MINI-REVIEW

Unplanned resection of soft tissue sarcoma

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Abstract Unplanned surgery of a soft tissue sarcoma is defined as the gross removal of a tumor without appropriate preoperative imaging, biopsy, or attention to the wide surgical margin. Referrals after unplanned surgery account for between 14.7% and 53% of new patients in sarcoma centers. Treatment includes multiple modalities. It has been reported that 35–74% of residual sarcomas are found in reexcised specimens. Therefore, additional reexcision is typically warranted to remove the residual tumor and obtain an adequately safe margin. Adjuvant radiotherapy is generally used if the sarcoma is large, high grade, and deeply located. Adjuvant chemotherapy remains controversial because of its marginal benefits. A recent study indicated that adjuvant chemotherapy, an ifosfamide/epidoxorubicin protocol, showed 19% improvement in overall survival at 4 years. Therefore, adjuvant chemotherapy should be reserved for patients with a large, high-grade, localized lesion, and stage-IV disease. Unplanned surgery of high-grade sarcomas has resulted in increased rates of local recurrence but not disease-specific survival. Adequate additional reexcision may improve local control and survival. To avoid unplanned surgery of soft tissue sarcomas, guidelines have been recommended for clinicians to increase their awareness of the clinical features that suggest malignancy in any soft tissue lump.

Keywords

local recurrence; soft tissue sarcoma; unplanned excision

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1. Introduction

Soft tissue sarcomas (STSs) are rare and heterogenic primary malignant tumors. They originate from the mesoderm and comprise < 1% of adult malignancies and 15% of all pediatric malignancies. Because of the rarity of this disease, patients and physicians are often unaware of the involved tumor, thus delaying diagnosis and initial proper treatment. In addition, most general surgeons may not be familiar with the advanced multidisciplinary management. Therefore, hasty biopsy and unplanned surgery before referral frequently complicate the subsequent definite surgery and lead to a poor clinical outcome.

Unplanned surgery is defined as an operation undertaken for any excision of STSs without appropriate preoperative imaging, biopsy, or attention to the wide surgical margin. Once unplanned surgery has been performed, the margin of reexcision must be more extensive than the standard wide margin. This may necessitate soft tissue reconstruction and result in a longer operation time, complications, and functional loss.

Referrals after unplanned surgery account for between 14.7% and 53% of new patients in sarcoma centers. Even if there is no gross evidence of disease from clinical examination or contrast-enhanced magnetic resonance imaging (MRI), 35–74% of residual sarcomas have been found in the reexcised specimen. Reexcision is generally warranted to remove the residual tumor or obtain an adequately safe margin. Numerous reports have addressed clinical problems that could occur after initial unplanned excision. However, considerable controversy exists regarding the criteria of reexcision and the sequencing of radiation and surgery.

2. Inappropriately executed biopsy

Biopsy is the first step in the diagnosis of STSs. Without appropriate planning, poorly performed biopsy or the malposition of drainage often compromises the subsequent local management of STSs. A transverse incision in the extremities, a common error for an unexperienced surgeon, typically results in a more extensive excision or the need for a flap reconstruction. Therefore, a transverse incision for biopsy is absolutely contraindicated.

On the basis of biopsy diagnosis and definitive diagnosis, Mankin et al reported an error rate of 17.8% in 597 patients. Of these 106 erroneous diagnoses, 81 (76%) were considered major errors and two-thirds occurred at referring institutions. When the biopsy was performed in a referring institute, the errors, complications, and dismal results were from two to 12 times greater compared with the biopsy performed in a sarcoma center. In addition, a 16% unnecessary amputation rate and 10% mortality rate were attributed to the complications of hasty biopsy. Therefore, although the biopsy is not a technically demanding procedure, it should be performed by the surgeon who will perform the definitive excision for the patient. Moreover, adhering to certain guidelines of the biopsy for extremity STSs is crucial (Table 1).

3. Evaluation after referral

Evaluating a referred patient consists of a physical examination, MRI of the tumor bed, computed tomography of the chest to determine the presence of metastases, and a complete review of the clinical data provided from the referring surgeon. Moreover, the original histologic material should be reviewed by an experienced musculoskeletal pathologist to confirm the diagnosis of STS. Determining the presence of a residual tumor after unplanned surgery remains challenging. Noria et al reported a 42% residual tumor rate in 65 patients who presented no gross evidence of a tumor from physical examination or MRI. Moreover, Manso et al reported that MRI may have a false-negative rate of 25%. Chandrasekar et al suggested several clinical parameters for determining the increased rates of a residual tumor, including tumors that are high grade, > 5 cm, and deep to the fascia.

After multidisciplinary evaluation, a treatment program is individually formulated with reexcision, adjuvant radiotherapy (RT), or chemotherapy, and soft tissue reconstruction if indicated.

4. Does unplanned surgery always require reexcision?

The reported rate of resection has varied from 35% to 100%, with the residual tumor rate ranging from 24% to 74%. According to the definition, for the patients presenting after unplanned surgery where margin is uncertain or positive, reexcision is generally recommended.

