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Original Article

Management of Giant Cell Tumour by Curettage and Bone Cement in Weight Bearing Bone - A Study Done in DMCH & NITOR.

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Abstract:

Giant cell tumour 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 cement in weight bearing bone is an effective method. This prospective experimental study was conducted among the patients with histologically proved giant-cell tumour who were admitted in the Department of orthopedic surgery, Dhaka Medical College Hospital (DMCH) and in National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) over a period of 18 months from January 2010 to June 2011. A total of 18 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 (27.8%) of the patients had GCT in the lower end of right femur, 33.3% in lower end of left femur, 22.2% in upper end of right tibia, 16.7% in upper end of left tibia and all patients had painful gait and swelling. According to campanacci grading, Grade-2 was found in all patients, and giant cell tumour 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 Lambert (1979) criteria excellent outcome was found in 38.9%, good in 44.4%, fair in 11.1% and poor in 5.6%. Surgery in the form of intralesional curettage and filling the cavity with bone cement 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 Cement.

Introduction:

Giant cell tumour of bone (GCT) is a relatively rare, benign tumour of the skeleton[1]. GCT is composed of a stromal population of osteoblastic origin and a distinctive osteoclast-like population of probable monocytic origin. Although classified as benign, GCTs can be aggressive and recur locally in up to 50% of cases. Up to 5% of GCT metastasize to the lungs and spontaneous transformation to a high-grade malignancy occurs in 1-3% of patients[2]. Recent developments in understanding the molecular and cellular biology of GCT have led to evaluation of newer therapeutic agents, including bisphosphonates and denosumab with encouragingly results[3].

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GCT represents approximately 3-5% of primary bone tumours and 20% of benign bone tumours in the United States, is almost never seen before epiphyseal closure, and usually occurs between ages 20 and 40 years[4]. 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 tumours in China[5]. 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 reported[6].

Destruction of the bone cortex may result in pathological fractures in up to a third of patients, and paraspinal tumours may present with neurologic signs and symptoms[7]. In general, the clinical outcome of pulmonary metastasis is better than with other connective tissue tumours, consistent with the generally benign character of the tumour[8]. 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[2]. Primary malignant GCT is rare, but has a poor prognosis[9].

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 proteins[3]. 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 transformation[10].

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.

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 cementing. Specific attention will be directed toward determination of the stabilization of joint movement.

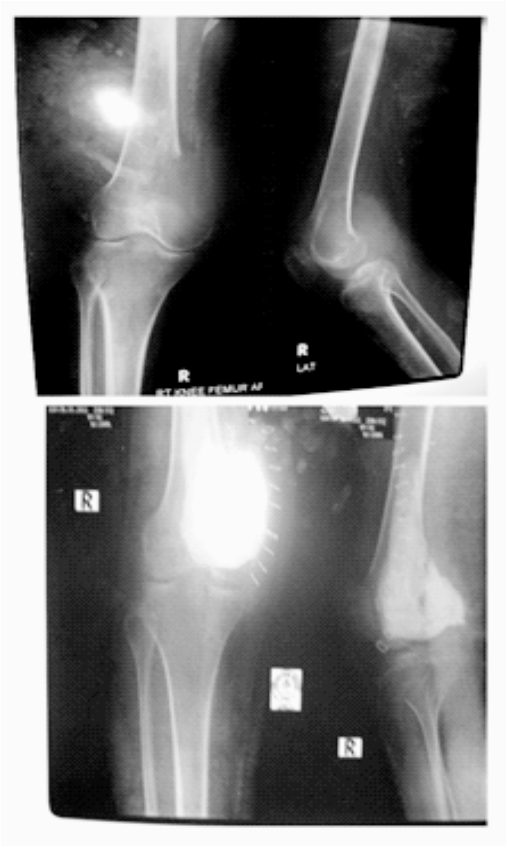
Materials and Methods:

The present study was carried out between January 2010 to June 2011 at DMCH and NITOR. Total 18 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 cement in weight bearing bone. All the relevent findings obtained from data analysis are presented in tables and figures.

Surgical technique:

The operative procedure was chosen by the surgeon. In general currettage of tumour followed by use of bone cement became more accepted. Operation was done under general or spinal anaesthesia and incision was made near the area with maximum cortical thinning. Cavity was curretted completely and was washed completely by normal saline.

The cavity was then completely obliterated by careful hand-packing with standard polymethylmethacrylate bone-cement.



Results:

Table I: Age distribution of the patients (n=18)

Age (in years)	Number of patients	Percentage
21-30	10	55.6
31-40	8	44.4

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

Table II: Sex distribution of the patients (n=18).

