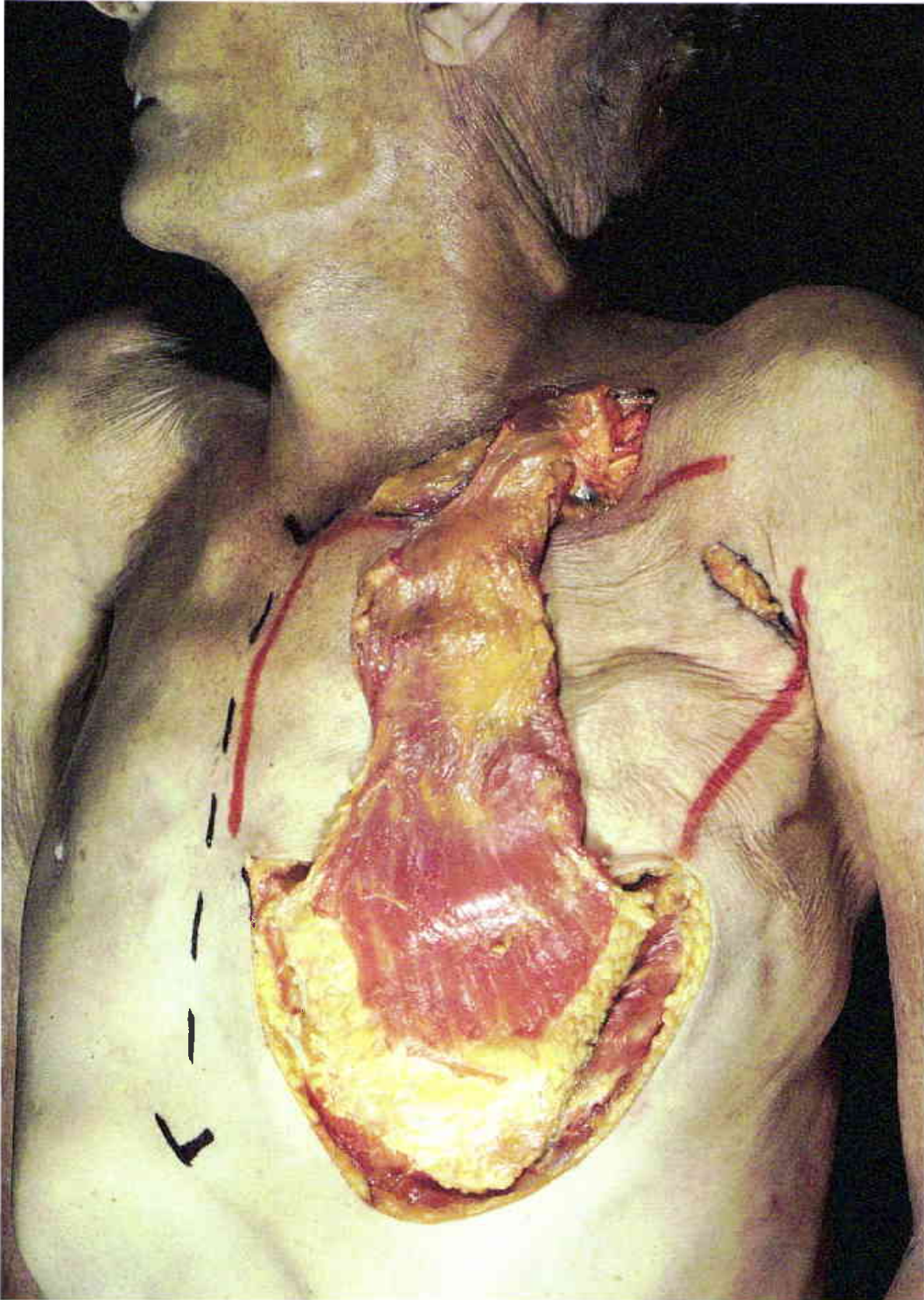
**6**

The pectoralis major muscle is elevated away from the pectoralis minor muscle and the chest wall. The thoracoacromial vessels are initially identified on the undersurface of the pectoralis muscle at the level of the third rib. The full width of the pectoralis muscle is not raised with the flap.



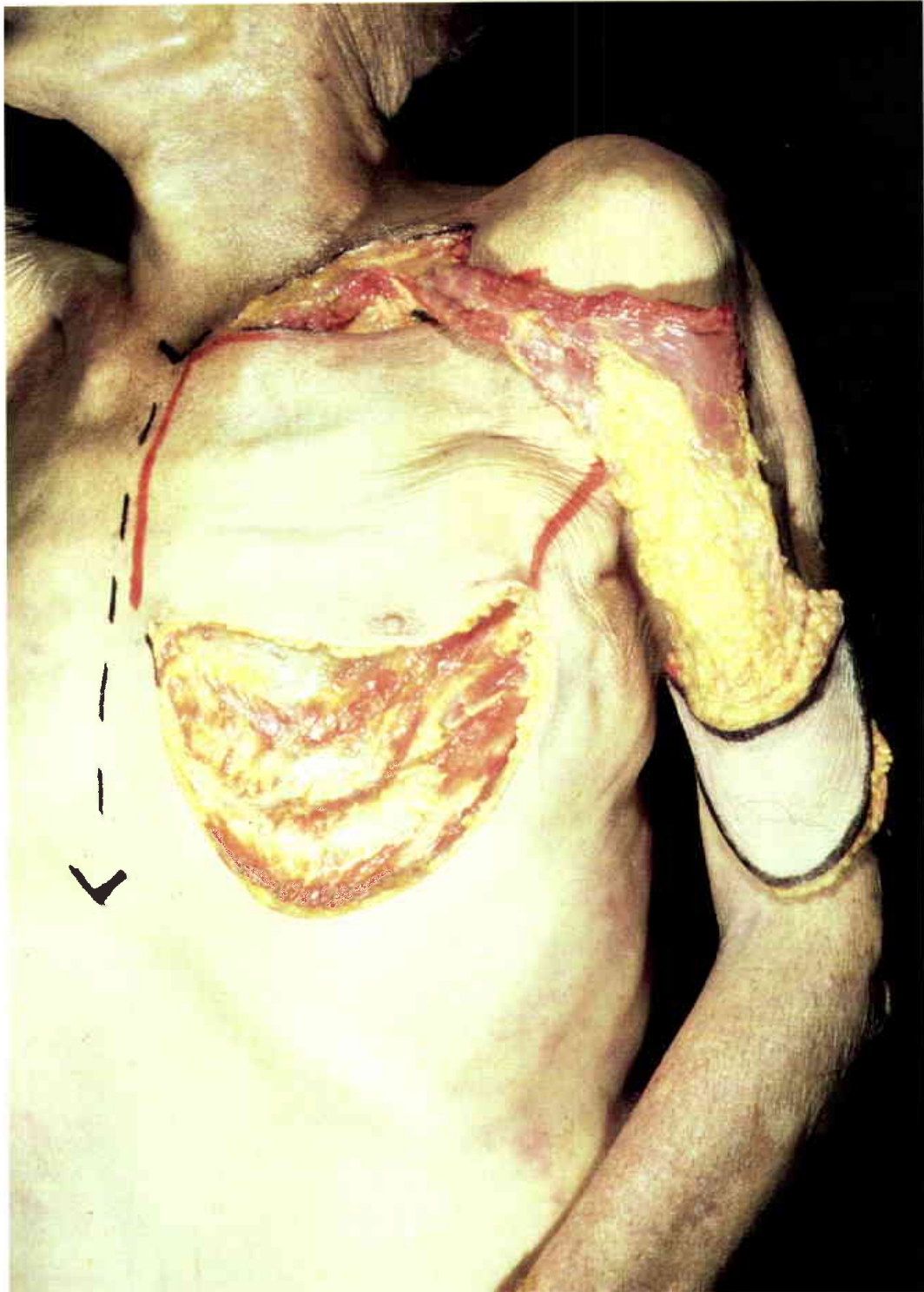
7

The pectoralis "paddle" is returned to the surface of the chest for demonstration purposes. The humeral insertion has been divided. Only a small strip of the pectoralis major muscle remains in the area of the neurovascular bundle.



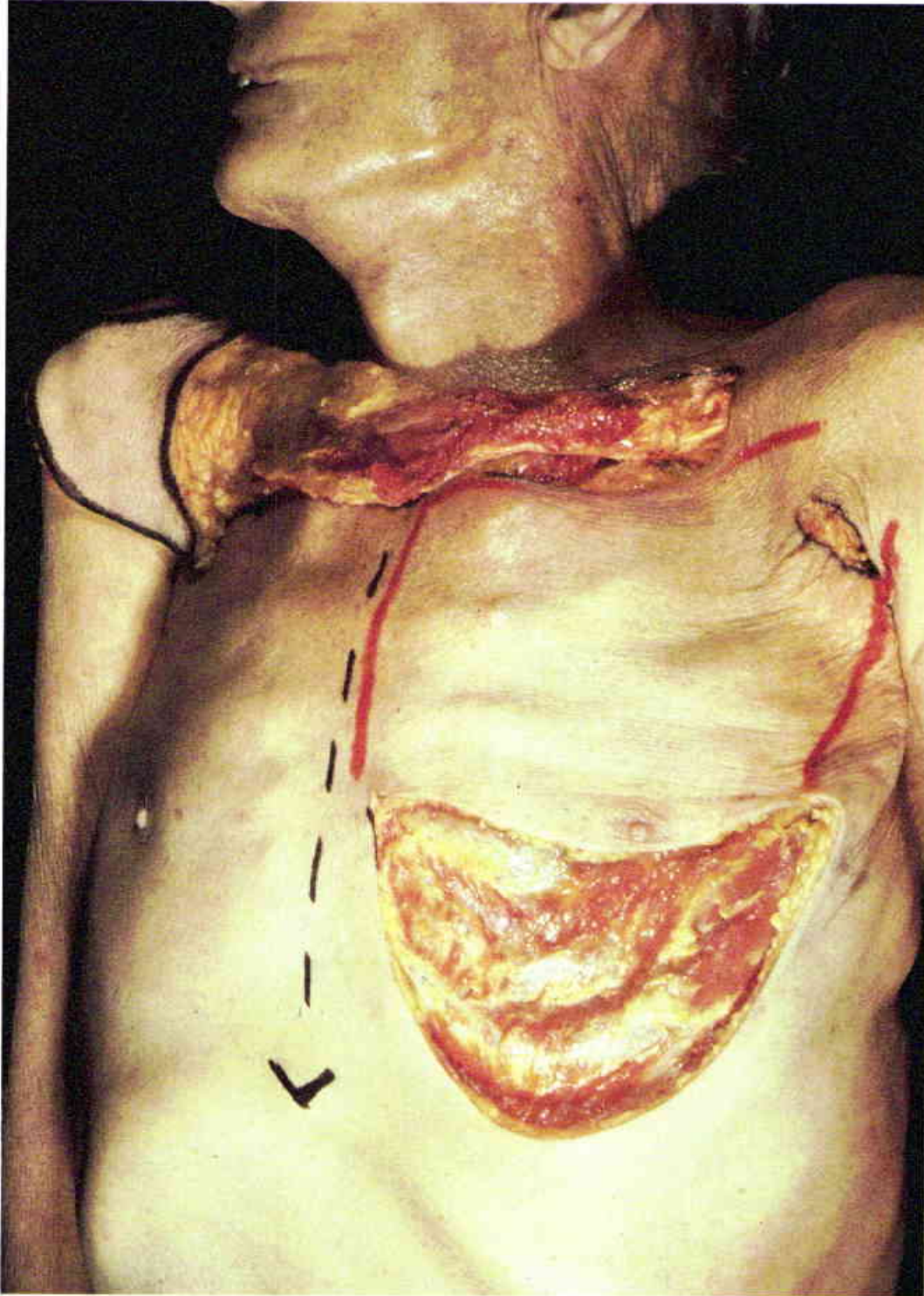
8

The muscle is rotated 180 degrees to show the pectoralis muscular attachment to the upper half of the skin "paddle." The rectus abdominis and serratus anterior fascial layers are seen distal to the pectoralis muscle. The thoracoacromial vessels can be seen in a fatty layer on the under-surface of the pectoralis muscle. The vessels are lost to surface visibility at the level of the third or fourth rib.



