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LONG TERM FUNCTIONAL OUTCOMES OF USING MESH IN ORTHOPEDIC ONCOLOGY SURGERIES

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ABSTRACT

Background: Malignant bone tumours are difficult to diagnose owing to the confusions associated with the diagnosis for a general orthopedic practicing surgeon. Results of limb salvage surgeries are markedly improved following the development of better diagnostic modalities and advancements in chemotherapy and radiotherapy fields. The standard protocol following limb salvage surgeries is tumor resection following replacing with mega prosthesis. Meshes are generally used to improve functional outcomes.

Aims: The present study was conducted to assess the long-term functional and clinical outcomes of using mesh in limb salvage surgeries conducted for malignant bone tumors based on a comparison of movement range with subjects without mesh

Methods: The present retrospective clinical study included 18 subjects having a minimum of 6 months records following orthopedic limb salvage surgery for malignant bone tumors including upper-end humerus, upper-end femur, upper-end tibia, and lower-end femur region followed by mega-prosthesis replacement. These subjects were divided into two groups based on the mesh used or not used. Mesh was used in primary reconstruction surgery.

Results: Musculo Skeletal Tumour Society (MSTS) scoring system was used for results assessment where it was seen that good movement range was seen in knee extension and Shoulder abduction was seen following limb salvage surgeries.

Conclusion: The present study concludes that mesh provides muscle and soft tissue anchorage along with fibrosis induction following limb salvage surgeries decreasing the time of immobilization and increasing range for active movements. This helps in better psychosocial rehabilitation of society and family.

Key Words: Bone cancer surgery, Limb salvage surgery, Mega-prosthesis, Mesh in Orthopaedic Oncology, Orthopaedic oncology surgery, Psychosocial rehabilitation in bone cancer

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INTRODUCTION

Malignant bone tumors are difficult to diagnose owing to the confusions associated with the diagnosis for a general orthopedic practicing surgeon. Results of limb salvage surgeries are markedly improved following the development of better diagnostic modalities and advancements in chemotherapy and radiotherapy fields. Limb salvage surgery has three steps including resection of the tumor, mega-prosthesis replacement, and reconstruction of the soft tissues. Reconstruction of the soft tissues is a vital aspect following mega-prosthesis replacement and muscle adherence to a prosthesis which is necessary to achieve limb movements following surgeries.[1]

Muscle adhesions to metallic prostheses can be achieved using various methods including the use of mesh, bone plug use, and Hydroxyapatite coating at sites of major tendon insertion. The present retrospective clinical study assessed the mega-prosthesis use in limb salvage surgeries conducted for the upper-end humerus, upper-end femur, upper-end tibia, and lower-end femur regions where mesh was used in a few cases and was not used in some. The results were assessed with MSTS system in both study groups. The literature data assessing the use of mesh versus non-mesh use in subjects undergoing orthopedic oncology surgery is scarce in the literature, especially where the long-term assessment was conducted.[2]

Treating malignant tumors with successful rehabilitation is vital in the psychological rehabilitation of family and society as young members are usually affected with malignant tumors affecting the financial status of the family as young members are usually the earning members.[3] The present study was conducted to assess the long-term functional and clinical outcomes of using mesh in limb salvage surgeries conducted for malignant bone tumors based on a comparison of movement range with subjects without mesh

MATERIALS AND METHODS

The present study was conducted to assess the long-term functional and clinical outcomes of using mesh in limb salvage surgeries conducted for malignant bone tumors based on a comparison of movement range with subjects without mesh. The study was conducted at Department of Orthopaedics. The study population was comprised of the subjects who underwent limb salvage surgeries for bone malignancies. The study included a total of 18 subjects from both genders with a minimum follow-up of 6 months. After explaining the detailed study design, informed consent was taken from all the subjects.

The inclusion criteria for the study were subjects who underwent limb salvage surgeries, had a minimum follow-up of 6months, and subjects who were willing to participate in the study. The exclusion criteria were subjects who had mesh complications, mesh complications in abdominal surgery, subjects having allergy history, and subjects not willing to participate or give consent.

For all included 18 subjects, tumor resection was done following conventional surgical procedures. Following pre-operative chemotherapy, MRI measurements were done, and resection margins were 3cm wide. From the proximal canal, the frozen section was taken, and surgery was performed after negative margins were confirmed. For all subjects, postoperative specimens were confirmed as 8-10mm margin-free. Following the advice of the Onco-physician, postoperative chemotherapy was given. In subjects of upper-end tibia replacement,

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after wrapping the mesh around implants tightly, a bone plug was kept at the site of patellar insertion creating a tight mesh sleeve between the patellar tendon and bony plug.

For the humerus upper-end, on the glenoid, the mesh was placed and sutured with the labrum. In cases not involving a greater tuberosity tip, it was not cut. In cases with proximal femur replacement, the same protocol as proximal humerus replacement was followed. In subjects where greater trochanter tip was preserved, suturing was done with implant-hole mesh in between, whereas, in cases where it was not preserved, iliopsoas tendon and muscle were sutured to great trochanter tip.

In lower femur replacement, a mesh that was tightly wrapped was sutured to the preserved. Till drain removal, for 5 days, intravenous antibiotics were given for five days, antibiotics were further continued for 10 days orally till sutures were removed. To immobilize the part and fibrosis induction, splintage was given for 4-6 weeks. During the immobilization period, static physiotherapy was advised which was to be replaced with dynamic exercise after 6 weeks following surgery. In cases where the lower limb was involved, the next day to surgery, partial weight-bearing was started using a walker. A walking stick/tripod was advised following 8-10 weeks of surgery.

