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PERSUADING THE LONG-TERM CLINICAL AND FUNCTIONAL EFFECTS OF UTILIZING MESH IN LIMB SALVAGE PROCEDURES FOR MALIGNANT BONE TUMORS- RETROSPECTIVE CLINICAL INVESTIGATION

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ABSTRACT

Background: A general orthopedic practicing surgeon may have difficulty diagnosing malignant bone tumors due to the diagnostic ambiguities involved. Following the development of better diagnostic tools and developments in the chemotherapy and radiation areas, the outcomes of limb salvage surgery have significantly improved. Tumor removal followed by massive prosthesis replacement is the normal approach after limb salvage operations. Meshes are frequently employed to enhance functional results.

Aims: Based on a comparison of movement range with participants without mesh, the current study was done to evaluate the long-term clinical and functional effects of utilizing mesh in limb salvage procedures for malignant bone tumors.

Methods: The upper end of the humerus, upper end of the femur, upper end of the tibia, and lower end of the femur area were all involved in the orthopedic limb salvage surgery for malignant bone tumors in the present retrospective clinical investigation, which involved 18 participants. Mega-prosthesis replacement was then performed. Depending on whether mesh was utilized or not, these patients were separated into two groups. In the first reconstructive procedure, mesh was employed.

Results: The Musculo Skeletal Tumor Society grading method was utilized to evaluate the outcomes, and it was discovered that after limb salvage procedures, shoulder abduction and knee extension had good mobility ranges.

In conclusion, mesh after limb salvage procedures offers muscle and soft tissue anchoring as well as fibrosis induction, reducing the duration of immobilization and expanding range for active motions. This helps in better psychosocial rehabilitation of society and family.

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

INTRODUCTION

A general orthopedic practicing surgeon may have difficulty diagnosing malignant bone tumors due to the diagnostic ambiguities involved. Following the development of better diagnostic tools and developments in the chemotherapy and radiation areas, the outcomes of limb salvage surgery have significantly improved. Three steps are involved in limb salvage surgery: removal of the tumor, replacement of the megaprosthesis, and repair of the soft tissues. Following the replacement of a megaprosthesis, reconstruction of the soft tissues is essential, and muscle adhesion to a prosthesis is required to enable limb motions after surgery.1

The use of mesh, bone plugs, and hydroxyapatite coating at locations of significant tendon insertion are only a few of the techniques that may be used to create muscle adhesions to metallic prostheses.

The usage of mega-prostheses in limb salvage operations for the upper-end of the humerus, upper-end of the femur, upper-end of the tibia, and lower-end of the femur was evaluated in the current retrospective clinical investigation. Mesh was used in some cases and was not utilized in others. With the MSTS system, the outcomes were evaluated in both research groups. There aren't many studies in the literature comparing the use of mesh against non-mesh in patients having orthopedic cancer surgery, particularly in those where the long-term evaluation was done.2

Young family members are typically affected by malignant tumors, which have a negative impact on the family's financial situation since they are typically the earners in the family. Therefore, treating malignant tumors with effective rehabilitation is essential for the psychological rehabilitation of the family and society.3

Based on a comparison of movement range with participants without mesh, the current study was done to evaluate the long-term clinical and functional effects of utilizing mesh in limb salvage procedures for malignant bone tumors.

MATERIAL AND METHODS

On the basis of a comparison of mobility range with participants without mesh, the current study was done to evaluate the long-term functional and clinical effects of utilizing mesh in limb salvage procedures performed for malignant bone tumors. The participants who underwent limb salvage operations for bone cancers made up the study population. A total of 18 participants from both sexes participated in the study, with a minimum follow-up of 6 months. Informed permission was obtained from each individual after a thorough explanation of the study's design.

Subjects who had limb salvage operations, had at least a 6-month follow-up, and were willing to participate in the study met the inclusion criteria. The exclusion criteria included patients who experienced mesh issues, mesh complications following abdominal surgery, subjects with a history of allergies, and subjects who were unwilling or unable to consent.

Tumor resection was carried out using standard surgical techniques on each of the 18 included individuals. After preoperative chemotherapy, MRI measurements were taken, and the resection margins were measured; they were 3 cm broad. The frozen slice was obtained from the proximal canal, and surgery was done once negative margins were established. Postoperative specimens were verified to be 8–10 mm margin-free for all individuals. Chemotherapy was administered postoperatively on the onco-physician's recommendation.

After securely wrapping mesh around implants in participants undergoing upper-end tibia replacement, a bone plug was retained at the location of patellar insertion to create a tight mesh sleeve between the patellar tendon and bony plug.

The mesh was positioned and sutured with the labrum on the glenoid of the upper end of the humerus. It wasn't cut in situations when there wasn't a bigger tuberosity tip. The identical procedure as for proximal humerus replacement was used in situations involving proximal femur replacement. In situations where the greater trochanter tip was not preserved, the iliopsoas tendon and muscle were sutured to the great trochanter tip. In patients where the greater trochanter tip was intact, suturing was performed with implant-hole mesh in between. A mesh that was firmly coiled was sutured to the preserved during lower femur replacement.

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. Splintage was used for 4-6 weeks to immobilize the affected area and to induce fibrosis. Static physiotherapy was recommended throughout the period of immobility, and after 6 weeks following surgery, vigorous exercise was to be substituted. The day after surgery, partial weight-bearing with a walker was initiated in situations where the lower leg was involved. After the procedure, which took 8–10 weeks, a walking stick or tripod was prescribed.

