

# Joint salvage by Sandwich technique and Internal fixation by Locking compression plate in the management of Giant cell tumors around the Knee Joint – Our experience

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**Abstract-** Giant cell tumour (GCT) of bone is one of the most common benign and locally aggressive bone tumours occurring around the knee joint. As this tumour occurs in the juxta articular region, it typically compromises the knee joint function resulting in painful restriction of movement, making the patient incapacitated and difficulty in carrying their activities of daily living like walking, sitting and squatting. Many methods of surgical treatment are described in literature for these tumours. Treatment by curettage alone has a high risk of local recurrence. In order to minimise the possibility of local recurrence, use of adjuvants (hydrogen peroxide, phenol, bone cement, cryosurgery) is recommended followed by reconstruction with autograft, allograft and bone cement. At our institute, the surgical protocol followed for the treatment of GCT of distal femur & proximal tibia was Intralesional extended curettage with high-speed burr, use of hydrogen peroxide, reconstructing the bone defect using sandwich technique followed by Locking compression plate fixation, thereby preserving the native Knee joint function and offering early weight bearing on the operated limb. A total of 15 cases were treated from January 2019 to May 2021. The aim of our study was to evaluate the pain free range of motion in the knee joint postoperatively and the patient's ability to carry on their activities of daily living independently. Postoperatively, all the patients had a significant improvement in their knee joint function rendering them to carry on their activities of daily living independently, thereby improving their quality of life. There was no recurrence in any of our cases during the follow-up period. From this study, we conclude that Joint function can be preserved using Sandwich technique for treating Giant cell tumours around the knee with favourable clinical outcomes.

**Keywords:** Giant cell tumour, Distal Femur and Proximal Tibia, Extended curettage using High speed burr, Sandwich technique, Internal fixation, Locking compression plate

## I. INTRODUCTION

Giant cell tumour (GCT) of bone is one of the common benign bone tumours affecting the distal femur and proximal tibia usually encountered in 30 to 40 year age groups. It is a locally aggressive lesion causing bone destruction and also prone for local recurrence as well as malignant transformation<sup>1</sup>. Surgical management by curettage alone carries a high risk of recurrence<sup>2,3</sup>. To lower the chances of tumour recurrence, local use of adjuvants like hydrogen peroxide, phenol, cryosurgery is recommended. This is usually followed by reconstruction of the bone defect with autograft or allograft and Polymethyl methacrylate bone cement. At our institute, the surgical protocol for the treatment of GCT's of distal femur & proximal tibia was Intralesional extended curettage using high-speed burr followed by the use of hydrogen peroxide and reconstruction of the bone defect using the sandwich technique,<sup>4</sup> in which the Iliac crest autograft (slivers of 4-5 cm in length & 2-3 mm thickness) are placed beneath the subchondral bone which is overlaid with layers of gel foam and the rest of the bone cavity is filled with bone cement. This study evaluated the post operative functional outcomes of 15 patients with GCT's around the knee joint (distal femur & proximal tibia) using the sandwich technique and internal fixation using locking compression plate.

## II. MATERIALS AND METHODS

Between January 2019 and May 2021, 9 women and 6 men aged between 32 to 68 years underwent Intralesional extended curettage with high-speed burr, use of hydrogen peroxide and reconstruction using the sandwich technique for GCT of the distal femur (n=10) and proximal tibia (n=5). No recurrence was found during the follow-up period. According to the **Campanacci grading system**,<sup>4</sup> 9 were of Grade II (with a relatively well-defined margin, thinned out and expanded cortex), and 6 were of Grade III (with indistinct borders with cortical destruction). Using C-arm Arm image intensifier, a cortical window was made centering over the lytic lesion on the anterior aspect of distal femur and on the anteromedial aspect of proximal tibia for the respective lesions. The tumour tissue was curetted out until normal bone was visualized macroscopically. Next, extended curettage was done up to 10 millimetres from the normally appearing bone margins, using a high-speed burr, with due care to avoid spillage of the tumour cells onto the surrounding areas. The cavity was thoroughly washed with hydrogen peroxide and peroxide soaked gauze was placed inside the cavity for 2 minutes. Autogenous iliac crest sliver grafts of 4-5 cm length and 2-3 mm thickness were placed beneath the subarticular surface making a layer of 6-10 mm thickness. Gel foam sheets were laid over the graft in 2 layers in order to protect the graft material from the thermal effects of bone cement. Later, an appropriate length Locking compression plate (LCP) was internally fixed to native bone on the lateral side of distal femur and proximal tibia, making sure that the LCP extended up to the subarticular

