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Various Factors Affecting Type of Surgery in Osteosarcoma Limb Salvage/Amputation

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ABSTRACT

The surgical treatment of osteosarcoma has historically been amputation/disarticulation. While there has been improvement in survival from inclusion of chemotherapy on the one hand, it has been paralleled by a shift of surgical treatment from amputation toward limb salvage surgery. This has led to a protocol of considering every patient for limb salvage surgery at all specialized centers. However, limb salvage should be considered in a patient only if the surgeon is reasonably confident that surgical excision of the tumor with wide margins is feasible, and that the expected function of the limb after limb salvage surgery will be better than ablative surgery in the form of amputation/disarticulation. Aim of this study is to determine the various factors that contribute to the type of surgery done in patients of osteosarcoma. There is a statistically no significant difference in the age gender distribution, staging and tumour volume between the two surgical treatment groups.

Keywords: osteosarcoma, amputation, disarticulation, limb salvage surgery

INTRODUCTION

Although rare, Osteosarcoma is the most common primary malignancy of the bone in children.[1] Osteosarcoma has a bimodal age distribution, with a first peak during the second decade of life and the second peak in older adults.[2] The surgical treatment of osteosarcoma has historically been amputation/disarticulation. As early as 1879, it was realized that the most ablative of surgeries will not result in cure of the vast majority of patients. It was not until 1970s that the role of chemotherapy in improving survival in osteosarcoma patients was established. While there has been improvement in survival from inclusion of chemotherapy on the one hand, it has been paralleled by a shift of surgical treatment from amputation toward limb salvage surgery. This has led to a protocol of considering every patient for limb salvage surgery at all specialized centers. However, limb salvage should be considered in a patient only if the surgeon is reasonably confident that surgical excision of the tumor with wide margins is feasible, and that the expected function of the limb after limb salvage surgery will be better than ablative surgery in the form of amputation/ disarticulation. Limb preservation surgery can be complex. Perhaps the most complicated and potentially life altering decision involves choosing the type of surgical procedure that will balance maximum potential for cure with an acceptable aesthetic outcome, long term mobility and quality of life. There are number of treatment options for reconstruction, these include manufactured endoprosthetic devices, bulk allografts, biological constructs or combination of these elements. Theoretically, limb preservation increases the rate of local recurrence, but in experienced hands it can be performed with little or no increase in local recurrence compared to amputation.[3]

Today most osteosarcoma patients receive neoadjuvant chemotherapy followed by surgical resection and a regime of chemotherapy post-operatively.[4] This article reviews the current status of surgical treatment of osteosarcoma. Aim of this study is to determine the various factors that contribute to the type of surgery done in patients of osteosarcoma.

MATERIALS & METHODS

This article reviews the current status of surgical treatment of osteosarcoma. Aim of this study to determine the various factors that contribute to the type of surgery done in patients of osteosarcoma. Prospective analysis of 25 biopsy proven cases of Osteosarcoma patients retrospectively.

