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# Flap choice does not affect complication rates or functional outcomes following extremity soft tissue sarcoma reconstruction

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## KEYWORDS

Extremity soft tissue sarcoma;  
Reconstruction;  
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**Summary Background:** Flap reconstruction plays an essential role in facilitating limb preservation in patients with extremity soft tissue sarcoma (ESTS). However, the effect of flap choice on the rates of postoperative complications and functional outcomes has not been clearly established. This study directly compares the outcomes of free and pedicled flap reconstructions in patients with ESTS.

**Methods:** Two hundred sixty-six patients who underwent flap reconstruction following ESTS resection were included. Associations between flap type and complications were determined using logistic regression analyses. Functional outcome was evaluated using the Toronto Extremity Salvage Score (TESS) and the Musculoskeletal Tumor Society Scales (MSTS).

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**Results:** There was no significant difference between complication rates in the pedicled and free flap groups (32% vs. 38%,  $p = 0.38$ ). In the lower limb, pedicled flaps had complication rates similar to those of free flaps on univariate analysis (odds ratio [OR] = 1.12, 95% confidence interval [CI] = 0.56–2.26,  $p = 0.75$ ). Conversely, in the upper limb, pedicled flaps were associated with fewer complications on univariate analysis (OR = 0.31, 95% CI = 0.11–0.86,  $p = 0.03$ ), but this was not significant on multivariate analysis (OR = 0.45, 95% CI = 0.13–1.59,  $p = 0.22$ ). Obesity was a strong predictor of complications in the upper limb group on multivariate analysis (body mass index [BMI]  $\geq 30$  kg/m<sup>2</sup>, OR = 7.01, 95% CI = 1.28–38.51,  $p = 0.03$ ). There was no significant difference in functional outcomes between both flap groups in either upper or lower limbs.

**Conclusions:** Postoperative complications and functional outcomes for patients undergoing free and pedicled flaps are similar in ESTS reconstruction. Selecting the most suitable reconstructive option in each individual case is paramount to preserving function while minimizing postoperative morbidity.

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## Introduction

Soft tissue sarcomas are rare heterogeneous neoplasms that commonly involve the extremities. Historically, these patients were treated by amputation, but improvements in surgical techniques, radiological imaging, and adjuvant therapies have now made limb preservation possible in the majority of cases.<sup>1,2</sup> Multidisciplinary management of patients with extremity soft tissue sarcoma (ESTS) frequently involves both wide resection to achieve clear margins and (neo)adjuvant radiation to minimize local recurrence. In many cases, this results in extensive soft tissue defects that cannot be managed using simple wound closure or skin grafting techniques. Reconstruction using pedicled or free flaps is therefore often necessary to provide coverage of vital structures or prostheses and facilitate limb preservation.

We previously reported that although flap reconstruction increases the complexity of surgery, it does not significantly increase postoperative complication rates in patients with ESTS.<sup>3</sup> However, the effect of the choice of flap on postoperative morbidity has not been clearly established in this patient population. As free flaps require microvascular anastomosis, they may be perceived to be more complicated and therefore associated with higher risks of complications. On the other hand, pedicled flaps often involve extensive surgical dissection adjacent to the zone of tumor ablation, which might adversely affect functional outcomes. Reports on patients with extremity trauma suggest that postoperative outcomes of free and pedicled flaps are similar.<sup>4–6</sup> However, this may not necessarily be the case following ESTS resection, as the patient population is more heterogeneous and variables such as older age and comorbidities may affect outcomes.<sup>7,8</sup> In addition, adjuvant treatments such as chemotherapy and particularly neoadjuvant radiation must be considered in oncological reconstruction.<sup>9–11</sup>

This study compares the complication rates and functional outcomes of free and pedicled flap reconstructions in a large cohort of patients with ESTS at a single major tertiary referral center.

## Methods

Institutional Research Ethics Board approval was obtained for this study. Patients who underwent resection of a soft tissue sarcoma of the upper or lower extremity and required either free or pedicled flap reconstruction between January 2006 and January 2015 were identified from a prospectively maintained database at Mount Sinai Hospital, Toronto, Canada. Patient demographics (age, sex, body mass index [BMI], smoking status, and comorbidities), tumor characteristics (histology, location, stage, grade, depth, diameter, and volume), surgical details (primary or secondary resection, timing of reconstruction, and reconstructive technique), and adjuvant therapies (radiation and chemotherapy) were recorded from the database and retrospective chart review.

All postoperative surgical complications occurring within 120 days of surgery were recorded and categorized. Major complications were defined as those requiring return to the operating room (OR), intravenous antibiotics, or prolonged wound care beyond 120 days. Minor complications included those requiring oral antibiotics, nonsurgical management of seroma or hematoma, and wound care concluding within 120 days of surgery. Any complications that delayed delivery of adjuvant therapies were considered major.

Functional outcomes were assessed using three measurement tools: the Toronto Extremity Salvage Score (TESS) and the Musculoskeletal Tumor Society (MSTS) 87 and 93 rating scales. The TESS was specifically developed for extremity sarcoma patients and is a patient-reported outcome tool that measures performance on activities of daily living.<sup>12,13</sup> Twenty-nine items are rated from 0 to 5, with higher scores indicating better function. The MSTS87 is a physician-derived assessment that evaluates seven aspects of joint function (mobility, pain, stability, deformity, strength, functional, and emotional acceptance).<sup>14</sup> The MSTS93 is a more limb-specific measure also assessed by physicians, which includes six domains of function (pain, function, emotional acceptance, positioning, dexterity, and strength) to determine functional impairment.<sup>15</sup> The MSTS87 and MSTS93 systems both score each item from 0 to 5. The TESS and

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