BACKGROUND

The posterior thigh (hamstring musculature) is the least common of the three compartments of the thigh for sarcomas to arise within. About 15% to 20% of the soft tissue sarcomas of the thigh arise within the posterior hamstring musculature. There is great variation in the size of tumors that occur in the posterior thigh, and the location varies from a proximal location near the ischium to a distal location involving the popliteal space. The posterior thigh is a quiet surgical area; the most significant structure is the sciatic nerve. Almost all low-grade sarcomas can be resected safely. Most high-grade sarcomas can be resected by either a complete or partial muscle group resection. The sciatic nerve is rarely involved, either because of direct tumor extension or because of a primary nerve tumor.

En bloc resection of the sciatic nerve with a malignant tumor of the posterior thigh rarely is done; this has traditionally been considered an indication for amputation. This approach was based on the belief that the expected motor and sensory loss around the leg and foot would result in an intolerable functional deficit and the development of pressure sores and, therefore, high rates of secondary amputation. However, it has been shown that limb-sparing resection of the sciatic nerve is associated with a good functional outcome in most patients who have this procedure. Most patients were ambulatory; all used a short-leg brace because of the peroneal nerve palsy, but only half required a walking aid (crutches or a cane).

ANATOMY

The posterior compartment consists of the semimembranosus, the semitendinosus, and the long and short heads of the biceps muscles. All of these muscles originate at the ischium and the linea aspera. No major artery is involved with this compartment.

The sciatic nerve is the most significant structure. It runs from the sciatic notch into the compartment from lateral to the ischium and divides the medial and lateral hamstrings. A thick sheath surrounds the nerve, acting as a barrier to direct tumor extension. Often tumors arise within one of the individual muscles of the posterior thigh or between the muscles. In most cases the sciatic nerve is displaced around an adjacent muscle.

INDICATIONS

Almost all low-grade sarcomas of the posterior thigh can be treated by partial or total resection of the involved muscle. High-grade sarcomas are treated by complete myomectomy of the muscle involved. If the tumor is extramuscular but still remains within the compartment, a partial muscle group resection is performed (FIG 1). Multiple muscles or the entire compartment can be resected instead of an amputation.

Contraindications for limb-sparing resections of the posterior compartment include:

- Extension into ischiorectal space: This makes the resection more difficult and may indicate the need for an amputation.
- Extension into the popliteal space with vascular compromise
- Femoral involvement with cortical destruction

IMAGING AND OTHER STAGING STUDIES

Preoperative evaluation must include the ischium, the ischiorectal space, the retroguttoal area, and the popliteal space for tumor extension. The most useful imaging studies are computed tomography (CT) and magnetic resonance imaging (MRI). Angiography is required only if tumor extends distally into the popliteal space (FIG 2).
FIG 2 • Axial (A) and coronal (B) MR images of a myxoid liposarcoma of the posterior thigh. The tumor is extramuscular, arising in the space between the medial and lateral hamstrings. Clinical picture (C) and axial MR image (D) of a high-grade neurofibrosarcoma of the posterior thigh in a patient with an underlying neurofibromatosis. Café-au-lait spots are present on the patient’s thigh. This is a primary tumor of the sciatic nerve and must be removed to obtain wide margins of resection.

Position and Dissection

The patient is placed in a prone position. A long midline incision is used. An ellipse of skin is outlined so that there is a 2-cm margin of skin around the old biopsy site. The skin flaps are dissected, with care being taken to taper the flaps as one encounters the lateral margins of the dissection. The medial extent of the dissection is the gracilis muscle, and the lateral extent is the iliotibial tract (TECH FIG 1A,B).
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HAMSTRINGS MUSCLE GROUP (POSTERIOR THIGH) RESECTION

TECH FIG 1 (continued). C. Fasciocutaneous flaps are created and retracted to expose the contents of the posterior compartment. The biopsy scar is left on the tumor. D. Muscles of the posterior compartment after skin flaps have been raised. E. High-grade neurofibrosarcoma of the sciatic nerve extending into the overlying medial and lateral hamstrings, which are removed en bloc with the tumor. F. Extramuscular liposarcoma of the posterior compartment. This tumor is surrounded by a well-defined capsule, which allows sparing of the adjacent hamstrings. The latter can therefore be retracted with the fasciocutaneous flaps to expose the tumor. (A, C, D: Courtesy of Martin M. Malawer.)

