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Evaluation of the Results of Giant Cell Tumor of Bone Treated with Curettage and PMMA Packing

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ABSTRACT

Giant cell tumor is an aggressive destructive epiphyseal lesion characterized by abundant multinucleated giant cells, accounting for some 5% of Prim Bone Tumours. This study was conducted to see to functional outcome after intralesional excision, chemical adjuvant of phenol and augmentation with PMMA packing. **Material and Methods:** Thirty patients of Companacci grade I and II were selected and operated with intralesional excision and PMMA packing. They were followed for 5 years. Final evaluation consisted of physical examination and radiographic evaluation. **Results:** Majority of the patients (80%) were from 3rd and 4th decades of life. There was slight male preponderance 55% and chief presenting complaints were pain and swelling (79%). The mean duration of symptoms was 8.4 months and 13 (65%) patients had lesions around knee either prox. Tibia and distal femur. Thirty percent patients were having grade I and 70% grade II lesions. Complications included recurrence in 10% limited range of motion 20%, superficial bone infection 10% and pain being most common 55% of patients. Otherwise overall fair to excellent results are seen. **Conclusion:** Majority of patients with giant cell tumour of bone can be treated satisfactorily with intralesional excision technique coupled with adjuvant treatment. Bone cement carrying advantage over conventional bone grafting, as it acts as spacer, fills the gap, gives stability and acts as cytotoxic agent killing remaining tumor cells. Furthermore it does not carry morbidity of graft harvesting.

INTRODUCTION

Giant cell tumor of bone is a relatively uncommon, locally aggressive type of tumor composed of stromal cells and osteoclast-like giant cells. Although it is a benign primary bone tumor, it has the potential to spread to other bones or to the lung.[1]

Typically, adults 20-40 years of age develop destructive bone lesions near the joints of the long bones of the leg or arm.[2] Most of the patients are cured with surgery that removes the bone containing the tumor, but recurrence rate is close to 20% years. When giant cell tumors recur, they may be more likely to spread to other parts of the body, especially if they recur multiple times.[3]

Currently, about 800 new giant cell tumor cases are identified in the United States each year, which account for about one fifth of all benign Primary Bone Tumors.[3,] Unfortunately, 5 to 10 percent of patients with giant cell tumor may also have metastatic tumors. The disease is more prevalent in patients with Paget's disease of the bone and in those of Chinese decent in which giant cell tumor may represent about 20 percent of all primary bone tumors, compared with 4 to 5 percent in other ethnic groups.[1]

Symptoms of giant cell tumor of bone include

Pain, tenderness and swelling

If the tumor has been growing for a long time, there may be instances of swelling.

Limitation of motion

If the tumor is close to a joint patients can have difficulty in movement. This is exacerbated by pain and swelling.

Bone fracture

Some patients may not have any symptoms

until they develop a pathologic fracture.[6]

The diagnosis of giant cell tumor relies on biopsies of the tumor and imaging of the bones using MRI, CT scans and PET scans.

Histologically the lesion consists of plump mononuclear cells with abundant multinucleated giant cells. The nuclei of both stromal and giant cells are similar in appearance.

Radiologically, the differential diagnosis include aneurysmal bone cyst, chondroblastoma, clear cell chondrosarcoma and osteosarcoma.[4]

Standard treatment of giant cell tumour of bone traditionally has been intralesional excision and autografts.[5] By definition however the intra-lesional excision leaves microscopic disease in the bone, regardless of how carefully or thoroughly performed, carrying a recurrence rate of 40% to even 60%.[6]

This is the reason, at the present time, the treatment of giant cell tumour of this bone in extremities involves the intra-lesional excision with an attempt to extend the curettage by either high speed burs, hypothermia with liquid nitrogen, chemically with phenol solutions or alcohol and finally producing hyperthermia with polymethylmethacrylate packing in grade I and II.[7] The goal of the treatment should be directed towards local control without scarifying joint function.

OBJECTIVES

To see the functional outcome after intra-lesional excision, chemical adjuvant of phenol and augmentation of PMMA packing.

