Original Article

Treatment of Benign Giant Cell Tumours of Bone in Singapore

YW Lim,[1] *FRCSEd (Ortho), M Med (Surg)*, MH Tan,[2] *FRCS (Edin & Glas)*

Abstract

Introduction: Giant cell tumour (GCT) is a distinct neoplasm of undifferentiated cells. The exact cell of origin is unknown. The multinucleated giant cells present are formed from the fusion of mononuclear cells. Giant cell tumour is more common in Southeast Asia than in the West. The incidence is about 20% compared to 4% to 5% in the West. Materials and Methods: Sixteen patients with giant cell tumour were treated in the Singapore General Hospital from 1993 to 2001. The average follow-up period was 64.4 months, with a range of 30 to 132 months. The average age of the patients was 33 years. The tumours were divided into 3 groups. The first group had meticulous curettage and high-speed burring followed by methylmethacrylate cementation. The second group had treatment similar to the first but in addition had an adjuvant treatment with liquid nitrogen, hydrogen peroxide or phenol before cementation of the cavity. The third group had wide resection done. There were 9 in the first group, 5 in the second group and 2 in the third group. The tumours were graded radiologically after the method of Campanacci et al. All patients were followed up clinically and radiologically. Of the 5 in the second treatment group, 1 had phenol irrigation, 2 had cryotherapy and 2 had hydrogen peroxide irrigation intraoperatively. Results: There was a total of 5 recurrences (31%). The 2-year recurrence-free survivorship was 75%. The mean recurrence period was 21 months. There were no complications like fracture, infection or thermal injury to the skin. There was no pulmonary metastasis or mortality. The first group, who had curettage, high-speed burr and cementation, had 44% (4 out of 9) recurrence; the second group, who had treatment like the first with additional adjuvant therapy, had no recurrence; and the third, who had wide resection, had 50% (1 out of 2) recurrence. All the recurrences had a Campanacci grade II or III tumour. There were no recurrences in the group that was treated with curettage, high-speed burr, adjuvant treatment and cementation. Conclusion: Currettage, high-speed burring with added phenol/liquid nitrogen treatment and cementation is a useful and safe method in the treatment of giant cell tumours. The advantages include a low recurrence rate, as well as immediate stabilisation allowing early mobilisation. Patients who have Campanacci grade I tumours have the highest chance of being disease-free after the first operation.

Ann Acad Med Singapore 2005;34:235-7

Key words: Cryotherapy, Hydrogen peroxide, Phenol

Introduction

Giant cell tumour (GCT) is a distinct neoplasm of undifferentiated cells. The exact cell of origin is unknown. The multinucleated giant cells present are formed from the fusion of mononuclear cells. Giant cell tumour is more common in South East Asia than in the West. The incidence is about 20% compared to 4% to 5% in the West.[1,2]

Peak incidence is in the third decade with 70% occurring between 20 and 40 years of age. There is a slightly higher female preponderance. Amongst these, 60% is localised in the knee. It has, however, widely divergent biological behaviour. They are generally locally aggressive but few can present with pulmonary metastasis[3] or may develop osteosarcoma or fibrosarcoma.[4] The appropriate treatment has been controversial. Adequate removal of the tumour lowers the risk of recurrence.[5] However, the justification for aggressive resections must be weighed against the fact

[1] Department of Orthopaedic Surgery
Changi General Hospital, Singapore
[2] Musculoskeletal Tumour Service, Department of Orthopaedic Surgery
Singapore General Hospital, Singapore
Address for Reprints: Dr YW Lim, Department of Orthopaedic Surgery, Changi General Hospital, 2 Simei Street 3, Singapore 529889.
Email: yeow_l@yahoo.com

that GCTs are benign. The treatment has generally ranged from curettage alone, curettage with adjuvant therapy, wide resection or amputation. Functional results after curettage are more favourable compared to marginal or wide resection, which carry poor functional outcome.[6] However, curettage alone has a higher incidence of recurrence (20%), while curettage with adjuvant therapy has been shown to reduce the recurrence rate to less than 2%.[7,8] The question raised is, what is adequate treatment? This is a retrospective study to analyse the best possible treatment outcome for such a tumour and its prognostic factors.

