International Journal of Research in Orthopaedics
Prabha A et al. Int J Res Orthop. 2021 Nov;7(6):1210-1214
http://www.ijoro.org

Original Research Article

DOI: https://dx.doi.org/10.18203/issn.2455-4510.IntJResOrthop20214190

Limb salvage surgery for giant cell tumours around knee joint: a single institute experience

Amritha Prabha[1], Urvish K. Shah[1]*, M. S. Ganesh[1], Hiranya K. Seenappa[2]

[1]Department of Surgical Oncology, [2]Department of Orthopaedics, Vydehi Institute of Medical Sciences, Bangalore, Karnataka, India

Received: 11 August 2021
Accepted: 07 September 2021

***Correspondence:**
Dr. Urvish K. Shah,
E-mail: urvish195@gmail.com

ABSTRACT

Background: Giant cell tumours (GCTs) of bone are benign but locally aggressive tumours. The surgical treatment of GCTs in the around knee joint mainly includes curettage and bone grafting, extended curettage and cement filling, segmental resection and modular endo prosthesis reconstruction.
Methods: Retrospective analysis of the presentation, the functional outcome following modular endoprosthetic reconstruction, prosthetic survival and the recurrence rate in 17 patients with Campanacci grade 3 GCTs involving distal femur and proximal tibia, who underwent segmental resection and modular endoprosthesis reconstruction in a single centre from 2015 to 2018. The surgery was performed according to the general principles of limb salvage surgery and modular segmental replacement was used. All stems were cemented in place. Isometric exercises and mobilization with crutches were started on 2nd postoperative day. Knee joint bending was started for proximal tibia patients after 2 to 3 weeks. Functional outcome was scored by musculoskeletal tumour society scoring (MSTS). Immediate post-operative complication like delayed wound healing, flap necrosis, wound infection, foot drop, leg length discrepancies were evaluated.
Results: The average MSTS functional score was 78%.3 year prosthetic survival was 100%. None of the patients had recurrence. One patient had left lower lobe metastasis for which wedge resection was done.
Conclusions: Segmental resection and endoprosthetic replacement has good functional outcome in patients with tumours around the knee joint. As GCTs are tumours with less chance of local and distant metastasis after complete excision, endoprosthetic prosthesis is a good treatment option after complete excision.

Keywords: Giant cell tumour, Segmental resection, Endoprosthesis, Score, Local recurrence

INTRODUCTION

Giant cell tumours (GCTs) of bone are benign but locally aggressive tumours that usually involve metaepiphyseal end of long bones (usually distal end of femur and proximal end of tibia).[1]

GCTs of the bone were first described by Cooper in 1818.[2] Later, Nelaton showed their local aggressiveness, and Virchow revealed their malignant potential.[3,4]

Patients with GCT usually present in their third decade of life, with approximately 80% of lesions occurring between 20 and 55 years of age.[5] The surgical treatment of GCTs in the around knee joint mainly includes curettage and bone grafting extended curettage (EC) and cement filling segmental resection (SR) and modular endo prosthesis reconstruction.[6-8]This study is a retrospective analysis of the presentation, the functional outcome following modular endoprosthetic reconstruction and the recurrence rate.

METHODS

Retrospective analysis of the presentation, the functional outcome following modular endoprosthetic reconstruction, prosthetic survival and the recurrence rate in 17 patients with Campanacci grade 3 GCTs involving distal femur and proximal tibia, who underwent segmental resection and modular endoprosthesis reconstruction in a single centre from 2015 to 2018.

Inclusion criteria

All patients with Campanacci grade 3 GCTs involving distal femur and proximal tibia, who underwent segmental resection and modular endoprosthesis reconstruction.

Patients with multiple recurrent lesions following failed curettage around knee joint were also included.

