

McCraw and Arnold's Atlas of Muscle and Musculocutaneous Flaps



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Global-HELP
Publication

RECTUS FEMORIS

ANATOMICAL CONSIDERATIONS

Surface Markings

The course of the rectus femoris muscle follows a line which passes directly between the anterior superior iliac spine and the patella. It is easily palpated during forcible extension of the knee.

Origin and Insertion

The rectus femoris muscle originates from the anterior inferior iliac spine and the upper border of the acetabulum and inserts into the patellar tendon. It is densely fused with the vastus lateralis and vastus medialis muscles through musculotendinous connections in the distal one-third of the thigh. The primary function of the rectus femoris muscle is in the terminal 15-20 degrees of knee extension.

Adjacent Muscles

The vastus lateralis and vastus medialis muscles parallel the rectus femoris muscle, and the vastus intermedius muscle is directly subjacent throughout its course. In the upper-third of the thigh the tensor muscle abuts on the lateral surface of the rectus femoris muscle, and the sartorius muscle crosses the proximal one-third of the rectus femoris muscle from lateral to medial.

Vascular Pattern

The rectus femoris muscle has a purely proximal vascular pattern with no minor pedicle distally. The profunda femoris vessels supply all of the anterior thigh musculature. These profunda femoris branches enter the anterior thigh muscles approximately eight to ten centimeters below the inguinal ligament. Branches of the lateral circumflex femoral vessels supply the tensor, vastus lateralis, and rectus femoris muscles after exiting the profunda femoris vessels. Just before entering the deep surface of the rectus femoris muscle, the lateral circumflex femoral artery divides into two major branches which are each two to three millimeters in diameter. The proximal branch primarily supplies the proximal one-third of the muscle while the distal branch supplies the distal two-thirds of the muscle. The "end-artery" nature of this vascular pattern suggests that the integrity of both of these branches should be preserved, but the viability of the rectus femoris muscle flap is apparently not harmed by the sacrifice of the distal set of vessels. An independent fasciocutaneous vessel enters the proximal cutaneous segment near the inguinal ligament so the preservation of the proximal skin bridge may enhance the viability of the rectus femoris myocutaneous flap.

Motor Nerve

Femoral nerve.

Sensory Nerve

Intermediate cutaneous nerve of the thigh.

USES

The rectus femoris myocutaneous flap is used primarily for lower quadrant and suprapubic abdominal coverage problems, particularly when it is desirable to transpose muscle and dense fascia. A musculofascial flap is the usual choice in reconstruction of the lower abdominal wall since skin replacement is seldom necessary. The lateral rotation of the "island" rectus femoris muscle flap easily extends to the greater trochanter and to the hip joint. It should be noted that the rectus femoris myocutaneous flap does not reach the central perineum, bladder, or vagina.

REGIONAL FLAP COMPARISONS

For suprapubic and lower abdominal coverage, the rectus femoris myocutaneous flap is preferred over the TFL flap because of its proximity, reliability, and ease of elevation. The TFL donor site is also associated with greater morbidity, and frequently requires skin grafting. Compared to the standard TFL flap, the rectus femoris myocutaneous flap does not serve as well for groin coverage. In addition, it will not reach the upper abdomen for purposes of abdominal wall reconstruction. The vastus lateralis muscle provides a larger muscle and a broader area of coverage than the rectus femoris flap. However, the vastus lateralis flap is much more difficult to elevate, and the fascia of the vastus lateralis muscle is less dense than the fascia of the rectus femoris muscle. The rectus femoris muscle flap alone is usually sufficient to correct recalcitrant hip wounds following the loss of a hip prosthesis.

DISADVANTAGES

The potential loss of terminal knee extension should not be realized if the vastus medialis and lateralis muscles are carefully centralized and repaired above the patellar tendon. The functional "reserve" of the strong quadriceps mechanism compensates for the loss of this single anterior thigh muscle in all but the athletic individual.

ADVANTAGES

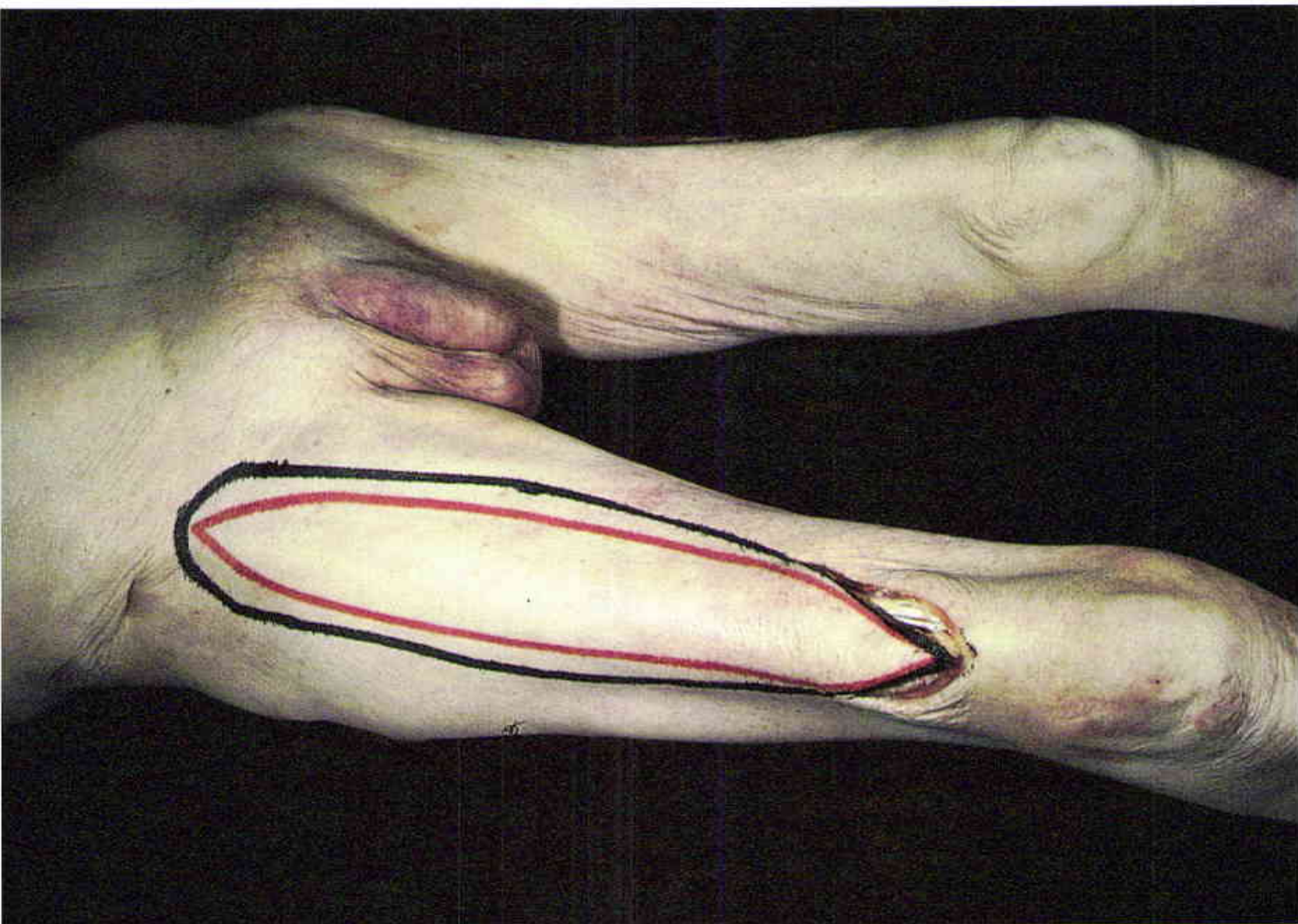
If the dominant vessels are not stretched or otherwise injured, the rectus femoris myocutaneous flap is one of our most dependable flaps. The cutaneous segment can be expanded safely to approximately three times the width of the rectus femoris muscle by including the adjacent fascia lata. This fasciocutaneous "extension" of the myocutaneous flap encompasses the majority of the anterior thigh skin. Although the muscle is only six centimeters in width, the associated muscle fascia is strong enough to reconstruct a much larger (e.g. fifteen to twenty centimeters) full-thickness defect of the abdominal wall.

