Pediatric and Adult Patients have Similar Functional Improvement after Endoprosthetic Reconstruction of Lower Extremity Tumors

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INTRODUCTION:

While the treatment of lower extremity bone tumors is similar between adult and pediatric patients, differences in functional and patient-reported outcomes are unknown. To date, there are no direct comparisons of outcomes between these two groups. Outcomes for lower extremity oncologic reconstruction have been challenging to study due to its low incidence and heterogeneity. The PARITY (Prophylactic Antibiotic Regimens in Tumor Surgery) trial is the largest prospective dataset assembled to date for patients with lower extremity bone tumors and presents an opportunity to investigate the differences in functional outcomes between pediatric and adult patients. In this study, a clinician-reported scale, MSTS-93, and a patient-reported measure of disability, the Toronto Extremity Salvage Score (TESS), were used to evaluate outcomes. The purpose of our study is to demonstrate if there is a difference in functional outcomes between pediatric and adult patients undergoing endoprosthetic reconstruction of lower extremity bone tumors. Secondarily, we aim to use these findings to help inform patients of their expected recovery after reconstruction.

METHODS:

As a secondary analysis of the PARITY study, patient details were acquired from the prospectively collected trial database. MSTS-93 and TESS questionnaires were administered preoperatively and 3, 6, and 12 months after surgery. Continuous outcomes between groups were compared using a Student's T-test and dichotomous outcomes compared using a Pearson's Chi square test.

RESULTS:

A total of 150 pediatric and 447 adult patients were included in our analysis. Pediatric patients were more likely to have primary bone tumor (146/150 vs. 287/447; p<0.001) and adjuvant chemotherapy (140/149 vs. 195/441; p<0.001). Reoperation rates were insignificant between the two (45/105 vs. 106/341; p<0.13). Pediatric patients had higher MSTS-93 (64.7 vs. 53.8; p<0.001) and TESS scores (73.4 vs. 60.4; p<0.001) at baseline. Pediatric patients scored significantly higher than adults on both MSTS-93 and TESS at nearly all follow-up visits, with the only insignificant difference on MSTS-93 at 6 months (74.4 vs. 71.0; p=0.12). By one year, pediatric patients continued to have higher MSTS-93 (82.0 vs. 76.8; p=0.02) and TESS scores (87.7 vs. 78.6; p<0.001). Despite these differences, both pediatric and adult patients demonstrated similar improvement from baseline to one year on MSTS-93 (mean differences 17.4 and 20.0; p=0.48) and TESS (mean differences 14.1 and 14.7; p=0.83).

DISCUSSION AND CONCLUSION:

Pediatric patients undergoing endoprosthetic reconstruction for primary bone tumors have better functional outcomes than adults at nearly all points in time. Both adults and pediatric groups improved on MSTS-93 and TESS scores on a similar scale throughout the course of treatment and to at least a minimally important difference by one year. Our study was limited by patient heterogeneity and the unclear ceiling effect in TESS and MSTS-93. These findings may guide patient expectations as they undergo endoprosthetic reconstruction of the lower extremity.

Table 1. Patient Characteristics

Characteristic	Pediatric Patients N = 150	Adult Patients N = 447	P-value
Age (SD)	15.6 (1.9)	49.6 (18.7)	<0.001
Gender			
Male	98	260	
Female	52	187	0.12
Location			
Femur	117	375	
Tibia	33	72	0.11
Diagnosis			
Primary Bone Tumor	146	287	
Soft Tissue Sarcoma	1	61	<0.001
Metastatic Bone Disease	0	56	
Giant Cell Tumor	3	43	
Preoperative Radiation	0/150	22/425	0.002
Preoperative Chemotherapy	129/150	158/447	<0.001
Muscle excised			
< 50cm^3	90	255	0.54
> 50cm^3	59	188	
Fascial tissue excised			
<5cm^2	125	360	0.46
>5cm^2	24	85	
Length of bone resected			
<10cm	17	55	0.89
>10cm	133	291	
Length of hospital admission (median, IQR)	5 (4, 7)	6 (5, 9)	<0.001
Reoperations	45/105	106/341	0.13
Adjuvant Chemotherapy	140/149	195/441	<0.001
Adjuvant radiation	8/149	35/441	0.36

Table 2. MSTS-93 and TESS Scores at Interval Follow-up

Study Outcome	Pediatric Patients N=146	Adult Patients N=421	Mean Difference (CI)	P-value
MSTS-93 at baseline	64.7 (23.2)	53.8 (30.5)	11.0 (5.2, 16.8)	<0.001
TESS at baseline	73.4 (22.3)	60.4 (28.8)	13.0 (8.3, 17.6)	<0.001
	N=127	**N=364**		
MSTS-93 at 3 months	64.7 (23.2)	59.4 (21.9)	5.1 (0.6, 9.6)	0.03
TESS at 3 months	73.7 (19.8)	65.3 (21.7)	8.3 (4.1, 12.6)	<0.001
	N=124	**N=334**		
MSTS-93 at 6 months	74.4 (22.2)	71.0 (21.2)	3.6 (-1.0, 8.0)	0.12
TESS at 6 months	81.5 (16.2)	73 (19.9)	8.4 (4.9, 12.1)	<0.001
	N=112	**N=308**		
MSTS-93 at 1 year	82.0 (20.2)	76.8 (19.8)	5.2 (0.9, 9.5)	0.02
TESS at 1 year	87.7 (14.7)	78.6 (18.2)	9.1 (5.3, 12.9)	<0.001
MSTS-93 score change from baseline to 1 year	17.4 (31.0)	20.0 (33)	-2.6 (-9.9, 4.6)	0.48
TESS score change from baseline to 1 year	14.1 (24.3)	14.7 (29.3)	-0.7 (-6.9, 5.5)	0.83