

## Clinical Outcome of Sandwich Technique Along with Locking Plate Augmentation in Giant Cell Tumor around Knee.

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### Abstract

**Introduction:** Giant cell tumor is very common around knee. As per conventional treatment we use to do extended curettage and sandwich method for reconstruction, but early weight bear in those cases is not possible. As a result stiffness, collapse of articular surface, and delayed pathological fractures are the possible complications. In this study we have done prospective study after extended curettage and sandwich with locking plate augmentation.

After locking plate augmentation in same sitting help us to allow early weight bear and movement, decrease chance of pathological fracture and better clinical outcome.

Material and method- Eighteen patients who had giant cell tumor of bone and were managed with extended curettage and reconstruction using either bone grafting or sandwich technique between July 2012 and December 2016 were studied. Aggressive curettage was done with the use of various, at Institute of post graduate education & research KOLKATA, West Bengal. We had used adjuvants like high speed burr, hydrogen peroxide along with locking plate augmentation for all cases.

**Results:** After a median duration of follow-up of 14.5 months, the average MSTS score at final follow up was 24.59. Age, gender, grade of tumor, technique and recurrence had no significant effect on the eventual functional outcome achieved by the patients. No complication found in our study after using locking plate. Rather all patients are very satisfied with near full range of movement of knee.

**Conclusions:** We concluded a good to excellent functional outcome without compromise of prognosis, can be achieved by using locking plate augmented sandwich technique following extended curettage. Most patients could resume their previous work and reach the earlier level of physical activities. Early mobilization helps to achieve good range of movement. Longer duration of follow-up of a larger group of patients is necessary to study the recurrence rates.

**Keywords:** giant cell tumor, extended curettage, Locking plate.

### I. Introduction

Giant cell tumor well known as locally aggressive tumor (2,3,4,5,) of bone may undergo malignant transformation. (6) It represents 4–5% of primary bone tumors and 20% of biopsy concluded benign bone tumours. (7) There is a slight female predominance (8) with a peak incidence in young adults aged 20–40 years. (2, 8, 9, 10) The most frequent sites are lower end femur, proximal tibia, lower end radius (11) and proximal humerus. (8,12) The treatment of GCT aims to eradicate the tumor tissue, reconstruct the bone defect, and restore a functional limb. When formulating a plan for local control of GCT, the treatment options are extended curettage (2, 4, 12, 13, 14) and reconstruction with bone graft or sandwich technique 15,16 and an en-bloc resection. (2,4, 13, 17, 18).

En-bloc resection (11) is carried out if the tumor is large enough to involve a wide area of surrounding soft tissue or when the articular cartilage is largely damaged, there is inadequate bone stock post curettage and when resection results in no significant morbidity as proximal fibula and flat bones. (18,19) To reduce local recurrence after curettage, various methods have been tried like the use of burr (20), phenol (3, 7, 21, 22), electrocautery (23), cryotherapy (5, 22), hydrogen peroxide (3, 23,) ringer lactate and argon laser (24) as adjuvant therapies. Reconstruction of the bone void is done using either autograft bone (20, 25, 26, 27); allograft bone (20, 25, 26, 27) and polymethyl methacrylate bone cement (PMMA). (4, 21, 26, 28, 29, 30,31) However it is very well documented that local tumor control depends on how thoroughly the tumor tissue has been excised. (20) Although a marginal or wide excision of the involved bone is curative if contamination is avoided with reported recurrence rate of 0- 32 % (32,33,34.) It is associated with reconstruction and disability problems. Recurrence rates after intralesional procedures have ranged from 30 -52% irrespective of use of adjuvants. (20, 23, 25,26, 27, 28, 29, 32, 33, 35) Although a lot of studies do define the cure rate and focus on

the recurrence and other surgical variables, there exists a lack of studies on the functional outcome after treatment of GCT. This study aims to find out the early functional outcomes after extended curettage and

reconstruction using either bone graft or sandwich technique with internal fixation. we are discussing the outcome after sandwich technique reconstruction augment with locking plate. we can allow

## II. Material And Method

Between July 2012 and December 2016, a total of 18 patients with giant cell tumor (GCT) of the long bones have been treated at the SSKM, ipgmer kolkata. All patients were evaluated by clinical examination, local plain X-ray, chest x-ray, computerized tomography and magnetic resonance imaging. Biopsy was taken in all cases to confirm the diagnosis and to define the histological grade of the tumor. The lesions were classified according to the radiographic parameters considered by Campanacci *et al*<sup>(7)</sup> into grade I, II or III. Different surgical modalities were used including: curettage with bone grafting; curettage with bone cement filling; Curettage and Adjuvant with bone cement and / or Bone graft; wide surgical resection; Curettage was done through a large cortical window by the manual curette and by the dental burr in all cases. The adjuvant local therapy used in our cases were hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) and electrical cautery. Selection of the surgical technique was based on the site and size of the lesion, soft tissue involvement (intra- or extra-compartmental), tumor grade (histological and radiological). Patients were clinically and radiologically a minimum of two years (2-4 years) to detect local recurrence, pulmonary metastasis, local of surgery and to assess the functional outcomes the patients.

