

Original Article

Management of Giant Cell Tumor by Curettage and Bone graft in Weight Bearing Bone - A Study Done in CENTRAL MEDICAL COLLEGE.

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Abstract

Background: Giant cell tumor of bone (GCT) has been characterized as benign but often locally aggressive neoplasm that commonly occurs in proximity to weight bearing bone. Management of giant cell tumor of bone by curettage and bone graft in weight bearing bone is an effective method. This prospective experimental study was conducted among the patients with histologically proved giant-cell tumor who were admitted in the Department of orthopedic surgery, Central Medical College Hospital over a period of 18 months from January 2018 to June 2020. A total of 12 consecutive patients with histologically proved giant-cell tumour were included in the study. Majority (55.6%) of patient was in 3rd decade and male female ratio was 1:1.3. More than one fourth (25%) of the patients had GCT in the lower end of right femur, 33.3% in lower end of left femur, 25% in upper end of tibia, 16.7% in lower end of tibia and all patients had painful gait and swelling. According to Campanacci grading, Grade-2 was found in all patients, and giant cell tumor was found in all patients, as evaluated by pre-operative biopsy. Cosmetically near normal appearance was found in 88.9% and 88.9% were able to do normal daily work. According to Schatzker and Lamber (1979) criteria excellent outcome was found in 41.7%, good in 50%, fair in 8.3%. Surgery in the form of intralesional curettage and filling the cavity with bone graft resulted in excellent relief of pain, cosmetically near normal appearance and patients were able to do normal daily work.

Key words: Giant Cell Tumour, Curettage, Bone Graft.

Introduction: Giant cell tumour of bone (GCT) is a relatively rare, benign tumour of the skeleton'. GCT is composed of a stromal population of osteoblastic origin and a distinctive osteoclast-like population of probable monocytic origin. Although classified as benign GCT can be aggressive and recur locally in up to 50% of cases. Up to 5% of GCT metastasizes to the lungs and spontaneous transformation to a high-grade malignancy². Recent developments in understanding the molecular and cellular biology of GCT have led to evaluation of newer therapeutic agents, including bisphosphonates and denosumab with encouraging results.³

Epidemiology:

GCT represents approximately 3-5% of primary bone tumours and 20% of benign bone tumours. GCT is

almost never seen before epiphyseal closure, and usually occurs between ages 20 and 40 years⁴. GCT usually occurs at the epiphyses of long bones, but may also affect other bones, and rarely is multicentric. The incidence of GCT is significantly higher in Asia than in the United States and accounts for 20% of all primary bone tumours⁵. The cause of GCT is not known, and no risk factors have been associated with GCT, although familial clustering of both Paget's disease and GCT has been reported⁶.

Clinical presentation:

Destruction of the bone cortex may result in pathological fractures in up to one third of patients, and paraspinal tumours may present with neurologic signs and symptoms⁷.

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In general, the clinical outcome of pulmonary metastasis is better than with other connective tissue tumours, consistent with the generally benign character of the tumours⁸. In a small but significant proportion of cases, true spontaneous malignant transformation of GCT has been reported, with outcomes similar to those of other high-grade sarcomas. Primary malignant GCT is rare, but has a poor prognosis⁹.

Radiology:

Radiologic imaging is critical for accurate staging of GCT. Plain radiographs usually demonstrate an epiphyseal lytic destructive lesion, with well-defined margins and no evidence of increased osteoblastic activity. Computed tomography (CT) is vital to define the extent of cortical destruction, whereas MRI can be particularly useful to assess invasion of adjacent soft tissues including Neurovascular structures.



Radionuclide bone scans have little role in staging or assessment of GCT. The metabolic activity of GCT may relate to the osteoclastic population, as osteoclasts express extremely high levels of trans-membrane ATP-dependent proton pump transporter proteins³. Therefore, it is important to note that, although PET has been reported to distinguish benign from malignant sarcomas and to correlate with tumour grade metabolic activity in GCT may not indicate malignant transformation¹⁰.

Classification:

The most commonly used staging system for GCT was designed to define the extent of surgery required to completely remove the disease (intralesional, marginal, wide or radical resection) and divided GCT into three categories according to radiologic extent (campanacci grading)⁷.

Grade-1: Well-defined tumor with radio-opaque rim tumours demonstrate a lytic lesion without

aggressive features, with a well-defined margin and intact cortex. **Grade-2:** Well-defined margins with moderately expanded but intact cortex and no radio-opaque rim tumours demonstrate cortical thinning and bony expansion, whereas **Grade-3:** Ill-defined margins with soft tissue mass. The primary modality of treatment was intralesional curettage and bone cementing tumours show cortical destruction and extension of tumour into surrounding soft tissues. GCT rarely invades adjacent joint space unless in association with a fracture.

