



Chapter 31

Adductor Muscle Group (Medial Thigh) Resection

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BACKGROUND

- The adductor compartment of the thigh is the second most common site for soft tissue tumors of the thigh, preceded by the anterior (quadriceps) compartment. Although resecting the muscular elements of this compartment does not considerably affect overall function of the lower extremity, the proximity of the major neurovascular bundle of the lower extremity requires special attention in the preoperative evaluation process and during tumor resection.
- Tumors arising within the adductor compartment are often extremely large at presentation. As they enlarge they often displace the superficial femoral and profundus vessels, and they may involve the extrapelvic floor musculature (obturator fascia) and bone (superior and inferior pubic rami and ischium) and even extend extracompartmentally to the medial hamstrings or the psoas muscle and the adjacent hip joint. These anatomic characteristics often make resection extremely difficult. Such large tumors were traditionally treated with amputation (ie, hemipelvectomy). However, effective chemotherapy and radiotherapy regimens have allowed limb-sparing resections to be performed at that site with low rates of local tumor recurrence.
- Lipomas and low-grade liposarcomas, which are the most common tumor type at that site, are usually removed easily with their enveloping capsule without having to manipulate the vascular bundle. High-grade soft-tissue sarcomas, however, may grossly adhere to and surround the vascular bundle and require partial or complete resection of the involved bundle segment. Therefore, a limb-sparing tumor resection at that site begins with dissection and preservation of the superficial femoral vessels.
- Large high-grade sarcomas usually necessitate ligation of the profundus femoris artery. The surrounding adductors are then detached from their origin along the inferior and superior pubic rami and ischium and removed en bloc with the tumor. The soft tissue defect remaining after tumor resection is usually reconstructed by transferring the sartorius muscle and the remaining medial hamstrings.

ANATOMY

- The adductor compartment of the thigh consists of the adductor magnus, brevis, and longus, the gracilis muscles, and the major vascular bundle of the lower extremity. Compartmental muscles arise from the pelvic floor and the medial aspect of the ipsilateral pelvic ring (symphysis pubis, inferior pubic ramus, ischium, and obturator fascia) and attach distally to the linea aspera and the medial aspect of the distal femur.
- The superficial femoral artery passes along the anterior and lateral margins of the entire compartment and forms the lateral border. This compartment is best thought of as an inverted funnel, with the base being the obturator ring and fascia, the lateral border being the femur and linea aspera, and the tip of the cone being the adductor hiatus (**FIG 1A,B**).

- The bony structures of the pelvic floor are the closest margins for large sarcomas that arise within this muscle group. Occasionally, tumors arising from the pelvic ring require resection of the pelvic floor (type III pelvic resection) if negative margins are to be obtained in conjunction with a formal adductor group resection. Rarely, proximal adductor tumors may extend as a dumbbell around the ischium into the ischiorectal fossa. The possibility of such extension must always be evaluated preoperatively (**FIG 1C**).
- The medial hamstrings also take their origin from the ischium. There is no intermuscular septum separating the adductor group from the posterior hamstrings proximally; therefore, extracompartmental extension may occur between the adductor muscles and the medial hamstrings as these tumors enlarge proximally. Adequate resection may require partial medial hamstring resection.

INDICATIONS

- Benign soft tissue tumors of the adductor compartment
- Soft tissue sarcomas of the adductor compartment

CONTRAINDICATIONS

- In general, a combination of several contraindications is required, most of which are related to extremely large tumors. In those cases, we recommend induction chemotherapy or isolated limb perfusion and repeated staging studies before a definitive decision is made regarding amputation.^{2,3}
- Contraindications to limb-sparing surgery include the following:
 - Major neurovascular involvement
 - Pelvic floor involvement
 - Extensive extracompartmental extension

