

Overview of giant cell tumour, outcomes of different surgical procedures

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Abstract

Introduction: These are aggressive bone tumor that arises adjacent to the sub-chondral bone of major joints. The areas of bone most often involved are the distal femur, proximal tibia, proximal humerus, and distal radius. Treatments ranging from surgical curettage to wide resection.

Objective: To determine the frequency of the different bones involved and different surgical procedures as well as outcome in patients suffering from Giant cell tumour.

Materials & Methodology: The data of 108 patients between 2004-2016 who have biopsy proven Giant cell tumour and were followed for at least 1 year were analyzed retrospectively in the Department of Orthopaedic and spine surgery of Ghurki trust teaching hospital, Lahore. There were 58 males and 50 females with a mean age of 28.66 ± 11.23 . Outcome of surgeries were determined in terms of Musculo skeletal Tumor Society (MSTS) score. The data was analyzed using SPSS 17.0 version.

Results: It is most common between 21- 40 years i.e. 68(63.0%). The most of the patients presented with both pain and swelling i.e. 46(42.6%) and the commonest site were proximal tibia 32(29.63%) followed by distal femur 20(18.52%). The commonest surgical procedure performed were curettage and bone cementation i.e. 36(33.33%), followed by wide excision of bone±cementation and usage of implant i.e. 34(31.5%). Curettage and bone grafting were done in 14(13%) patients, 10(9.3%) patients underwent above knee amputation, 6(5.55%) patients underwent custom made arthroplasties, 8(7.40%) patients underwent disarticulation. The recurrence were more in curettage and bone graft. The mean MSTS score was 25.7 out of 30 (standard deviation, 3.3; range, 16–30)

Conclusion: Giant cell tumour can occur at any age, most commonly in 3rd & 4th decade and any bone can be involved but mostly proximal tibia and distal femur. The choice of surgical treatment varies among individuals which depends on the extent of bone destruction, risk of tumor recurrence and type of bone involved.

Keywords: giant cell, tumour, arthroplasty, disarticulation, bone cement, amputation

Introduction:

Cooper in 1818 first described Giant cell tumors (GCT) of the bone. Later Nelaton showed their local aggressiveness, and Virchow revealed their malignant potential.¹ The term “giant cell tumor” implies that the multinucleated giant cells are responsible for the proliferative capacity of this tumor, there is evidence that the stromal cells, the major components of the mononuclear cell population, represent the true neoplastic components of giant cell tumor of the bone

(GCTB).² It accounts for 5% of primary skeletal tumors and 21% of all benign bone tumors.³ The disease is more common in China and India, where it constitutes approximately 20% of all primary bone tumours. Most lesions develop in the long bones (75%–90%), with most cases (50%–65%) occurring near the knee.⁴ Approximately 1% of cases present as multiple synchronous or metachronous lesions.⁵

It primarily occurs in young adults between the

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ages of 20 and 40 years and paediatric cases of GCT are even less frequent and are believed to comprise only 1.7% of all cases of GCTB.⁶ Although usually a benign tumor, GCTB frequently recurs locally after surgical resection.⁶ Campanacci et al reported a recurrence rate of 34% after intra-lesional excision, 7% after marginal excision, and none after wide excision.⁷

Secondary transformation, which follows radiation therapy or less commonly surgical intervention, accounts for approximately 70% of malignant GCT. Primary malignant GCT, which arise de novo along-side typical GCT, make up the remainder of malignant cases.⁸ The incidence of metastases is estimated to be from 1-6%. The metastatic lesions are histologically identical to the primary lesions, showing no tendency to de-differentiate. The majority of metastatic lesions are to the lung. Solitary metastasis to regional lymph nodes, the mediastinum and the pelvis have been reported, as has involvement of the scalp, bone and paraaortic nodes. The mean interval between the onset of the tumor and the detection of lung metastases is about four to five years.⁹

Treatment often involves curettage, with or without bone filler or adjuvants such as polymethylmethacrylate (PMMA) or phenol.⁸ Early treatment methods of GCT involved simple curettage with or without a bone graft, and the consequent recurrence rate was approximately 40%. In 1969 Vidal et al. introduced reconstruction with bone cement after thorough intral-lesional curettage.¹⁰

Less invasive procedures, such as radiotherapy, radio-frequency thermal ablation, or chemo-embolization, may be used in cases where surgery is not possible. Wide resection may be reserved for cases in which surgery results in relatively minor functional impairment or for tumors with extensive local destruction.⁸

There is no local data available regarding the demography, site of occurrence, surgical procedure and recurrence rate. There is dearth of information on the pattern of this tumour in our envi-

ronment. In this study, we set out to describe the profile of all histologically diagnosed cases of giant cell tumour of the bone seen in our centre over a twelve year period.

