

Functional outcomes of sandwich reconstruction technique for giant cell tumor around the knee joint

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Objective: To evaluate the functional outcomes after extended curettage and reconstruction using a combination of bone graft and bone cement (sandwich).

Methodology: In this prospective case series 16 skeletally mature patients with primary giant cell tumor around the knee were included. Patients with previous surgically treated, malignant transformation, degenerative knee changes and those presenting with pathological fracture were excluded. The tumor was excised with bone graft filling space beneath the articular cartilage and a block of gel foam was placed over the cortical surface of picked bone graft. Remaining cavity was filled with polymethylmethacrylate cement (sandwich) with or without internal fixation. The functional evaluation was done using Musculoskeletal Tumor Society (MSTS) Score six months postoperatively and after one year.

Schatzker and Lambert Score was used in the last visit to assess the functional outcome

Results: The mean MSTS Score was 27.13 ± 3.030 (range, 20-30) and the mean functional arc of motion around the knee was 123.13 ± 12.230 degrees (range, 90–135). According to Schatzker and Lambert Score 75% had excellent results, 12.5% had good results and 12.5% had fair results. Two patients (12.5%) had a recurrence of the tumor, and one (6.25%) developed postoperative fracture in the distal femur.

Conclusion: Sandwich reconstruction for giant cell tumor is a good option for definite management and there is improvement in the quality of the patient's life. (Rawal Med J 202;45:637-640).

Keywords: Articular cartilage, giant cell tumor, knee, sandwich.

INTRODUCTION

Giant cell tumor (GCT) is benign tumors which can be aggressive and has ability to metastasize.¹ It account for about 5% of all primary bone lesions and 1/5 of benign tumors of the bone. The peak incidence is around third decade, with 80% of cases arising between 20 and 45 years old with female predominant.² They are usually solitary lesions; however, 1% to 2% may be multicentric and has pulmonary metastases in about 3%. Ninety percent occur in metaphyseal-epiphyseal region, and often reach to the articular subchondral bone or the cartilage. Patients typically present with rest pain, night pain, and some time as a pathologic fractures as initial presentation especially in weight-bearing bones.³

GCT are classified depending on X-ray appearance.¹ Surgical excision is the standard method, intralesional or wide resection with filling the cavity by bone graft, artificial bone substitute, or

polymethylmethacrylate.^{3,5} Recently, denosumab has good option for locally progressive GCT. Consequently, it should be standard for the unrespectable disease to facilitate intralesional surgery at a later stage to avoiding more invasive surgery.⁶ The present study assessed functional outcomes after extended curettage and reconstruction using a combination of bone graft and bone cement (sandwich).

METHODOLOGY

This prospective case series study was conducted on 16 patients (6 males and 10 females) with biopsy-proven diagnosis of GCT from October 2016 to August 2018. Follow up was done after one year. All patients with GCT around the knee were included from outpatient clinic at Al-Yarmouk and AL-Kindy teaching hospital. Patient with previous surgically treated, malignant transformation, degenerative knee changes, and pathological fracture were

excluded. A written informed consent was taken from each patient.

Full history, laboratory tests, plain X-ray with CT scan and MRI to affected limb were taken for all patients (Figure). During surgery, we evacuate all tumors by using high-speed burr, electro cautery, lavage cavity with normal saline and gauze soaked with phenol 5% for 2-3 minutes. The cancellous surface of the collected graft from ipsilateral iliac crest was placed near the subchondral bone. The curvature of the bone graft was done approximately the concavity of the inner surface of the femoral condyles. Small gap between the graft and the articular cartilage was filled with cancellous bone.

A block of Gel Foam (absorbable gelatin sponge (Pfizer)) was placed over the cortical surface of picked bone graft to avoid cement leakage into the subchondral space and allow hemostasis. The cavity remaining was filled with polymethylmethacrylate cement (PMMA). Internal fixation were used in most of the patients with the large cavity more than one-third of bone diameter. Divergent screws were used in three patients, plate and screws in nine patients and four patients got surgery without internal fixation.

After surgery, first visit was done after 7 days to see the wound. Stiches were removed after 14 days postoperatively. Active knee exercises were used immediately after the pain subsided and non-weight bearing crutches for 12 weeks. They were evaluated by using MSTS score (Musculoskeletal Tumor Society Score) at six months, one year and last visit

was compared with preoperative MSTS score. High scores were assessed at six months and after one year for better outcome and knee range of motion.⁷ Further assessment is done by Schatzker and Lambert score.⁸

Statistical Analysis: The data were analyzed through SPSS version 20. The level of significance (P-value) was set at 0.05, to be considered as significant difference.

RESULTS

The mean age of participants was 34.43 ± 11.21 (range 18-57 years), six male and ten females with ratio 1:1.6. Eight patients had GCT in the upper tibia and 8 patients in distal femur. According to Enneking and Campanacci Grading Systems, two patients had grade I (12%), ten patients (63%) had grade II and four patients (25%) had grade III symptoms.

There was a statistically highly significant difference ($P=0.00$, $P<0.01$) between the mean of MSTS score level in all comparisons.

Mean of MSTS score level, elevated with follow up period as preoperative (14.38 ± 2.5), in 6 months (18.38 ± 2.705), after one year (22.94 ± 3.172) and in last follow up was (27.13 ± 3.03) as described in (Table 1) ($P=0.041$). Mean of knee flexion level, elevated with follow up period as preoperative (109.88 degree ± 15.414). After 6 months, results was (115.00 degrees ± 14.832), after 1 year (119.69 degree ± 10.873) and in last follow up (123.13 degree ± 12.230).

