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# Management of Soft Tissue Sarcoma after Microsurgery

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**Abstract**

Sarcoma is a tumor of mesenchymal origin with great variation in anatomical location. Sarcoma affecting bone often requires an interdisciplinary approach to resection and reconstruction. However, as limb salvage is only a secondary goal of tumor surgery, it is important that micro reconstruction strategies do not adversely affect tumor safety and overall survival. There is a high demand for safe and functional treatment of soft tissue and bone sarcomas. Primary reconstruction of sarcoma-related defects using microsurgical techniques allows limb-sparing and adequate oncosurgical cancer treatment without increasing the risk of local recurrence or prolonged hospitalization. Treatment of sarcoma patients should be limited to large centers with experienced plastic surgeons integrated into a holistic treatment concept.

**Keywords:** Sarcoma; Reconstruction; Cancer; Treatment

## Introduction

Sarcoma is a rare and complex tumor arising from tissue of mesodermal origin. Sarcoma is not confined to a specific anatomical site because mesoderm forms smooth and skeletal muscle, connective tissue, fat, and synovial tissue. Although this highly diverse group of malignancies accounts for less than 1% of all adult malignancies, the current WHO Classification of Diseases and Tumors classifies sarcomas into over 100 histologic subtypes doing [1]. Therefore, the diversity of localization and histologic findings presents a major challenge for treating surgeons.For most subtypes [2]; the mainstay of treatment is surgical resection of the sarcoma. Innovations in reconstructive surgery and interdisciplinary therapy have recently led to safe limb-sparing cancer treatments with amputation rates of less than 10%. Improved reconstruction options incorporated into multimodal therapy increased limb survival to over 95% [3]. Moreover, recent studies have evoked a paradigm shift in surgical margins for soft tissue sarcomas, yielding long-term reliable results in limited sarcoma resections. If primary closure cannot be achieved after tumor resection, microsurgical reconstruction with free tissue transplantation allows for adequate soft tissue coverage and preservation of limb function [4].

At the University Hospital of Freiburg, Germany, patients with localized soft tissue sarcoma are primarily treated by plastic and hand surgery. Most patients with bone or soft tissue sarcomas involving bone require multidisciplinary surgical intervention and are therefore treated with orthopedic and trauma surgery departments. Optimizing all aspects of cancer care (neo) adjuvant and intraoperative radiotherapy or chemotherapy, each case will be discussed in a multidisciplinary tumor committee [5].

Surgical resection with limb sparing has become the standard of care in the management of soft tissue sarcomas of the extremities. His current MRI technique allows full assessment of tumor extent, compartment location and proximity to neurovasculature [6]. This provides surgeons with detailed knowledge of the expected tolerance for preoperative planning of surgical access and the use of adjuvant therapy. The addition of preoperative radiation has also enabled further efforts in limb-sparing surgery [7]. Because radiation theoretically sterilizes the reaction zone around the tumor, it has been shown that marginal resection when required near critical structures can be safely performed without compromising local control rates. If radiation therapy is given after surgery, the tumor bed should be clamped with metal clamps to allow for more precise radiation therapy.

The surgical procedure should begin with careful preoperative planning using MRI to map the desired resection plane. Skin incisions should be made longitudinally along the course of critical neurovascular structures to allow for proximal and distal extension as needed [8]. A wide oval of normal tissue surrounding the biopsy should remain contiguous with the tumor. This will remove any malignant cells that may remain in the biopsy tube. Care should be taken to lift the full-thickness flap to include the underlying fascia to preserve blood supply as much as possible. Otherwise, the flap should be as thick as oncological principles allow to minimize the risk of marginal wound necrosis. Similarly, surgeons should avoid using forceps on skin edges, especially after chemotherapy or radiation therapy. Dissection should then be performed around the tumor, leaving a cuff of normal tissue until the depth of the planned deep resection margin is reached. At this point, the tumor is deeply recruited at one end and lifted under tension until released [9]. If a tourniquet is used, it must be retracted prior to closure and hemostasis achieved prior to closure. It is recommended to leave at least one deep suction drain in place for all but the smallest tumors. Large hematomas and seromas contribute to postoperative wound complications. The drain should come out along the skin incision if possible in case an amputation is needed later [10]. They are typically left until the yield is less than 30 milliliters per 8 hour shift. The skin is closed in layers with appropriate sutures for each wound. This should be taken into consideration as the risk of these injuries is high and sutures may need to be left in place for an extended period of time [11]. Again, care should be taken not to squeeze the edge of the wound with the forceps.