Materials and Methods

Two surgeons treated 16 consecutive patients with giant cell tumour from 1993 to 2001 in the Singapore General Hospital. The data were retrospectively reviewed. The tumours were divided into 3 groups. The first group had meticulous curettage and high-speed burring followed by methylmethacrylate cementation. The second group had treatment similar to the first but in addition had an adjuvant treatment with liquid nitrogen, hydrogen peroxide or phenol before cementation of the cavity. The third group had wide resection done. The tumours were graded radiologically after the method of Campanacci et al[9] (Table 1). All patients were followed up clinically and radiologically.

Table 1. Radiological Classification of Giant Cell Tumour of Bone

Campanacci	Definition
Grade I	Tumour associated with a well-defined margin and a thin rim of mature bone.
Grade II	Tumour is well-defined but has no radiopaque rim.
Grade III	Tumour has fuzzy borders.

There were 16 patients with a mean age of 33 years (range, 22 to 58). There were 9 females and 7 males. The mean follow-up period was 64.4 months (range, 30 to 132).

Nine patients had GCT around the knee, 3 in the proximal femur, 1 each in the elbow, distal radius, calcaneum and sacrum. 62.5% (10) of the patients had Campanacci grade III tumour, 25% (4) of the patients had grade II and 12.5% (2) had grade I (Table 2). There were two grade I, two grade II and five grade III patients in treatment group 1. In treatment group 2, there were one grade II and 4 grade III patients. In treatment group 3, there were one grade II and one grade III patient. The treatment groups were divided into three: 1) those who had curettage with high-speed burr and cementation; 2) those had additional adjuvant treatment; and 3) those who had wide resection. There were 56% (9) in the first group, 31% (5) in the second group and 13% (2) in the third group. Of the 5 in the second treatment group, 1 had phenol irrigation, 2 had cryotherapy and 2 had hydrogen peroxide irrigation.

Results

There were a total of 5 recurrences (31%). The overall 2-year recurrence-free survivorship was 75%. The mean recurrence period from the time of diagnosis to operation date was 21 months. There were no complications like fracture, infection or thermal injury to the skin. There was no pulmonary metastasis or mortality. The first group who had curettage, high-speed burr and cementation had 44% (4 out of 9) recurrence, the second group who had additional adjuvant therapy had no recurrence. The third group who had wide local resection had 50% (1 out of 2) recurrence.

There was no recurrence in the grade I group, 2 (50%) recurrences in the grade II group and 3 (30%) recurrences in the grade III group.

Table 2. Summary of Results

No	Age (y)	Race	Gender	Campanacci	Treatment	Site	Recurrence*	Follow-up (mo)
1	25	Chinese	Male	I	1	Rt calcaneum	No	33
2	49	Chinese	Female	III	2	Lt distal femur	No	41
3	30	Chinese	Female	III	3	Rt fibula	No	94
4	29	Chinese	Female	III	2	Lt prox tibia	No	35
5	26	Malay	Female	III	1	Sacrum	No	30
6	44	Chinese	Female	II	2	Rt prox tibia	No	112
7	26	Chinese	Female	III	1	Lt prox tibia	Yes (46)	132
8	29	Chinese	Female	III	1	Rt prox femur	Yes (10)	69
9	22	Chinese	Female	II	1	Lt prox femur	Yes (13)	104
10	58	Chinese	Female	II	3	Rt fibula	Yes (7)	49
11	40	Chinese	Male	III	1	Lt distal femur	Yes (5)	40
12	31	Chinese	Male	I	1	Lt distal femur	No	117
13	37	Chinese	Male	III	2	Rt distal femur	No	42
14	32	Indian	Male	III	2	Rt elbow	No	36
15	23	Chinese	Male	III	1	Left prox femur	No	36
16	31	Chinese	Male	II	1	Lt upper tibia	No	61

* Parentheses in the “recurrence” column refers to the period (in months) from first diagnosis to the operation date.