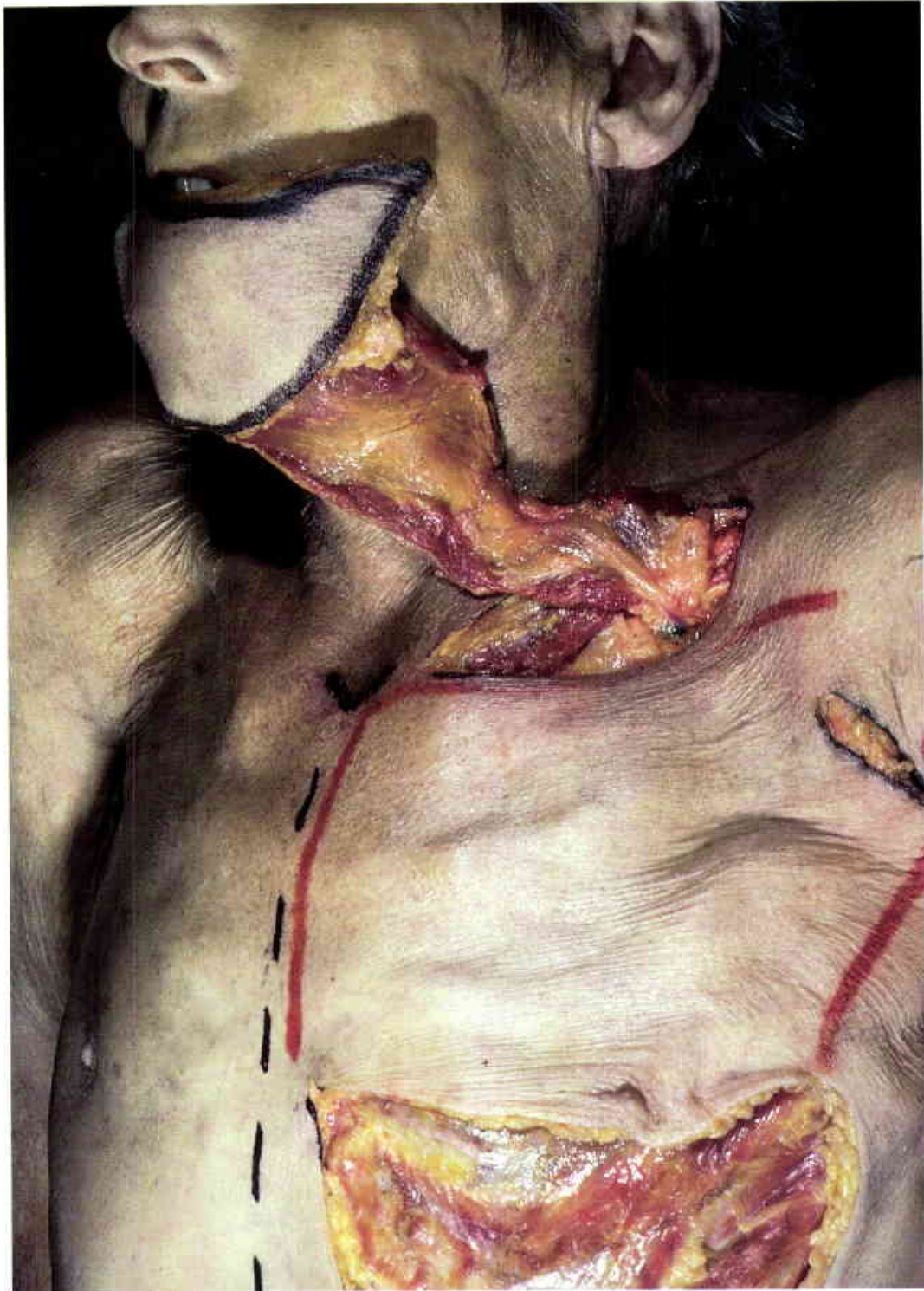
9

The pectoralis myocutaneous flap will reach the arm, the shoulder, and the axilla. Less distortion of the nipple will result if the lower chest wall skin is transposed superiorly to close the donor defect.



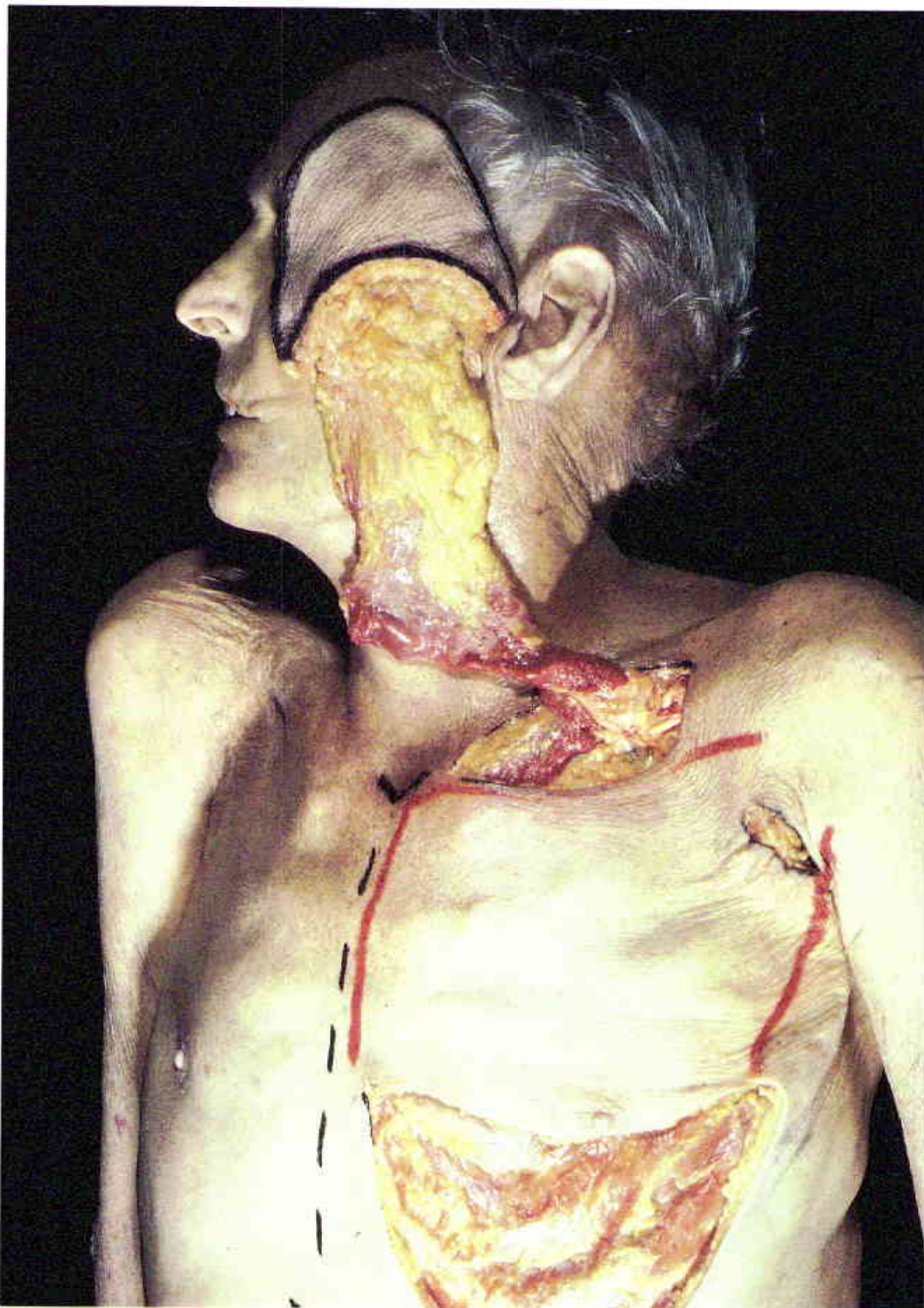
10

The contralateral arc of the flap passes through the area of the xyphoid and the nipple in its course to the opposite shoulder.



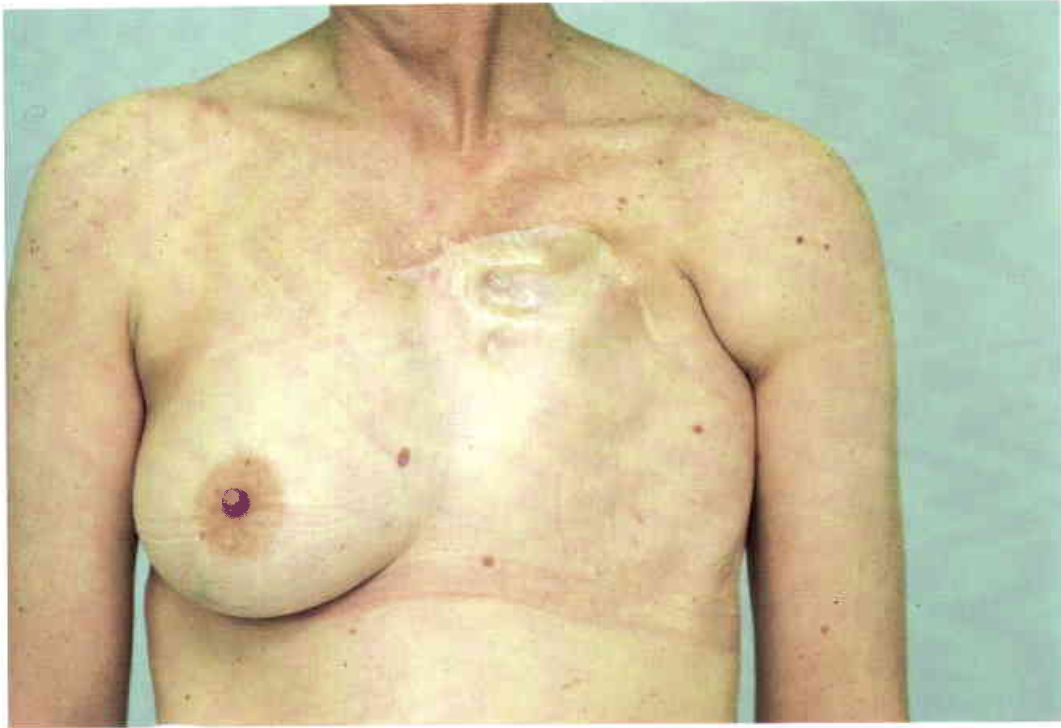
11

The flap will reach the chin and the anterior mouth without any "bow-stringing" of the muscle or the vascular pedicle.