COMPLICATIONS, PITFALLS, AND DONOR SITE

One must be careful not to place too much tension or torsion on the dominant vessels because they are subject to vascular "spasm." This caused a significant loss of the cutaneous segment of the flap in one case, but flap necrosis has not been encountered in any other case. The dissection is straightforward, but entry into the su-

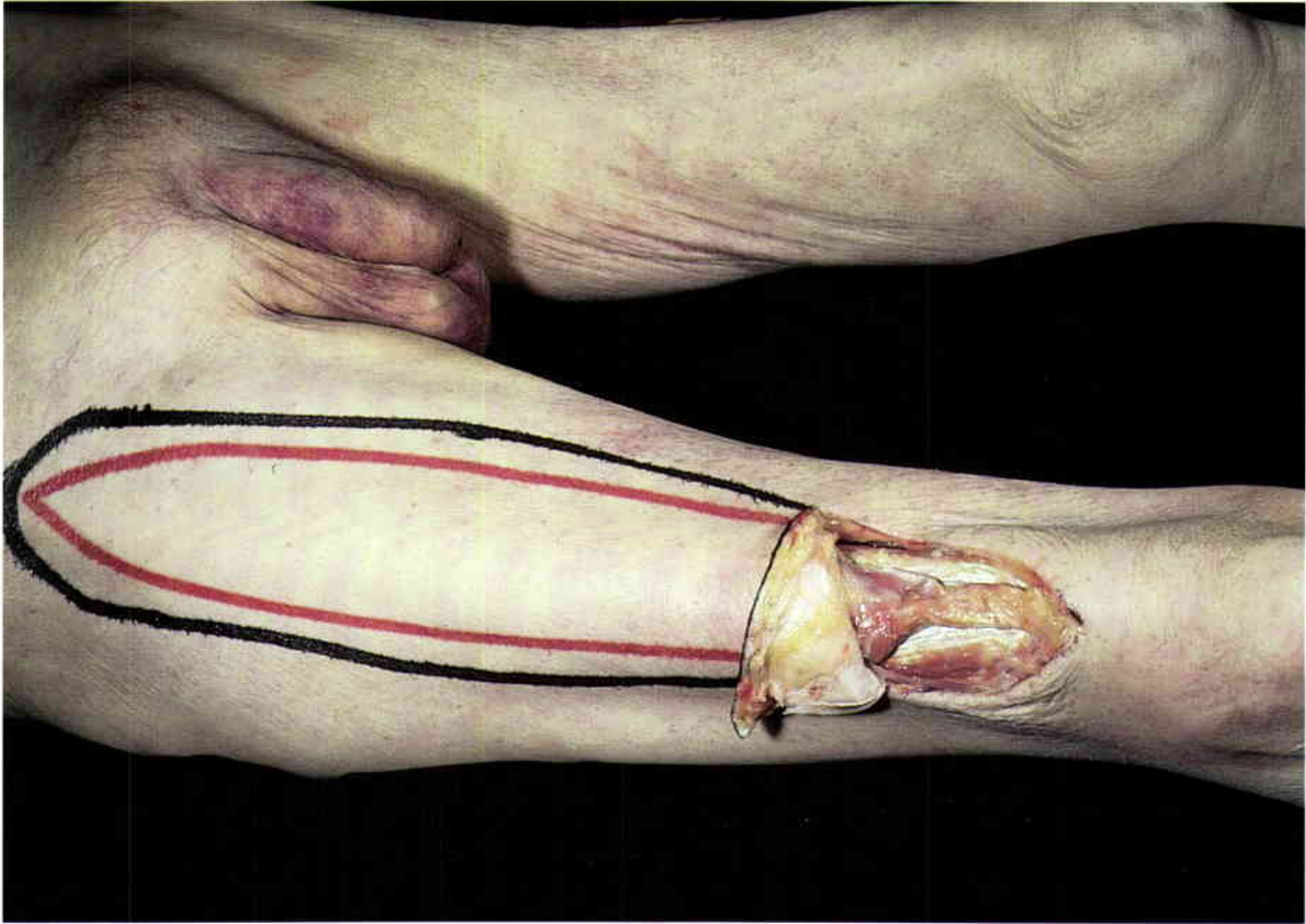
prapatellar bursa should be carefully avoided. One should also take extreme care to protect the femoral nerve which lies on the surface of the vastus intermedius muscle and provides the motor supply to the entire quadriceps muscular mechanism. Since the dominant vessels are the limiting factor in upward flap rotation, division of the muscular origin does not facilitate upward mobility of the flap. To prevent any loss of active knee extension, the vastus medialis and vastus lateralis muscles should be approximated in the midline for a distance of approximately fifteen centimeters above the knee.

The donor site is quite favorable when it can be closed primarily. It holds the same disadvantages as the TFL donor site if it must be skin grafted, but this is rarely necessary. For some reason, seroma formation and prolonged drainage have not occurred with the rectus femoris donor site as frequently as they have with the TFL donor site. The permanent loss of muscular function has not been detectable by any measurable means in our cases, even in the aged patient. Despite this favorable experience, one might expect that the use of this "important" muscle would result in some disability in the athletic individual.