IMAGING AND OTHER STAGING STUDIES

- Preoperative staging studies must evaluate the sartorial canal, pelvic floor, medial hamstrings, ischium, psoas muscle, and hip joint to determine the full extent of bone and soft tissue involvement.
- Plain radiographs, computed tomography (CT), and magnetic resonance (MR) imaging of the affected thigh, ipsilateral hip joint, and hemipelvis are indicated.
- Most adductor tumors displace the superficial femoral vessels but rarely directly involve these structures (**FIG 2**). The profundus femoris artery, on the other hand, is often involved and must be ligated as it passes through the adductor brevis. The obturator artery and nerve, which pass through the obturator fascia, are routinely ligated.
- In light of the above, preoperative vascular evaluation of the patient should include direct questioning about intermittent claudication, limb swelling, and deep vein thrombosis. Vascular evaluation should include, in addition to physical examination, ankle-brachial pressure index and duplex ultrasound scanning

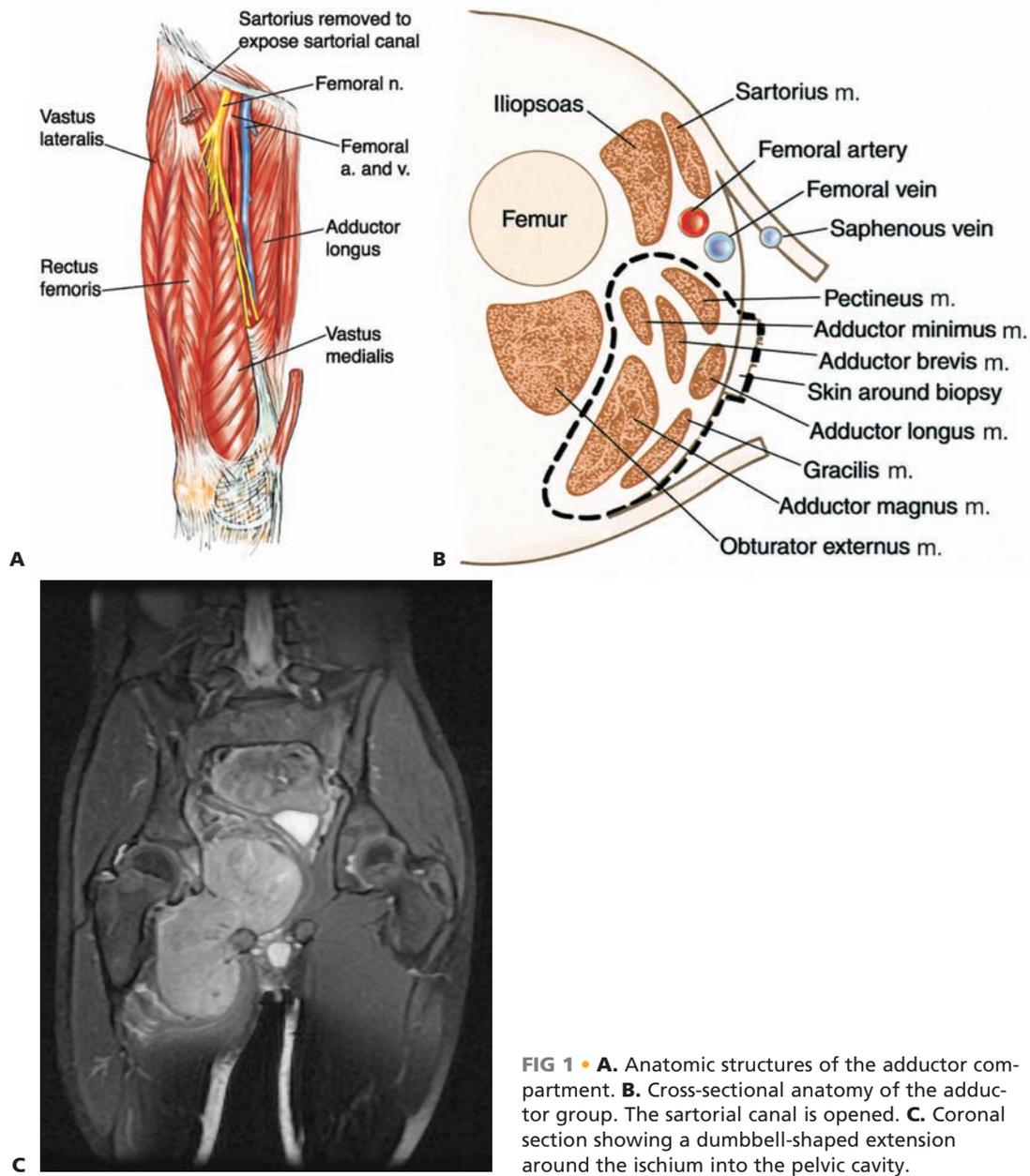
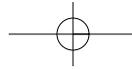