12

The superior excursion of the "island" pectoralis "paddle" is demonstrated. The flap will also reach the periorbital area and the occiput.



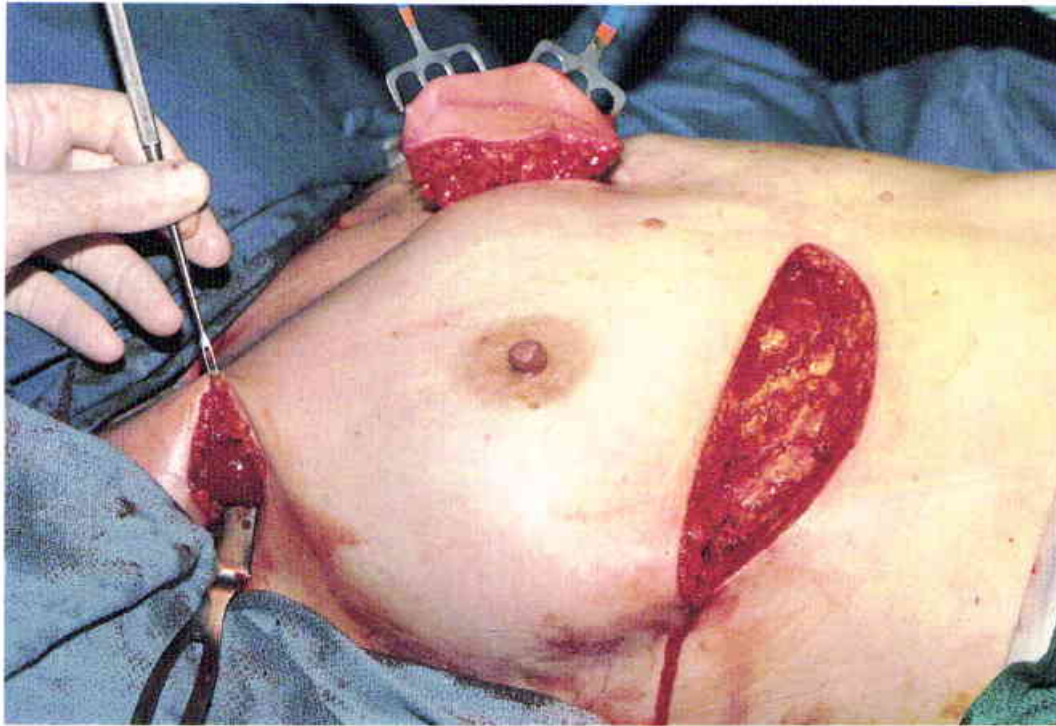
13

Thirty-eight-year-old female who had undergone a radical mastectomy and irradiation. The patient sought relief from the painful skin graft. The left latissimus dorsi muscle was devascularized. A breast reconstruction was not anticipated. (Case of J.B. McCraw)



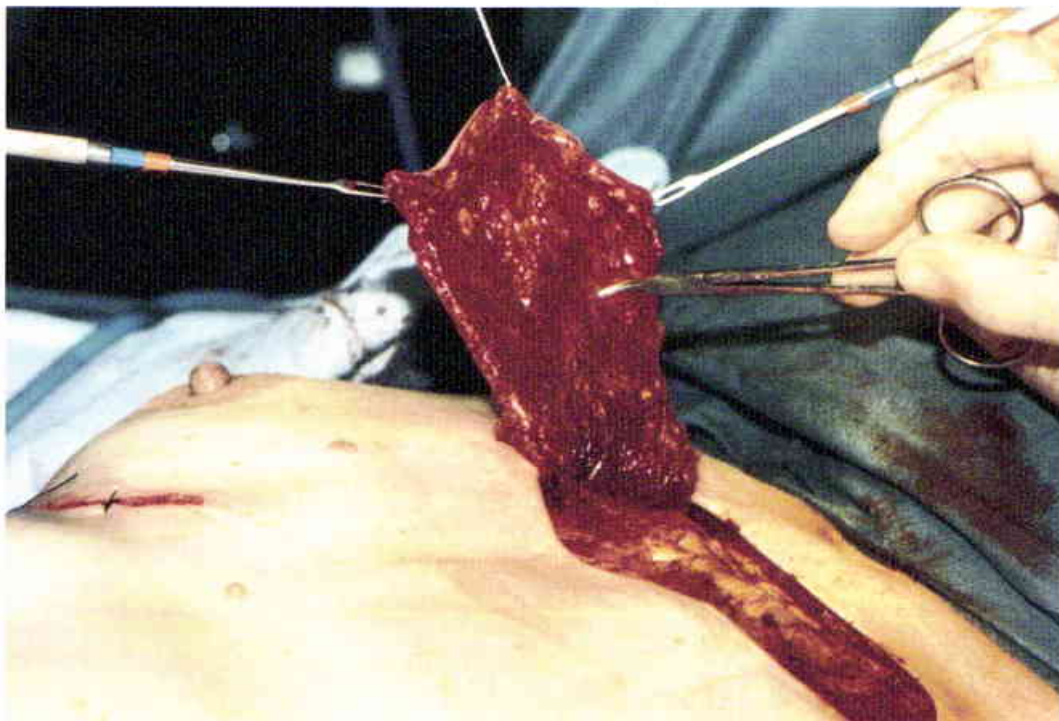
14

Outline of the pectoralis "paddle" overlying the inframammary fold. This procedure was designed before the term "paddle" was coined. This was our first attempt to "carry" this remotely attached skin with the pectoralis muscle.



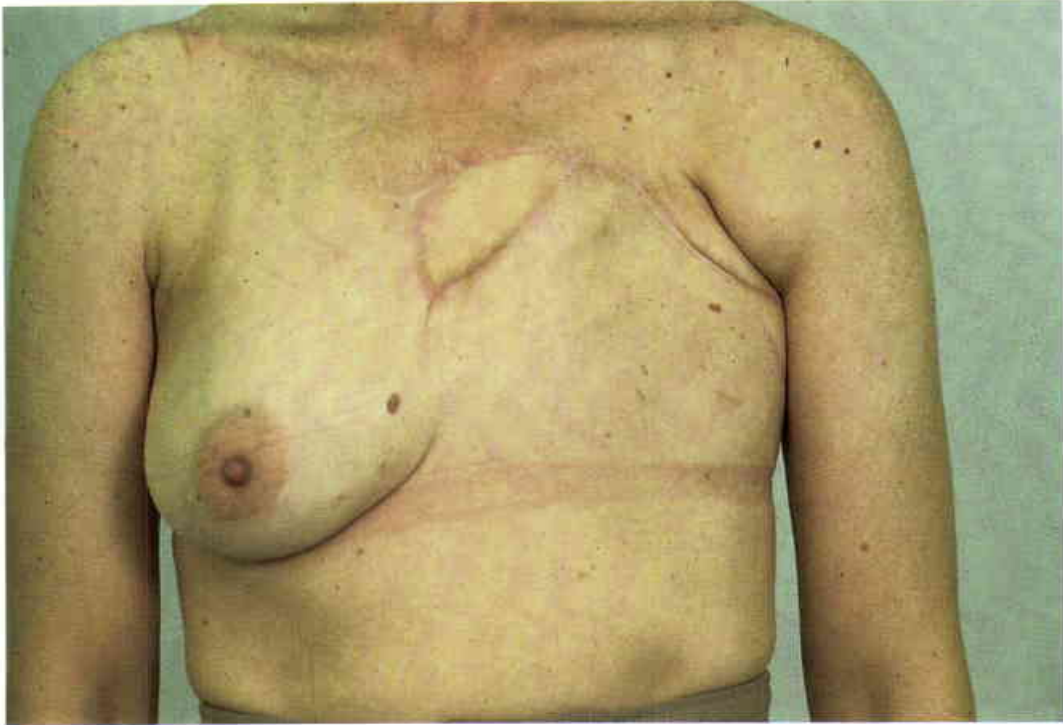
15

The pectoralis "paddle" is passed beneath the breast. The humeral insertion is retracted. It was not necessary to divide the insertion in order to facilitate the flap mobility.



16

The clamp denotes the distal extent of the muscular attachments to the skin "paddle." It was presumed that the fascial extensions of the pectoralis muscle would "carry" the inframmary fold skin. Had this not been the case, it was known that the pectoralis muscle alone could have been used to correct the defect.



17

Healed pectoralis “paddle.” The right breast contour is essentially unchanged.



18

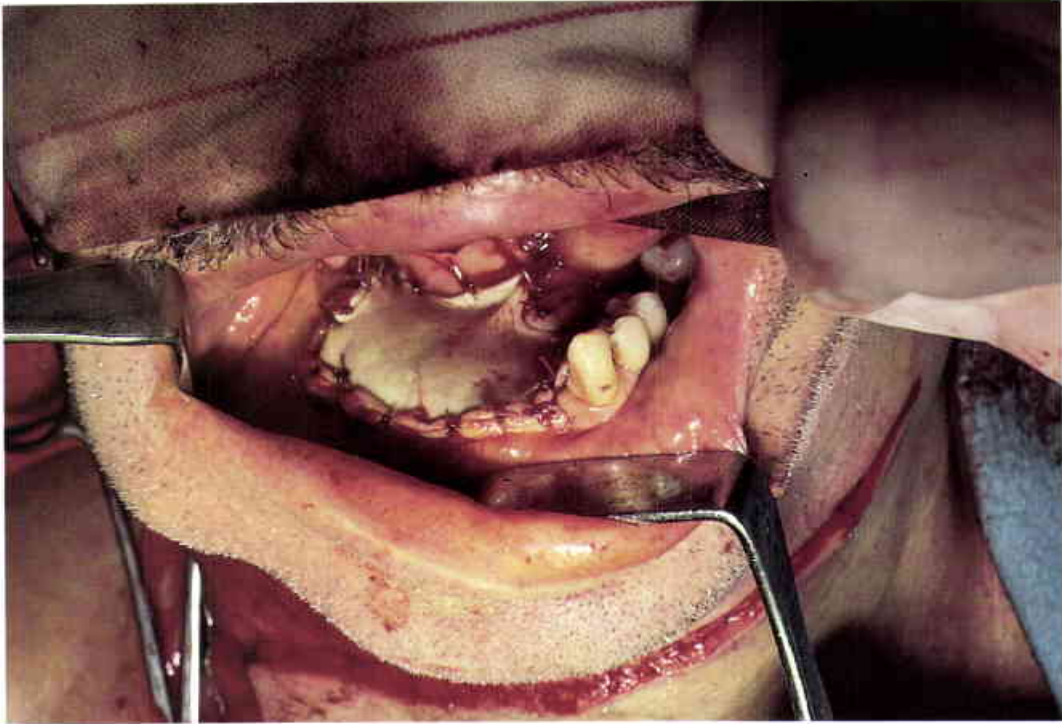
Fifty-six-year-old man with a squamous cell carcinoma of the floor of the mouth which did not involve the mandible. The patient had undergone preoperative irradiation to the lesion and the neck. An in-

continuity neck dissection was done at the time of the tumor excision. A pectoralis "paddle" is outlined. (Case of J.B. McCraw and D. Sly)



19

Elevated pectoralis "paddle." The pectoralis muscle provides a protective layer for the carotid artery at the time of the neck dissection.