PATIENTS AND METHODS

Twenty patients of Companacci grade I and II were selected and operated with intra-lesional excision and PMMA packing. They were followed for 5 years. Final evaluation consisted of physical examination and radiographic evaluation.

RESULTS

In this study, the youngest patient treated was of 20 years of age and oldest was 44 years of age. 16 patients (80%) of this study were from 3rd and 4th decade of life with mean age of 28.9±2.3 (Table 1).

Total 20 cases with giant cell tumour who were treated with curettage and bone cement 11 (55%) were male and 9 (45%) were female (Table 2).

Nineteen patients (95%) presented with pain of the involved area, 18 (90%) patients presented with swelling which in most of cases was mild to moderate degree. 11 (55%) patients gave history of decreased movements of the adjacent joint and only 1 patient (5%) gave history of numbness and parasthesia of the radial 3½ fingers with giant cell tumour involving distal radius (Table 3).

Table-1: Age distribution (n = 20)

Age (Year)	Number of patients	Percentage
11-20	2	10.0
21-30	9	45.0
31-40	7	35.0
41-50	2	10.0

Table-2: Gender distribution (n = 20).

Gender	Number of patients	Percentage
Male	11	55.0
Female	09	45.0

Table-3: Clinical presentation (n = 20).

Complaints	No. of patients	Percentage
Pain	19	95.0
Swelling	18	90.0
Limitation of motion	11	55.0
Neurological symptoms	01	05

The earliest presentation was of 5 months with pain and swelling and longest was of 36 months. 7 patients (35%) presented with less than 6 months history. 8 patients (40%) with 7-12 months, 2 (10%) with 13-18 months, 1 (5%) with 19-24 months, 1 (5%) with 25-30 months and 1 (5%) with 31-36 months of history. The mean duration was 8.4 months (Table 4).

Table-4: Duration of symptoms at the time of presentation (n = 20)

Duration (month)	No. of patients	Percentage
≤ 6	7	35.0
7-12	8	40.0
13-18	2	10.0
19-24	1	05.0
28-30	1	05.0
31-36	1	05.0

Thirteen patients (65%) had lesions around knee region *i.e.* 5 (25%) of proximal tibia and 8 (40%) of distal femur. Three patients (15%) were of distal tibia and only 1 patient (5%) was of distal radius and proximal femur. Proximal humerus contributed 1 patients (10%) (Table 5).

Table-5: Skeletal distribution among cases giant cell tumour (n = 20).

Site	Number of patients	Percentage
Proximal tibia	5	25.0
Distal femur	8	40.0
Distal tibia	3	15.0
Proximal humerus	2	10.0
Proximal femur	1	05.0
Distal radius	1	05.0

Table-6: Radiological grading (Campanacci) (n = 20)

Grade	Number of patients	Percentage
Grade-I	06	30.0
Grade-II-A	11	55.0
Grade-II-B	03	15.0

Six patients (30%) were having Companacci radiological grade-I lesion, 11 patients (55%) had grade II-A and 3 (15%) had grade II-B lesion. The grade III lesions were already excluded from this study Grade II-B lesion (15%) as were accompanied with pathological fracture, so we had to fix them up internally (Table 6).

The most common postoperative complications was pain around the lesion and adjacent joint, documented in 11 (55%) of patients. Most of the time, the pain was mild, off and on and non-specific. It was relieved with intake of ordinary oral analgesics. Pain settled completely in almost 80% patients in 6-8 weeks time. Only 2 patients (10%) had postoperative wound infection in scar area, which was superficial and settled with intravenous followed by oral antibiotics in couple of weeks time without any residual soft tissue problem. The movement of adjacent joint was limited in 4 patients (20%) patients. The logical reason in 2 of these cases was internal fixation along with bone cement packing and immobilization in POP postoperatively. The rest of 2 patients were non compliant as regards the postoperative rehabilitation physiotherapy programme. Recurrence was seen in 2 patients (10%) (Table 7).

Table-7: Postoperative complications treated with intralesional excision and bone cement (n=20).