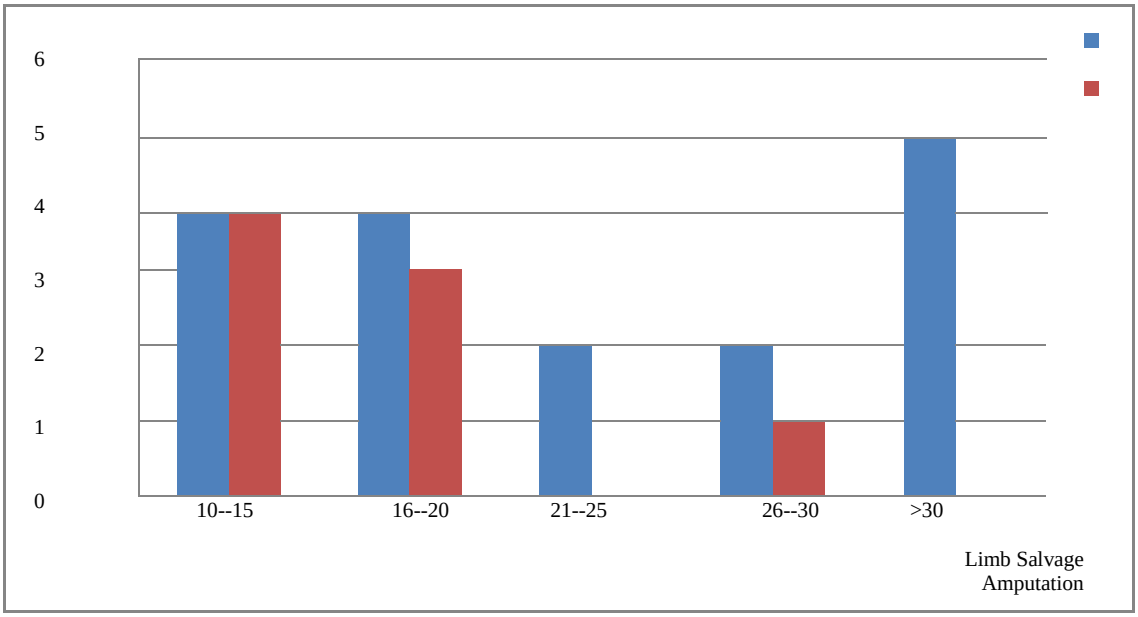
RESULT

AGE

The age wise distribution between the limb salvage surgery and amputation was calculated.

Table 1: Age group wise distribution between Limb Salvage Surgery and Amputation

Age groups in years	Limb salvage group		Amputation group		Total patients	
	Number in group	Percentage in group	Number in group	Percentage in group	Total Number	Percentage
10-15	4	23.5%	4	50%	8	32%
16-20	4	23.5%	3	37.5%	7	28%
21-25	2	11.8%	0	0%	2	8%
26-30	2	11.8%	1	12.5%	3	12%
>30	5	29.4%	0	0%	5	20%
Total	17		8		25	

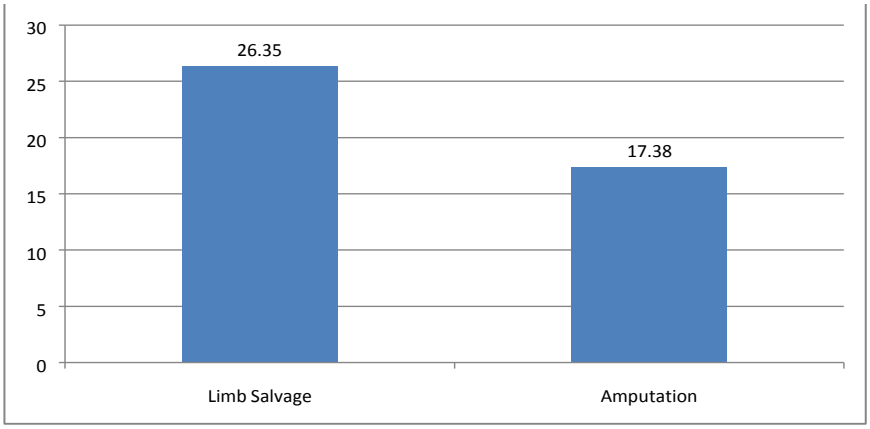


Graph 1: Age group wise distribution between Limb Salvage Surgery and Amputation

The mean age of the study group was 23.48 years range between 13 to 64 years. The mean age of the patients in Limb Salvage group was 17 ± 13.747 years, range lies between 17 years to 64 years. Meanwhile the mean age of patients in Limb Amputation group as 17.38 ± 5.37 years, range lies between 13 years to 30 years. There is a statistically no significant difference in the age between the two treatment groups with p=0.090 (table 2 and graph 2).

Table 2: Mean age distribution between Limb Salvage Surgery and Amputation

Treatment method	Number of patients	Mean age	Standard deviation	P value
Limb Salvage Surgery	17	26.35 years	13.747	P=0.090
Amputation	8	17.38	5.370	



Graph 2: Mean age distribution between Limb Salvage Surgery and Amputation

Gender

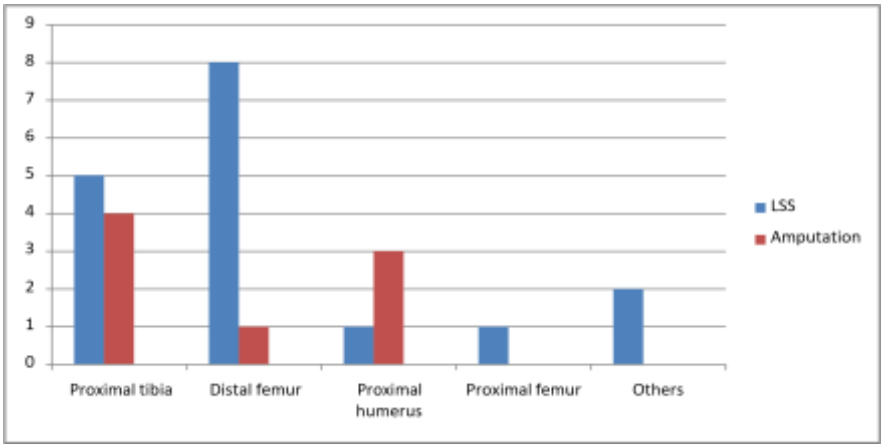
There are twenty male and five female patients. The p value was not found to be significant (p value=0.115). (Table 3)