area of respective bones, so as to provide good stability for early weight bearing. Finally, the remaining bone void was packed with bone cement and pressurised. Postoperatively, early partial weight bearing was started as tolerated by the patient. Oral bisphosphonates were given for a period of 6 months to all patients. Functional outcomes were evaluated using the **Musculoskeletal Tumour Society (MSTS) score**,<sup>5</sup> which involves 6 parameters (pain, function, gait, walking ability, use of walking aids and emotional acceptance). Scores for each parameter range from 0 to 5; Higher the score, better is the outcome. Recurrence was defined as progressive lysis of >5 mm at the bone-cement interface or absence of the sclerotic rim at the bone-cement interface. **Mirel's criteria** includes 4 parameters (site, size, nature of the lesion, pain). Score more than 8 recommends prophylactic fixation.

### III. RESULTS

The mean follow-up period was 2 years (7 months – 28 months). The mean MSTS score was 25 out of 30. Mirel's score was 8-10. Post-operative range of motion in the knee joint was pain free, compared to painful restriction of movement in the preoperative period. All the patients were able to carry out their activities of daily living independently without much morbidity, thereby improving their quality of life. No patient had recurrence during the follow up period.

Fig 1: GCT of Distal Femur pictures

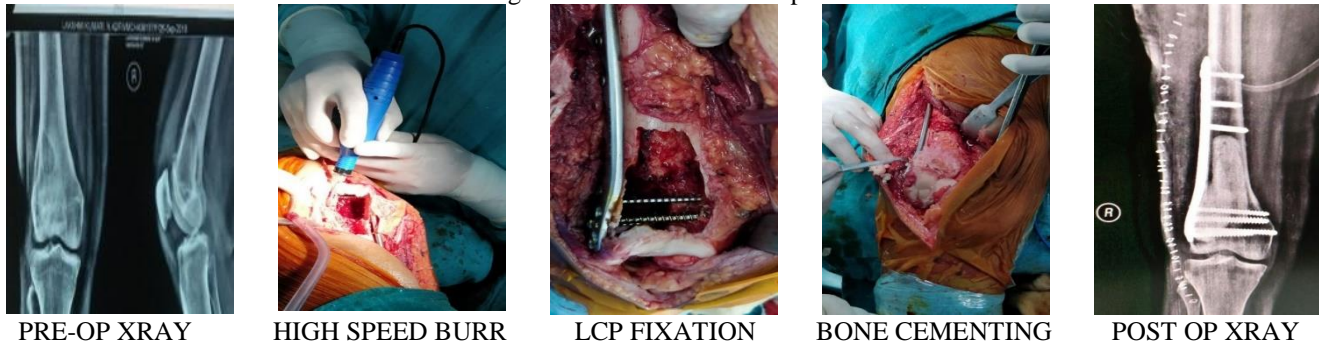
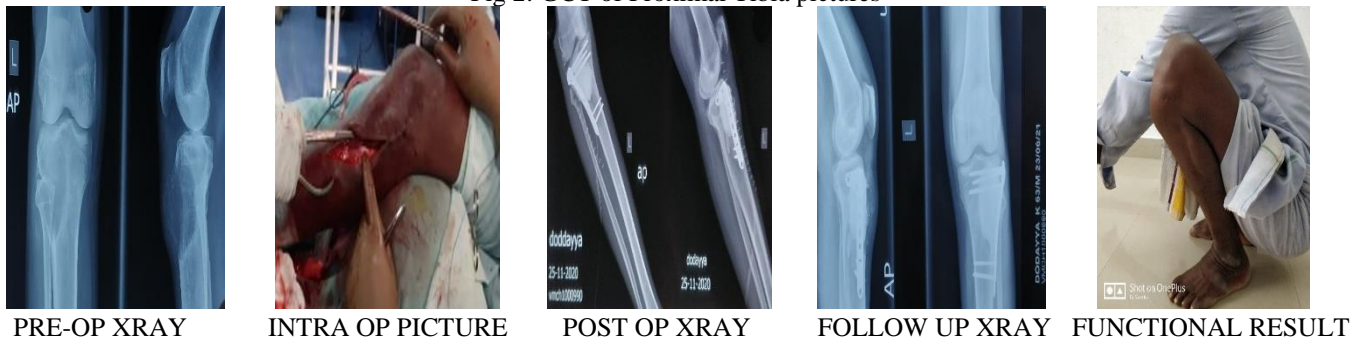