Complications	No. of patients	Percentage
Wound infection superficial	02	10.0
Postoperative pain	12	60.0
Limitation of movements	04	20.0
Recurrence	02	10.0

One case was of proximal tibia and 2nd of distal femur. Both of these recurrences were seen within a year after surgery (1st being at 6 months and 2nd at 12 months). Both were treated with re-do curettage and PMMA packing and follow-up of about a year shown poor results as far as the functional outcome is concerned but there were no signs of recurrence either clinically or radiologically. Seven patients (35%) had stay of less than a week, 12 (60%) with less than 2 weeks and only 1 (5%) stay of more than 2 weeks. Twenty patients were having follow-up visits at 4 weeks, 3 months and than at every 6 months interval. The minimum follow-up was 4 months in one last case and maximum was 24 months.

Table-8: Hospital stay ((n = 20).

Hospital stay (days)	No. of patients	Percentage
0-7	07	35.0
8-14	12	60.0
15-21	01	05.0

Table-9: Follow-up ((n = 20)

Follow-up (month)	No. of patients	Percentage
≤ 6	2	10.0
7-12	5	25.0
13-18	5	25.0
19-24	8	40.0

Table-10: End result evaluation (n = 20).

Site	Excellent	Good	Fair	Poor
Distal femur	2	3	2	1
Proximal tibia	1	2	1	1
Distal tibia	-	2	1	-
Proximal humerus	-	1	1	-
Distal radius	1	-	-	-
Proximal femur	-	-	1	-
Total	**4 (20%)**	**8 (40%)**	**6 (30%)**	**2 (10%)**

DISCUSSION

Typically giant cell tumour occurs in patients in the 3rd and 4th decades of life and the age distribution in this study is consistent with that published in previous reports.[8]

There is slight male preponderance in this study which is very much in consistence with some earlier studies[9] but is similar to some others particularly Sung et al 1982,[10] which also revealed male preponderance. However Campanacci et al 1975[11] and Larsson et al 1975[12] have also shown no sex predilection.

In the past there was a tendency to use a more aggressive surgical approach towards giant cell tumours, similar to that used in malignant tumours, to achieve negative resection margins. This results in better control at the expense of greater functional deficit in patients who usually were young and healthy. Currently wide resection is limited to patients with severe grade-III tumours, patients with displaced pathological fractures and poor bone stock not allowing for internal fixation even with cement, or in patients with joint destruction. Resection is advised for giant cell tumour involving expandable bone such as proximal fibula because the functional deficit is minimal.[13] For Campanacci grade-I and grade-II lesions, thorough intralesional excision with adjuvant phenol catuterization and packing of the cavity with PMMA have shown good results in this study as regards the functional outcome, low incidence of complications and even low incidence of recurrence which occurred in only 10% cases with 6-24 months of follow-up.

Local adjuvants such as those used in this study in combination with thorough tumour resection using large currets and cortical window rate which is 10% in this study. Out of these 2 recurrences (10%) which was noted in this study, one was of proximal tibia and radiological grade was 1. The second was in distal femur with radiological grade-II.

First recurrence of proximal tibia occurring after 6 months of surgery with radiological evidence of lysis and radiolocency at cement – bone interface and was managed again with thorough curettage after removal of previous cement. Aduvant used was phenol and it was packed with PMMA with follow-up of next 12 months there was no recurrence.

The second case was of distal femur with Campanacci grade-II lesion, recurrence occurring after 12 months of initial surgery with lucency at cement bone interface and no definite sclerotic rim formation. Second surgery with thorough curettage and phenol cauterization of PMMA packing was performed and there was no clinical or radiological recurrence with follow-up of next 12 months.

In both of these cases, the recurrence occurred within one year of initial surgery which is in consistent with most of other studies.[14,15]

In this study, the radiological recurrence is noted before the clinical signs of recurrence are seen, lucent rim was 5mm in 1st and 6mm in 2nd case which goes very much in favour of definite recurrence again in consistent with radiological

signs of recurrence as shown by the Remedios et al.[15] Another inference is that the recurrence is independent of radiological grading of the tumour and depends upon the residual tumour tissue after intralesional excision.