### Operative technique

We used to do **core needle biopsy** for all cases. during final help us to discard the biopsy tract by sacrificing very small tissue ,after proper skin flap Adequate exposure was achieved **large cortical window by electric saw** to access the tumor so as having to curette under overhangingshelves or ridges of bone. **mirror** was used which helped for better visualization. The part the cavity which is composed of soft tissue or a thin bony excised.

**Multiple angled curettes** helped to identify and access small pockets of residual disease which may otherwise result in recurrence. The remaining cristae and septa in the cavity were excised **flexible cable light sources**. When the wall of the cavity contains many small holes caused by local invasion of the tumour, each hole should be meticulously cleared.

Fig-1,2 – distal femur campanacci-3 lesion  
 Fig-3,4-curratage through cortical window  
 Fig-5,-high speed burr,  
 Fig-6- laryngeal mirror, endoscopic flexible light source  
 Fig-7 - sandwich technique  
 Fig-8- DFLP augmentation.  
 Fig 9,10- full range of movement and weight bear

followed-up, years) to complications operation it amount of by making a to avoid A **dental** of the wall of shell was



fig-1.,2. Fig--3



fig-4



fig-5fig-6fig-7



fig-8fig-9,10 -full range of movement.

They usually do not penetrate the periosteum, but a dead space may be found between cortex and the periosteum. A **high power burr** may be used to break the bony ridges. A **pulsatile jet lavage** system was used after curettage to bare the raw cancellous bone and physically wash out tumor cells. Adjuvants such as **hydrogen peroxide** were used routinely. Reconstructing the defect after curettage was done with either bone graft alone or using a Sandwich technique depending on the thickness of the subchondral bone along with **anatomical locking plate** augmentation. Sandwich technique included using a sheet of morselised bone graft to cover the articular cartilage. **Gel foam** was placed over the bone graft and cement was then used to fill the entire cavity so as to restore the anatomical shape of the bone. Closure of the soft tissue, subcutaneous tissue and skin was done in layers. Postoperatively, non-weight-bearing crutch walking was started immediately. After 2 weeks, weight bearing was allowed as tolerated. Intravenous zoledronate (4 mg) once monthly was given for 6 months which help in long osteoblastic bone formation as well as local control of giant cell activity.(19,20)



Fig-1

fig-2

fig-3

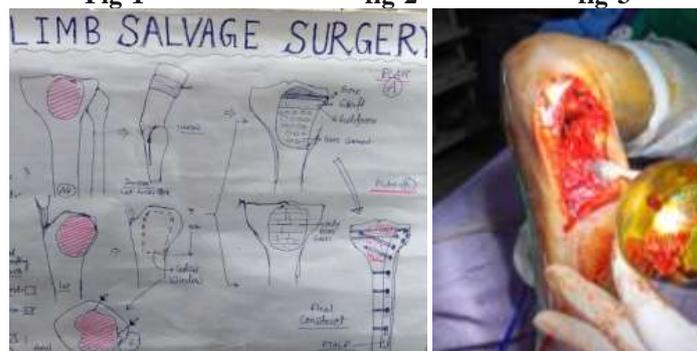


FIG-4FIG-5



fig-6



Fig7,

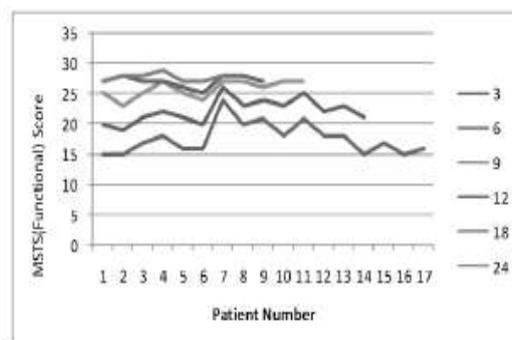
fig8

Fig1,2 –proximal tibial campanacci -1 lesion.  
 Fig3- core needle biopsy  
 Fig-4,5,- planning of ot and intra op pic.  
 Fig-6,7,8 post op construct and fullrange of motion.