One-way ANOVA and the t-test were used to formulate the results after the obtained data were statistically evaluated using SPSS software version 21 (Chicago, IL, USA). Data were presented as percentages and numbers, as well as their means and standard deviations. P 0.05 was used as the significance threshold.

RESULTS

On the basis of a comparison of mobility range with participants without mesh, the current study was done to evaluate the long-term functional and clinical effects of utilizing mesh in limb salvage procedures performed for malignant bone tumors. A total of 18 participants from both sexes participated in the study, with a minimum follow-up of 6 months. Table 1 lists the demographic information and disease-related characteristics of the research participants. The research individuals' ages ranged from 28 to 56 years, with a mean age of 48.6 4.82

years. While the average follow-up was 3.6 years, the study patients' follow-up periods ranged from 7 months to 4.2 years.

In the current study, there were 61.11% (n=11) men and 38.88% (n=7) females. The locations that were affected were the proximal femur in 22.22% (n=4) study participants, the distal femur in 27.7% (n=5), the proximal tibia in 33.3% (n=6) participants, and the upper humerus in 16.6% (n=3) participants. In 14 research participants, the mesh was implanted in the lower end of the femur, 11.1% at the higher end of the humerus, and 22.2% in the upper end of the tibia (Table 1).

When comparing the MSTS scores between the two groups of research participants, it was found that the MSTS score for the knee (lower femur and upper tibia) was 20, while the MSTS score for the upper-end humerus and upper-end femur were both 22.

For the four subjects where mesh was not used, the MSTS scores for the upper-end humerus, upper-end femur, and knee (lower femur and upper tibia) were 12, 13, and 9, respectively, as shown in Table 2. When the MSTS scores were defined according to the region and the criteria used for each region, it was discovered that the upper-end humerus was evaluated for deformity (range of motion), the strength of shoulder abduction, and combined movements.

DISCUSSION

On the basis of a comparison of mobility range with participants without mesh, the current study was done to evaluate the long-term functional and clinical effects of utilizing mesh in limb salvage procedures performed for malignant bone tumors. A total of 18 participants from both sexes participated in the study, with a minimum follow-up of 6 months. The research individuals' ages ranged from 28 to 56 years, with a mean age of 48.6 4.82 years. While the average follow-up was 3.6 years, the study patients' follow-up periods ranged from 7 months to 4.2 years. In the current study, there were 61.11% (n=11) men and 38.88% (n=7) females.

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. In 14 research participants, the mesh was implanted in the lower end of the femur, 11.1% at the higher end of the humerus, and 22.2% in the upper end of the tibia. These findings were in line with research conducted by Buch RG et al in 2009 and Liu B et al in 2019 on participants with similar features in an orthopedic surgery setting.

The MSTS scores for the upper-end humerus, upper-end femur, and knee (lower femur and upper tibia) were seen to be 22, 24, and 20, respectively, in subjects where mesh was used, according to the study results assessing the MSTS scores in the two groups of study subjects.

The results for four patients showed that the upper-end humerus had an MSTS score of 12, the upper-end femur had an MSTS score of 13, and the knee (lower femur and upper tibia) had an MSTS score of 9. These findings concurred with those of Strony D et al in 2019 and Uehara K et al, who indicated that participants who underwent orthopedic surgery when mesh was being utilized had higher MSTS scores thereafter.

When the MSTS scores were broken down by region and the criteria used for each region, it became clear that the upper-end humerus' deformity (range of motion), the force of shoulder abduction, and combined motions were the areas analyzed. Hip abduction was the area of the upper-end femur that was taken into account for functional result.

MSTS scores for knee (lower femur and upper tibia) were based on emotional acceptance and functional activity. These results were comparable to those from research by Umari A. in 2017 and Wang B. et al. in 2015, when the MSTS scores of a related region were evaluated.

CONCLUSION

Within its constraints, the current study draws the conclusion that mesh usage in limb salvage procedures can offer soft-tissue anchoring and cause fibrosis. Thus, with the mesh aiding in the psychological rehabilitation of society, family, and individual, less time may be spent immobilized and good active motions range can be accomplished. The present study did, however, have certain drawbacks, such as a small sample size, a briefer monitoring period, and geographic region biases. A firm conclusion will thus be reached with the aid of more longitudinal studies that have a bigger sample size and a longer monitoring period.

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S. No	Characteristics	Percentage (%)	Number (n)
1.	**Mean age**	48.6±4.82	
2.	**Follow up range (months to years)**	7-4.2	
3.	**Mean follow-up (years)**	3.6	
4.	**Age Range**	28-56	
5.	**Gender**		
a)	Females	38.88	7
b)	Males	61.11	11
6.	**Site involved**		
a)	Proximal femur	22.22	4
b)	Distal femur	27.77	5
c)	Proximal Tibia	33.33	6
d)	Upper humerus	16.6	3
7.	**Mesh use based on site**		
a)	Upper-end tibia	22.2	4
b)	Upper-end humerus	11.1	2
c)	Lower end femur	27.7	5
d)	Upper-end femur	16.6	3

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

S. No	Involved Region	MSTS score with mesh (max. 35)	MSTS score without mesh (max. 35)
1.	**Upper-end humerus**	22	12
2.	**Upper-end femur**	24	13
3.	**Knee (Lower femur and upper tibia)**	20	9

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

S. No	MSTS score	Region
1.	**Upper-end humerus**	Combined movements Strength of shoulder abduction Deformity (range of motion) Stability
2.	**Upper-end femur**	Hip abduction
3.	**Knee (Lower femur and upper tibia)**	Functional activity Acceptance

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