As far as the role of adjuvant therapy is concerned, it has been shown in this series, that phenol cauterization has shown good results with less danger of surrounding soft tissue damage as proposed by the use of liquid nitrogen. In 5 cases out of 20. Electrocauterization was additionally used along with phenol cauterization and the results are good in all those cases. Moreover for soft tissue dissection electrocauterization was used keeping in view following factors.[16]

- It potentially extends the margin of tumour kill during close tumour dissection.
- Injury to unrecognized peripheral motor nerve is averted because of nerve stimulation.
- Thirdly it was our own preference especially in recurrent cases.

We referred to use bone cement after curettage and adjuvant therapy as in 90% cases, the articular surface was remaining viable, the bone defect was contained and we predicted the long term survival of the construct.

However in 2 of our cases more than 50% of the cross-sectional area of bone was involved so internal fixation was also done.[13] In 1st case of distal femur, pathological fracture was also present along with bone lesions, so after through curettage internal fixation with 2 cancellous screws was done and postoperatively, plaster of paris cylinder was given for 4 weeks.

In 2nd case of proximal femur pathological fracture of intertrochanteric area was suspected, so bone cement was added with internal fixation of dynamic hip screw. Weight bearing was allowed gradually after 4-6 weeks.

There were fair result in distal femur with cancellous screws as in follow-up, patient had pain which was relieved with oral analgesics and there was reduction in knee movements. With full physiotherapy, knee range of motion and isometric exercises, we could achieve 15° to 80° of range of motion after 12 months follow-up.

However in 2nd case of proximal femur with cement and internal fixation, postoperative course was rather unremarkable, there was mild limp in walk which improved in 4 months time and patient was fully ambulant with out support at 6th months of follow-up.

As regards the duration of symptomatology, it is in average 8.4 months in this study which is in comparison with the international literature.[17]

Only one patient had relatively longer stay of 16 days which was due to the superficial infection of the wound and it settled with intravenously followed by oral antibiotics for 2 weeks.

Skeletal distributions also not very much different from other studies[9],[10] but distal radius as shown by many authorities is 3rd most commonly involved site. In this study distal tibia is the 3rd most common site but it could be due to relatively small number of the patients included in this study.

Apart from superficial infection in 10% of cases and limitation of 1motion[16,] of the joint in 20% cases and recurrence which occurred in 10% of cases, there were no major complications noted in this series like sarcomatous transformation of primary benign giant cell tumour or lung metastasis.

Comparing the results of this study of intralesional excision and bone cement with other studies, it is shown that the results are not very much different considering demographic data, clinical presentation, complications and outcome.

Recurrence rate is 10% in this study which is even lower than other studies[14,18] showing recurrence rate of 15-30% which again could be due to the relatively small number of the patients.

Comparing this study with local studies, Akhtar[82] in his series of 40 patients with giant cell tumour, he did curettage and bone cement in 10 and claimed good results with recurrence occurring in only 2 patients.

Khan[19] reported in his study for giant cell tumour with 30 patients. Out of 30, 5 patients were treated with curettage and bone cement showing fair to good results with no documented recurrence.

CONCLUSION

The majority of the patients with giant cell tumour of bone can be treated satisfactorily with intralesional excision technique coupled with adjuvant treatment as described. The bone cement has its own benefits over grafting which has traditionally been used. Bone cement acts as spacer, fills the gap and gives immediate stability so early mobilization is possible. Further more it acts as cytotoxic agent and kills if any remaining tumour cells. Moreover this procedure does not aid morbidity of harvesting autograft from iliac crest, no delay in weight bearing is required for incorporation of graft.

There is low incidence of recurrence with this technique as cement is supposed to kill the residual tumour cells although there are reports which still do not favour this concept.

The other modes of treatment like wide resection should be reserved for patients with local bone loss that is too extensive and is not suitable for intra-lesional procedures and for patients with giant cell tumour in those bone wherein the functional deficit after complete excision of the involved portion of the bone is anticipated to be minimal. The limb salvage if at all possible is always better than amputation.

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