Figure. Preoperative planning with X-ray, CT scan and MRI.

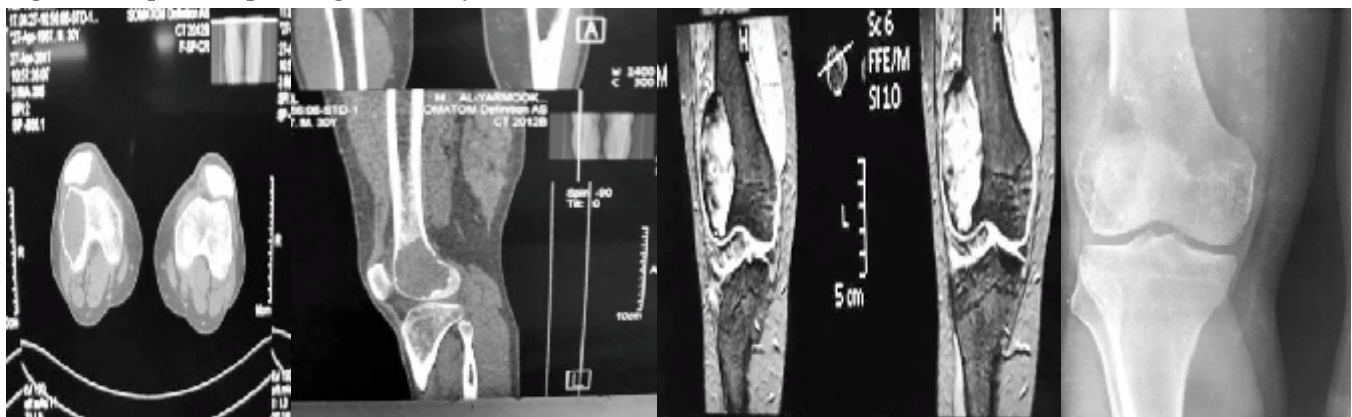


Table 1. MSTS score level according to follow up period.

MSTS score	N	Mean of MSTS score	Std. Deviation	Std. Error	ANOVA Test (p-value)
Preoperative	16	14.38	2.500	0.625	P=0.00 Highly Sign. (P<0.01)
In 6 months	16	18.38	2.705	0.676	
After 1 year	16	22.94	3.172	0.793	
In last follow up	16	27.13	3.030	0.758	

Table 2. Knee flexion level according to a period of follow up.

Knee flexion degree	N	Mean of Knee flexion degree	Std. Deviation	Std. Error	ANOVA test (P-value)
Preoperative	16	109.88	15.414	3.853	P=0.041 Sign. (P<0.05)
In 6 months	16	115.00	14.832	3.708	
After 1 year	16	119.69	10.873	2.718	
In last follow up	16	123.13	12.230	3.058	

For comparisons between MSTS score level for patients with Schatzker and Lambert score through the period of follow up for total groups and reported there was a statistically highly significant difference (P=0.009), in preoperative period, (P=0.001) in six months and (P=0.001) after one year and in last follow up (Table 2).

DISCUSSION

We found male to female ratio was 1:1.6, similar result by Miguel et al,¹⁰ Karmakar NC et al,¹² Balke et al¹³ and Saibaba et al.¹⁴ We also found a decrease in functional outcomes and an increase in local recurrence rate in patients with grade III regarding Campanacci and Enneking staging system. Tain-Hsiung Chen et al,¹⁵ Morii T et al¹⁶ and Meena et al¹⁷ found no correlation between the grade of the tumor and functional outcome like our study. Saikia et al,⁹ Abdelrahman et al,¹⁸ Kundu et al¹⁹ and Anand et al¹⁷ showed that about 2.5 times degeneration of the cartilage after cementation when the tumor was less than 1 cm from the articular surface and this was comparable with our study.

Van der Heijden et al²⁰ found no proof that the existence of bone cement close to the knee joint was associated with the development of degenerative arthritis. When we followed up our patients, we found that sandwich procedure after an extended curettage resulted in good knee function and can

continue without articular failure. The mean MSTS score in this study was 27.13±3.030 (range, 20-30) and according to Schatzker and Lambert score it was excellent 75%, good 12.5%, fair 12.5% and mean functional range of knee motion was 123.13 ±12.230 degrees (range 90-135). Our result was lower to Karmakar et al¹² and similar to results of Meena et al,¹⁷ Abdelrahman et al¹⁸ and Kundu et al.¹⁹ In our study, recurrence rate was 12.5%, which higher than Anand et al²⁰ and Panchwagh et al²¹ and similar to result of Kundu et al.¹⁹

In our study, one patient developed unicortical fracture in distal femur postoperatively which is lower than Abdelrahman et al¹⁸ while similar to Anand et al²⁰ and Panchwagh et al.²¹ All fractures ultimately united with conservative management after an average of 3 months.

In our study, one patient has surgical site infection (6.25%) which is higher than Abdelrahman et al¹⁸ and was treated conservatively. Longer follow-up and larger sample is required to comment if these outcomes are enduring and to assess the recurrence rates. We recommend using other types of modality in the treatment of grade III GCT for patients with breached and extensive destruction of the articular surface.

CONCLUSION

The definite and subjective improvement of the patient can be achieved by using a sandwich reconstruction technique with or without internal fixation following aggressive curettage with the use of phenol and other modalities as adjuvants.

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