FIG 1 • **A.** Anatomic structures of the adductor compartment. **B.** Cross-sectional anatomy of the adductor group. The sartorial canal is opened. **C.** Coronal section showing a dumbbell-shaped extension around the ischium into the pelvic cavity.

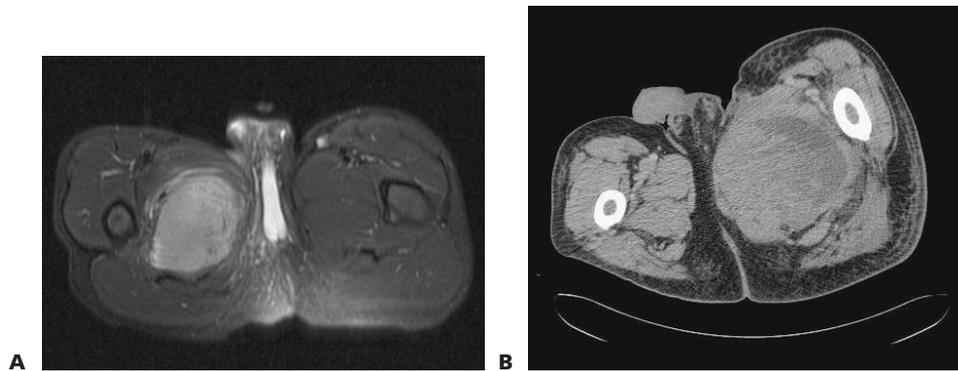
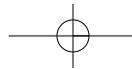


FIG 2 • **A.** Axial MRI showing a sarcoma of the adductor compartment. **B.** CT showing a large sarcoma of the proximal adductor compartment with displacement of the common femoral vascular bundle. Although the vessels are considerably displaced, a plane of dissection is evident between them and the tumoral mass.



of the femoral arteries and veins in the affected leg and of the greater saphenous vein in both legs.

Underlying chronic obstructive arterial disease should prompt liberal use of angiography, CT angiography or MR angiography. Biplanar angiography, especially in patients older than 40, should be done to evaluate the patency of the superficial femoral artery; ligation of the profundus artery

without a patent superficial femoral artery will lead to a non-viable extremity.