Material and Methods:

This retrospective study was carried out on 108 patients of either sex and of any age who utilized medical services admitted at Department of Orthopaedics and Spine Centre of Ghurki Trust Teaching Hospital, Lahore either through out patient department (OPD) or Emergency. The data had been collected from hospital database record and from the patient hospital charts after hospital ethical committee approval and permission from concerned department. The patients who has biopsy proven Giant Cell tumour between 2002 to 2016 and were followed for at least 1 year and maximally 10 years were included in study and those whose record were incomplete and were lost in 1st year of follow up were excluded from the study. The data included patients age, sex, history, examination, radiological findings, histo-pathology report whether benign or malignant, multiplicity of site (synchronous or metachronous), mode of presentation, interval between onset of symptom and mode of presentation, type of surgery performed, recurrence and follow up record. The patients were divided into three groups according to age i.e. < 20 years, 20-40 years and > 40 years. The lesion of all patients were staged according to the system of Campanacci et al. Grade I tumors were intraosseous lesions; grade -II tumors were extraosseous lesions without loss of cortical continuity and with a thin cortex; and grade-III tumors were extraosseous lesions that broke through the cortex and extended into soft tissue. Pathological fractures were classified as grade-III. 20 patients having Grade-I, 70 patients had a grade-II lesion and 18 had a grade-III lesion. Functional outcomes were evaluated using the Musculo-skeletal Tumor Society (MSTS) score,¹¹ which involves 6 parameters (pain, function, emotional acceptance, use of walking aids, walking ability, and gait). Scores for each parameter range from 0 to 5; higher scores indicate better outcome.

Table 1: Distribution by site of bone involvement and presenting symptoms

		Frequency(n)	Percent(%)
Site of Bone involved	Proximal tibia	32	29.63%
	Distal femur	20	18.52%
	Proximal humerus	16	14.82%
	Others	40	37.03%
Presenting symptom	Pain only	38	35.2%
	Swelling only	18	16.7%
	Pain & swelling	46	42.7%
	With fracture	6	5.6%

Table 2: Distribution by surgical procedure

Procedure	Frequency (n)	Percent(%)
Curettage + bone cementation	36	33.33%
Curettage + bone graft	14	13%
Amputation	10	9.3%
Custom made joint replacement	6	5.55%
wide excision of bone ± cementation and usage of implant except arthroplasties	34	31.5%
Disarticulation	8	7.40%
Total	108	100%

The data were initially recorded on a pre-formed proforma and then were entered into SPSS version 17.0. All frequencies and percentages were calculated. All data are presented as the mean ± standard deviation. Data presented in tables and graphs where necessary.

Results:

A total of 108 patients with male 58(53.70%) and females 50(46.30%) and with mean age of 28.67±11.18 and mean follow up of 32.3 months (range 16- 48 months). The patients with age less than 20 years were 30 (27.8%), those between 21- 40 years were 68(63.0%) and above 40 were 10 (9.3%). The average duration between first time onset of symptom and presentation were 12.44±9.181 months. The 66(61.1%) patients presented for the first time while the remaining 42(38.9%) were operated elsewhere and were referred. The patients with presenting symptom of only pain were 38(35.2%), with swelling only were 18(16.7%), with both pain and swelling were 46(42.6%) and those with pain and fracture were 6(5.6%).

The commonest site were proximal tib-

ia 32(29.63%) followed by distal femur 20(18.52%) and then proximal humerus 16(14.82%). (Table 1)

The commonest surgical procedure performed were curettage and bone cementation i.e. 36(33.33%), followed by wide excision of bone ± cementation and usage of implant i.e. 34(31.5%). Curettage and bone grafting were done in 14 (13%) patients, 10(9.3%) patients underwent above knee amputation, 6(5.55%) patients underwent custom made arthroplasties, 8(7.40%) patients underwent disarticulation. (Table 2). Pre and post opp images of some patients are given below. (Figure 1-10)

7 (10.61%) presented with recurrent tumour among those 66 patients who were managed in our unit from beginning. Among these 4 patient having recurrence who were managed with curettage and autologous bone graft and 3 patients who were managed with curettage and bone cement. Among 42 patients with recurrent tumour, after extensive surgical procedure only 1 patient presented with another recurrence. These were managed accordingly. Recurrence occurred at an average time of 9 months (range 4-22 months). The mean MSTS score was 25.7 out of 30 (standard deviation, 3.3; range, 16–30)

Discussion:

Giant cell tumour can occur at any age and any bone can be affected. It mostly occur in the 3rd and 4th decade of life. The females are slightly more affected as compared to males.^{12,13} However the study conducted in Nigeria there is male more affected as compared to females.¹⁴ Pain and swelling were the presenting complaint and most of the patients presented late in our study. Similar findings were found in the study conducted by Cajetan U.^{14,15} The reasons for their late presentation were multiple; most of the patients were poor, few having no knowledge, some went towards bone setters who managed with cultural ointments. Patients came when these were failed. In most of the studies the distal femur followed by the proximal tibia and then distal radius are affected.^{10,14,16} However in our study the sequence is slightly changed. Prox-



Figure 1: 30 years old man came with pain and swelling of Left arm since 2 years



Figure 2: Post-opp x-rays after hemiarthroplasty



Figure 3: Pre-opp x-ray of 25 years old female with 1 year history of swelling and pain left knee .