Materials and methods

Standard investigations done at our centre for all the patients include X-ray of the part involved and of the chest, and magnetic resonance imaging of the part. All these findings were recorded. Following non-invasive investigations, image guided core needle biopsy of the lesion was performed and for patients with biopsy done outside, blocks were reviewed. All biopsies were performed by a trained oncosurgeon and planned in such a way that the biopsy scar can be safely included in the incision while performing definitive surgery.

The surgery was performed according to the general principles of limb salvage surgery. Modular segmental-replacement system prosthesis with a simple-hinge component for the proximal part of the tibia, and the distal part of the femur were used. (Figure 1 and 2). All stems were cemented in place. Isometric exercises and mobilization with crutches were started on 2nd postoperative day after check X-ray (Figure 3 and 4). Knee joint bending was started for proximal tibia patients after 2 to 3 weeks.

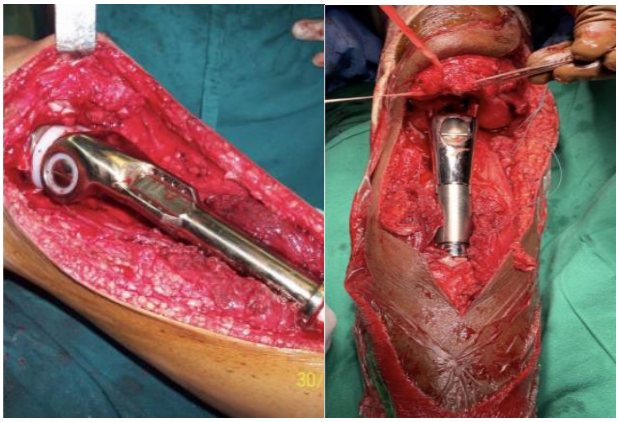

Figure 1: Tibial modular prosthesis in situ.

Follow up

The patients were followed up on quarterly basis for initial two years and thereafter on six monthly intervals. On follow-up visits, a thorough clinical examination was carried along with digital X-ray of the part. Magnetic resonance imaging (MRI) of the part was done when indicated. Chest imaging was done routinely. If a suspecious lesion was seen on the X ray chest then chest computed tomography (CT) scan was done.

Figure 2: Femoral modular prosthesis in situ.

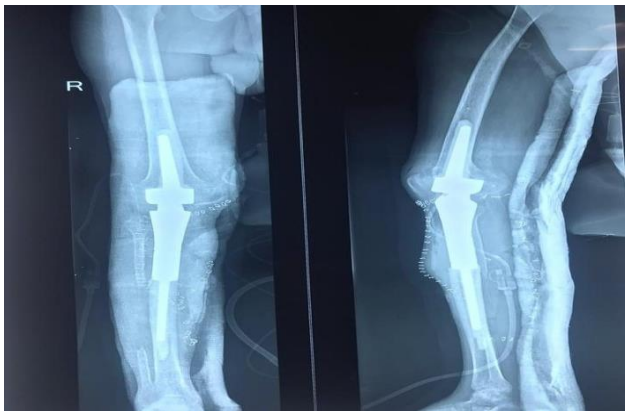

Figure 3: Post-operative X-ray showing tibial prosthesis.

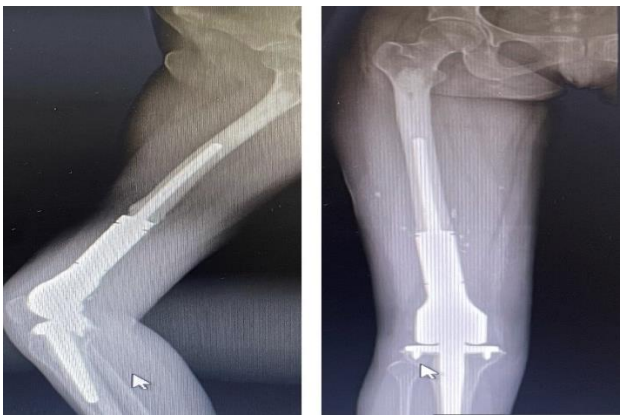

Figure 4: Post-operative x ray showing femoral modular prosthesis.

