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Major wound complication risk factors following soft tissue sarcoma resection

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Abstract

Background and objectives: Wound-healing complications represent an important source of morbidity in patients treated surgically for soft tissue sarcomas (STS). The purpose of this study was to determine which factors are predictive of major wound complication rates following STS resection, including tumor site, size, grade, and depth, as well as radiotherapy and chemotherapy.
Methods: We reviewed 256 cases of STS treated surgically between 2000 and 2011. The primary outcome was occurrence of major wound complications post STS resection.
Results: Major wound complications were more likely to occur post STS resection with larger tumor diameters ($p = 0.001$), high grade tumors ($p = 0.04$), location in the proximal lower extremity ($p = 0.01$), and use of preoperative radiotherapy ($p = 0.01$). Tumors located in the adductor compartment were at highest risk of complications. We did not demonstrate a significant difference in complications rates based on method of closure. Diabetes, smoking, obesity, tumor diameter, tumor location in the proximal lower extremity, and preoperative radiotherapy were independent predictors on multivariate analysis.
Conclusions: There are multiple predictors for major wound complications post STS resection. A more aggressive resection irradiated soft tissues, combined with primary reconstruction, should be considered in cases with multiple risk factors.

Keywords: Humans; Postoperative complications/surgery*; Retrospective studies; Sarcoma/radiotherapy; Sarcoma/surgery; Wound healing

Synopsis
Retrospective review of 256 patients to determine risk factors for major wound complications post soft tissue sarcoma resection.

Introduction

Principles of treatment of soft tissue sarcomas (STS) include local and systemic control, as well as preserving maximal function of the limb and minimizing morbidity.[1,2] Resection with negative margins is the primary goal of surgical treatment. Amputations are reserved for cases in which the involvement of crucial anatomical structures precludes negative margins, or when limb conservation is likely to have an unacceptable functional outcome, and represent approximately 10% of cases.[3,1]

While the treatment of STS has considerably evolved in recent years, postoperative wound complications remain an important source of morbidity.[3–6] Wound complications include wound dehiscence, cellulitis, abscess, seromas, hematomas, and wound necrosis. These complications occur in up to 16–56% of cases.[6,7]

Radiotherapy is commonly used as an adjunct to surgery for high grade tumors. Side effects vary according to timing and dose of radiation, as well as volume of irradiated tissue.[3–5] Data suggests an important difference in major wound complication rates according to timing of radiotherapy with respect to surgery, with wound complications rates of 35% and 17% in cases treated with preoperative and postoperative radiotherapy, respectively.[4]

Proposed risk factors for wound complications following sarcoma resection can be subdivided into tumor

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characteristics, dose and timing of radiotherapy, wound closure method, undermining of skin flaps, residual dead space, duration of surgery, blood loss, and allogeneic blood transfusion quantity, as well as the host's comorbidities.[2,4,8] There is evidence of significantly higher rates of wound complications in the lower extremity,[2–4] especially in the proximal compartments of the thigh.[2] The lymphatic drainage system of the lower extremity, predominantly located in the adductor compartment, is particularly vulnerable during surgical dissection, leading to seromas as well as subsequent infections.[9] A study by Korah et al. concluded that anatomic tumor location was the most important risk factor for wound complications.[2] Data also suggests an increased risk of postoperative wound complications in relation to tumor size. Various studies have demonstrated this effect with tumor diameter greater than 8–10 cm.[2,4,7] Recently, Baldini and colleagues demonstrated an increase in wound complication rates when tumor proximity to the skin surface was equal to or less than 3 mm.[7]

Some studies have shown a significant protective effect of immediate free flap reconstruction in cases treated with preoperative radiotherapy, resulting in wound complications rates similar to those treated with postoperative therapy.[6,10,11] This effect can be attributed to the substitution of irradiated soft tissue for healthy soft tissue from a donor site, thereby optimizing soft tissue vascularization at the resection site.[10] Other studies show only a modest improvement in wound complications in this context.[4]

The purpose of this study was to review the predictive factors of major wound complications post STS resection and validate previously published work.

It is our hypothesis that the pattern of lymphatic drainage in the thigh is one of the principal factors behind the significant risk increase associated with STS in the proximal lower extremity.

Materials and methods

Study cohort

A retrospective review of all STS cases within a prospective database between 2000 and 2011 was carried out using the orthopedic oncology database of the main center. We identified 256 patients treated surgically for STS during this time period, including 254 adults and 2 minors of fifteen and nine years of age.

Endpoints

The primary end point was the presence of major wound healing complications following STS resection, defined for the purposes of our study as any wound complication requiring debridement and negative pressure therapy (NPT) applied on an outpatient basis, or a surgical intervention for wound repair, such as debridement, drainage of seroma or hematoma, or secondary wound closure. It is important to specify that patients with wound complications requiring deep persistent packing, as defined by O'Sullivan,[4] were all treated with debridement and negative pressure therapy, and were consequently included within the major complications group. We did not include cases of intravenous antibiotic therapy alone. The time interval between surgery and diagnosis of wound complications was also recorded. Patients were followed up every 3 months for 2 years, then every 6 months for 2 years, followed by yearly checkups until 10 years postoperatively.

Data collection

We recorded patient gender, height, weight, and comorbidities (smoking status diabetes, arterial hypertension, hypercholesterolemia, and obesity), as well as tumor site, size, depth, subtype, and grade. Obesity was defined as a body mass index equal or superior to 30 kg/m^2. Tumor site was subdivided into head and trunk, proximal versus distal upper extremity, pelvis, proximal versus distal lower extremity, and ankle and foot. In addition, specific identification of the adductor compartment of the thigh was noted. Tumor size was defined as the maximal cross-sectional diameter, according to the final pathological examination report, and stratified in three groups: less than 10 cm, greater or equal than 10 cm and smaller than 20 cm, or greater or equal than 20 cm. Tumor grade was split into low grade or high grade. Tumor depth was evaluated as deep or superficial to fascia, as well as by proximity to the skin, through magnetic resonance imaging, and stratified as less than or equal to 3 mm, or greater than 3 mm.

We then assessed adjunctive treatment methods, including dosage and timing of radiotherapy, as well as the use and timing of chemotherapy. Whether pre or postoperatively, the time interval between radiation therapy and surgery was noted. Lastly, we recorded whether the surgical wound was closed by primary closure, as opposed to any type of soft tissue reconstruction.

Data analysis

We performed Fisher's exact test to relate tumor grade and depth, as well as gender, radiotherapy, chemotherapy, and plastic surgery reconstruction, to our primary end point of major wound complications. Chi square analysis was used to evaluate the statistical relationship between grouped tumor size and major wound complications, as well as tumor site. Logistic regression was performed to evaluate the association between major wound complications and the independent variables of body mass index, delay of radiotherapy with respect to surgery, and ungrouped tumor size. Multivariate analysis was performed by logistic regression and included tumor diameter, site, and depth, preoperative radiotherapy, chemotherapy, and immediate plastic surgery reconstruction, as well smoking status,