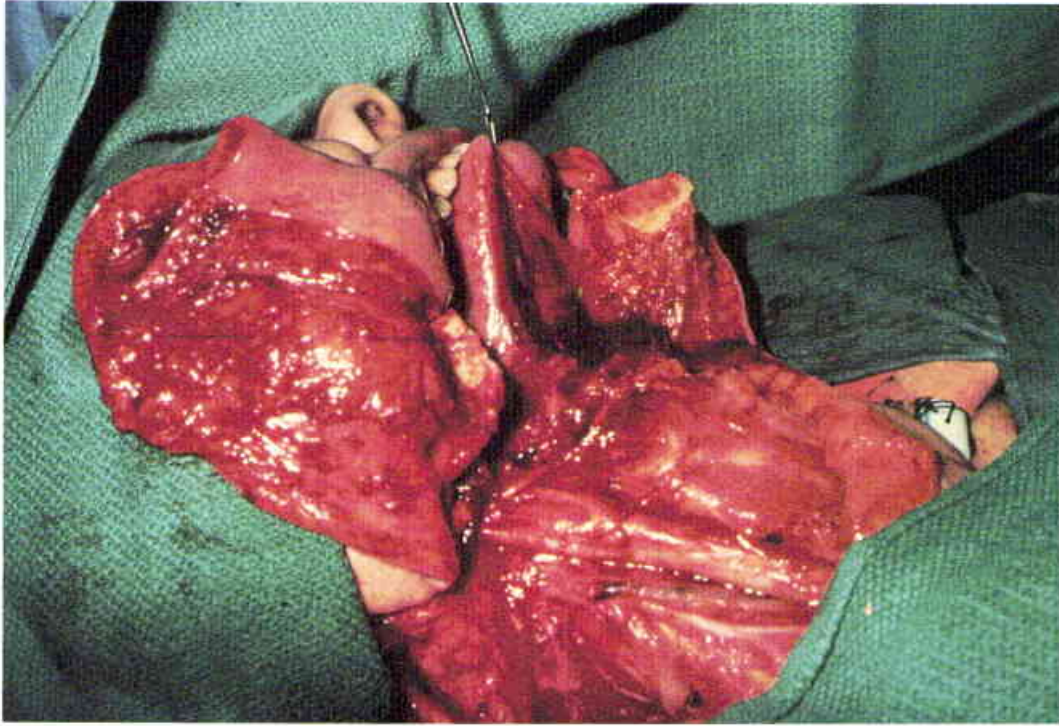
20

Inset flap. Only the inner half of the mandible was excised.



21

Healed flap at two years.



22

Fifty-six-year-old female with an aggressive squamous carcinoma of the floor of the mouth. The resection included the central mandible and a portion of the tongue. (Case of W.P. Magee)



23

Healed pectoralis "paddle." The fourth rib was carried with the flap to reconstruct the central mandible.



24
Six months following the hemimandibular replacement.



25
Lateral view of the mandibular contour at six months.



26

Resection of a malignant spindle cell tumor of the neck in a sixty-seven-year-old male. (Case of J.B. McCraw)



27

Pectoralis 'paddle' brought into the neck for skin replacement.



28

Healed donor site. Note the unnecessary muscle bulk in the upper chest which accentuates the lower chest concavity.



29

Healed flap at two weeks when irradiation treatments were begun. The pale color of the flap persisted.



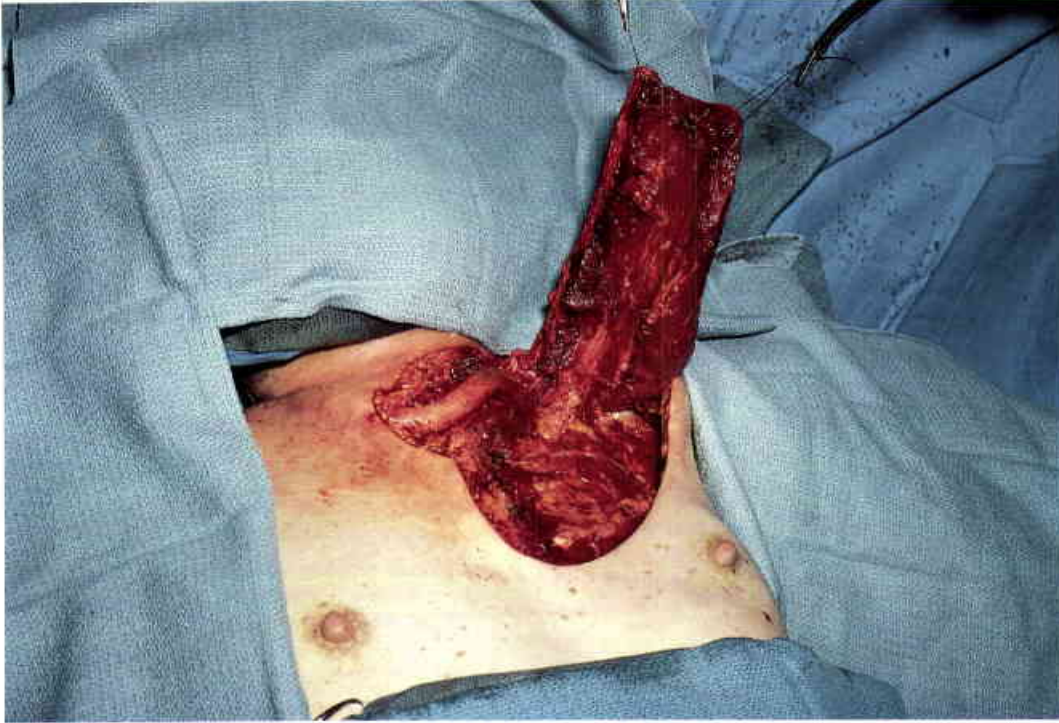
30

Infected Dacron[®] prosthesis from the right subclavian artery to the left carotid artery. The right carotid and vertebral arteries were occluded. The Dacron[®] graft was critical to survival. (Case of P.G. Arnold)



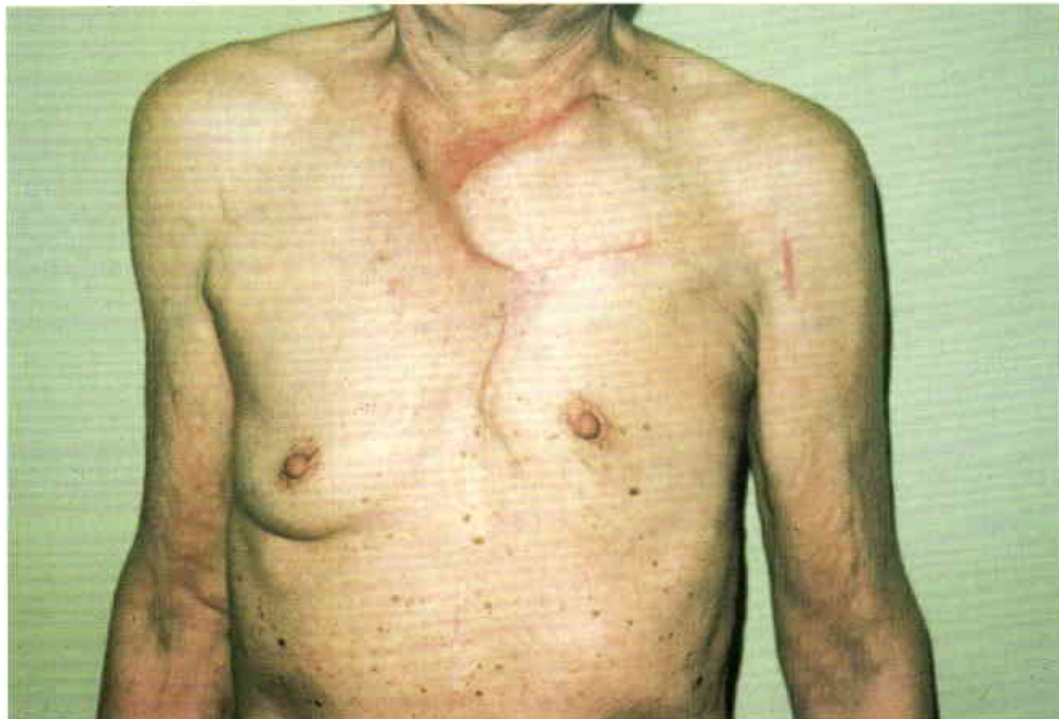
31

Open wound and exposed vessels. A pectoralis myocutaneous flap is outlined.



32

Elevated pectoralis major myocutaneous flap. The debrided Dacron[®] graft is visible in the neck wound. Dilute Betadine[®] irrigation was used for two weeks.



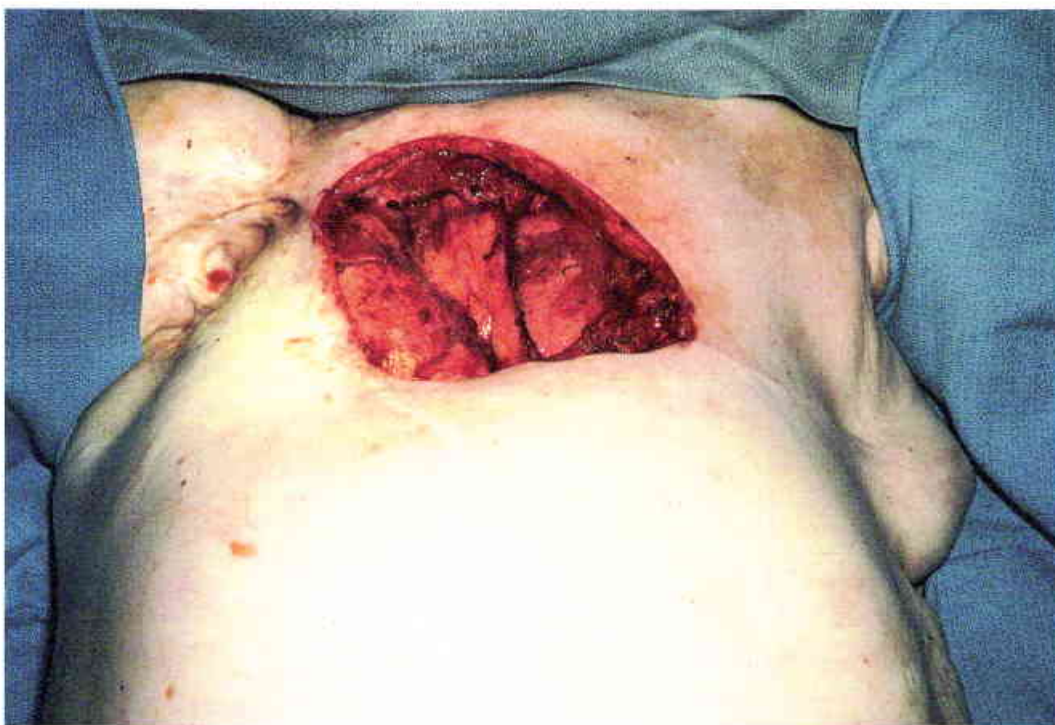
33

Healed flap at six weeks. The patient succumbed to a heart attack after seven months. The vascular graft was found to be uninfected at the time of the postmortum examination.