Functional outcome was scored by musculoskeletal tumour society scoring (MSTS).[9] Numerical values from 0 to 5 points were assigned for each of the following 6 categories: pain, function, emotional acceptance, use of supports, walking ability and gait. These values were added, and the functional score was presented as a percentage of the maximum possible score. The results were graded according to the following scale: excellent – 75% to 100%; good – 70% to 74%; moderate – 60% to 69%; fair – 50% to 59% and poor – <50%.

RESULTS

During the study period total 92 bone tumours were treated in our department.in that, 67 were tumours around knee joint. Of that, 23 were GCTs and in that 17 had grade 3 Campanacci GCTs and underwent LSS with endoprosthetic reconstruction (Table 1). Of that 7 were males and 10 were females with age group 17 to 42 (mean 30). Pre-operative presentation was with pain and swelling around knee joint .All except 5 underwent tru-cut biopsies. 3 had undergone previous biopsies with scar in the lateral aspect of knee joint which was excised at the time of surgery. 2 had previous curettage done else were with recurrence at presentation. All 17 underwent LSS with adequate margins. Compared to other malignant bone tumours, in our experience, soft tissue involvement was less in GCTs.

Table 1: Characteristics of GCT patients around knee joint in our centre.

Variables	Total numbers
Sex	
Male	7
Female	10
Age (in years)	
11-20	2
21-30	9
31-40	4
>40	2
Symptom at presentation	
Swelling	4
Pain	3
Pain and swelling	10
Tumour size (cm)	
<8	3
>8	14
Tumour location	
Distal femur	11
Proximal tibia	6

In one case of proximal tibia GCT, the patella extensor mechanism was found to be involved by the tumour and hence part of the extensor tendon was removed with the tumour and then the proximal cut end was attached to prosthesis by using Dacron tape. Modular prosthesis was used in all patients and for proximal tibia tumours medial gastrocnemius flap was used to cover the prosthesis.

Immediate pre-operative complication like delayed wound healing, flap necrosis, wound infection, foot drop, leg length discrepancies were evaluated (Table 2). Compared to malignant bone tumours, wound healing was faster and complications were less in GCTs. Out of 17 patients with GCTs 3 had anterior flap necrosis, 1 post curettage and 1 post open biopsy with lateral scar. Debridement and primary closure was done in 2 patients and 1 case SSG was needed to cover the defect. One patient with proximal tibial lesion had foot drop post-surgery which was managed with foot drop splint.

Function outcome was analysed with MSTS score.

The average MSTS functional score was 78 % (range 65% to 100%). 3 year survival rate of the prosthesis was 100% in our study. Average range of movements at 3 years was 80 (70-90).

Aseptic prosthetic loosening occurred in one patient, 4 years after surgery for whom replacement was advised. Prosthetic fracture was nil during these years (3 to 6 years). None of the patients had local recurrence. One patient had metastasis in left lung lower lobe for which wedge resection was done and is recurrence free till date.

Table 2: Complications in our study.

Complications	Distal femur (n=11)	Proximal tibia (n=6)
Flap necrosis	2	1
Wound infection	1	1
Foot drop	0	1
Leg length discrepancy (>2 cm)	0	0

DISCUSSION

GCTs represent 3-4% of all primary tumours of bone.[10] Various classification systems were proposed for GCTs over the years. Campanacci et al classified the GCT into three grades depending on their radiographic appearance: grade 1 lesion (latent) has a well-defined margin and an intact cortex; grade 2 lesion (active) has a relatively well-defined margin but no radiopaque rim, and the cortex is thinned and moderately expanded; and grade 3 lesion (aggressive) has indistinct borders and cortical destruction.[11] Enneking et al proposed a clinico-radiological classification of three stages for benign bone tumours including GCT: stage 1 (latent) refers to a confined totally by bone, asymptomatic, inactive on bone scan, histologically benign lesion; stage 2 (active) refers to an expanded cortex with no breakthrough, symptomatic (often with a pathologic fracture), active on bone scan, histologically benign lesion; stage 3 (aggressive) refers to a rapidly growing mass, cortical perforation with soft

tissue mass, may metastasize, symptomatic, extensive activity on bone scan, histologically benign; and stage 4 (malignant) refers to a sarcomatous lesion contiguous with a benign GCT.[12]