RT alone without additional excision was occasionally indicated in patients who were either medically inoperable or in whom further surgery would increase morbidity. Bell et al reported a 50% local control (LC) rate for patients who were received RT only without reexcision following unplanned surgery. Zagars et al, 371 of 666 patients who could not receive reexcision because of various reasons underwent RT only at a total dosage of 60–70 Gy. The 15-year LC, disease-free survival, and distant metastasis-free survival rates were 73%, 48%, and 64%, respectively. The results were less favorable compared with the group that underwent reexcision with postoperative RT.

Once unplanned surgery has been performed, the surgical margin of reexcision must be more extensive than the initial margin.

5. Reexcision timing

The mean interval from the initial unplanned surgery to reexcision varies from 36 days to 108 days. Delay of a reexcision theoretically allows the proliferation of residual tumor cells, thus increasing the likelihood of local recurrence. Patients’ delay was presumed to be one of the main reasons. Patients are recommended to receive reexcision as soon as possible, ideally within 3 weeks after the unplanned surgery. However, delaying reexcision could improve wound healing and prevent wound complications.
In addition, increased fibroblastic scar formation could capture the tumor cell and provide a more defined margin, thus allowing more effective LC. Han et al. reported that any influence of delayed remargin surgery is likely to be of minor clinical importance.

6. Adjuvant radiotherapy and chemotherapy

RT would not be recommended for patients without a residual tumor after reexcision or for patients with a low-grade STS with a negative margin. Adjuvant RT is generally used if the sarcoma is large, high grade, and deeply located. Most series have used at least selective adjuvant therapy after reexcision for high-risk patients following unplanned surgery. RT can be administrated prior to, during, or following the reexcision. Regarding the sequencing of RT and reexcision, substantial controversy exists. The differences between preoperative RT and postoperative RT are quality and the timing of toxicity. In addition, preoperative RT has theoretical advantages such as producing less radiation at a lower dosage, sterilizing the reactive zone, avoiding tumor hypoxia, and reducing radiosensitivity. However, increased wound complications are a major concern in preoperative RT. Postoperative RT does not interfere with the pathological evaluation of the residual tumor and avoids increasing the risk of wound complications. However, postoperative RT may result in greater long-term toxicity including fibrosis, edema, bone fracture, and functional impairment.

Adjuvant chemotherapy remains controversial because of its marginal benefits. A recent study indicated that adjuvant chemotherapy, an ifosfamide/epidoxorubicin protocol, showed 19% improvement in overall survival at 4 years. Therefore, adjuvant chemotherapy should be reserved for patients with a large, high-grade, localized lesion, and stage-IV disease.

7. Impact of unplanned surgery on prognosis

Several studies have investigated the disease-specific survival, metastasis, and local recurrence rates of patients who underwent unplanned surgery of STSs. Variable outcomes have been reported from several sarcoma centers. Ueda et al. found that the local recurrence rate was higher in patients who received unplanned surgery than those who received successful primary wide excision. Fiore et al. analyzed 597 consecutive patients with primary STSs. Of the 597 patients, 318 were referred after unplanned surgery and the remaining 279 patients underwent primary resection. The 10-year cumulative incidences in the reexcision and primary-operated groups were respectively 18.7% and 16.4% for local recurrence, 17.6% and 20.2% for metastasis, and 20.4% and 22.4% for mortality. The outcome of patients who underwent reexcision was similar to that of patients who had primary resection. Hoshi et al. reported that the 5-year overall survival was 76.3% and the outcomes were almost equivalent to those in previous reports. They addressed the significant role of wide reexcision in improving the outcome of unplanned resection compared with inadequate treatment without reexcision.

Chandrasekar et al. found that despite reexcision, the risk of local recurrence remains high. The risk is doubled when a residual tumor is present in reexcised specimens and for high-grade tumors, marginal reexcision, and deep-seated tumors.

8. Conclusion

In contrast to other orthopedic fields, a disease encountered in musculoskeletal oncology could be life threatening. Most soft tissue tumors are not malignant, and STSs are often misdiagnosed clinically as benign lesions (e.g., lipoma, hemATOMA, and lymph nodes). The relatively higher incidence rates of local recurrence and amputation in the unplanned surgery group emphasizes the importance of referrals and preventing iatrogenic mistakes such as hasty biopsy and margin-positive primary resections. To avoid unplanned surgery of STSs, guidelines for clinicians to increase their awareness of the clinical features that suggest malignancy in any soft tissue lump are recommended. The more clinical features are present, the greater is the risk of malignancy. On excision of any soft tissue tumor, surgeons should be aware of the potential risk

### Table 1 Guidelines for incisional biopsy for extremity soft tissue sarcoma.

- For a small longitudinal incision, the biopsy tract should not transverse the normal musculoskeletal compartment or neurovascular bundle.
- Transverse incisions are contraindicated.
- Avoid crushing or distorting the texture of the specimen.
- Obtain a frozen section to determine the adequacy of the specimen.
- Use meticulous hemostasis.
- Use drainage if necessary. The port of entry must be positioned in proximity to & along the planned incision of the definitive surgery, not its sides.
- Close the wound carefully to prevent necrosis.

### Table 2 Red flag signs of soft tissue lumps.

- Mass size > 5 cm
- Rapid tumor growth
- Mass located deep to the fascia
- Painful lump
of erroneous management of malignancy. Education and standardization of the treatment for STSs are essential for avoiding unplanned surgery.

References