The collected data were subjected to the statistical evaluation using SPSS software version 21 (Chicago, IL, USA) and one-way ANOVA and t-test for results formulation. The data were expressed in percentage and number, and mean and standard deviation. The level of significance was kept at $p<0.05$.

RESULTS

The present study was conducted to assess the long-term functional and clinical outcomes of using mesh in limb salvage surgeries conducted for malignant bone tumors based on a comparison of movement range with subjects without mesh. The study included a total of 18 subjects from both genders with a minimum follow-up of 6 months. Demographic and disease-related characteristics of the study subjects are described in Table 1. It was seen that the mean age of the study subjects was 48.6±4.82 years with the age range of 28-56 years. The follow-up period for study subjects was 7 months to 4.2 years, whereas the man follow-up was 3.6 years. There were 38.88% (n=7) females and 61.11% (n=11) males in the present study. For sites involved, proximal femur was involved in 22.22% (n=4) study subjects, distal femur in 27.7% (n=5), proximal tibia in 33.3% (n=6) subjects, and upper humerus in 16.6% (n=3) study subjects. The mesh was placed in 14 study subjects including 22.2% (n=4) in upper-end tibia, 11.1% (n=2) in Upper end humerus, 27.7% (n=5) in Lower end femur (Table 1).

On assessing the Musculo Skeletal Tumour Society (MSTS) scores in the two groups of study subjects, it was seen that in subjects where mesh was used, it was seen that for the upper-end humerus, MSTS score was 22, for the upper-end femur, MSTS score was 24, and for knee (lower femur and upper tibia), MSTS score was 20. For 4 subjects where mesh was not used, it was seen that MSTS score for upper-end humerus was 12, for the upper-end femur, MSTS score was 13, and for knee (lower femur and upper tibia), MSTS score was 9 as shown in Table 2.

On defining the MSTS scores based on the region and criteria followed for each region, it was seen that for the upper-end humerus, regions assessed were deformity (range of motion),

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the strength of shoulder abduction, and combined movements. For the upper-end femur, the region considered for functional outcome was hip abduction. MSTS scores for knee (lower femur and upper tibia) were based on the emotional acceptance and functional activity as shown in Table 3.

DISCUSSION

The present study was conducted to assess the long-term functional and clinical outcomes of using mesh in limb salvage surgeries conducted for malignant bone tumors based on a comparison of movement range with subjects without mesh. The study included a total of 18 subjects from both genders with a minimum follow-up of 6 months. It was seen that the mean age of the study subjects was 48.6±4.82 years with the age range of 28-56 years. The follow-up period for study subjects was 7 months to 4.2 years, whereas the man follow-up was 3.6 years. There were 38.88% (n=7) females and 61.11% (n=11) males in the present study. For sites involved, proximal femur was involved in 22.22% (n=4) study subjects, distal femur in 27.7% (n=5), proximal tibia in 33.3% (n=6) subjects, and upper humerus in 16.6% (n=3) study subjects. The mesh was placed in 14 study subjects including 22.2% (n=4) in upper-end tibia, 11.1% (n=2) in Upper end humerus, 27.7% (n=5) in Lower end femur. These results were consistent with the studies of Buch RG et al in 2009 and Liu B et al in 2019 where authors assessed subjects with comparable characteristics in orthopedic surgery context.

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On defining the MSTS scores based on the region and criteria followed for each region, it was seen that for the upper-end humerus, regions assessed were deformity (range of motion), the strength of shoulder abduction, and combined movements. For the upper-end femur, the region considered for functional outcome was hip abduction. MSTS scores for knee (lower femur and upper tibia) were based on emotional acceptance and functional activity. These findings were comparable to the studies of Umari A in 2017 and Wang B et al in 2015 where a similar region was assessed for MSTS scores.

CONCLUSION

Within its limitations, the present study concludes that in limb salvage surgeries mesh use can provide soft-tissue anchorage and induce fibrosis. Hence, less immobilization time and good active movements range can be achieved with the mesh helping in the psychological rehabilitation of society, family, and individual. However, the present study had a few limitations including a small sample size, shorter monitoring period, and geographical area biases. Hence, more longitudinal studies with a larger sample size and longer monitoring period will help reach a definitive conclusion.

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TABLES

Characteristics	**Percentage (%)**	**Number (n)**
Mean age	48.6±4.82	
Follow up range (months to years)	7-4.2	
Mean follow-up (years)	3.6	
Age Range	28-56	
Gender		
Females	38.88	7
Males	61.11	11
Site involved		
Proximal femur	22.22	4
Distal femur	27.77	5
Proximal Tibia	33.33	6
Upper humerus	16.6	3
Mesh use based on site		
Upper-end tibia	22.2	4
Upper-end humerus	11.1	2
Lower end femur	27.7	5
Upper-end femur	16.6	3

Table 1: Demographic and disease-related characteristics in the study subjects

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Involved Region	MSTS score with mesh (max. 35)	MSTS score without mesh (max. 35)
Upper-end humerus	22	12
Upper-end femur	24	13
Knee (Lower femur and upper tibia)	20	9

Table 2: MSTS scores in the two groups of study subjects

MSTS score	Region
Upper-end humerus	Combined movements Strength of shoulder abduction Deformity (range of motion) Stability
Upper-end femur	Hip abduction
Knee (Lower femur and upper tibia)	Functional activity Acceptance

Table 3: MSTS scores based on region distribution in the study subjects