Fig 2: GCT of Proximal Tibia pictures



### IV. DISCUSSION

Wide array of surgical treatment methods are described in literature for the treatment of Giant cell tumours which range from curettage alone, extended curettage, extended curettage with adjuvant therapy and wide local resection followed by reconstruction, arthrodesis, or mega-prosthetic joint replacement. Intralesional curettage alone has a high recurrence rate of 60%,<sup>6</sup> whereas while addressing the periarticular lesions, wide resection is associated with functional disability jeopardizing the joint movement. Joint function preservation is an advantage with intralesional curettage compared to wide local resection. In our study, Intralesional extended curettage and reconstruction of the bone defect with the sandwich technique followed by locking compression plate fixation yielded good clinical outcomes. Thorough extended curettage can be achieved by making an adequate cortical window, wherein the tumour margins are clearly visible and using a high-speed burring on the entirety of the tumour surface with due care not to cause damage to the subarticular surface of the bone. Literature strongly recommends the use of Hydrogen peroxide as a chemical adjuvant to kill or destroy the residual tumour cells. Autogenous iliac crest graft slivers are placed beneath the subchondral region and overlaid with a layer of gel foam, and the rest of the cavity is filled with polymethylmethacrylate bone cement. The exothermic reaction and the subsequent heating effect of bone cement during its setting phase is supposed to destroy any remaining tumour cells<sup>7</sup>. The autogenous Iliac crest bone graft slivers placed in the subchondral region helps maintain joint function and prevents articular degeneration<sup>8</sup>. The benefits of bone cement include immediate stability and early weight bearing and its thermal effects minimise the risk of local recurrence, but it is associated with degeneration of articular cartilage in the subchondral region of the weight bearing zone<sup>9</sup>. Keeping layers of bone graft slivers and gel foam not only protects the underlying articular cartilage from the thermal effect of the bone cement but also reinforces the subchondral area. Conventionally, grade III lesions are treated with wide resection to prevent local recurrence.<sup>2</sup> Thus, the sandwich technique appears to be a promising and viable alternative to wide local resection. Bisphosphonate therapy in the postoperative period reduces tumour size and recurrence rate in GCT of bone<sup>10-13</sup>. Bisphosphonates bind to bone and inhibit bone resorption by osteoclasts<sup>14,15</sup>. Bisphosphonates not only induce apoptosis of osteoclasts and neoplastic stromal cells, but also possess a direct anti-tumour and anti-angiogenesis activity<sup>16</sup>. Bisphosphonates do not have any adverse effect on osteoblasts or reparative mechanisms of bone<sup>17</sup>.

## V. CONCLUSION

Intralesional extended curettage with high-speed burr, use of hydrogen peroxide, reconstruction with sandwich technique (using Iliac crest autograft slivers, gel foam & bone cement) and internal fixation with a locking plate for GCT of distal femur & proximal tibia achieved good functional outcomes by preserving the Knee joint function, thereby enabling the patient's to perform their activities of daily living independently, in a pain free manner. However, we feel that a further longer follow up period and a larger study sample is needed in order to establish the effectiveness of sandwich technique as well as to study the rate of recurrence in Giant cell tumours around the Knee joint.

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