Treatment:

Giant cell tumor (GCT) of bone is one of the commonest benign bone tumour encountered by an orthopedic surgeon. The reported incidence of GCT in the Oriental and Asian population is higher than that in the Caucasian population and may account for 20% of all skeletal neoplasms. It has a well-known propensity for local recurrence after surgical treatment. Certain controversies in the treatment of GCT continue to intrigue treating surgeons. Do adjuvants like phenol or cryotherapy for extension of curettage have any benefit; is it better to pack the defect with bone graft or cement; should a recurrent lesion be curetted again or widely excised; does one contemplate joint salvage or resection especially in large GCTs. These are some of the issues that offer topics for eternal debate. This study endeavors to outline the principles of management of giant cell tumor of bone and addresses current opinion regarding some of these dilemmas.

The present study will describe the treatment of giant-cell tumour of the long bones with curettage and grafting. Specific attention will be directed toward determination of the stabilization of joint movement.

Materials and Methods:

This prospective experimental study was conducted among the patients with histologically proved giant-cell tumor who were admitted in the Department of orthopedic surgery, Central Medical College Hospital over a period of 18 months from January 2018 to June 2020. Total 12 patients with Giant cell tumour were selected, the purpose of the study was to evaluate the outcome of treatment of GCT by curettage and bone graft in weight bearing bone. All the relevant findings obtained from data analysis are presented in tables and figures.



Surgical technique:

The operative procedure was chosen by the surgeon. In general, curettage of tumour followed by use of bone graft became more accepted. Operation was done under general or spinal anesthesia and incision was made near the area with maximum cortical thinning. Cavity was curetted completely and was washed completely by normal saline and hydrogen peroxide (H₂O₂).

The cavity was then completely obliterated by Auto genous Corticocancellous (Iliac crest & fibula) Bone Graft & Allograft.



Results:

Table I: Age distribution of the patients (n=12)

Age (in years)	Number of patients	Percentage
21-30	7	58.33
31-40	5	41.67

The above table shows that majority (55.6%) of patients were in 3rd decade.

Table II: Sex distribution of the patients (n=12)

Sex	Number of patients	Percentage
Male	5	41.67
Female	7	58.33

The above table shows the sex distribution of the study patients. Male was found 5 (41.67%) and female 7 (58.33%). The female ratio was 1:1.3

Table III: Distribution of the patients according to location of the giant cell tumour of bone (n=12)

Tumour of bone	Number of patients	Percentage
Lower end of right femur	3	25
Lower end of left femur	4	33.3
Upper end of tibia	3	25
Lower end of tibia	2	16.7

The above table shows the patients according to the location of the giant cell tumour of bone. More than one fourth 3(25%) of the patients had GCT in the lower end right femur, 4(33.3%) in the lower end of left femur, 3(25%) in the upper end of tibia and 2(16.7%) in the lower end of tibia. According to Schatzker and Lambert (1979) criteria excellent outcome was in found in 5(41.7%), good in 6(50%), fair in 1(8.3%).

Discussion:

The method of curettage and packing with polymethyl methacrylate (PMMA) cementing in the management of GCT was first described in 1969. Limited information is available about the risks of recurrence following curettage and bone cementing in Grade II and III GCTs of the long bone¹¹. Most of the recurrences (80-97%) following primary treatment reported to occur within two years¹². Curettage has been advocated in GCT up to Grade III tumour where there is no joint invasion, less than 50% metaphyseal destruction and soft tissue mass in one plane only¹¹.

Extended curettage was advocated when at least 2 mm of sub-articular bone was free of the tumour with no soft tissue spillage as assessed on a recent MR¹³.

Exothermic reaction of PMMA generates local hyperthermia, which induces necrosis of any remaining neoplastic tissue without causing any local complication¹⁴. Curettage and packing with bone graft has advantage to its association with low rate of recurrence and it provides immediate support and allows for intensive curettage even in the case of large tumour cavities¹⁵. The additional advantages are lowcost, ease of use, lack of donor-site morbidity. It facilitates the radiographic detection of local recurrence earlier and easier. Adequate removal of the tumor seems to be more an important predictive factor for the successful outcome of primary surgery. Thus, use of high-speed burr is helpful and encouraging¹⁶. This prospective experimental study was carried out to observe the outcome of management of giant cell tumour of bone by curettage and bone graft in weight bearing bone. A total of 12 patients with histologically proved giant-cell tumour, were enrolled in this study, who were admitted in the Department of Orthopedic-Surgery in Central Medical College over a period of 18 months from January 2018 to June 2020. The present study findings were discussed and compared with previously published relevant studies.

In this study it was observed that majority (58.33%) of patient were in 3rd decade and the mean age was 32.6±5.2 years with range from 25 to 40 years. O'Donnell et al observed the mean age 31 years with range from 17 to 62 years¹⁷. Similarly, Saikia et al showed the meanage of their study patients at operation were 32.4 years with range from 18 to 54 years¹⁸. Zhen et al found that the mean age at the time of diagnosis was 31 years with range from 15 to 59 years, which are comparable with the current study¹⁹.

In this present series it was observed that male female ratio was 1:1.3, which indicates that female was predominant in this study. Similar observation regarding the female predominance were also made by O'Donnelli et al, Blackely et al and Zhen et al^{17,19,21}.