## Outcomes of Limb-Sparing Surgery Combined with Radiation

As described in the radiation section of this review, the local control rate for soft tissue sarcoma combined with radiation is >90%.

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A University of Florida series has shown that preoperative radiation equates to a postoperative local control rate of 95%, even when marginal margins are required to promote functional limb preservation. . Although this was not the primary endpoint of their study, O'Sullivan et al. Their randomized controlled trial showed that there was no significant difference in local control or distant metastases when patients were treated with preoperative and postoperative radiotherapy [12]. However, this group showed a high probability of late radiation sequelae such as dermal fibrosis, edema, joint stiffness and fractures in arms treated with postoperative radiation. Based on this evidence, our institution prefers to treat soft tissue sarcomas with preoperative radiation followed by surgical resection.

## Management of Unplanned Excision

The mistaken removal of a tumor assuming it is benign is called an unplanned resection. It is estimated that up to 90% of subcutaneous sarcomas are initially treated with unplanned excision. Approximately 49% to 59% of sarcomas treated with unplanned resection have residual tumor [13]. These patients should undergo re-excision of the tumor bed, and adjuvant radiation therapy should be considered depending on tumor grade and marginal histologic status at the time of re-excision. Although there is no apparent impact on patient overall survival, the presence of microscopic residual disease is a risk factor for local recurrence, and the risk of recurrence is higher than in patients treated with primary wide excision. Many of these patients require a skin graft or flap to cover the soft tissue due to extensive resection of the tumor bed. On the other hand, primary occlusion was possible if appropriate oncological techniques were used first.

## Surveillance

After definitive treatment of soft tissue sarcoma, patients should be closely monitored for the possibility of local recurrence or metastasis. For local recurrence, we prefer to monitor the site through regular patient self-examination and physical examination of the surgical site at regular intervals. If the physical examination raises concerns or if the patient is at particularly high risk of local recurrence, MRI with or without gadolinium contrast is indicated to assess the potential for local recurrence.

Since most metastases are likely to occur in the lungs, monitoring with regular chest CT scans is necessary. For high-grade sarcoma, chest CT scan every 3 months for his first 2 years after surgery, every 4 months for his 3rd year, every 6 months for his 4th year and her 5th year is recommended. At the patient's and doctor's request, an annual chest x-ray can be performed [14]. For low-grade sarcoma, it makes sense to selectively use her CT scan for high-risk patients and chest x-ray for those with low risk of metastasis.

Five-year overall survival is poor for patients with metastatic soft tissue sarcoma. In patients with lymph node metastases, the 5-year overall survival rate has been estimated at 23-59%. On an individual basis, the prognosis of metastatic lymph node disease depends on the time of appearance of metastatic disease, with improved prognosis in patients with metachronous rather than synchronous metastases. Pulmonary metastases from soft tissue sarcoma have a 5-year survival rate of approximately 10% or less in untreated patients for metastases. Five-year survival increases to approximately 15–52% for patients who develop pulmonary metastases after a disease-free interval and metastatic lesions suitable for complete resection [15]. Favorable prognostic indicators are a single pulmonary metastasis, disease-free interval of ≥12 months, and negative surgical margins upon removal of metastases. For this reason, aggressive treatment with excision or other resection procedures such as stereotactic radiosurgery is recommended when metastasis presents as a single or several discrete lesions after a prolonged disease-free period.

## Conclusion

Soft tissue sarcomas represent a wide variety of malignancies and appropriate treatment begins with an appropriate staging examination followed by a carefully planned and well-executed biopsy. Biopsy and subsequent treatment should ideally be performed at a sarcoma center. Treatment plans should be developed in an interdisciplinary framework that includes input from surgeons, medical oncologists, radiation oncologists, radiologists, and pathologists. Limb-sparing surgery is standard treatment. However, there are situations where disconnection is necessary or preferred. Radiation therapy combined with surgical resection is highly effective in achieving local control. Although the use of chemotherapy is evolving, it is currently poorly defined. Patients should be closely monitored for local recurrence and metastasis after disease is resected.

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