SKIN FLAPS AND EXPOSURE

- The medial (semitendinosus and semimembranosus) and lateral (long and short heads of biceps femoris) muscles are exposed (TECH FIG 1C). The extent of the dissection is determined by the location of the tumor, but it generally involves the long head of the biceps femoris, the semimembranosus, and the semitendinosus (TECH FIG 1D–F). It is possible for part of the lateral quadriceps mechanism to be included with the specimen.

- Likewise, one or more muscle bundles of the adductor muscle group may be included if this will afford a more generous margin. The three muscles mentioned, which originate from the ischial tuberosity, are superficial to the sciatic nerve. With a tumor-free margin of resection on a tumor-free plane superficial to the posterior limits of this compartment, it is clear that the next adjacent structure is the sciatic nerve itself.

TUMOR REMOVAL

- Benign and low-grade extramuscular tumors can be removed with their enveloping capsule (TECH FIG 2A). High-grade sarcomas or tumors that involve muscles of the posterior compartment, however, require en bloc muscle resection.

- Dissection begins by exposing the ischial tuberosity. It is easily identified on the skin surface. The hamstring muscles are released at their origin from the ischial tuberosity (TECH FIG 2B). Traction is then placed on the muscle group, which is secured with a clamp. Blood ves-
The extramuscular liposarcoma shown in Techniques Figure 1F can be safely removed without adjacent muscle tissue. Dissection and release of the hamstrings origin is the first stage of tumor removal. Tumor mass and enveloping muscles are elevated from the sciatic nerve and the base of the compartment by blunt and sharp dissection. Tendinous insertion of the biceps femoris muscle on the lateral aspect of the thigh is transected. Sciatic nerve is grossly surrounded by high-grade sarcoma of the posterior compartment. No plane of dissection exists, and resection of the sciatic nerve is mandatory to achieve wide margins of resection. Tendinous insertion of the medial hamstrings is transected. (B–D,F: Courtesy of Martin M. Malawer.) (continued)
TECH FIG 2 • (continued) G. Photograph of the posterior thigh after resection of an extramuscular liposarcoma. Posterior thigh musculature is preserved and retracted, and the tibial and common peroneal nerves are seen underneath. H. Posterior thigh after en bloc resection of a high-grade sarcoma with the overlying muscles and the sciatic nerve; only the semimembranosus muscle is left in the surgical field.

WOUND CLOSURE

- The superficial fascia and skin are meticulously closed. Generous suction drainage is applied. The suction drains should not exit through the skin flaps, but just above the gluteal crease (TECH FIG 3).

PEARLS AND PITFALLS

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POSTOPERATIVE CARE

- A short-leg brace is applied and passive range-of-motion exercises are practiced immediately after surgery to avoid Achilles tendon shortening. 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

- Function after posterior thigh resection is almost normal: knee flexion is maintained by the remaining sartorius, gracilis, and gastrocnemius muscles.
- Most patients who underwent en bloc resection of the sciatic nerve with a tumor of the posterior thigh were ambulatory; only half required a walking aid.1 All used a short-leg
brace because of the loss of the peroneal nerve. Padded shoes are used to prevent pressure sores.

- Although all patients have an anesthetic ipsilateral foot, phantom limb pain, causalgia, pressure sores, and secondary amputation have not been documented. It seems that patients who had resection of the nerve at a lower anatomic level have better functional outcomes than patients whose resections involved a higher level. A possible explanation is that the innervation to the semimembranosus, semitendinosus, and long head of the biceps femoris is preserved in lower-level resections.

**COMPLICATIONS**

- Deep infection
- Flap ischemia and necrosis
- Sciatic nerve partial to complete dysfunction
- Local tumor recurrence

**REFERENCES**