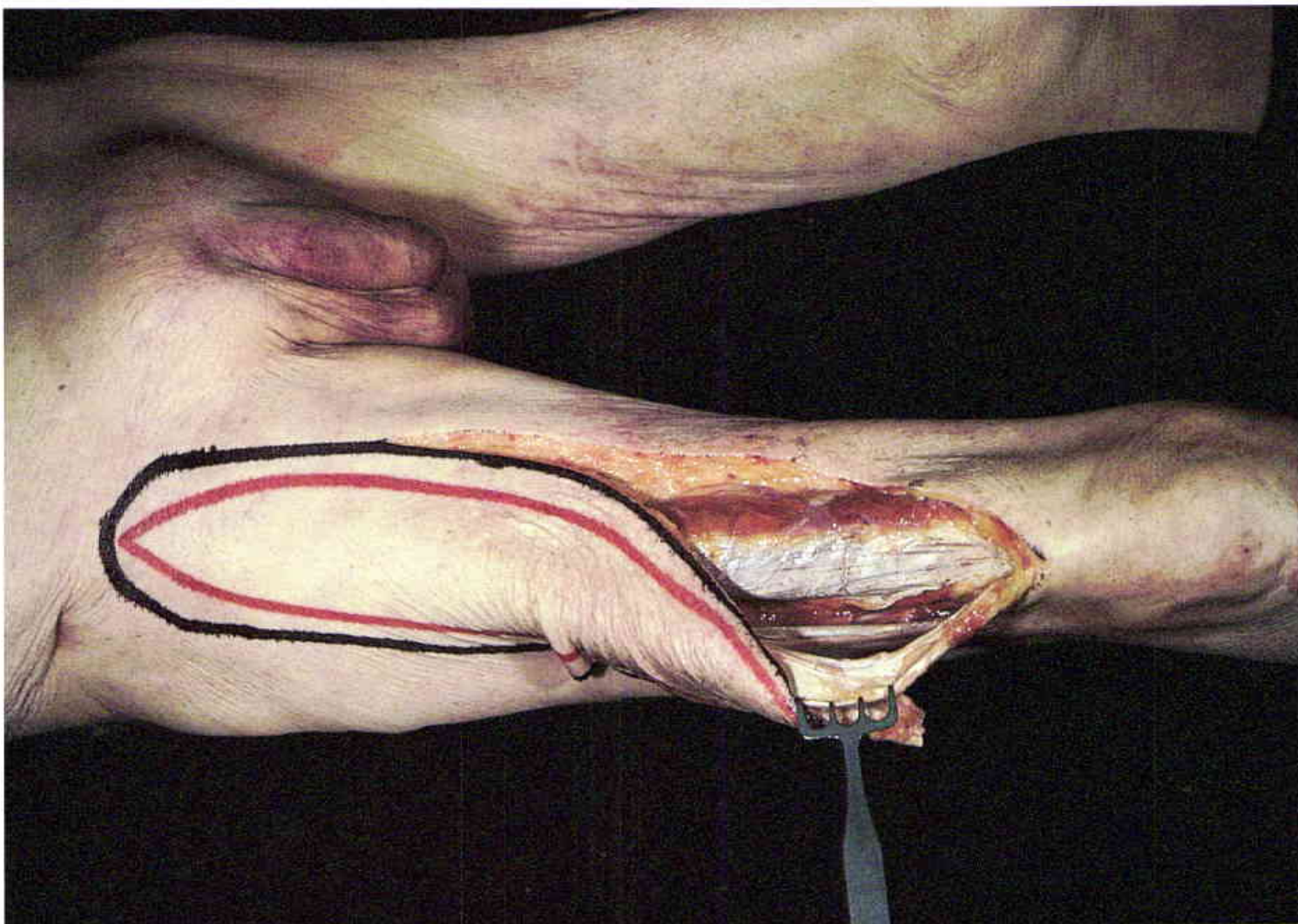
1

The course of the rectus femoris muscle is depicted on a line between the patellar tendon and the anterior iliac spine. The standard cutaneous segment is outlined in black. A much larger cutaneous segment can be carried if the adjacent fascia lata is included with the myocutaneous flap.



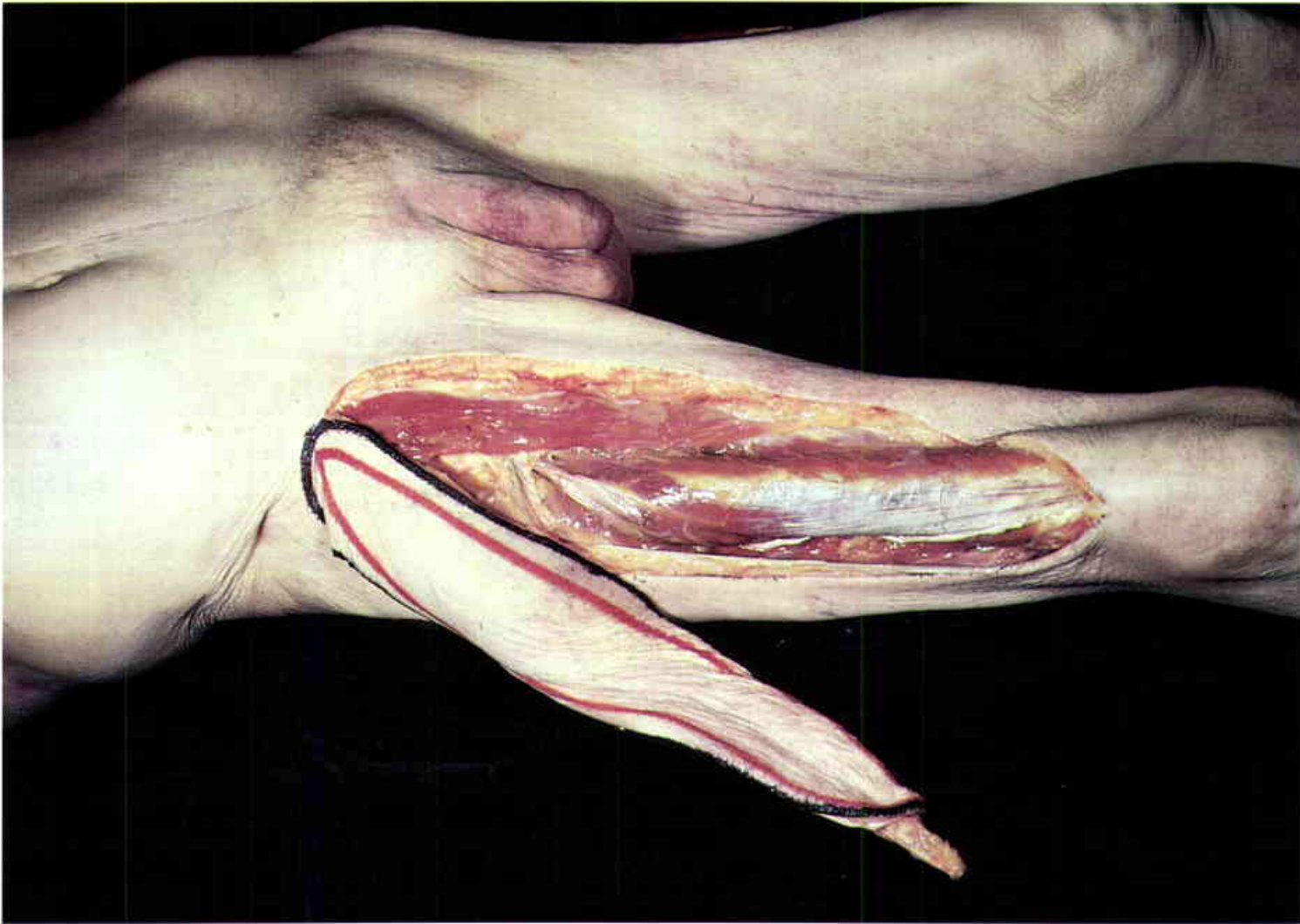
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The rectus femoris tendon is isolated on the surface of the vastus intermedius muscle after it is separated from the tendinous attachments of the adjacent vastus medialis and vastus lateralis muscles. The integrity of the suprapatellar bursa is protected in this part of the dissection.