Table 3: Gender distribution of patients

Age groups in years	Limb salvage group		Amputation group		Total	P value
	Males	Females	Males	Females		
10-15	2	2	4	0	8	0.115
16-20	2	2	3	0	7	
21-25	2	0	0	0	2	
26-30	1	1	0	0	2	
>30	5	0	1	0	6	
Total	17		8		25	

Table 4: Anatomic site relation with the treatment method

Site	Limb Salvage Surgery	Amputation	Total	P value
1.Proximal tibia	5	4	9	0.131
2.Distal femur	8	1	9	
3.Proximal humerus	1	3	4	
4.Proximal femur	1	0	1	
5.Others	2	0	2	
Total	17	8	25	



Graph 3: Anatomic site relation with the treatment method

Tumor staging

Out of 25 patients data was not available for 7 patients. For rest 18 patients tumour staging of patients was done according to the Enneking and American Joint Committee on Cancer (AJCC) and no significant difference was found(table 5,6 and graph 4,5).

Table 5: Enneking Staging between Limb Salvage Surgery and Amputation

Enneking Staging	Limb salvage group		Amputation group		Total patients		P value
	Number in group	Percentage in group	Number in group	Percentage in group	Total Number	Percentage	
1a	0	0%	0	0%	0	0%	P=0.809
1b	0	0%	0	0%	0	0%	
2a	4	30.8%	1	20%	5	27.8%	
2b	8	61.5%	4	80%	12	66.66%	
3	1	7.7%	0	0%	1	5.55%	
Total	13		5		18		

Graph 4: Enneking Staging between Limb Salvage Surgery and Amputation

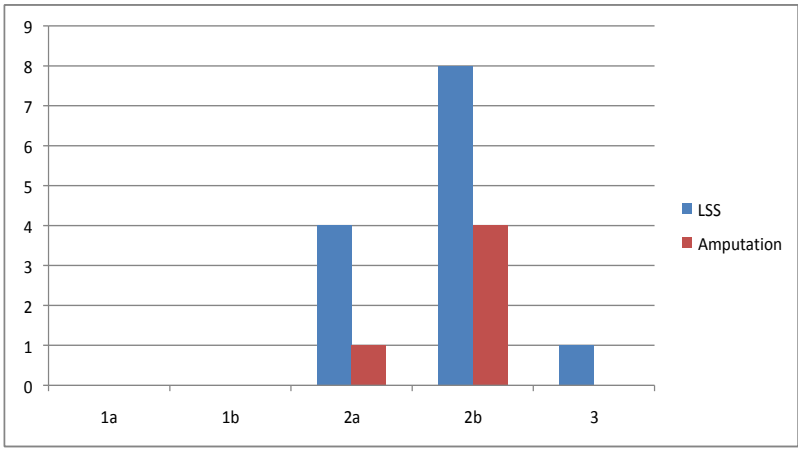
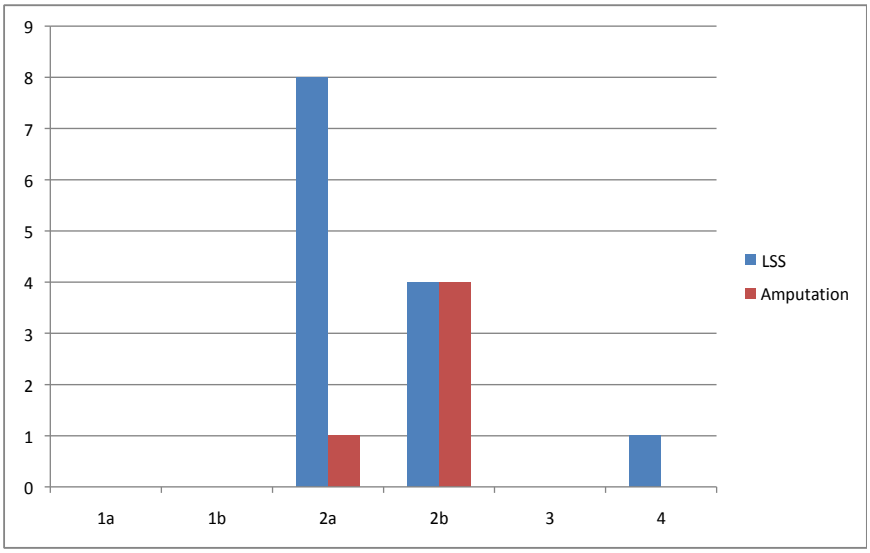