Surgery is the treatment of choice for GCTs. Surgical outcomes are optimal when the tumour is removed to tumour-free margins, with minimal surgical morbidity and an acceptable functional outcome. Following curettage recurrence rates are higher (12–65%), but morbidity and functional impairment for the patients are less.[13] Therefore, it has been the mainstay of treatment for the majority of patients with Enneking stage I or II lesions. Wide excision is usually reserved for more aggressive tumours with extra osseous extension, unresectable or multiply recurrent tumours. Megaprosthesis is the most common form of reconstruction for stage 2 and 3 GCTs around the knee.[14]

The reconstruction by megaprosthesis provides immediate stability and allows early mobilisation and weight-bearing. Other benefits are good functional results, especially in the distal femur, excellent cosmesis and patient acceptance, and a relatively low complication rate. In addition, the surgeons may require megaprosthesis in the setting of recurrence or extensive soft tissue involvement for local control of the tumor.[15] The study by Sharil et al showed that overall early functional outcomes of resection and endoprostheses placement of the distal femur and proximal tibia tumour were good.[16] There was no difference in functional outcome between both anatomical sites. Similarly our study also demonstrated the same. The prosthesis survival of the proximal tibia has been reported to be lower than that of the distal femur. Poor soft tissue coverage, difficulties with anchoring the patellar tendon and possible injuries to the neurovascular system are the most likely causes for this difference.[17] In our study the survival was 100% at 3 years for both distal femur and proximal tibia tumours.

The rate of infection was 11.7% in our study. Providing adequate soft tissue coverage after reconstruction is one of the most critical factors for reducing infection. Hence we covered all our proximal tibia flaps with medial gastrocnemius muscle flap. One of our proximal tibia tumour patient had post op peroneal nerve palsy mostly due to the excessive dissection associated with that tumour, and was managed with foot drop splint. All the 17 cases were excised with 3 cm margin and the margins were reported to be negative in all cases. None of the 17 cases have any recurrence till date. The retrospective analysis of limb salvage treatment for GCTs in weight bearing long bones Deheshi et al has shown that segmental resection were the preferred treatment for patients with severe joint destruction or dislocation, comminuted or intra articular fractures.[18]

The study by Balke et al have found that segmental resection is more recommended for recurrent GCTs because it can achieve satisfactory oncological prognosis.[19] One of our patient with recurrent distal femur lesion had single metastasis in left lung lower lobe for which wedge resection was done. Various studies have shown that approximately 3% of GCTs metastasizes to lung at certain point of time after the diagnosis of primary GCT. Various factors have been explained in various studies as factors for such metastasis.[20]

The study by Rock et al had reported a six fold higher risk of lung metastasis in patients with recurrent tumour than those without recurrence.[21] Our patient is recurrence free post wedge resection with a functional limb.