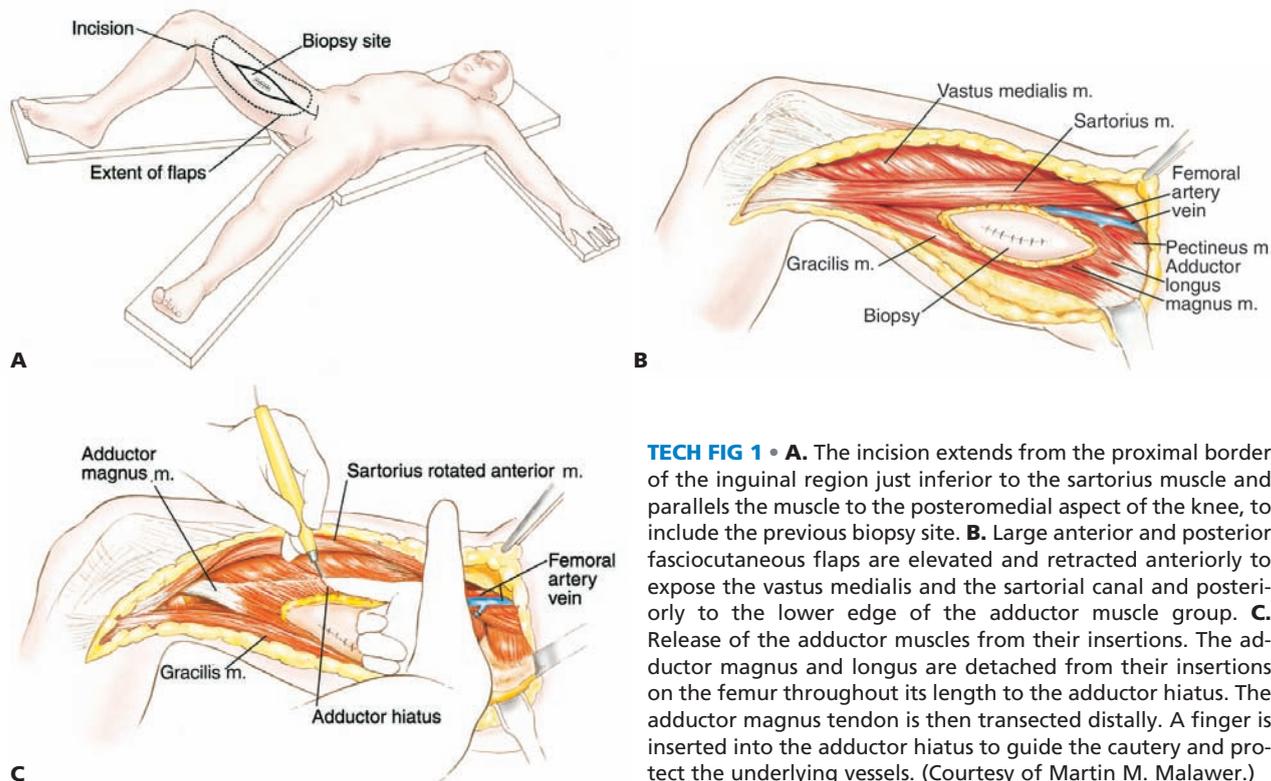
In the past, angiography was also used preoperatively to outline the course of the vascular bundle within the affected thigh and to assess the likelihood of vascular reconstruction. High-definition MR scans provide the same useful information.

INCISION AND EXPOSURE

- The incision extends from the proximal border of the inguinal region just inferior to the sartorius muscle and parallels the muscle to the posteromedial aspect of the knee to include the previous biopsy site (TECH FIG 1A). This incision permits large anterior and posterior flaps to be developed to visualize the vastus medialis, the sartorial canal, and the entire adductor compartment. The incision can be extended to expose the popliteal space medially if required. The superior extent may have to be T'd along the border of the inferior pubic ramus if there is a large soft tissue component extending to the obturator fossa and ischium.
- Large anterior and posterior fasciocutaneous flaps are elevated and retracted anteriorly to expose the vastus

medialis and the sartorial canal and posteriorly to the lower edge of the adductor muscle group (TECH FIG 1B). The biopsy site is left en bloc with the underlying adductor muscles.