Figure 4: Post-opp x-ray of 25 year old female managed with curettage and cementation



Figure 5: Pre-opp xray of Right distal femur GCT



Figure 6: Post-opp xray. Patient underwent Custom made TKR



Figure 7: Pre- opp xray of distal tibia GCT In 14 years old female child



Figure 8: Post-opp xrays. Patient underwent excision with Ilizarovo and Proximal Corticotomy



Figure 9: Post-opp xrays of Proximal femur GCT, Custom made THR done.



Figure 10: Post-opp xrays in 50 years old of Lt.Elbow GCT, Total Elbow Arthroplasty done



Figure 11: Proximal femur GCT. Post-opp x-rays after curettage, cementation and DHS

imal tibia followed by distal femur and then the proximal humerus are affected.

Certain controversies in the treatment of GCT continue to intrigue treating surgeons. The main problem in the management of GCTB is local recurrence after surgical treatment: 27%–65% after isolated curettage, 12%–27% after curettage with adjuvants such as high-speed burr, phenol, liquid nitrogen, or poly-methyl-metha-crylate (PMMA) and 0%–12% after en bloc resection.¹⁷ 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?

Derek F et al¹² in his study concluded that the most common sites were proximal tibia followed by distal femur and then distal radius. There is small high number of females as compared to males. More over the there were no recurrence

rate after simple curettage and adjuvants. However they didn't grade the tumor.

Sheng Sun et al¹⁸ in his study determined that there is no recurrence rate after curettage and local methotrexate gel foam adjuvant treatment and filling of the cavity with allo-graft and/or homo-graft bone as compared to control group in which only curettage were done. Paritosh Gogna in his study found that Cavities <60cm³ do not require filling and those with < 5mm of subchondral bone are well managed with sandwich technique.¹⁹

Balaji Saibaba et al¹³ managed 36 patients with sandwich technique with or without implant. In their study there were slight female predominancy and almost half of the patients were Grade-2. There were no recurrence in any Grade -2 tumour, however 1 patient with Grade 3 having recurrence and concluded that sandwich procedure is an alternative to wide excision having low recurrence rate in Grade 3.

Emad G.K et al¹⁶ used different adjuvants after curettage. The highest recurrence were found in cemented group followed by those in whom no adjuvants were used, after curettage only bone graft were used and then the least recurrence were found in whom burr as well as cement were used. However no recurrence were found in whom burr and phenol were used.

Excision or en bloc resection of the tumor was proposed as the first line treatment for these tumours due to failiure of histological findings to prognosticate its recurrence, which was as high

as 60% after intra lesional curettage and autologous bone grafting. However, wide resection has been found to be associated with higher morbidity and complications as compared to intralesional curettage.²⁰ On the other hand Campanacci grade 3 GCTB, where both the bone and soft tissue are affected, conventional tumor curettage and bone grafting are difficult to guarantee the complete removal of lesions, resulting in a high rate of recurrence after operation. For these patients, tumor resection and prosthesis replacement can resolve the problem.²

Although surgery remains the method of first choice in the treatment of GCTB, in some cases with locations in the spine, sacrum or pelvis which hinder surgery the use of adjuvant radiotherapy is appropriate.²¹

The giant cells over express a key mediator in osteoclastogenesis: the RANK receptor, which is stimulated in turn by the cytokine RANKL, which is secreted by the stromal cells. The RANK/RANKL interaction is predominantly responsible for the extensive bone resorption by the tumour. Studies with denosumab, a monoclonal antibody that specifically binds to RANKL, resulted in dramatic treatment responses, which led to its approval by the United States Food and Drugs Administration (US FDA).^{1,4}

There are some limitations in our study. First of all the study was a retrospective study and limit data available. So, the number of variables were kept low. Most of the patients were lost in follow up. So, further studies needed to determine the outcome in a prospective way.

Conclusion:

Any patient especially in 3rd and 4th decade with pain and swelling at any area mostly around knee should seek medical care as soon as possible. There should be proper public health awareness program at community level. Moreover an appropriate surgical method should be decided for patients with a Campanacci grade of 2 or 3 for complete removal of the tumour as well as to prevent the recurrence.

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