

ORIGINAL RESEARCH ARTICLE

CLINICAL OUTCOME OF OPERATIVE TREATMENT IN 18 CASES OF GIANT CELL TUMORS OF BONES

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ABSTRACT

Background: Giant Cell Tumor of the bone (GCTB) has got variable outcome after the different methods of surgical treatment depending upon the site and grade of lesion and extent of tumor removal. This retrospective prospective analysis of operatively treated cases of GCTB of different sites aimed to highlight the clinical outcome.

Methods: This was a prospective observational study of 18 cases of GCTB; proximal tibia (n=6), distal femur (n=5), distal radius (n=4), proximal femur (n=1), proximal fibula (n=1) and anterior arc of first rib (n=1) treated with different operative management with mean follow up of 53.61 months. Functional outcome with Musculoskeletal Tumor Society Score (MSTS), recurrence and complications were analyzed with at least 24 months of follow up.

Results: There were 10 females and 8 males with average age at presentation 27.3 years (range 15-38). Average duration of symptom was 4.72 months. 2 were cases of recurrence previously operated and 16 were de novo cases. Mean MSTS was 84.27% with good to excellent result in 88%. There were no non-union, graft failure, metastasis, prosthetic failure or wound infection till at least 24 months of follow up in any of the cases.

Conclusions: Extended curettage or reconstruction with auto graft in grade I and II tumor or endoprosthesis in higher grade or recurrence of GCTB can give good to excellent functional result in majority of the cases.



INTRODUCTION

Giant Cell tumor of Bones (GCTB) is a common locally aggressive intermediate bony lesion with rare chance of metastasis. It constitutes about 5% of all primary bone tumors and 20% of all benign bone tumors.¹

Surgical treatment with curettage or excision of the lesion with or without reconstruction is the mainstay of treatment. Radiotherapy is suitable for GCTB inaccessible to curettage or excision such as spine or pelvis. The major concern in the treatment of these tumors is to minimize the chance of local recurrence. Local recurrence varies from 0-62% and depends on the treatment methods. Highest local recurrence rate has been found with the intralesional curettage only (up to 57%).²⁻⁴

There are different techniques of adjuvant treatment such as liquid nitrogen, phenol, polymethyl methacrylate and bone burr after curettage to reduce the chance of local recurrence. It can reduce recurrence rate to 0-34%.² Since most of the GCTB are near the joints such as knee, proximal femur and distal end radius, resection and reconstruction can be the only options for higher grade tumor with extension to joint or soft tissue or recurrent tumor. Functional outcome and satisfaction rate

are better in intralesional treatments methods at the cost of higher recurrence rate as compared to en-block excision with reconstruction.

This retrospective prospective study aimed to present clinical result of 18 cases of GCTB at different sites, operated by single surgeon with extended curettage, excision or reconstruction.

METHODS

This was a prospective observational study of 18 cases of GCTB treated with different operative methods by a single surgeon from period of 2009 to 2017 with minimum follow up of 24 months. There were total of 24 cases of GCT bones operated in this period and 6 lost to follow up and hence 18 cases were available for final outcome analysis. Patients included were from age range 15-38 years with mean of 27.33 years. There were 10 females and 8 males. Patient's details about preoperative demographics, intraoperative procedure and postoperative status were analyzed from admission records and follow up data about function, union, complications, MST score, recurrence and metastasis were analyzed during the subsequent follow up prospectively. Ethical clearance was obtained from the institutional review board.

Diagnosis of GCTB was based on the case chart details of clinical history, examination and typical radiological findings. MRI was done in 12 cases to further confirm the plain imaging findings. FNAC was done in 8 cases and incisional biopsy in 6 cases only to confirm the diagnosis of GCTB. Rest of the cases were operated on the basis of typical clinicoradiological presentation of GCTB.

Campanacci grading of the tumor was done according to the following description.

Grade I-Tumor with good cortical margin and bone stock

Grade II-Tumor with thin cortical margin left

Grade III-Large tumor with indistinct tumor margin or cortical breach or extension to soft tissue

Operative procedure depended upon the site of GCTB, Campanacci grading and recurrence. 10 cases of distal femur and proximal tibia underwent extended curettage and cavity was filled with autogenous bone graft and polymethylmethacrylate (PMMA), 6 cases underwent excision and reconstruction and 2 cases were treated with excision for the lesion in expendable bones (1 proximal fibula and 1 first rib). All the operations were carried out by single surgeon.