Table 6: AJCC Staging between Limb Salvage Surgery and Amputation

AJCC	Limb salvage group		Amputation group		Total patients		P value
	Number in group	Percentage in group	Number in group	Percentage in group	Total Number	Percentage	
1a	0	0%	0	0%	0	0%	P=0.165
1b	0	0%	0	0%	0	0%	
2a	8	61.5%	1	20%	8	44.44%	
2b	4	30.76	4	80%	8	44.44%	
3	0	0%	0	0%	0	5.55%	
4	1	7.69%	0	0%	1	5.55%	
Total	13		5		18		

Graph 5: AJCC Staging between Limb Salvage Surgery and Amputation



DISCUSSION

We evaluated 25 patients with osteosarcoma, who underwent tumour resection and endoprosthetic reconstruction and limb amputation. Patients with malignant tumors received neo-adjuvant chemotherapy and post operative chemotherapy based on the histo-pathology and immuno-histochemistry of the excised specimen as per standard chemotherapy regimens and protocols.

Amputation was the main and standard therapeutic option for patients with osteosarcoma before the 1970s, and the 5-year overall survival rate with amputation alone was 5–23%.[5,6] Today, amputation is not a first choice anymore owing to advances made in chemotherapy, surgical techniques, surgical devices, and diagnostic methods.

Endoprosthetic reconstruction, the most common option in limb-salvage surgeries, is an attractive alternative to other surgical options and plays a key role in keeping the patients quality of life. This surgical technique can provide early mobilization, stability, and weight- bearing for patients.[7,8] On the other hand, the disadvantages of endoprosthesis surgery have to be considered, such as infection, loosening of prosthesis, joint stiffness, limb-shortening or lengthening and implant fracture.

The mean age of our study group was 23.48 years (range 13 to 64 years). The mean age of the patients in Limb Salvage group was 17 ± 13.747 years (range 17 to 64 years). Meanwhile the mean age of patients in Limb Amputation group was 17.38 ± 5.37 years (range 13 to 30 years). We found no significant difference between the mean age and the surgical treatment they received (p value=0.09).

Out of 25 patients we enrolled, 20 were male (80 %) and 5 were females (20%). Limb Salvage surgery was done in 12 male patients and 5 female patients and Limb Amputation was done in 8 male patients. No significant difference (p value=0.115) was found between the gender distribution across various age groups and the treatment they received. Tunn et al, found higher prevalence of osteosarocma in female patients.[9]

The most common site of osteosarcoma in our study was found to be around knee with 9 patients (36 %) having proximal tibia, 9 patients (36 %) having distal femur as the site of involvement, 4 patients (16%) and 1 patient (4%) had involvement of proximal humerus and proximal femur respectively. 2 patients (8%) had diaphyseal involvement. We found no significant difference between the site of involvement and the treatment method (p value 0.131).

Tumor staging of patients was done according to the Enneking and American Joint

Committee on Caner (AJCC). We found that 12 patients (66.7%) were Enneking stage 2b and 5 patients (27.8%) were having Enneking stage 2a, 1 patient was in Enneking stage 3. The number of patients in Limp Salvage and Amputation group were 13 and 5 respectively. Data was not available for 7 patients. According to the AJCC staging, the number of patients in stage 2a was 9 (50%), stage 2b was 8 (44.4%), while 1 patient (5.5%) each was in stage 4. No significant difference was found between the Enneking staging (p value=0.698) and the AJCC staging (p value=0.165) and the treatment method. Tumour volume was calculated using the MRI reports and two groups were made with tumour volume $<200cm^3$ and $> 200\ cm^3$. Reports were not available for 7 patients, for the rest 17 patients, where tumour volume was known, no significant difference was found between tumour volume and the treatment. Poudel et al concluded that high tumour volume was not a significant predictor of local recurrence in osteosarcoma, thus patients with high tumour masses should not be denied limb salvage.[10]

CONCLUSION

There is a statistically no significant difference in the age between the surgical

treatment groups. No significant difference was found between the gender distribution across various age groups and the surgery performed on them. Tumour staging of patients was done according to the Enneking and American Joint Committee on Caner (AJCC) and no significant difference was found. Likewise, no significant difference was found between tumour volume and the type of surgery.

Declaration by Authors

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