### III. Result

The mean follow up was  $17.76 \pm 4.38$  months (range 12 to 31 months). The functional score pre-operatively was  $10.82 \pm 3.43$  (range: 0-16). At 3 months post-operative follow up, it was  $17.64 \pm 2.57$  (range, 15-24). At 6 months, it improved to  $22.14 \pm 1.99$  (range, 19-26), which further improved to  $25.73 \pm 1.42$  (range, 23-27) at 9 months. The functional score at 1 year was  $27 \pm 1$  (range, 25-28) and at 1 ½ year follow up was  $27.71 \pm 0.76$  (range, 27-29). There was only 1 patient with a follow up of more than 2 years with a functional score of 28 points as per the MSTS Score. The data revealed that there was significant improvement in the functional scores at each follow up visits.

**Figure 1:** Line Diagram showing improvement in functional score over time



Functional evaluation of these patients was performed according to the most recent system of the Musculoskeletal Tumor Society (MSTS) .22 The pre- operative and postoperative MSTS Score was determined and compared to study the functional outcome of the patients. The patients were followed for twelve to thirty-one months (mean: 17.76 months). Subgroup analysis was done by classifying the group according to age (<30,>30), gender (male, female), grade of tumor, technique (bone grafting alone or sandwich technique) and primary of recurrent lesion. Statistical analysis was done using online calculators. MannWhitney 'U' test and ANOVA test were used for subgroup analysis. Since five subgroups were analysed, the normal allowed beta error of 5% was divided by 5 and p value <0.01 was taken to be significant.

#### **IV. Discussion**

Treatment for GCTs around the knee include curettage with adjuvant therapy ( **hydrogen peroxide, bone cement, or bone graft**), and marginal/wide resection, followed by reconstruction, arthrodesis, or mega-prosthetic joint replacement. Intralesional curettage alone has a high recurrence rate of 60%,(6) whereas marginal/wide resection is associated with functional disability. Preservation of joint function is an advantage of intralesional curettage compared to wide resection. In our study, intralesional curettage and reconstruction with the sandwich technique, along with locking plate augmentation, achieved a good functional outcome (92.3%). To ensure thorough curettage, adequate exposure through a wide cortical window is necessary, followed by breaking the bony ridges in the tumour using a high-power burr. Structural allograft is laid in the subchondral region and overlaid with a layer of gel foam, and the rest of the cavity is filled with polymethylmethacrylate bone cement. The heating effect of cement destroys remaining tumour cells.(9) The bone graft in the subchondral region helps maintain joint function and prevents articular degeneration.(10) Care must be taken to prevent inadvertent cortical breach or removal of the posterior fibroperiosteal pseudocapsule during curettage. The posterior periosteum acts as a biological barrier, preventing the escape of bone graft or cement filled in the cavity. The risk of neurovascular injury by phenol increases if the posterior periosteum is deficient. Intact posterior periosteum is crucial for the reconstitution of the posterior cortex, especially after bone grafting.(11)

The cavity can be reconstructed with allograft, bone cement, or calcium phosphate. The advantage of allograft is that if it is successfully incorporated, the reconstruction is permanent, but its disadvantages include difficulty in detecting recurrence and the requirement of a bone bank. The benefits of bone cement include immediate weight bearing and its cytotoxic and thermal effects to minimise the risk of recurrence, but it is associated with degeneration of articular cartilage in the subchondral region of the weight bearing area.(12) Applying a layer of bone graft and gel foam not only protects the underlying articular cartilage from the thermal effect of the curing.

Localized lesions are said to be best treated with curettage with bone grafting. Use of appropriate fixation method is recommended whenever bone stock is adequate. We used fixation in all cases fixed with anatomical locking plates. This adds stability to the bone graft and permits early mobilization and weight bearing. Use of sandwich technique has definite indications and has been used by several authors.(15,16) The main aim in this technique is to preserve the surviving articular cartilage by preventing damage by cement hyperthermia. We used this technique in (8) patients. There was no case of collapse of the sandwich and the results were similar to cases treated with bone grafting alone. Thus, this technique can be safely used in selected cases. Meticulous planning and Jamshedi needle biopsy followed by using multiple angle scup, high speed burr, hydrogen peroxide, dental mirror, endoscopic light sources along with bone cement prevent recurrences.

#### **V. Conclusion**

The results of this study suggest that a definite and subjectively appreciable improvement in quality of life of the patient can be achieved by using a bone graft or sandwich technique reconstruction following aggressive curettage with the use of various adjuvants. Patients of various ages and both gender equally benefited from surgery in terms of functional improvement. The tumor grade as per the Campanacci's grading system and surgery on primary or recurrent cases did not affect the functional outcome. We had one case (6%) of recurrence in our series of 17 patients at an average follow-up of 14.6 months. However, a longer follow-up is required to comment if these outcomes are enduring and to assess the recurrence rates. Also a larger case series is needed to report if similar results are reproducible in majority of patients.

#### **Disclosure**

No conflicts of interest were declared by the authors.

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