Incision was made longitudinally centering the lesion under proper anaesthesia. Oval window at the bony lesion was made sufficiently large so as to visualize the lesion all around. Precaution was taken at the same time to preserve the mechanical strength of the bone as much as possible. Thorough curettage of the cavity on all the four walls was done taking care not to leave any macroscopic portion of the tissue. Burring on all the walls inside the cavity was done as part of extended curettage. Then, 3% Hydrogen peroxide mopped gauze piece or tetra was used to pack the cavity for 3 minutes as part of adjuvant treatment and haemostasis. After thorough lavage and drying up, cavity was filled with bone cement with the intention to provide mechanical strength and hope to destroy residual tumor cells by its exothermic reaction. Cortical surface was covered with corticocancellous bone graft. In the lesion with subchondral extension with only cartilage wafer left after curettage, bone graft was put in the layers subchondrally to support and prevent cartilage injury by direct bone cement application in Campanacci III lesion. Wound was closed and limb was protected with knee brace or slab.

En-block excision and reconstruction were opted in total of 8 cases of Campanacci III for distal femur, recurrence of proximal femur and distal radius with cortical breach. Distal radius was operated under general anaesthesia through dorsal or volar approach depending upon the site of cortical breach and more expanded lesion side. Excision of the lesion en-block 3 cm proximal to the X-ray lesion site was done. Resection length of the radius was measured and ipsilateral non vascularized proximal fibula graft was used to reconstruct the distal radius. Length of the graft was kept about 3-5 mm longer than the resected

length so as to achieve tight fit at the host graft junction and carpal bones. 3.5 mm Dynamic compression plate (DCP) was used to fix the host graft junction with 6 cortices on each side. Two K wires were used for graft carpal bone stabilization and one for graft-ulna fixation at the distal end. Corticocancellous bone graft harvested from the iliac crest was applied at the radio-fibular junction site to secure union. Distal femur lesion with pathological fracture was managed with extended curettage, bone graft and Ilizarov stabilization (fig 1). One proximal femur GCT operated at other center 8 months back with curettage, bone cement and Dynamic Hip Screw (DHS) stabilization presented with massive recurrence with pathological fracture with soft tissue extension. It was operated with en-block resection and reconstruction with proximal femur megaprosthesis.

En-block excision was done in two GCTB with expendable bones; 1 anterior arc of first rib and one fibular head. For the GCTB around knee, slab was removed at two weeks and intermittent ROM exercise was started at 2 weeks. Partial weight bearing was permitted immediately as per pain tolerance and full weight bearing was permitted at 6 weeks. For the GCT at distal radius treated with reconstruction with non-vascularized ipsilateral fibula, slab was removed at 6 weeks and kept on wrist brace. K-wires were removed at 8-12 weeks and ROM at wrist was started.

Follow up with X ray was done at 3 months, 6 months and yearly to assess function, ROM, union, recurrence, union, prosthesis loosening or metastasis. Musculoskeletal Tumor Society Score (MSTS) was done at the last follow up to assess the functional outcome. Total possible best score is 30 and final score for each patient is calculated in percentage by dividing total score obtained by 30 and multiplying it by 100. MSTS of 75%-100% was categorized as excellent, 70%-74% as good, 60%-69% as moderate, 50%-59% as fair and <50% as poor result.

RESULTS

There were total of 18 patients with GCTB with at least 2 years of follow up with mean age of 27.33 years (range 15-38). Sex distribution was female 10 and male 8. Average duration of symptoms before presenting in the hospital was 4.72 months (range 3-12 months). Mean follow up duration was 53.61 month after the operation with range from 24-90 months. There were 2 cases in Campanacci grade I, 6 in grade II and 10 in Grade III. There were two cases of recurrence of GCT treated in other centre; one distal end radius and one proximal femur. Average hospital stay was 4.27 days. Demographic and treatment summary of the all the patients are given in the Table 1.

In the group of GCTB treated with extended curettage with or without fixation, no case had recurrence locally or evidence of metastasis till last follow up. Full weight bearing walking with full ROM was possible at 6 weeks of operation in 6 cases of GCT proximal tibia and 3 distal femur treated with extended curettage and filling with bone cement and bone graft. Two distal femur GCT needed fixation; one with Ilizarov after curettage and bone graft and one with distal femur locking plate after curet-

tage and bone cement. Mean ROM at knee was 130 degree at 3 months and pathological fracture united well at 3 months in the case fixed with Ilizarov ring fixator. None in this group had local infection or donor site morbidity. Mean MST score was 84.27% at last follow up with 88.88% having good to excellent result and 11.11% having moderate functional result.