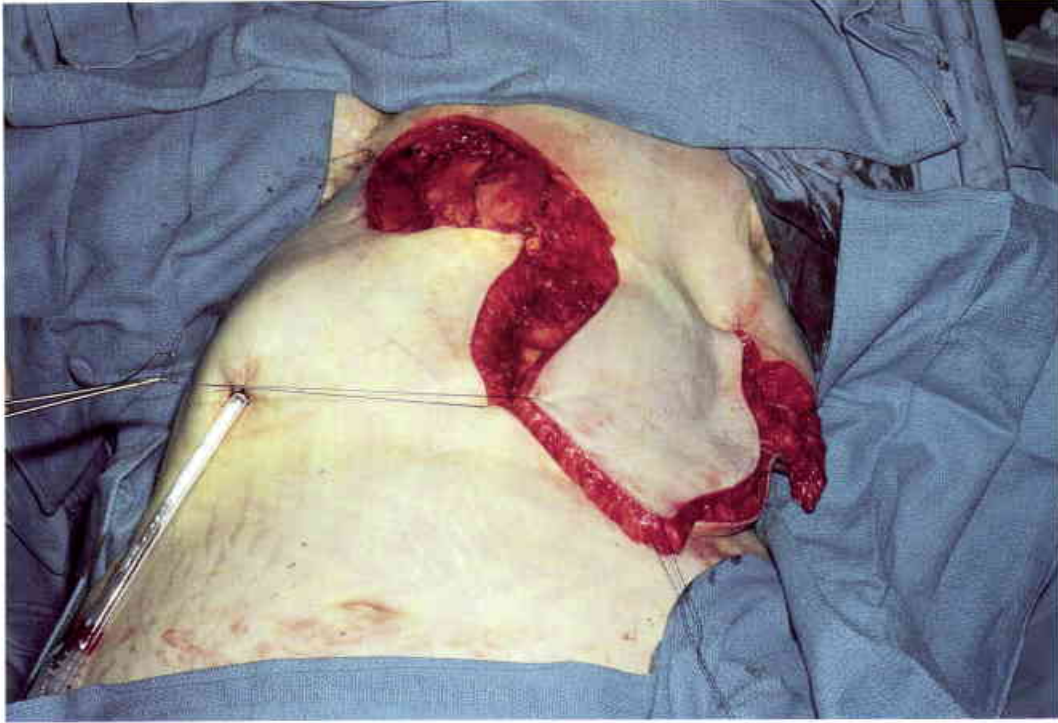
34

Sixty-year-old female with extensive osteoradionecrosis of the right upper chest wall. The patient had previously undergone a right radical mastectomy and a left modified mastectomy. (Case of P.G. Arnold)

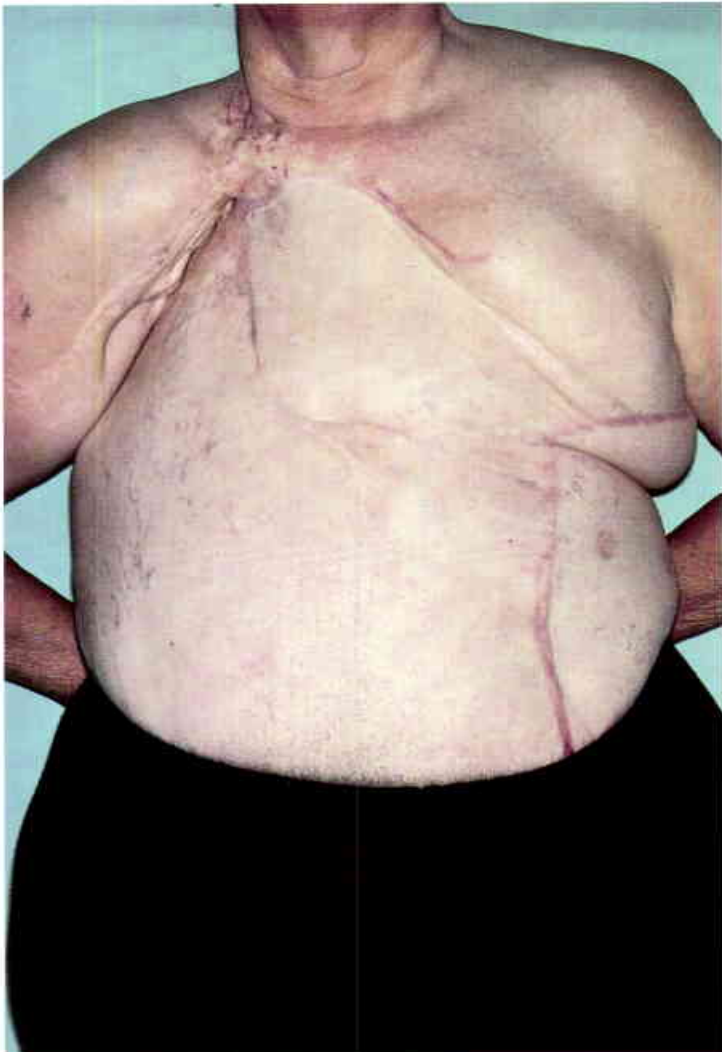


35

The chest wall resection included four ribs and the sternum. Note the transverse left mastectomy scar.

**36**

Elevated left pectoralis myocutaneous flap with the transverse mastectomy scar at the "base" of the flap. The pectoralis muscle was left attached to the skin distal to the mastectomy scar.

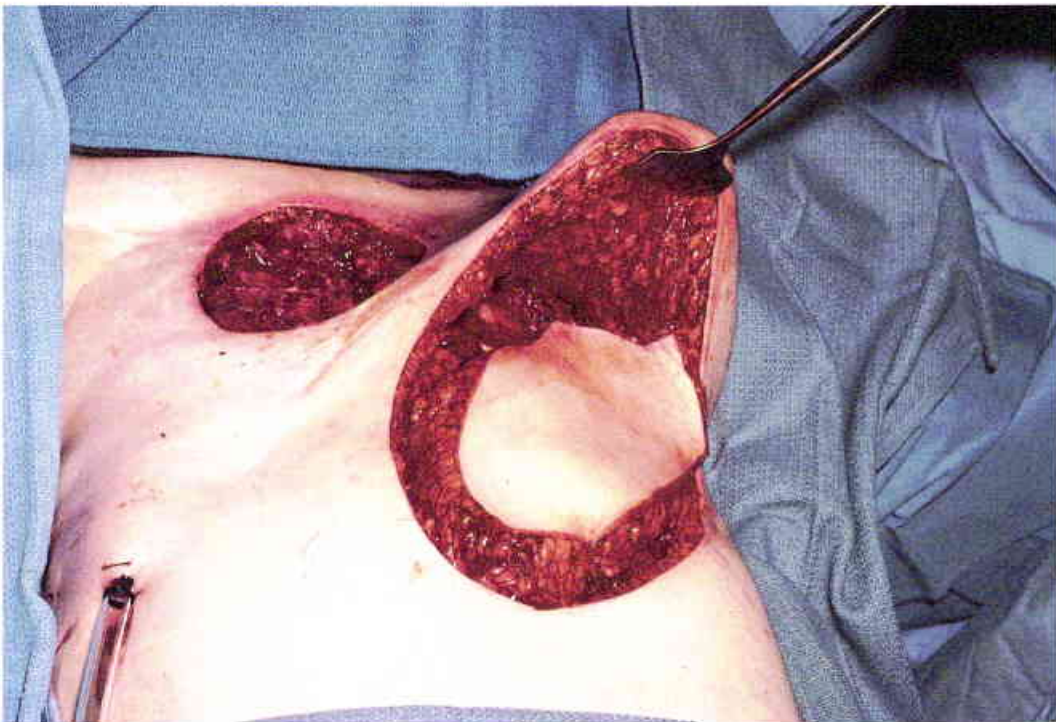
**37**

Stable chest wall at two years. Note that the skin "island" is supplied by pectoralis muscle attachments which developed after the mastectomy.



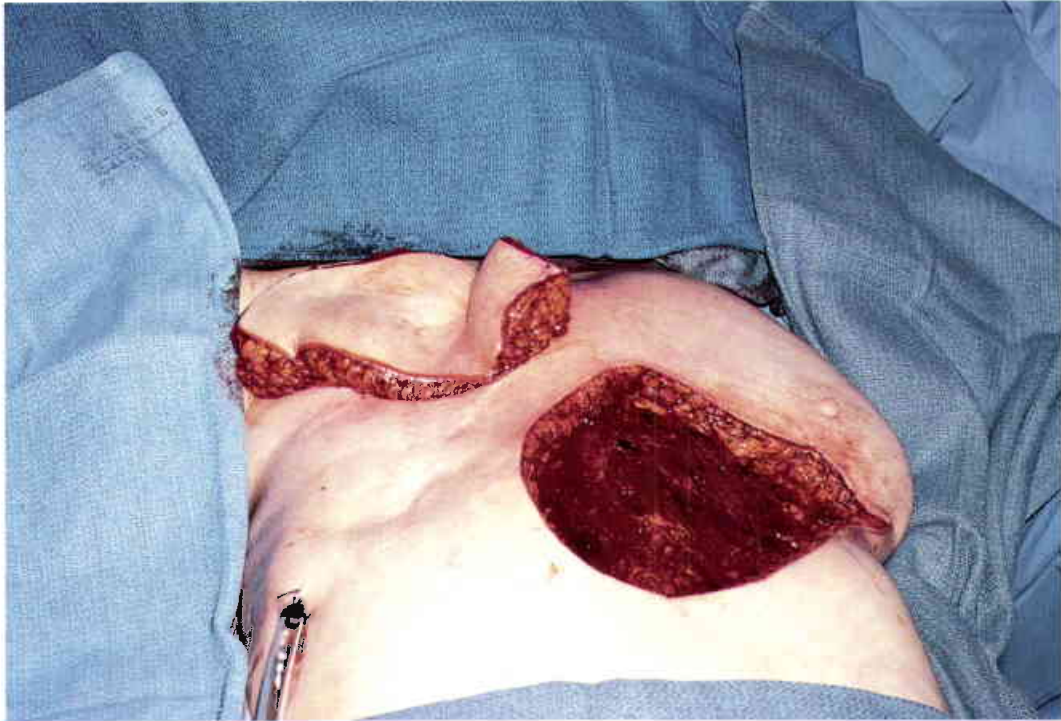
38

Sixty-five-year-old female with painful osteoradionecrosis eight years following a right radical mastectomy. A chest wall recurrence had been treated with irradiation three years earlier. (Case of P.G. Arnold)