Sex	Number of patients	Percentage
Male	8	44.4
Female	10	55.6

The above table shows the sex distribution of the study patients. Male was found 8 (44.4%) and female 10 (55.6%). The male female ratio was 1:1.3

Table III: Distribution of the patients according to location of the giant cell tumour of bone (n=18)

Tumor of bone	Number of patients	Percentage
Lower end of right femur	5	27.8
Lower end of left femur	6	33.3
Upper end of right tibia	4	22.2
Upper end of left tibia	3	16.7

The above table shows the patients according to location of the giant cell tumour of bone. More than one fourth 5(27.8%) of the patients had GCT in the lower end of right femur, 6(33.3%) in the lower end of left femur, 4(22.2%) in the upper end of right tibia and 3(16.7%) in the upper end of left tibia. According to Schatzker and Lambert (1979) criteria excellent outcome was found in 7(38.9%), good in 8(44.4%), fair in 2(11.11%).

Discussion:

The method of curettage and packing with polymethylmethacrylate (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 bone[11]. Most of the recurrences (80-97%) following primary treatment reported to occur within two years[12]. 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 only[11].

Extended curettage was advocated when at least 2 mm of subarticular bone was free of the tumour with no soft tissue spillage as assessed on a recent MRI[13]. Exothermic reaction of PMMA generates local hyperthermia, which induces necrosis of any remaining neoplastic tissue without causing any local complication[14]. Curettage and packing with bone cement 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 cavities[15]. The additional advantages are low cost, 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 encouraging[16]. This prospective experimental study was carried out to observe the outcome of management of giant cell tumour of bone by curettage and bone cement in weight bearing bone. A total of 18 patients with histologically proved giant-cell tumour, were enrolled in this study, who were admitted in the Department of Orthopedic-Surgery in DMCH and in NITOR over a period of 18 months from January 2010 to June 2011. The present study findings were discussed and compared with previously published relevant studies.

In this study it was observed that majority (55.6%) 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 years[17]. Similarly, Saikia et al showed the mean age of their study patients at operation were 32.4 years with range from 18 to 54 years[18]. 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 study[19].

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 observations regarding the female predominance were also made by O'Donneli et al, Blackely et al and Zhen et al[17,19,21].

Historically simple curettage of giant cell tumour of long bones was associated with rate of local recurrence between 27 and 55% with or without bone graft. These led many surgeons to adopt wide excision as the treatment of choice and rate of local control increased to more than 90 percent. However, the functional results were not as good as when the joint had been preserved.

So when developing a treatment protocol for giant cell tumour of bone, a surgeon must decide whether to perform an intralesional excision or enblock 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 methylmethacrylate cement. The higher the temperature and longer the time, the stronger the hyperthermic effect. Study showed that the heat above 60^0 centigrade produce during polymerization lasted for about 10 min. After heat treatment at 60^0C for 10 minutes, no neoplastic cells could have survived. This study has clarified the tumoricidal effect of methylmethacrylate by hyperthermia from the heat caused by polymerization. The immediate stability afforded by cement 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 (27.8%) of the patients had GCT in the lower end of right femur, 33.3% in the lower end of left femur, 22.2% in the upper end of right tibia and 16.7% in the upper end of left 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 tibia[19]. 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 diaphysis[17]. 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 tumor[17]. GCT is characterized macroscopically as a haemorrhagic, 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 precursors[22].

In this study it was observed that 2 (11.1%) patients had post operative infection. 7(38.9%) patients had 0^0-130^0 knee flexion, 8 (44.4%) patients had 0^0-120^0 knee flexion and 3 (16.7%) patients had 0^0-100^0 knee flexion. Stiffness were found in 4 (22.2%) and absent in 14 (77.8%). Elimination of tumour was 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 0^0-130^0 knee flexion, 0^0-120^0 knee flexion and 0^0-100^0 knee flexion[22].

In this study it was observed that the pain status according to Schatzker and Lambert (1979)[23]; 5 (27.8%) patients had pain and 13 (72.2%) had no pain. Cosmetically normal appearance was found in 88.9% and 88.9% patients were able to normal daily work and rest 11.1% patients were able to do near normal daily work and no recurrence was found during the follow up period. Packing with cement 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, cement provides immediate support and stability even of large tumour cavities. Also, the contrast between the barium-impregnated cement and the bone makes radiographic detection of a local recurrence easier[24,25]. It was feared that the presence of cement in the subchondral region might lead to early degeneration of cartilage, but this has not been observed. So, the patients are be 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 83.3% and unsatis factory 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 cement is limited[17]. But the data suggest that initial use of curettage and cement does not adversely affect the outcome of subsequent procedures. This finding is in accordance with those of previous report[26]. Cure after intralesional curettage and packing with bone cement is clearly superior to other modalities of treatment of giant cell tumor.

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