So, when developing a treatment protocol for giant cell tumour of bone, a surgeon must decide whether to perform an intralesional excision or unblock resection, whether to use adjuvant therapy to eradicate residual microscopic disease and what material to be used to fill the resultant defect in the

bone. The high risk of recurrence after bone grafting led to the technique of intralesional curettage followed by packing of the defect with methyl methacrylate cement. The higher the temperature and longer the time, the stronger the hyperthermic effect. Study showed that the heat above 60 centigrade produce during polymerization lasted for about 10 min. After heat treatment at 60°C for 10 minutes, no neoplastic cells could have survived. This study has clarified the tumoricidal effect of methyl methacrylate by hyperthermia from the heat caused by polymerization. The immediate stability afforded by graft permits early range of motion and weight bearing thereby reducing the morbidity of immobilization.

In this study it was observed according to location of the giant cell tumour of bone. More than one fourth (25%) of the patients had GCT in the lower end of right femur, (33.3%) in the lower end of left femur, (25%) in the upper end of tibia and (16.7%) in the lower end of tibia. Zhen et al showed in their study that 38% were in the distal femur, 28% in the proximal tibia, 8.0% in the proximal femur, 5.0% in the proximal humerus, 3.0% in the distal radius, 3% in the distal humerus, 4% in the sacrum, 3.0% in the ilium, 2.0% in the talus, one 1.0% in a metacarpal joint and one 1.0% in the distal tibia¹⁹. O'Donnell et al. (1994) showed 42.0% were in the proximal part of the tibia; 38.0% in the distal part of the femur; 17.0%, in the distal part of the radius: 2.0%, in the proximal part of the femur and one in the radial diaphysi¹⁷.

Radiograph finding according to campanacci grading, Grade-2 was found in all patients. Metastasis was not found in chest X-ray. Giant cell tumour was found in all patients, evaluated by pre-operative biopsy. In a study O'Donnell et al showed grade II tumor 67.0% and 27.0% grade III tumor¹⁷. GCT is characterized macroscopically as hemorrhagic, loosely aggregated, soft, lobulated mass eroding bone. Microscopically, the tumour is characterized by a mononuclear stromal cell population and a second population of mononuclear monocytes and multinucleated giant cells with centrally located nuclei without atypia. These prominent multinucleated cells may exceed 50.0% of the total cell content of the tumour and are derived from monocytic precursors²².

In this study it was observed that 1(8.33%) patients had post-operative infection. 5(41.66%) patients had 0°-130° knee flexion, 4(33.33%) patients had 0-120° knee flexion and 2(16.7%) patients had 0-100° knee flexion. Stiffness were found in 2(16.7%) and absent in 10 (83.33%). Elimination of tumour found completely. Thomas and Skubitz reported that GCT most commonly presents with pain and deformity at the distal femur, proximal tibia and this deformity was measured by range of movement of knee joint in angle such as 0-130° knee flexion, 0-120° knee flexion and 0-100° knee flexion²².

In this study it was observed that the pain status according to Schatzker and Lambert (1979) 23; 2(16.7%) patients had pain and 10 (83.33%) had no pain. Cosmetically normal appearance was found in 88.9% and 88.9% patients were able to normal daily work and rest 8.33% patients were able to do near normal daily work and no recurrence was found during the follow up period. Packing with graft after curettage of a giant-cell tumour has been advocated for many reasons in addition to its association with apparently lower rates of recurrence. By virtue of its material properties, graft provides immediate support and stability even of large tumour cavities. Also, the contrast between the barium-impregnated graft and the bone makes radiographic detection of a local recurrence easier^{24,25}. It was feared that the presence of graft in the subchondral region might lead to early degeneration of cartilage, but this has not been observed. So, the patients are able to do daily work without any difficulty. Duration of hospital stay was also short 19.8±4.5 with range 14-34 days.

Total follow-up period was 2-12 months. According to Schatzker and Lambert (1979)²³ criteria it was found in this study excellent 38.9%, good 44.4%, fair 11.1% and poor 5.6%. According to Schatzker and Lambert (1979) criteria, excellent and good outcome are considered as satisfactory & fair and poor outcome are considered as unsatisfactory. In this present study it was observed that satisfactory result was found in 3.3% and unsatisfactory in 16.7%. O'Donnell et al experienced with the treatment of recurrent giant-cell tumours of the long bones after curettage and packing with graft is limited¹⁷. But the data suggest that initial use of curettage and graft does not adversely affect the outcome of subsequent procedures. This finding is in accordance with those of previous report²⁶. Cure after intralesional curettage

and packing with bone graft is clearly superior to other modalities of treatment of giant cell tumor.

Conclusion: GCT are locally aggressive benign neoplasm with a large biological spectrum. Currently there are no reliable predictors of recurrence, malignant transformation or metastatic behavior. Curettage is the preferred treatment option can be performed alone or in combination with local adjuvant such as hydrogen peroxide, zinc chloride, cryoablation, phenol, alcohol with bone graft. Systemic agents such as bisphosphonates, denosumab or IFN may also be administered for effective control of the local and metastasis of disease. We avoid PMMA cement due to its side effect & difficulty in revision surgery.

However, even though the biology, pathophysiology and treatment options for GCT have been extensively studied there are still too many unanswered questions to be explored.

CONFLICT OF INTEREST:

There is no conflict of interest among the authors.

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