39

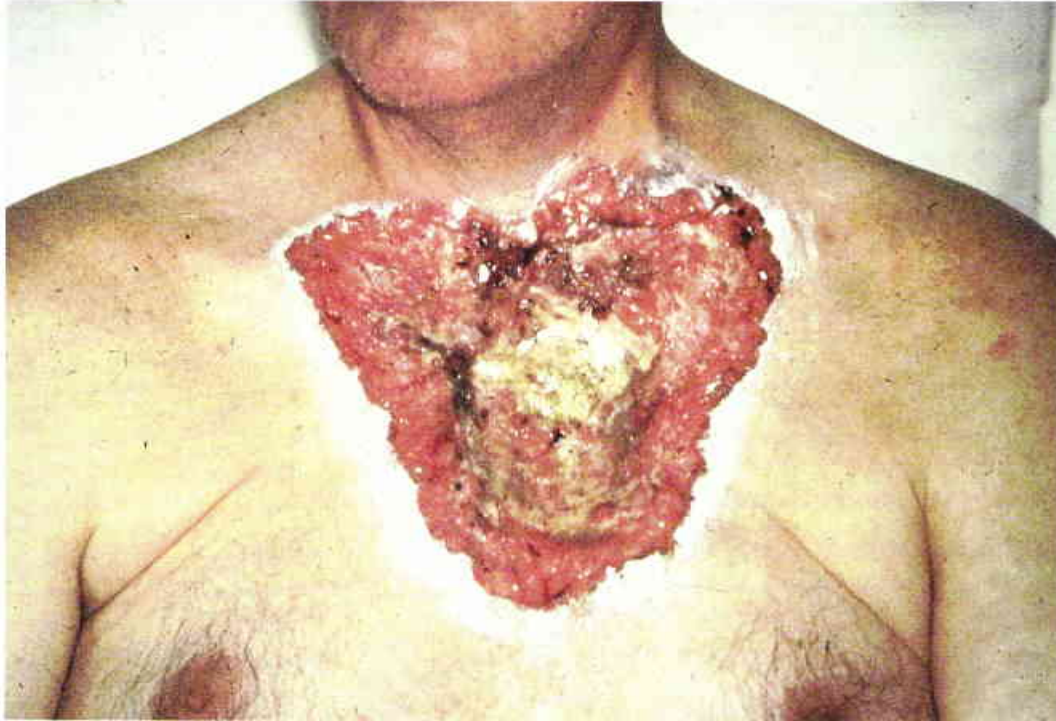
Large pectoralis "paddle" elevated. The full-thickness chest wall defect is seen above.

**40**

Transposed pectoralis flap. The large donor defect will be closed primarily.

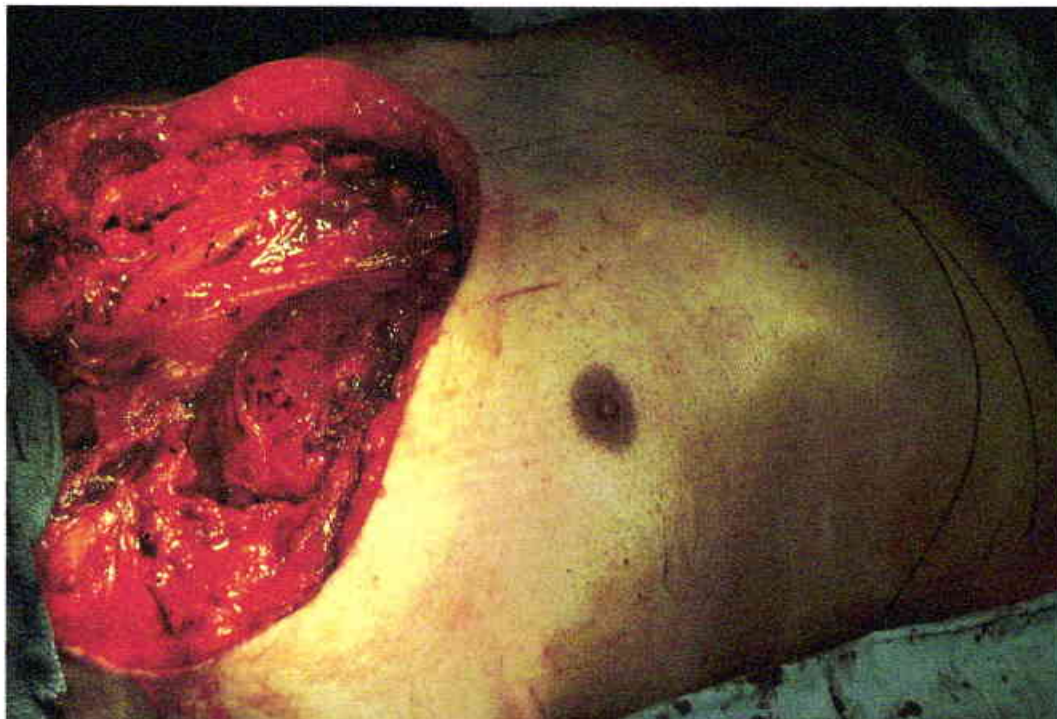
**41**

Healed flap at two years. The patient continues to do well six years postoperatively.



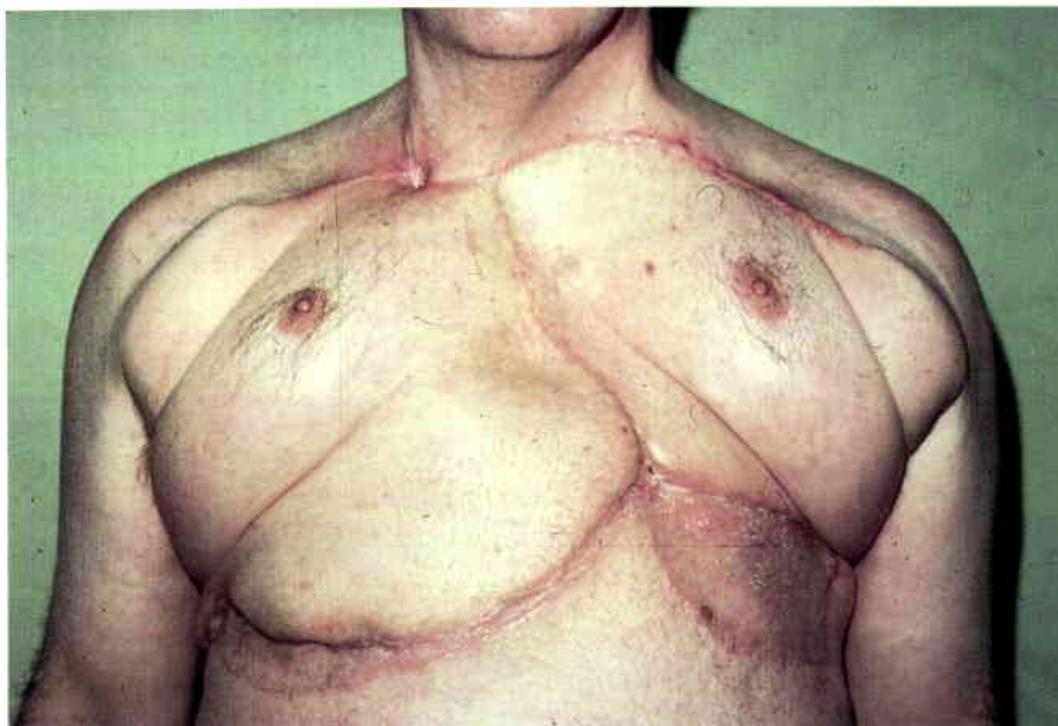
42

Neglected basal cell carcinoma of the anterior chest in a fifty-seven-year-old male. (Case of P.G. Arnold and J. Masson)



43

This massive resection of the sternum and the adjacent ribs extended laterally to the thoracoacromial vessels. Bilateral pectoralis myocutaneous rotation flaps are outlined.



44

Healed pectoralis myocutaneous flaps. No additional skeletal reconstruction was required. Although the closure is unattractive, it solved an extremely difficult problem.



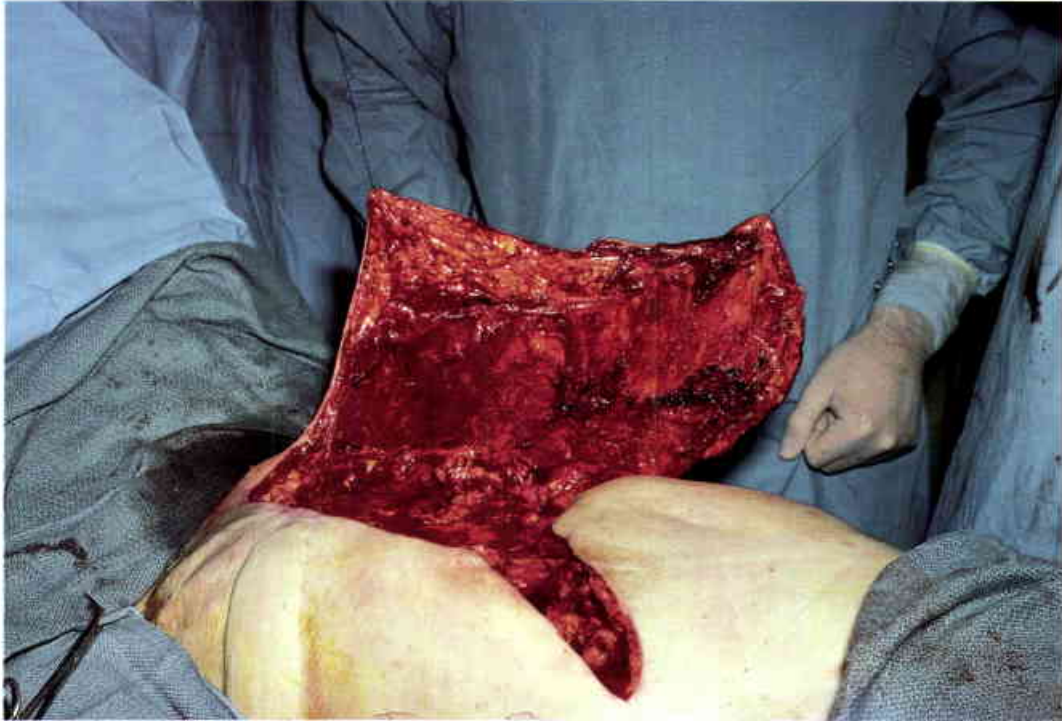
45

Sixty-seven-year-old female with osteoradionecrosis of the sternum and costal cartilages. A right radical mastectomy had been done twenty-five years earlier. Three years of intensive antibiotic therapy had not changed the nature of the infection. (Case of P.G. Arnold)



