Predictors of functional recovery among musculoskeletal oncology patients undergoing lower extremity endoprosthetic reconstruction

Aaron M. Gazendam, MD\textsuperscript{1,2}, Patricia Schneider, BSc\textsuperscript{1}, Mohit Bhandari, MD, PhD\textsuperscript{1,2}, Jason W. Busse, DC, PhD\textsuperscript{2}, Michelle Ghert, MD, FRCSC\textsuperscript{1,2}

On behalf of the PARITY Investigators

1. Division of Orthopaedic Surgery, McMaster University, Hamilton, Ontario, Canada
2. Department of Health Research Methods, Evidence, and Impact, McMaster University

Cover Letter: Young Investigator Award

I am currently a fourth-year orthopaedic surgery resident and will be undergoing a fellowship in musculoskeletal oncology at the University of Toronto in 2023-24. With respect to the current abstract, I was the lead author who conceived the idea, analyzed the data and wrote the abstract/manuscript.

Abstract

**Background:** Functional outcomes are important for oncology patients undergoing lower extremity reconstruction; however, there remains important knowledge gaps. We characterized patient reported function after surgery and identified predictors of postoperative function in musculoskeletal oncology patients undergoing lower extremity endoprosthetic reconstruction.

**Methods:** We acquired functional outcome data from the recently completed *Prophylactic Antibiotic Regimens in Tumor Surgery* (PARITY) trial; specifically, the 100-point Toronto Extremity Salvage Score (TESS) which was administered preoperatively and at 3, 6 and 12 months postoperatively. Higher scores indicate better physical functioning, and the minimally important difference is 11-points. We calculated mean functional scores at each timepoint after surgery and developed a logistic regression model to explore predictors of failure to achieve excellent postoperative function (TESS $\geq 80$) at 1-year after surgery.

**Results:** The 555 patients included in our cohort showed important functional improvement from pre-surgery to 1-year post-surgery (mean difference 14.9 points, 95% CI 12.2 to 17.6; $p<0.001$) and 64% achieved excellent postoperative function (Figure 1, Table 1). Our adjusted regression model found that poor (TESS 0-39) preoperative function (odds ratio [OR] 3.3, 95%CI 1.6 to 6.6); absolute risk [AR] 24%, 95%CI 8% to 41.2%), older age (OR per 10-
year increase from age 12, 1.32, 95%CI 1.17, 1.49; AR 4.5%, 95%CI 2.4% to 6.6%), and patients undergoing reconstruction for soft-tissue sarcomas (OR 2.3, 95%CI 1.03 to 5.01; AR 15.3%, 95%CI 0.4% to 34.4%), were associated with higher odds of failing to achieve an excellent functional outcome at 1-year follow-up. Patients undergoing reconstruction for giant cell tumors were more likely to achieve an excellent functional outcome postoperatively (OR 0.40, 95%CI 0.17 to 0.95; AR -9.9%, 95%CI -14.4% to -0.7%).

**Conclusions:** The majority of patients with tumors of the lower extremity undergoing endoprosthetic reconstruction achieved excellent function at 1-year after surgery. Older age, poor preoperative function, and endoprosthetic reconstruction for soft tissue sarcomas were associated with worse outcomes; reconstruction for giant cell tumors were associated with better post-operative function.

**Figure 1.** Changes in the TESS scores over time with points indicating means and error bars indicating standard deviations

PFR: proximal femur reconstruction, DFR: distal femur reconstruction, PTR: proximal tibia reconstruction
Table 1. TESS change scores over time.

<table>
<thead>
<tr>
<th>Functional Score</th>
<th>Mean Differences (95% CIs)</th>
<th>0–3 months</th>
<th>P-value</th>
<th>0–6 months</th>
<th>P-value</th>
<th>0–12 months</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TESS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>3.4 (0.7, 6.2)</td>
<td>0.015</td>
<td>10.0 (7.4, 12.6)</td>
<td>&lt;0.001</td>
<td>14.9* (12.2, 17.6)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>PFR</td>
<td>2.7 (-3.7, 9.0)</td>
<td>0.410</td>
<td>12.3* (6.1, 18.6)</td>
<td>&lt;0.001</td>
<td>16.6* (10.6, 22.6)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>DFR</td>
<td>7.1 (3.8, 10.5)</td>
<td><em>&lt;0.001</em></td>
<td>10.8 (7.5, 14.0)</td>
<td>&lt;0.001</td>
<td>16.5* (13.0, 20.0)</td>
<td><em>&lt;0.001</em></td>
<td></td>
</tr>
<tr>
<td>PTR</td>
<td>-7.0 (-13, -0.5)</td>
<td>0.034</td>
<td>4.8 (-1.1, 10.7)</td>
<td>0.11</td>
<td>8.2 (1.8, 14.6)</td>
<td>0.013</td>
<td></td>
</tr>
</tbody>
</table>

TESS = Toronto Extremity Salvage Score; CI = confidence interval; PFR = proximal femur reconstruction; DFR = distal femur reconstruction; PTR = proximal tibia reconstruction; *bolded* = statistically significant when evaluated with paired t-tests; *exceeds minimal important difference cut-off.