In the group of GCT treated with e-block excision and reconstruction with autograft or endoprosthesis, all the host graft junction united at all the cases of distal end radius (n=4) at 12-16 weeks. Mean range of motion was palmer flexion 25.46

degree (range 15-35), dorsiflexion 56 degree (range 40-70), ulnar deviation 7.5 degree (range 5-12), radial deviation 6 degree (range 5-8), supination 42.62 degree (range 30-55 degree) and pronation 54.24 degree (range 40-70), Grip strength was 78 % of the normal side. One case had unusual dorsal prominence of fibular head graft but it was painless and only of minor cosmetic concern. There was no reconstructed fibulocarpal dislocation. One case of GCTB distal end radius Campanacci III had soft tissue recurrence after 6 months of en-block excision and reconstruction with fibula and was treated with excision of the recurred mass.

Table 1: Demographic data, intervention types and MSTS score of patients

Age	Sex	Site of Lesion	Average Duration of Symptom	Campanacci Grade	Operative Intervantation	MSTS(%)
23	f	radius DE	6	III	Recons	87
45	f	radius DE	4	III	Recons	80
15	m	fibula head	3	II	Excision	95
24	f	1st rib	6	II	Excision	96
28	f	femur DE	5	III	Recons	83
36	f	prox tibia	3	III	ext curet	90
22	m	prox tibia	4	III	ext curet	74
27	f	prox femur recurrence	3	I	recons endop	65
24	m	distal femur	12	III	ext curet n fixn	85
27	f	distal femur	6	III	ext curet n fixn	84
32	m	prox tibia	5	II	ext curet	79
20	m	prox tibia	3	I	ext curet	86
38	f	radius DE	4	II	Recons	76
28	m	distal femur	5	III	ext curet	90
24	m	prox tibia	4	II	ext curet	92
32	f	distal radius	3	III	Recon	78
28	m	prox tibia	4	II	ext curet	87
19	f	distal femur	5	III	ext curet	90

Note:-m=male, f=female, prox tibia= proximal tibia, DE=distal end, ext curet=extended curettage, recons endop=reconstruction with endoprosthesis, fixn=fixation, recons=reconstruction

One case of Previously operated recurrence of proximal femur neck and trochanteric area with pathological fracture with large soft tissue extension treated with en-block resection and reconstruction with megaprosthesis had abductor lurch. ROM was flexion 0-100 degree, extension 5 degree, abduction 45 degree and adduction 10 degree. She was able to walk without cane for 100 meters but was comfortable with cane support during long walking. Mild residual pain during walking and abduction lurch was due to need to sacrifice Gluteus medius and minimus due to infiltration by tumor mass. There was no evidence of infection, local recurrence, donor site deficit or lung metastasis in distal radius reconstruction group of patients till at least 2 years of follow up.

One case of anterior arc of first rib GCT who underwent en-block excision had no residual symptom of pain, neurological deficit or any other complications. One case of GCT fibular head in immature skeleton (15 year boy) treated with en-block

excision had no evidence of peroneal nerve palsy, lateral knee instability, stiffness, local recurrence or lung metastasis.



Figure 1: A, Distal femur GCT with pathological fracture treated with extended curettage, bone graft and Ilizarov ring fixator. B, X ray after ring fixator removal and fracture union without evidence of recurrence at 1 year

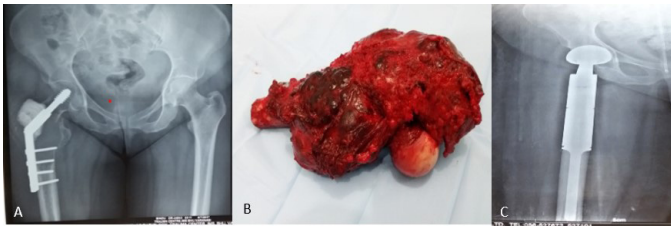


Figure 2: Extensive recurrence of GCT proximal femur A. with soft tissue extension with pathological fracture with DHS in situ, B. resected tumor along with proximal femur, C. Endoprosthetic reconstruction with proximal femur megaprosthesis