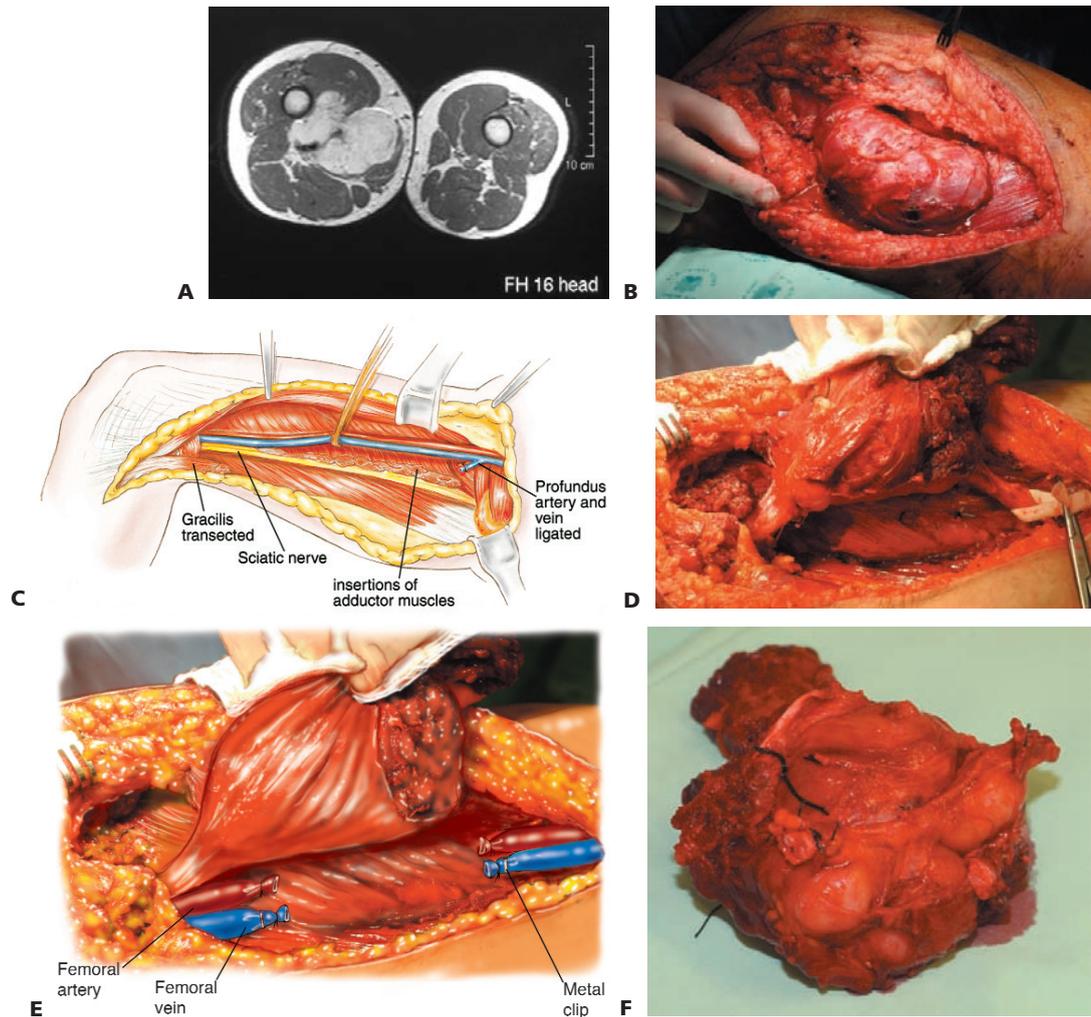
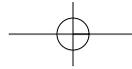
- The sartorius muscle is the key to the dissection of the entire muscle group. The sartorial canal is opened proximally to identify the common femoral artery before ligating the profundus vessels. The muscles are detached from their origin (superior and inferior pubic rami) and along the obturator foramen. The dissection continues from proximal to distal: the obturator vessels, then the profundus femoral vessels, are ligated and transected (TECH FIG 1C).



TUMOR RESECTION

- Low- and high-grade sarcomas, require en bloc removal of an overlying cuff of adductor musculature (TECH FIG 2A-C). Vascular involvement without a plane of dissec-

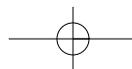
tion necessitates en bloc resection of the involved vascular segment (TECH FIG 2D-F).