CONCLUSION

Segmental resection and endoprosthetic replacement has good functional outcome in patients with tumours around the knee joint. As GCTs are tumours with less chance of local and distant metastasis after complete excision, endoprosthetic prosthesis is a good treatment option after complete excision.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Turcotte RE. Giant cell tumour of bone. Orthop Clin North Am. 2006;37(1):35-51.
2. Cooper AP, Travers B. Surgical essays, vol. I. London 7 Cot and Son and Longman & Co. 1818.
3. Ne´laton E. D'une nouvelle espe`ce de tumeur be´nigne des os ou tumeur a` mye´loplaxes. Paris7 Adrien Delahaye. 1886.
4. Virchow R. Die Krankhaften Geschwulste. Berlin7 Hirschwald. 1846;2.
5. Reid R, Banerjee S, Sciot R. Giant cell tumour, in The WHO Classification of tumors. Pathology and genetics: tumors of soft tissue and bone. Fletcher D, Unni K, Mertens F, Editors. Lyon, France, IARC Press. 2002.
6. Niu X, Zhang Q, Hao L, Ding Y, Li Y, Xu H, et al. Giant cell tumor of the extremity: retrospective analysis of 621 Chinese patients from one institution. J Bone Joint Surg Am. 2012;94:461-7.
7. van der Heijden L, van de Sande MA, Heineken AC, Fiocco M, Nelissen RG, Dijkstra PD. Mid-term outcome after curettage with polymethylmethacrylate for giant cell tumor around the knee: higher risk of radiographic osteoarthritis? J Bone Joint Surg Am. 2013;95:159.
8. Grimer RJ, Aydin BK, Wafa H, Carter SR, Jeys L, Abudu A, et al. Very longterm outcomes after endoprosthetic replacement for malignant tumours of bone. Bone Joint J. 2016;98B:857-64.
9. Enneking WF, Dunham W, Gebhardt MC. A system for the functional evaluation of reconstructive procedures after surgical treatment of tumors of the

musculoskeletal system. Clin Orthop Relat Res. 1993;286:241-6.
10. Natarajan MV, Prabhakar R, Mohamed SM, Shashidhar R. Management of juxta articular giant cell tumors around the knee by custom mega prosthetic arthroplasty. Indian J Orthop. 2007;41:134-8.
11. Campanacci M, Baldini N, Boriani S, Sudanese A. Giantcell tumor of bone. J Bone Joint Surg Am. 1987;69(1):106-11.
12. Enneking WF, Spanier SS, Goodman MA. A system for the surgical staging of musculoskeletal sarcoma. Clin Orthop Relat Res. 1980;415:4-18.
13. Zhen W, Yaotian H, Songjian L, Ge L, Qingliang W. Giant-cell tumour of bone. The long-term results of treatment by curettage and bone graft. J Bone Joint Surg Br. 2004;86(2):212-6.
14. Faisham WI, Zulmi W, Halim AS, Biswal BM, Mutum SS, Ezane AM. Aggressive giant cell tumour of bone. Singap Med J. 2006;47:680.
15. Gaston CLL, Goulding K, Grimer RJ. The use of endoprostheses in musculoskeletal oncology. Oper Tech Orthop. 2014;24:91-102.
16. Sharil A, Nawaz A, Azman MN, Zulmi W, Faisham WI. Early functional outcome of resection and endoprosthesis replacement for primary tumor around the knee. Malays Orthop. 2013;7:30-5.
17. Biau D, Faure F, Katsahian S Jeanrot C, Tomeno B, Anract P. Survival of total knee replacement with a megaprosthesis after bone tumor resection. J Bone Joint Surg Am. 2006;88:1285-93.
18. Deheshi BM, Jaffer SN, Griffin AM, Ferguson PC, Bell RS, Wunder JS. Joint salvage for pathologic fracture of giant cell tumor of the lower extremity. Clin Orthop Relat Res. 2007;459:96-104.
19. Balke M, Ahrens H, Streitbuerger A, Koehler G, Winkelmann W, Gosheger G, et al. Treatment options for recurrent giant cell tumors of bone. J Cancer Res Clin Oncol. 2009;135:149-58.
20. Muherumu A, Niu X. Pulmonary metastasis in giant cell tumour of bones. World J Surg Oncol. 2014,12:261.
21. Rock MG. Curettage of giant cell tumour of bone: factor influencing local recurrences and metastasis. Chir Organi Mov. 1990;75:204-5.

Cite this article as: Prabha A, Shah UK, Ganesh MS, Seenappa HK. Limb salvage surgery for giant cell tumours around knee joint: a single institute experience. Int J Res Orthop 2021;7:1210-4.