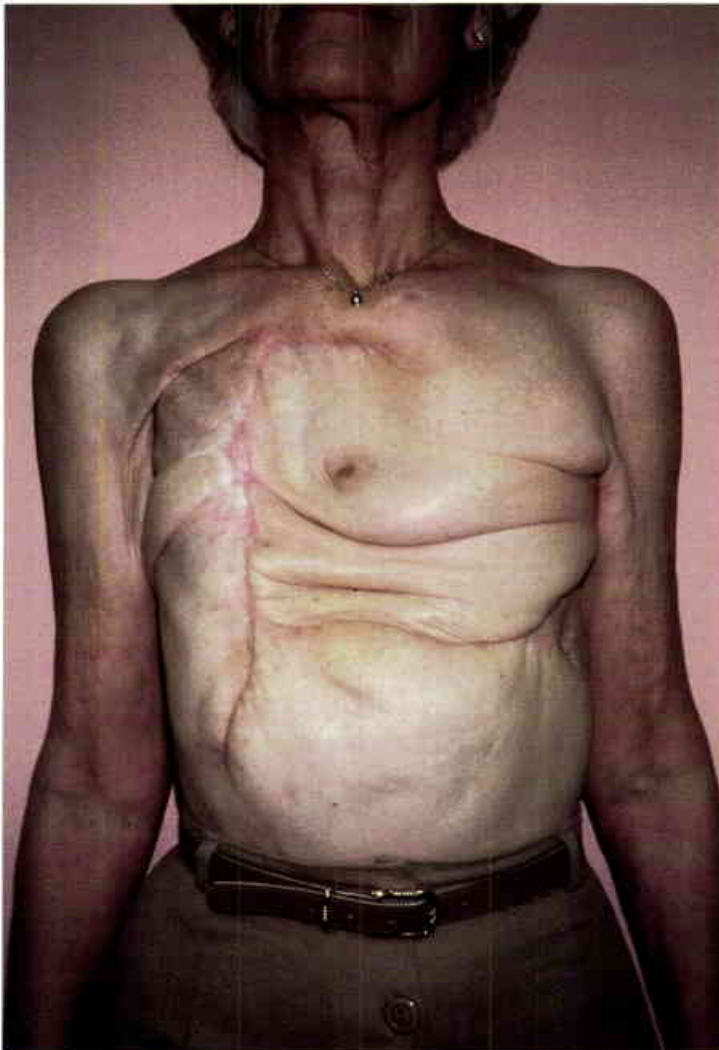
46

The massive resection included the entire sternum and all of the costal cartilages.



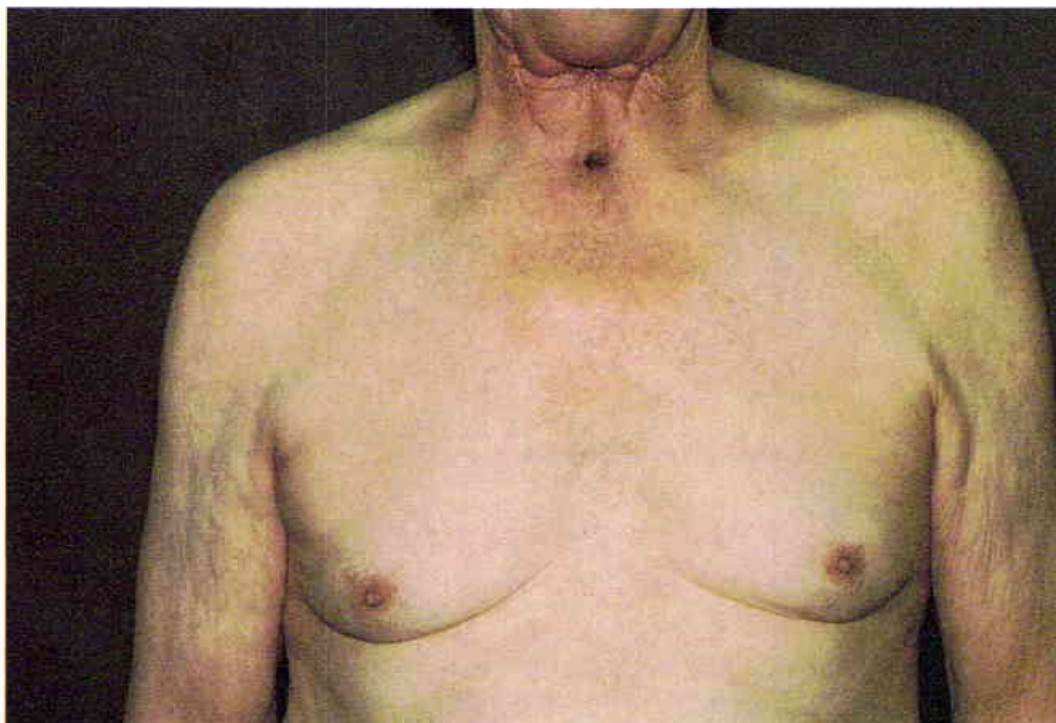
47

The left pectoralis and latissimus muscles were used to carry a large compound chest wall flap.



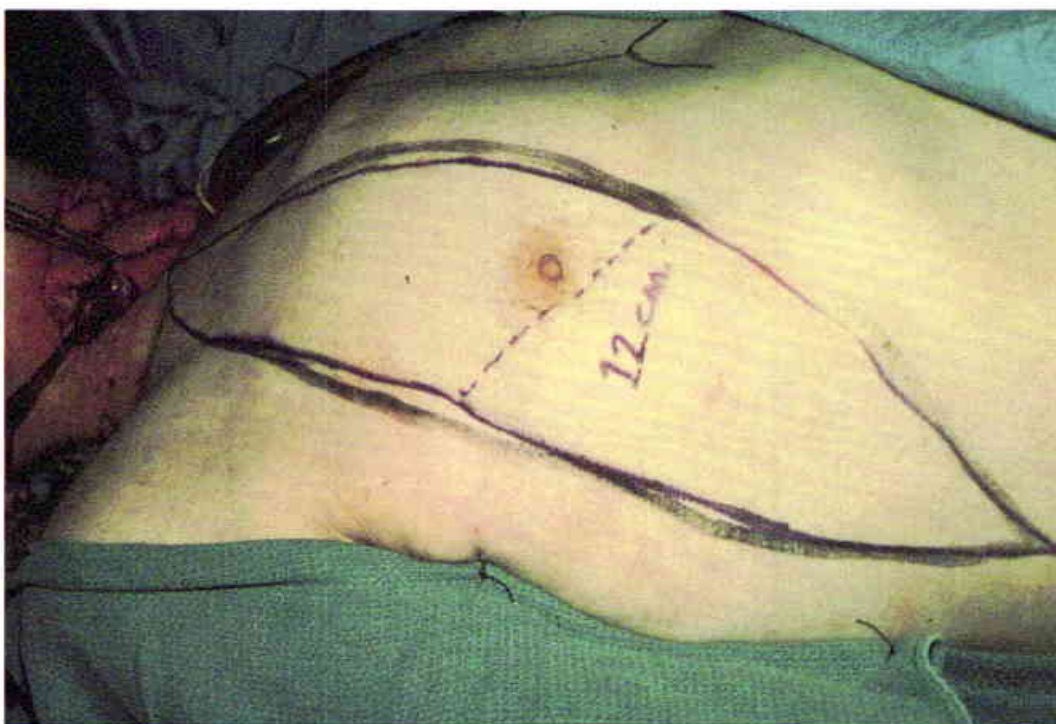
48

Healed wound at one year. The donor defect was partially closed with a "reversed" abdominoplasty. The centralized breast was an acceptable price to pay for relief from the recalcitrant infection.



49

Fifty-seven-year-old man following a laryngectomy and irradiation to both necks. The tumor was locally recurrent at the tracheal stoma and in the pharynx. The patient was unable to swallow saliva. (Case of J.B. McCraw and G. Meredith)



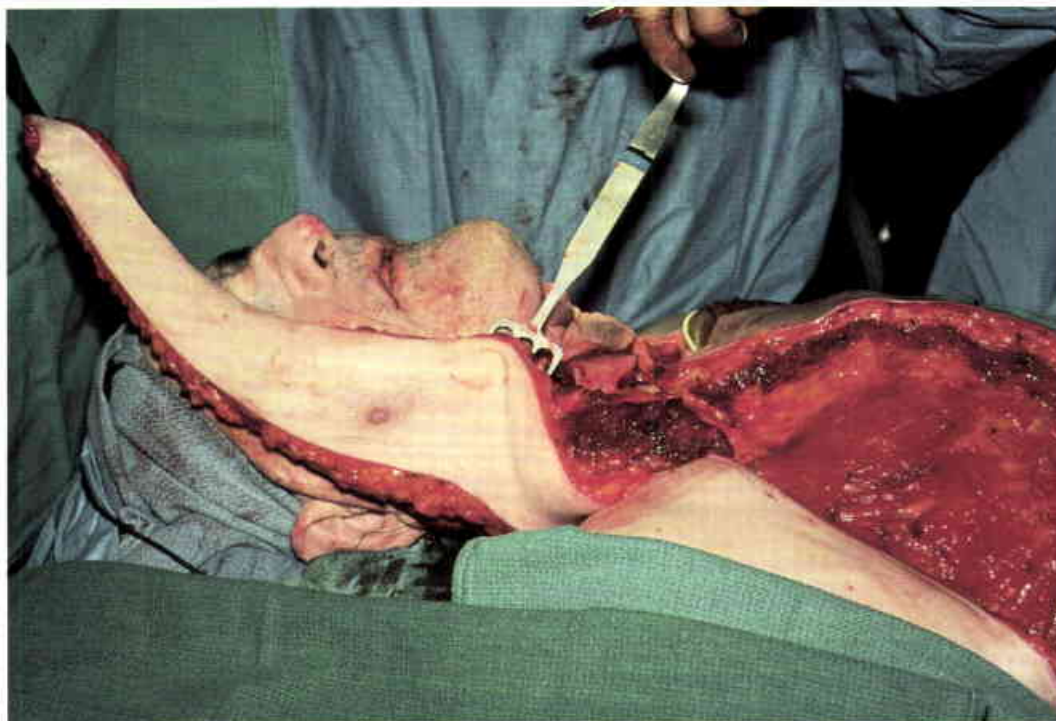
50

Pectoralis major myocutaneous flap outlined. The lower margin of the pectoralis muscle is marked at the level of the nipple. The distal flap extends well below the margin of the rib cage.



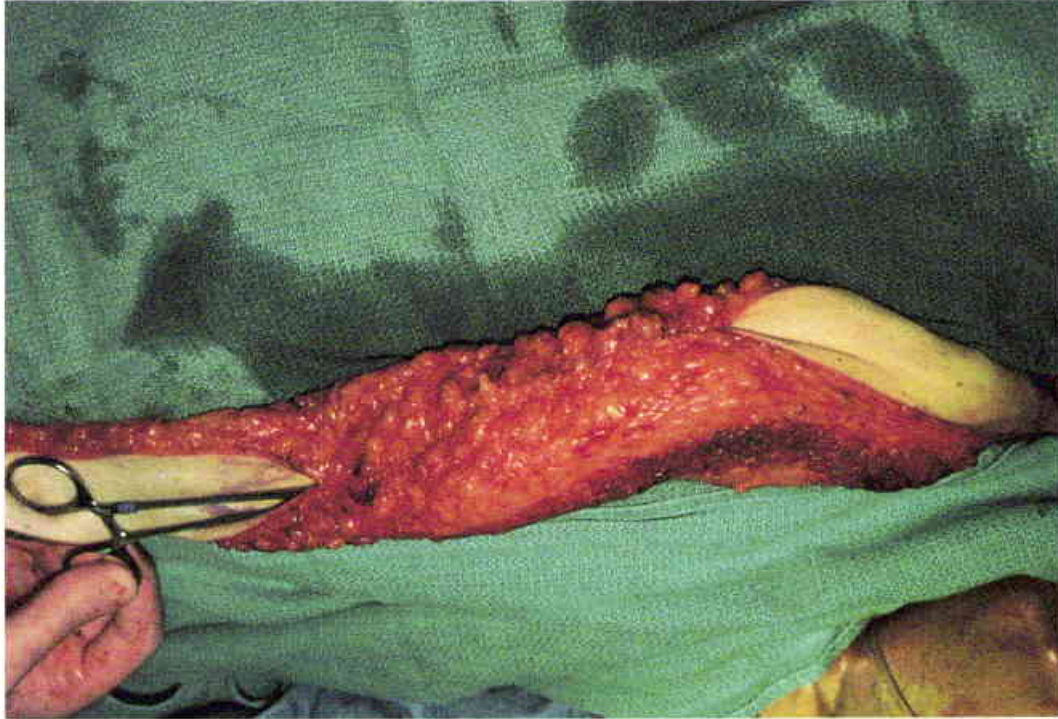
51

Completed pharyngectomy and bilateral neck dissections which included the majority of the anterior neck skin.