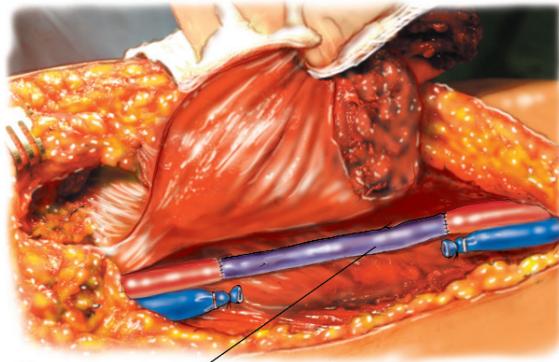


TECH FIG 2 • **A**. Axial MRI of the mid thigh showing a well-differentiated liposarcoma of the adductor compartment. **B**. The tumor is well encapsulated and can be safely removed with a narrow cuff of adductor musculature. **C**. Completion of tumor removal. The remaining structures to be transected are the insertions onto the distal femur, as well as portions of the gracilis muscle if required. The entire tumor is then removed and the wound is inspected. The superficial femoral artery and vein are inspected for any leaks. The cut edge of the muscles along the femur may be oversewn for hemostasis. If there is a large adductor tumor, occasionally a portion of the proximal medial hamstrings must also be removed en bloc. **D**. High-grade sarcoma of the adductor compartment extending into the superficial femoral vessels. Note the metal clip over the profundus femoral artery stump at the tumor bed. **E**. Blood vessels are suture-ligated and removed en bloc with the tumor. **F**. Gross surgical specimen. (**C**: Courtesy of Martin M. Malawer.)

VASCULAR AND SOFT TISSUE RECONSTRUCTION

- Resection of only a portion of the circumference of the artery for a short segment may be repaired by autologous vein patch. End-to-end anastomosis of a full circumferential resection is likely to be associated with considerable tension, and an interposition graft is required in those cases. Such reconstructions should be carried out with autologous tissue, primarily the greater saphenous vein (**TECH FIG 3**).
- It is best to use the vein from the contralateral thigh to preserve venous drainage as much as possible around the primary surgical site. This is particularly important if the femoral vein has to be ligated because of tumor extension around it or because of inadvertent injury. If the greater saphenous vein is inadequate or has been previously removed, the use of a prosthetic conduit is acceptable.
- An arm vein graft, although more time-consuming, is a better long-term solution. If the superficial femoral artery is chronically occluded, removal of the occluded segment is of no direct consequence. Careful intraoperative and postoperative evaluation of the profunda collaterals is mandatory; construction of a femoral





Vascular reconstruction
with vein graft

TECH FIG 3 • Vascular reconstruction with autologous greater saphenous vein.

- popliteal bypass is done at the first sign of calf and foot ischemia.
- Reconstruction of the superficial femoral vein after en bloc resection with the tumor is more controversial. It is time-consuming and associated with high failure rates, even when a prosthetic material is used. Ligation is therefore a valid option in most of these cases.
- Prophylactic calf fasciotomy is strongly advised if superficial femoral arterial reconstruction and venous ligation were done and compromise of the venous collaterals is anticipated.
- The sartorius muscle is mobilized to cover the vascular bundle. Fasciocutaneous flaps are closed with interrupted layers of sutures over suction catheters.

PEARLS AND PITFALLS

- Preoperative imaging of the entire adductor compartment and pelvic floor as well as detailed vascular evaluation
- Full exposure of the vascular bundle before tumor resection
- En bloc resection and reconstruction of affected vascular segments
- Prophylactic calf fasciotomy if arterial reconstruction and venous ligation were done

POSTOPERATIVE CARE

- Continuous suction is required for 3 to 5 days, and perioperative intravenous antibiotics are continued until the drainage tubes are removed. Full weight bearing is allowed as tolerated.

OUTCOMES

- Resections around the adductor compartment are usually associated with minimal loss of function. Limb edema, however, may occur in patients who had vascular reconstruction and venous ligation. Adjuvant radiation therapy also increases the likelihood of chronic limb edema, which can be managed with lymphatic drainage.
- Patients who require a vascular reconstruction have similar rates of local tumor control and systemic relapse compared with patients who have not. However, these patients have higher chances of wound complications and deep vein thromboses.¹

COMPLICATIONS

- Deep wound infection
- Vascular insufficiency
- Deep vein thrombosis
- Flap ischemia
- Local tumor recurrence

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