Above-knee Amputation

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OVERVIEW
Above-knee amputation is most often performed for advanced soft-tissue sarcomas of the distal thigh and leg, or for primary bone sarcomas of the distal femur and proximal tibia. It is usually indicated because of major involvement of the main neurovascular bundle or the presence of an extensive involvement of the soft tissues. Above-knee amputations may be performed through the distal aspect of the femur (supracondylar), the middle section of the femur (diaphyseal), or just below the lesser trochanter (high above-knee).

The clinical and surgical considerations surrounding above-knee amputations, as well as details of the surgical technique, are described in this chapter. Emphasis is on flap design and meticulous dissection, use of continuous epineural analgesia, myodesis of the major muscle groups to the distal femur, meticulous wound closure, and application of a rigid dressing.
INTRODUCTION

Until recent decades, lower-extremity amputation was the standard method of treatment for most soft-tissue and bone sarcomas. Since then, better understanding of the biological behavior of these tumors and advances in surgical technique, bioengineering, radiographic imaging, radiotherapy, and chemotherapy have led to the advent of limb-sparing surgery. Preoperative chemotherapy, given via the intravenous or intra-arterial route or using isolated limb perfusion, has been found to reduce tumor size, cause significant tumor necrosis, and make previously unresectable tumors amenable to limb-sparing procedures. Limb-sparing surgery is now the standard of care for bone and soft-tissue sarcomas of the extremities and is performed in approximately 90% of all cases (Figure 22.1). All patients must be considered and evaluated for limb-sparing surgery, and the decision to proceed with an amputation should be made on a case-by-case basis. Such decisions are based on local anatomic considerations, tumor grade and stage, and consideration of the functional and psychological impact of the procedure.

GENERAL INDICATIONS FOR LOWER EXTREMITY AMPUTATION

Considerations and indications to be borne in mind when deciding whether amputation is advisable are as follows:

1. **Local recurrence** was once considered a primary indication for amputation; however, local recurrence of a soft-tissue sarcoma has now been shown to have a minimal impact on patient survival. The capability to resect the recurrent tumor without compromising the function of the extremity should, therefore, be the determining factor on which the decision to amputate is based. Although the applicability of these findings to primary bone sarcomas is questionable, most orthopedic oncology centers treat local recurrence of a primary bone sarcoma in the same manner, and the mere presence of a recurrent tumor is not an indication for an amputation (Figure 22.2).

2. **Major vascular involvement**. Invasion of a major blood vessel by a sarcoma is generally indicative of a poor prognosis. In the past the increased morbidity of a limb-sparing surgery with a vascular graft made amputation the procedure of choice in most of these cases. Because of the availability of reliable vascular grafts, vascular involvement per se is no longer an indication for an amputation. It is the concomitant involvement of a major nerve and the expectation that function of the extremity will be poor that rule out the possibility of limb-sparing surgery.

3. **Major nerve involvement** often occurs within the popliteal space. In general, one nerve may be removed, but a two-nerve deficit results in a poorly functioning extremity. Most patients with such a deficit who have undergone a limb-sparing procedure report that a useless extremity is worse than no limb at all. Nerve involvement is usually combined with a major vascular involvement, and the combination of the two makes amputation the recommended treatment.

Amputations are rarely performed for extensive, neglected benign lesions. In these cases it is the extensive bone destruction, lack of soft tissues for reconstruction, and neurologic compromise that indicate the need for amputation (Figure 22.3).

4. **Soft-tissue contamination** as a result of pathologic fracture through a bone sarcoma or of a poorly performed biopsy was also once considered an indication for amputation. The efficacy of the current chemotherapy regimens makes the limb-sparing procedure a safer option in minor cases of contamination; however, the extent of soft-tissue resection and flap design often have to be modified. Magnetic resonance imaging (MRI) allows one to evaluate the full extent of a hematoma and plan a limb-sparing procedure. Amputation is usually inevitable in extensive hematomas.

5. **A poorly planned biopsy** can interfere with limb-sparing surgery. The biopsy incision and tract are assumed to harbor tumor cells, and therefore have to be excised en-bloc with the primary tumor and with the same wide margins. The diameter of the biopsy tract and the associated hematoma determine the extent of soft-tissue resection. Amputation is indicated if, following excision of the biopsy tract, the viability of the muscle flaps or function of the extremity would be significantly impaired. Core needle biopsies are strongly recommended in the evaluation of soft-tissue and bone lesions. The hazards of the recommendations for execution of a musculoskeletal tumor biopsy are discussed in Chapter 2.

6. **Infection**, either superficial or deep, is usually the result of tumor ulceration through the skin or infection at the biopsy site. It may negate the possibility of limb-sparing surgery, especially if prosthetic materials will be used. In addition, an infection will impair the ability to administer adequate preoperative and postoperative chemotherapy. Limb-sparing surgery is feasible only if the infection is completely controlled prior to surgery, or if the infected tissues can be completely removed at surgery.

7. **Skeletal immaturity** is still considered a major problem because significant leg-length discrepancy may occur following limb-sparing surgery that involves a