Long-term outcomes of local control procedures in peri-articular bone sarcomas of the knee – a report from the Childhood Cancer Survivor Study

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INTRODUCTION:

Short- and long-term outcomes after local control of pediatric lower extremity sarcomas are difficult to ascertain with large sample sizes. Utilizing the Childhood Cancer Survivor Study (CCSS) data we sought to ascertain, for pediatric patients with peri-articular bone sarcomas about the knee, 1) What are the long-term functional and psychological outcomes of surgical management? 2) What were the frequency of and indications for unplanned reoperations after local control, including subsequent amputation?

METHODS:

The CCSS is a longitudinal study of >38,000 North American pediatric cancer patients surviving more than five years from sarcoma diagnosis. We identified 281 patients had peri-articular knee tumors included in statistical comparisons between procedure groups. Data regarding tumor location, local control procedure (LCP), and unplanned secondary surgeries were collected. Follow-up surveys collected survivors' SF-36 mental and physical component scores (MCS and PCS)as measures of quality of life (QoL) and the Brief Symptom Inventory (BSI) for psychological well-being. Physical activity information was similarly self-reported, and unplanned surgical procedures within five years of diagnosis were abstracted from operative reports. Multivariable linear and proportional hazards regression models were used to compare outcomes among procedure groups while adjusting for confounding variables.

RESULTS:

272 patients (189 distal femur, 92 proximal tibia tumors) underwent above-knee amputation (AKA) (19%), rotationplasty (5%), or limb salvage with endoprosthetic (44%), allograft (26%), or allograft-prosthesis composite (APC) (6%) reconstruction. At 35.5 years mean follow-up, PCS for AKA and endoprosthesis were >5 points (the minimal clinically important difference, [MCID]) below the population mean, with rotationplasty 5 points above (p=0.045) (Table 1). All LCPs had MCSs similar to the population mean(p>0.05). The GSI differed among groups (p=0.044); rotationplasty had the best score.

Unplanned reoperations varied significantly; AKA and rotationplasty underwent the fewest (Figure). The proportion of unplanned amputations within five years of diagnosis were 0% (rotationplasty), 4.3% (allograft), 9.2% (endoprosthesis), and 17.6% (APC). Undergoing more reoperations was associated with lower odds of being physically active at most recent follow up (Table 2). Finally, patients with secondary (versus initial) amputations did not differ by PCS, MCS, GSI, or physical activity

DISCUSSION AND CONCLUSION:

In this long-term study of pediatric sarcoma LCP outcomes, MCS was similar among groups and the population mean, though PCS varied significantly. Variations in unplanned reoperations, including amputation, impacted activity levels.

Figure: The proportion of patients from each local control procedure who underwent specific numbers of subsequent unplanned surgeries.

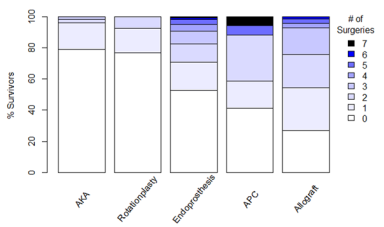

Table: Unadjusted means and standard deviations of SF-36 component scores and Brief Symptom Inventory tests, by local control procedure, and, logistic regression results for Meeting CDC Recommended Physical Activity Levels

Outcome	Peri-articular tumors of the knee N=272	AKA N=52	Rotationplasty N=13	EP N=120	Allograft N=70	APC N=17
SF-36 MCS Mean (SD)	49.5 (12.3)	48.5 (11.3)	53.9 (5.4)	50.7 (12.7)	49.3 (12.0)	49.1 (12.0)
SF-36 PCS * Mean (SD)	45.5 (11.6)	41.9 (12.9)	55.0 (3.8)	44.2 (11.1)	48.6 (11.5)	46.1 (10.8)
BSI Global Status Index †* Mean (SD)	47.0 (11.6)	50.6 (12.2)	44.2 (6.8)	46.1 (11.3)	45.3 (11.0)	50.9 (14.9)
Secondary amputation within 5 years	17 (6.0%)	---	0 (0)	11 (9.2%)	3 (4.3%)	3 (17.6%)

Outcome	Risk Factor	Category	Odds Ratio	Lower 95% Confidence Interval	Upper 95% Confidence Interval	P-value
Meets CDC Recommended Level of Physical Activity	Age at physical activity report	-	0.95	0.90	1.02	0.13
	Sex	Female	0.40	0.20	0.82	0.012
		Male	1.00	-	-	-
	Number of secondary surgeries	at least one secondary surgery	0.40	0.19	0.86	0.019
		no secondary surgery	1.00	-	-	-
	Local Control Procedure	Endoprosthesis	2.13	0.81	5.59	0.13
		Allograft	1.85	0.63	5.41	0.26
		APC	2.18	0.44	10.71	0.34
		AKA	1.00	-	-	-

AKA = Above knee amputation; EP = Endoprosthesis; MCS = Mental component score; PCS = Physical component score; BSI = Brief Symptom Inventory.
Minimum clinically important difference for SF-36 was 5, and the general population mean is 50.
* = Statistically significant group difference on multivariable analysis
† = Lower scores indicate better health status