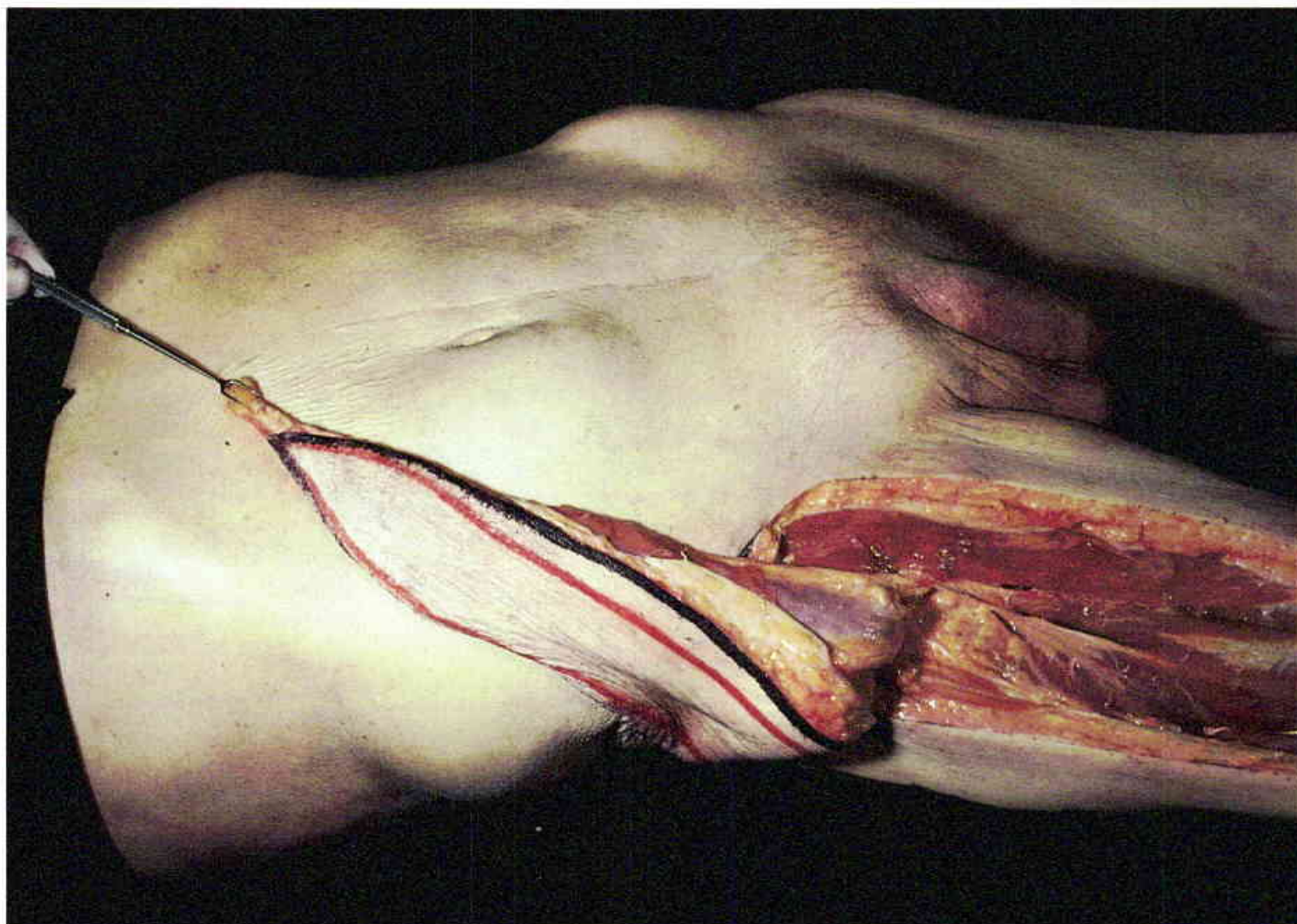
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The rectus femoris muscle is elevated away from the underlying vastus intermedius muscle once the attachments of the vastus medialis and vastus lateralis muscles have been divided. The loose areolar plane between the rectus femoris and vastus intermedius muscles is easily developed.



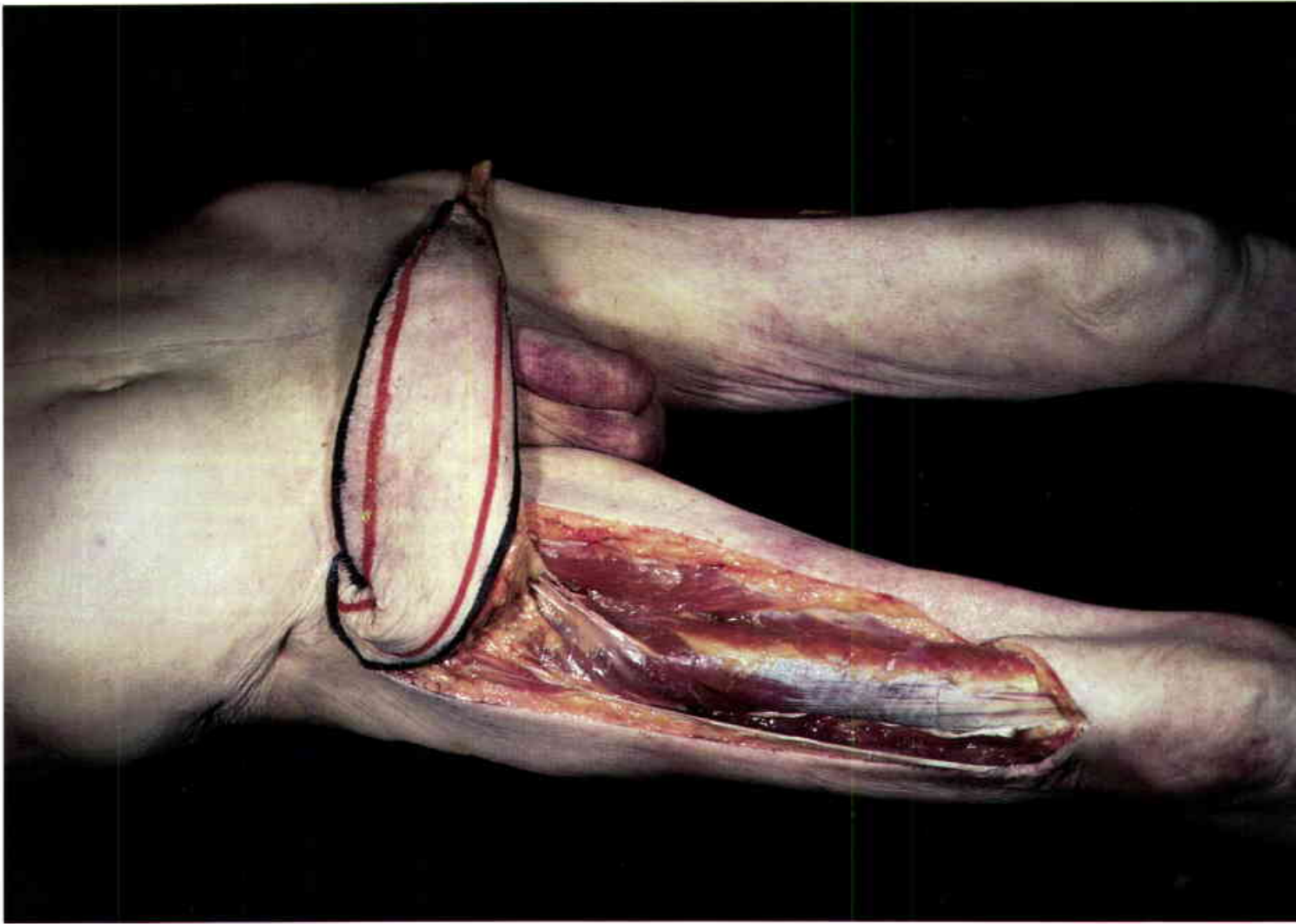
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The lateral circumflex femoral vessels and the femoral nerve are seen on the surface of the vastus intermedius muscle. These dominant vessels pass beneath the sartorius muscle approximately ten centimeters below the inguinal ligament. Note the remaining fascial margin on the vastus lateralis and vastus medialis muscles. This dense fascia will be used to approximate the two muscles in the midline of the thigh.