Discussion

Giant cell tumour is a challenging surgical problem due to its divergent biological behaviour. Curettage, high-speed burring and cementation has been shown to be a useful method in the treatment of giant cell tumours. It offers a low recurrence rate, immediate stabilisation and early radiological diagnosis of recurrence. The addition of an adjuvant therapy like liquid nitrogen or phenol seems to lower the risk of recurrence. In our series, there was no recurrence in Group 2, where patients were treated with curettage, high-speed burring, adjuvant treatment and cementation. There was a recurrence rate of 44% in Group 1 patients who did not have additional adjuvant therapy. Contrary to this study, a recent study showed a much lower recurrence rate of about 10% in patients receiving treatment without adjuvant therapy.[10] However, in another study, patients receiving adjuvant therapy[11] with liquid nitrogen and phenol showed 6.4% recurrence. This may be explained by the small cohort of patients in that group, as well as the different Campanacci grades within that group. Adjuvant therapy, such as liquid nitrogen and phenol, as used in this study, has been shown to be safe, without any obvious complications. Most of the recurrences occur in the first 30 months after the index surgery.[10,12] In our series, most of the recurrences occurred within 24 months (4 out of 5). The majority of our patients (88%) had the higher Campanacci grade II or III. This may also translate to the higher overall recurrence rate of 31%.

Conclusion

Currettage, high-speed burring with added phenol/liquid nitrogen treatment and cementation is a useful and safe method in the treatment of giant cell tumours. The advantages include a low recurrence rate (0% in our series), as well as immediate stabilisation allowing early mobilisation. Patients who have Campanacci grade I tumours have the highest chance of being disease-free after the first operation (0% recurrence rate in our series). All patients should be closely followed for recurrence, especially during the first 2 years, which is reflected by the overall recurrence rate of 31%.

REFERENCES

1. Sung WH, Kuo DP, Shu WP, Chai YP, Liu CC, Li SM. Giant cell tumour of bone: analysis of two hundred and eight cases in Chinese patients. J Bone Joint Surg Am 1982;64:755-61.
2. Yip KM, Leung PC, Kumta SM. Giant cell tumour of bone. Clin Orthop 1996;323:60-4.
3. Cheng JC, Johnston JO. Giant cell tumor of bone: Prognosis and treatment of pulmonary metastases. Clin Orthop 1997;338:205-14.
4. Mondal A, Kundu B, Gupta S, Biswas J. Secondary malignant giant cell tumour of bone – a study of five cases with short review of literature. Indian J Pathol Microbiol 2002;45:273-5.
5. Blackley HR, Wunder JS, Davis AM, White LM, Kandel R, Bell RS. Treatment of giant-cell tumors of long bones with curettage and bone-grafting. J Bone Joint Surg Am 1999;81:811-20.
6. Renard AJ, Veth RP, Pruszczynski M, Wobbes T, Lemmens JA, van Horn JR. Giant cell tumor of bone: oncologic and functional results. J Surg Oncol 1994;57:243-51.
7. Marcove RC, Weis LD, Vaghaiwalla MR, Pearson R, Huvos AG. Cryosurgery in the treatment of giant cell tumors of bone. A report of 52 consecutive cases. Cancer 1978;41:957-69.
8. O'Donnell RJ, Springfield DS, Motwani HK, Ready JE, Gebhardt MC, Mankin HJ. Recurrence of giant-cell tumours of long bones after curettage and packing with cement. J Bone Joint Surg Am 1994;76: 1827-33.
9. Campanacci M, Baldini N, Boriani S, Sundanese A. Giant-cell tumor of bone. J Bone Joint Surg Am 1987;69:106-14.
10. Gross M, Mohan R. The mid-term results of giant cell tumours of bone treated by curettage, high speed burring and cementation. J Bone Joint Surgery Br 2002;84-B:Suppl III.
11. Ward WG Sr, Li G 3rd. Customized treatment algorithm for giant cell tumor of bone: report of a series. Clin Orthop 2002;397:259-70.
12. Delephine F, Delepine G. Treatment of benign giant-cell tumours of the lower radius: Long-term outcome in eight cases. J Bone Joint Surgery Br 2002; 84-B:Suppl I.