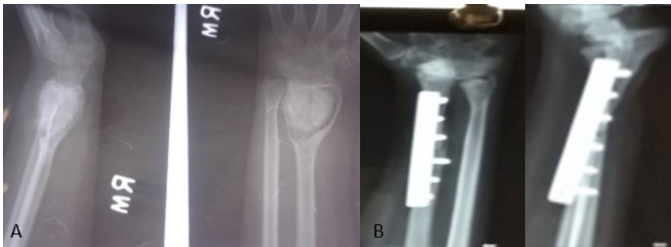


Figure 3: Distal radius recurrence of GCT A. with infection treated with WLE, B. reconstruction with non-vascularized fibular graft

DISCUSSION

Treatment of the GCTB still remains challenge to the treating surgeon because of difficulty in balancing the preservation of normal function and minimizing the chance of recurrence. Extended curettage is still the first choice of treatment as it preserves the maximum function of the limb but carries the risk of recurrence. This risk of recurrence has significantly gone down with combination of multiple adjuvant therapy after thorough curettage.

The most common site for this tumor is knee and our study findings (60.5%) is consistent with the other study findings in the literature.^{5,6} Female predominance as observed in majority of the studies is also present in our study. Mean age of presentation in this study was 27.33 years which is consistent with the most of the previous studies.^{5,6}

While extended curettage remains the mainstay of treatment in the Campanacci Grade I, II and few III tumors around the major joints to preserve the normal function, it is often difficult to balance the chance of recurrence. Recurrence rate is unacceptably high, up to 47%, in simple curettage. Adjuvant therapy with other means are the established practice.⁷ Agents used in the form of extended curettage are high speed burring, polymethylmethacrylate (PMMA), Hydrogen peroxide, liquid nitrogen and phenol.

Use of PMMA has exothermic reaction and helps to minimize chance of local recurrence to 0-25% due to necrosis of residual tumor cells.⁸⁻¹⁰ It has also got mechanical advantage of early mobilization and ambulation and ease of early detection if there is tumor recurrence. All the cases of GCTB around knee in this study have used curettage, high speed burr, Hydrogen peroxide as adjuvant treatment. Cavity was filled with autogenous corticocancellous bone graft from ipsilateral iliac crest

and PMMA. Though, it's very small series but none has shown local recurrence. One case of Campanacci III was treated with curettage with bone graft and ring fixator and united well at 3 months.

En-block excision with reconstruction may be a better choice for Campanacci III lesion of distal end radius, recurrent lesion, soft tissue extension with cortical breach. Biological reconstruction with bone graft in the form of arthrodesis has longer life span compared to reconstruction with endoprosthesis. In this small series of distal end radius GCTB treated with excision and reconstruction with non-vascularized ipsilateral fibular graft has shown good functional results. All the graft host united well. One case of soft tissue recurrence was due to probably microscopic residual tumor in the soft tissue while doing en-block excision of Campanacci grade III lesion. Other option for GCTB distal radius is curettage with graft or bone cement in grade I or II lesion, excision and reconstruction with vascularized fibular graft, tranlocation of ulna with wrist arthrodesis with comparable results.¹¹ One case of aggressive GCTB recurrence in proximal femur with extension of lesion to neck, trochanteric and subtrochanteric area with pathological fracture with soft tissue extension previously treated with curettage with PMMA with prophylactic fixation with DHS had no alternative to endoprosthetic reconstruction. Post-operative abduction lurch was because of unavoidable situation of tumor extension to gluteus medius.

GCTB arising from expendable bones such as proximal fibula, ribs, distal ulna can be safely treated with en-block excision without leaving residual deficits. One case of GCTB arising from anterior arc of first rib, very rare presentation, was treated with excision without any complication in this study. Proximal fibula is very uncommon site for GCTB and that too in immature skeleton is rare. One case of GCTB arising from proximal fibula was treated well with excision and anchoring lateral collateral ligament of knee at proximal lateral metaphysis of tibia with heavy suture. There was no knee instability or pain in the long term follow up. There is controversy regarding position of the lateral collateral ligament after proximal fibula excision in the literature.¹² Some are in favour of leaving as such while others prefer to anchor it along with biceps femoris tendon to proximal metaphysis of lateral part of tibia. Results are not significantly different in either of the groups.¹² Very limited number of cases and wide distribution of site of lesion and treatment methods are the constraint of this study.

CONCLUSION

Clinical results of GCTB treated with extended curettage and filling with bone cements and autograft are encouraging with good to excellent functional outcome in most of the cases in this small series. Reconstruction of distal radius after en-block excision and reconstruction with simple technique of ipsilateral non vascularized fibular graft can result in satisfactory results in Grade III tumors.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

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