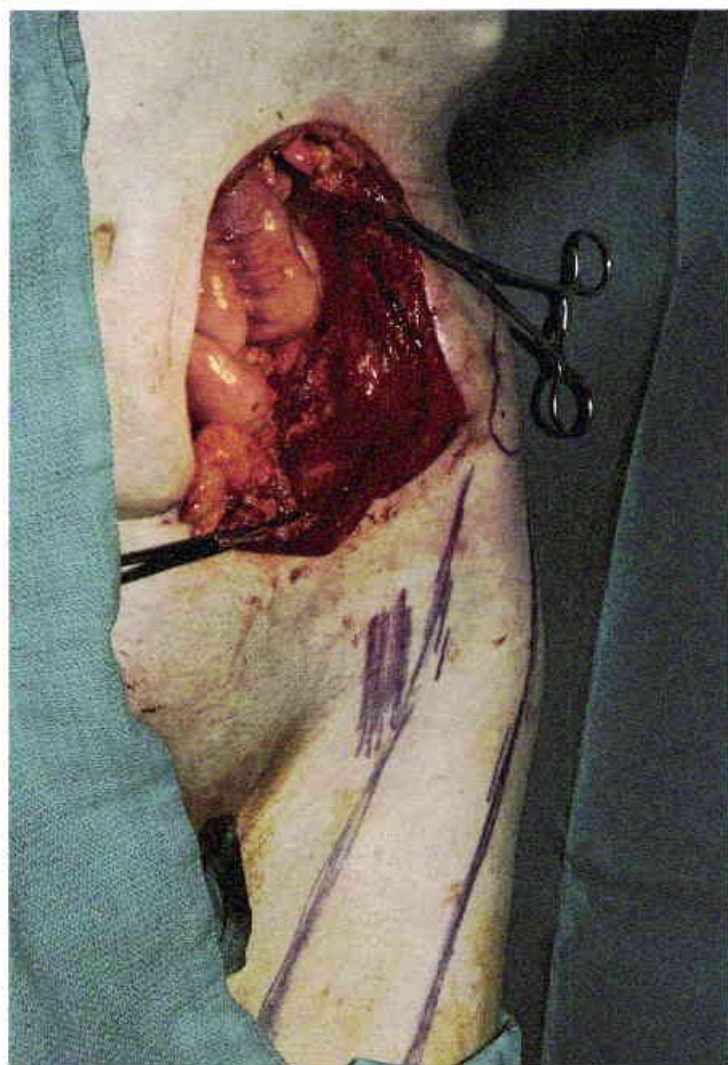


5

The upward mobility of the flap is limited by the vascular pedicle, which is seen passing beneath the lateral margin of the sartorius muscle. The flap excursion is not enhanced by the division of either the muscular origin or the proximal skin bridge. The tip of the myocutaneous flap reaches a point between the umbilicus and the xiphoid.

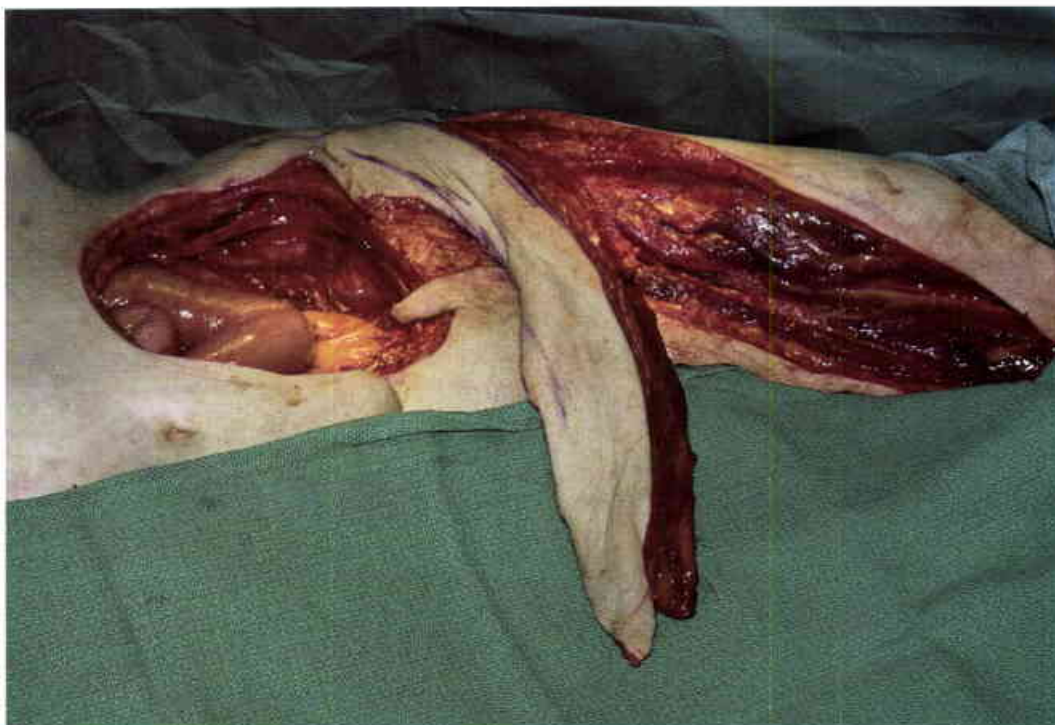
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The rectus femoris flap is most useful for the repair of lower abdominal wall defects. The flap covers the suprapubic area and reaches the opposite anterior spine of the iliac crest.