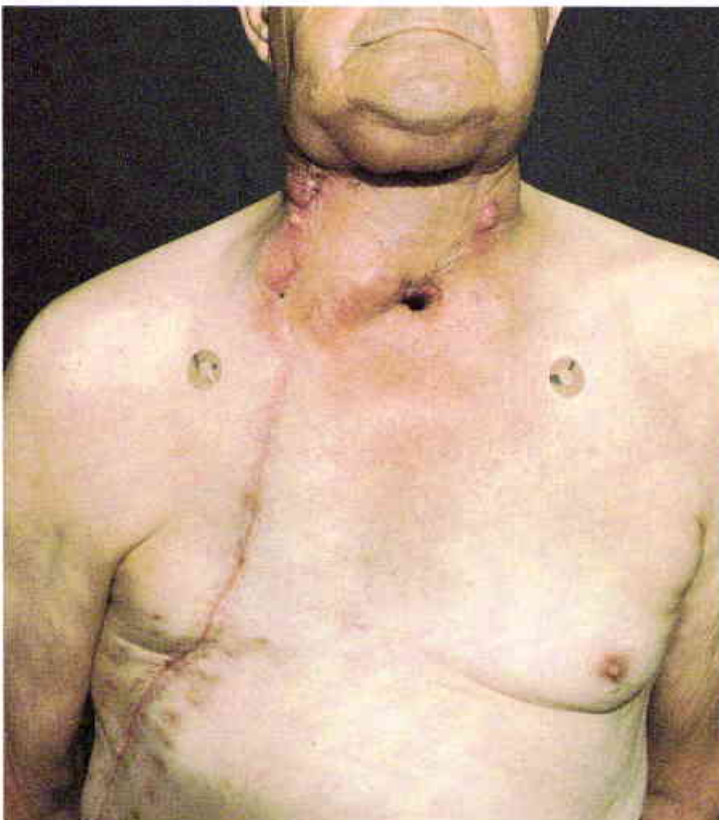
52

Superiorly elevated flap with the transposed nipple at the level of the ear. The flap skin fluoresced completely.



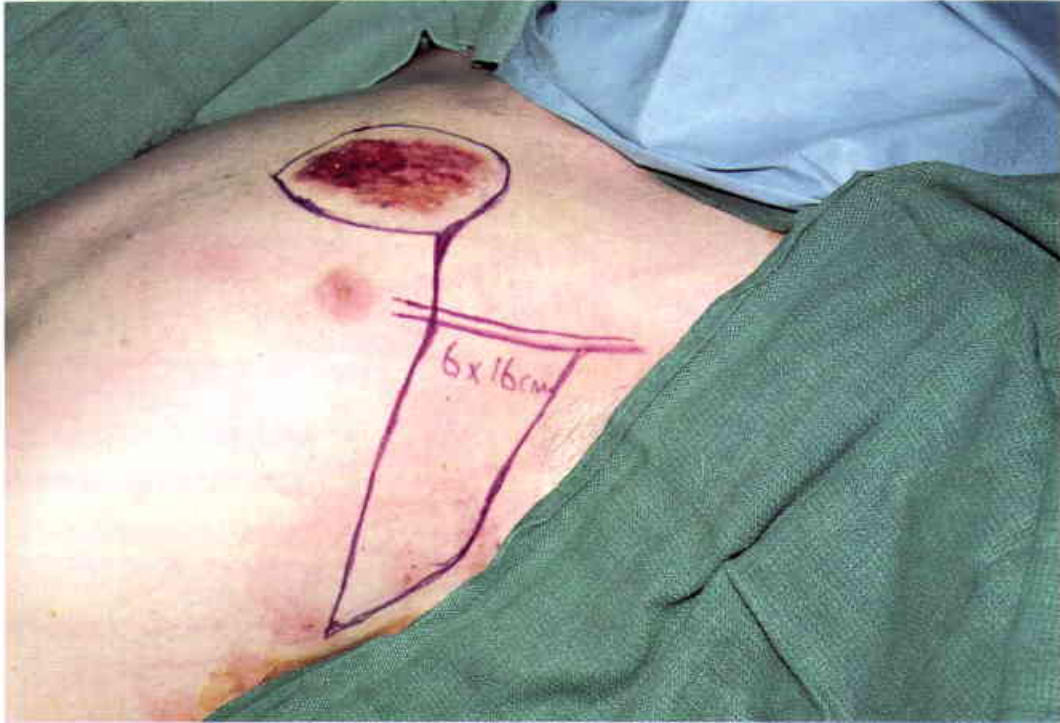
53

The cutaneous segment was tubed for the total pharyngeal reconstruction. The muscular surface of the flap will be skin grafted.



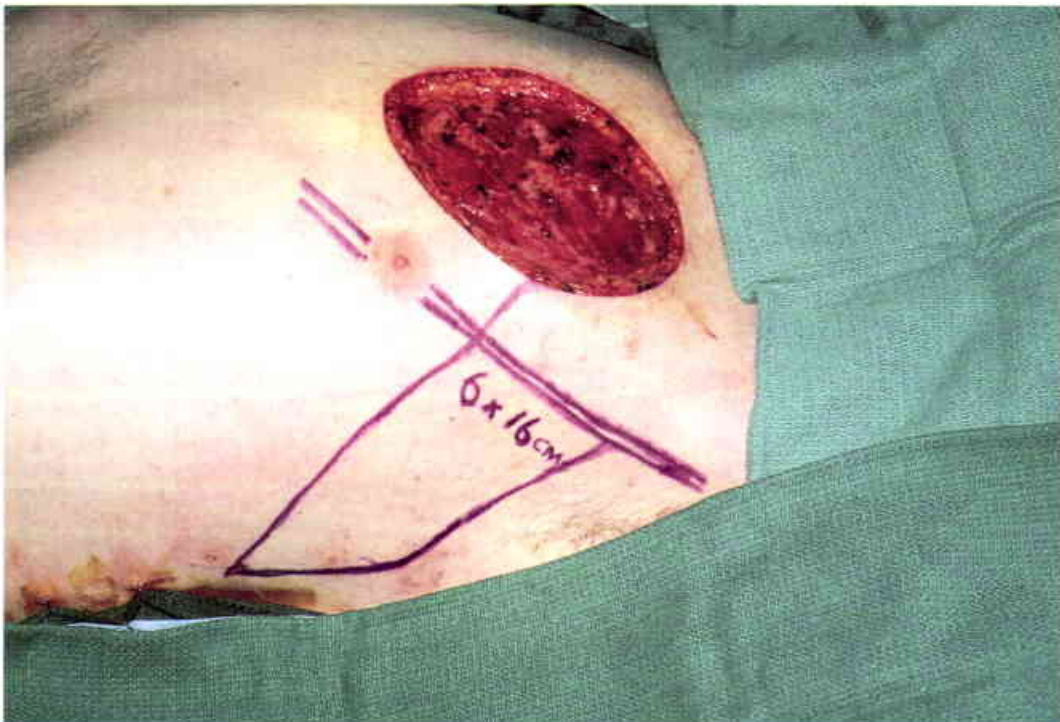
54

Healed flap and donor site. The patient was able to swallow immediately, but the tumor recurred in a matter of weeks.



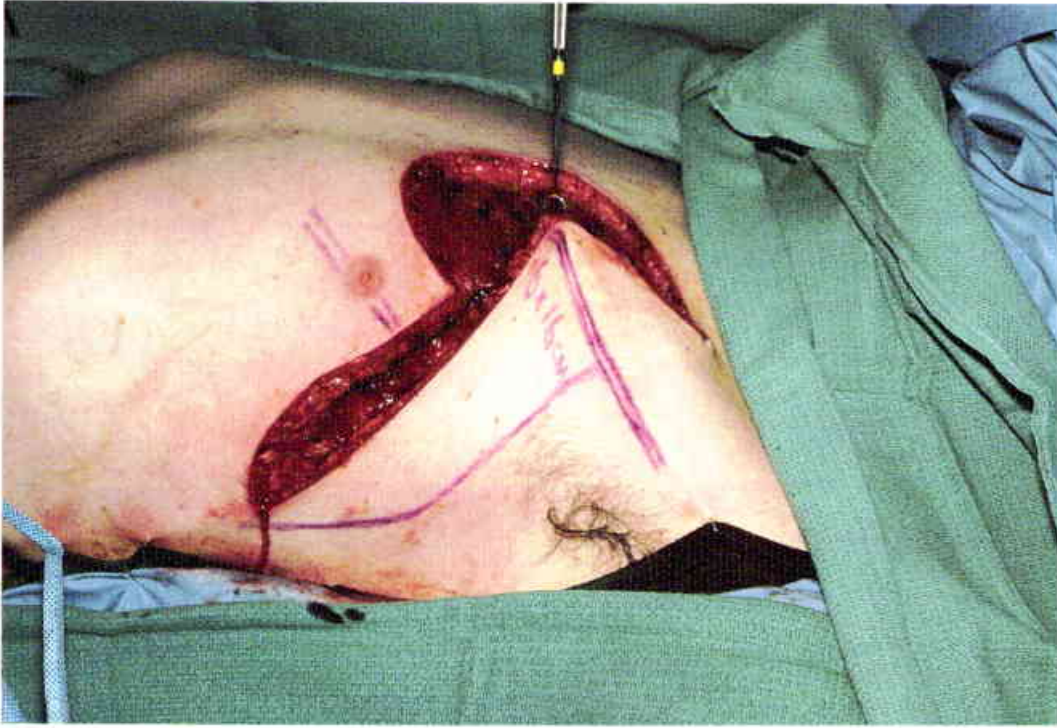
55

Neglected, ulcerated basal cell carcinoma of the sternal area in a fifty-two-year-old man. (Case of J.B. McCraw)



56

Operative defect and proposed pectoralis myocutaneous flap. The lateral margin of the pectoralis major muscle is outlined in blue. Distal to this line, the flap skin is not attached to the muscle.



57

Advancement of the skin from any direction would have distorted the nipple position.



58

Healed transposition flap from the lateral chest at three months. The contour restoration is superior to a skin graft and the nipple position is unchanged.

PECTORALIS MYOCUTANEOUS FLAP

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