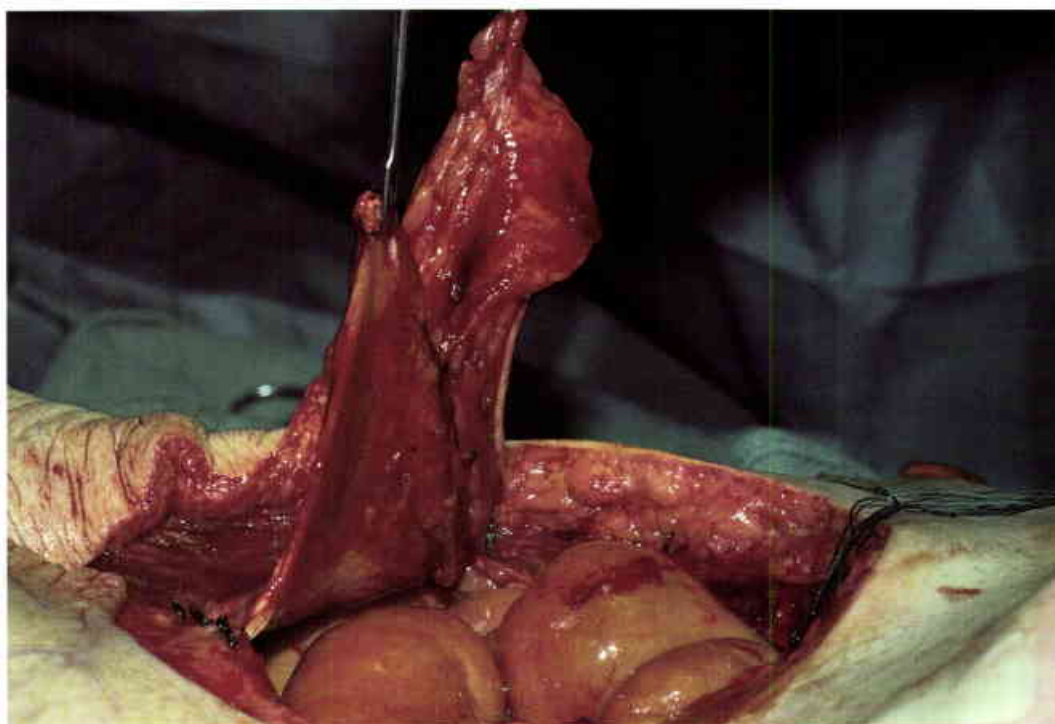
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Sixty-year-old man with a fungating adenocarcinoma arising from the left colon and invading the abdominal wall. The patient previously had undergone a right colectomy for an adenocarcinoma of the colon. This new tumor represented a second metachronous adenocarcinoma of the left colon. The patient was considered to be a candidate for curative resection, but it was feared that the massive abdominal defect would be lethal to a man with severe chronic lung disease unless the structural component of the abdominal wall could be immediately reconstructed. (Case of J.B. McCraw and R. Ludwig)

8
An en bloc resection of the left colon and the abdominal wall was carried out. The fifteen by twenty centimeter abdominal defect extended from the inguinal ligament to the iliac crest inferiorly and to a point five centimeters above the umbilicus superiorly. The resection also included the left rectus abdominis muscle.



9

The rectus femoris flap was raised after the extirpation was completed. The flap dimensions of this early case (1975) helped to dispel the prevailing "length-width" theory of the day.



10

The dense fascia of the rectus femoris muscle was strong enough to accommodate a tense closure of the large abdominal wall defect.



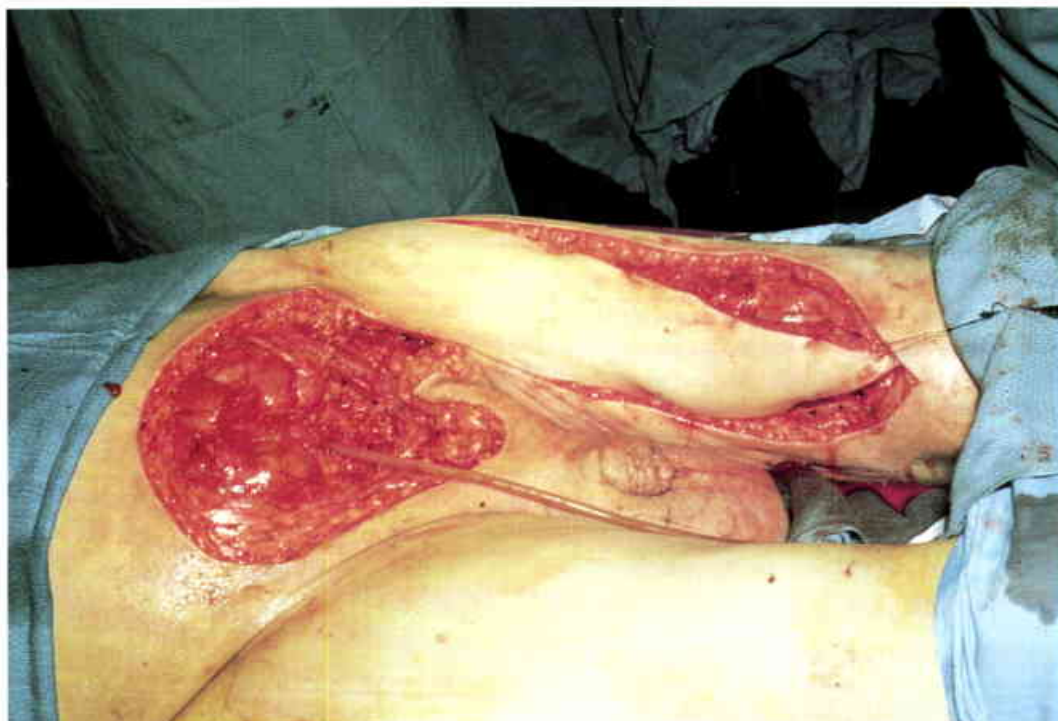
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Healed flap and donor site at six months. The abdominal wall was stable. The patient was killed in a motor vehicle accident two years following the surgery.



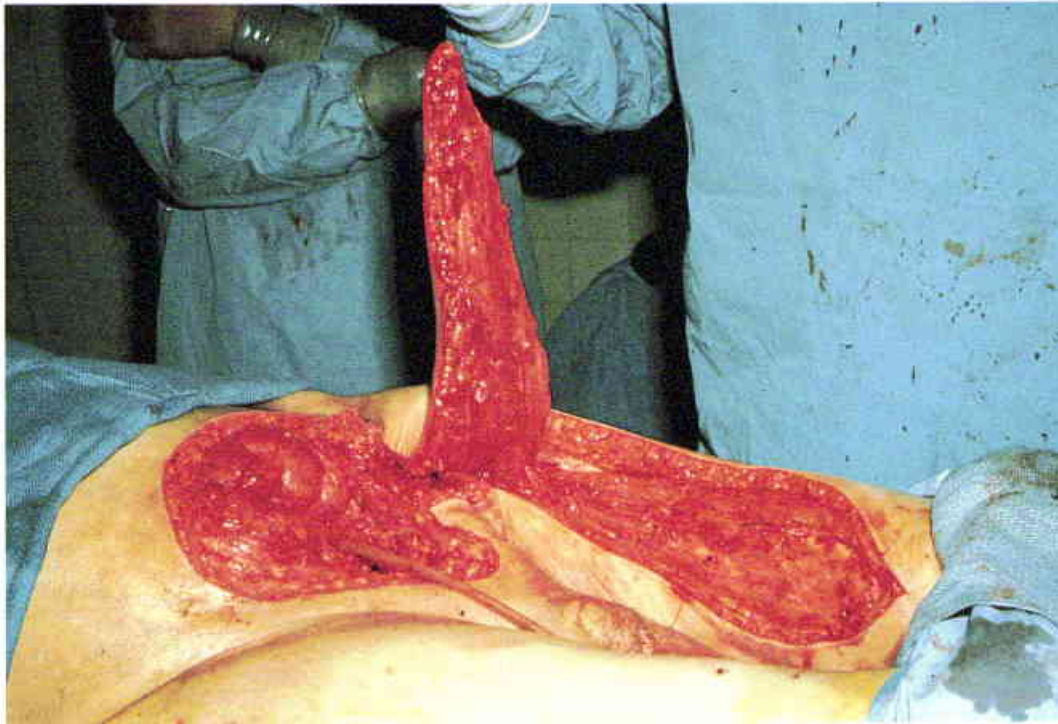
12

Fifty-four-year-old paraplegic man with a squamous cell carcinoma of the bladder involving the suprapubic tube tract. (Case of P.G. Arnold)



13

The anterior half of the urinary bladder and the overlying abdominal wall were resected en bloc. The remaining bladder wall was repaired around the suprapubic catheter.



14

A left rectus femoris myocutaneous flap is elevated for the abdominal wall closure.



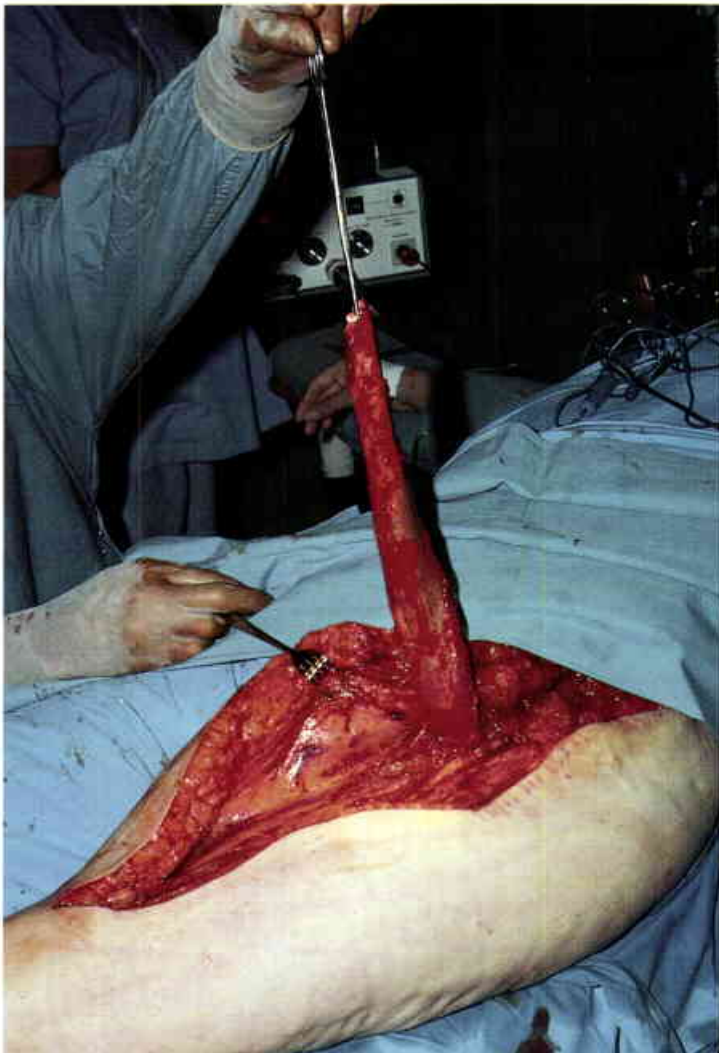
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Healed wound at six months. The patient has done well for seven years.



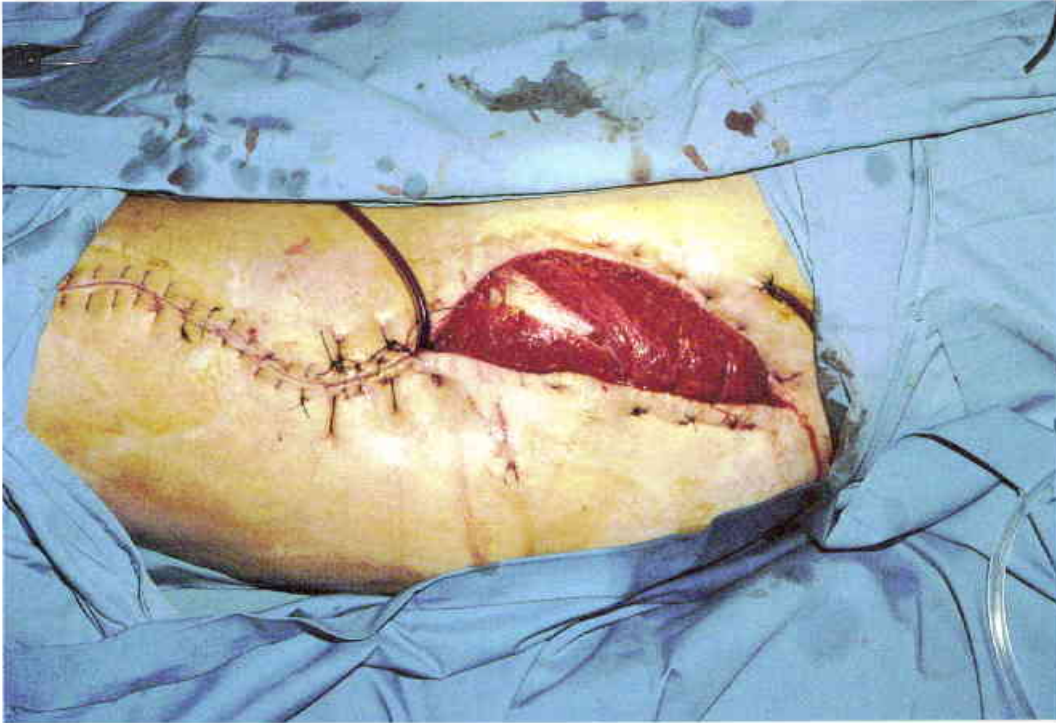
16

Fifty-three-year-old female with osteomyelitis of the iliac crest following the harvesting of a bone graft for an ankle fusion. The osteomyelitis had been resistant to multiple attempts at direct closure and the patient was referred for definitive treatment. (Case of P.G. Arnold)



17

The adjacent rectus femoris muscle was elevated through an extension of the previous incision.



18

The transposed rectus femoris muscle completely obliterated the iliac crest defect. The muscle was skin grafted two days later.



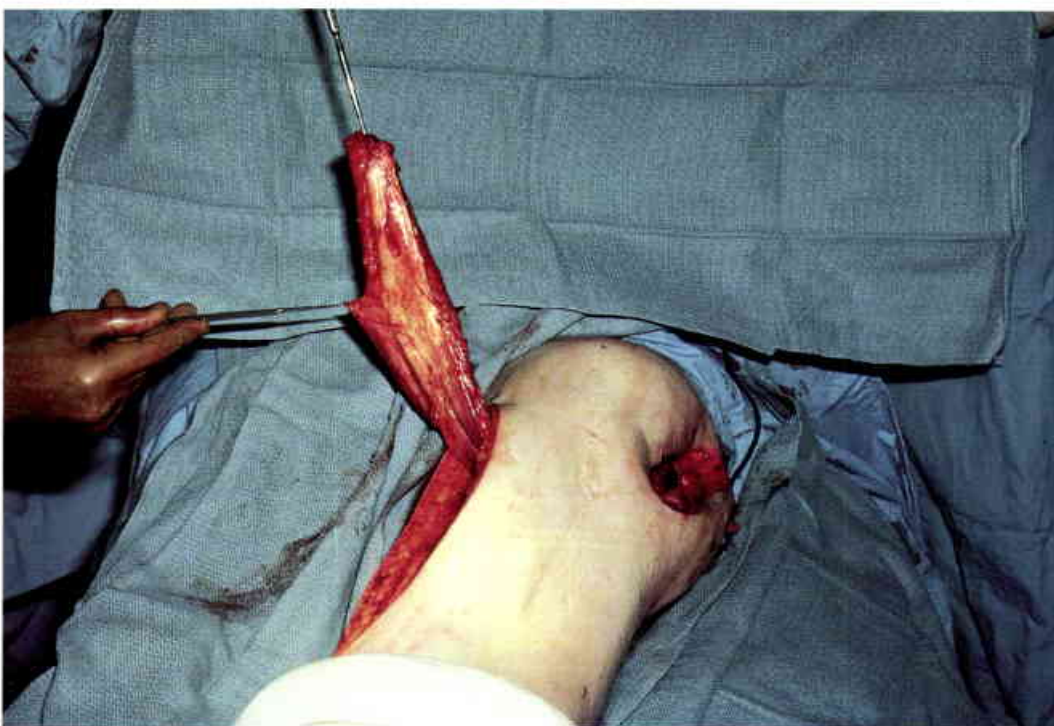
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Healed wound at three years. The osteomyelitis has not recurred over a nine-year period.



20

Sixty-year-old man with a failed total hip procedure. The osteomyelitis involved both the femur and the acetabulum. A previous TFL flap closure had been unsuccessful. (Case of P.G. Arnold)



21

Elevated rectus femoris muscle flap. A generous tunnel was created for the muscle flap transposition.



22

Rectus femoris muscle flap passed into the "total hip" defect. Approximately half of the rectus femoris muscle is visible beyond the hip defect.



23

Healed skin closure over the buried muscle flap. The wound has remained stable for seven years.

RECTUS FEMORIS

- Arnold, P.G. and Witzke, D.J. "Management of failed total hip arthroplasty with muscle flaps." *Ann. Plast. Surg.* 11(6): 474, 1983.
- Bell, M.S. and Earnshaw, P.H. "Rectus femoris myocutaneous flaps for trochanteric ulcers." *Can. J. Surg.* 24(5): 496, 1981.
- Bhagwat, B.M., Pearl, R.M., and Laub, D.R. "Uses of the rectus femoris myocutaneous flap." *Plast. Reconstr. Surg.* 62: 698, 1978.
- Bostwick, J., III, Hill, H.L., and Nahai, F. "Repairs in the lower abdomen, groin, or perineum with myocutaneous or omental flaps." *Plast. Reconstr. Surg.* 63: 186, 1979.
- Brandell, B.R. "Functional roles of the calf and vastus muscles in locomotion." *Am. J. Phys. Med.* 56(2): 59, 1977.
- Ikuta, Y., Kubo, T., and Tsuge, K. "Free muscle transplantation by microsurgical technique to treat severe Volkmann's contracture." *Plast. Reconstr. Surg.* 58(4): 407, 1976.
- Knight, K.L., Martin, J.A., and Londeree, B.R. "EMG comparison of quadriceps femoris activity during knee extension and straight leg raises." *Am. J. Phys. Med.* 58(2): 57, 1979.
- Lotze, M.T. and Sugarbaker, P.H. "Femoral artery based myocutaneous flap for hemipelvectomy closure: amputation after failed limb-sparing surgery and radiotherapy." *Am. J. Surg.* 150(5): 625, 1985.
- Manktelow, R.T. and McKee, N.H. "Free muscle transplantation to provide active finger flexion." *J. Hand Surg. (Am.)* 3(5): 416, 1978.
- McCraw, J.B., Dibbell, D.G., and Carraway, J.H. "Clinical definition of independent myocutaneous vascular territories." *Plast. Reconstr. Surg.* 60: 341, 1977.
- McGregor, I.A. and Jackson, I.T. "The groin flap." *Br. J. Plast. Surg.* 25: 3, 1972.
- Renstrom, P., Grimby, G., and Larsson, E. "Thigh muscle strength in below-knee amputees." *Scand. J. Rehabil. Med. (Suppl.)* 9: 163, 1983.
- Schenck, R.R. "Rectus femoris muscle and composite skin transplantation by microneurovascular anastomoses for avulsion of forearm muscles: a case report." *J. Hand Surg. (Am.)* 3(1): 60, 1978.
- Sugarbaker, P.H. and Chretien, P.A. "Hemipelvectomy for buttock tumors utilizing an anterior myocutaneous flap of quadriceps femoris muscle." *Ann. Surg.* 197(1): 106, 1983.
- Titone, C., Lipsius, M., and Krakauer, J.S. " 'Spontaneous' hematoma of the rectus abdominis muscle: critical review of 50 cases with emphasis on early diagnosis and treatment." *Surgery* 72(4): 568, 1972.