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Curettage and reconstruction by the sandwich technique for giant cell tumours around the knee

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Abstract
Purpose: To evaluate outcomes of 12 patients who underwent curettage, use of phenol, and reconstruction using the sandwich technique for giant cell tumour (GCT) of bone around the knee.
Methods: 7 women and 5 men aged 20 to 45 (mean, 28.5) years underwent intralesional curettage, use of phenol, and reconstruction using the sandwich technique for GCT of the proximal tibia (n=7) or distal femur (n=5). One of the cases were recurrences. Two, 18, and 9 tumours were classified as grade I, grade II, and grade III, respectively. Five of the grade III tumours were associated with an extra-articular pathological fracture. Patients underwent intralesional curettage, use of phenol, and reconstruction with allograft, gel foam, and cement (the sandwich technique). Pathological fractures were fixed with plates. Functional outcome was evaluated using the Musculoskeletal Tumor Society (MSTS) score.
Results: The mean follow-up period was 2 (2.5–11) years. The mean MSTS score was 28.7 out of 30 (standard deviation, 3; range, 16–30). One patient with a grade III tumour in the proximal tibia had a recurrence detected elsewhere after 2 years. Her MSTS score at 2 years was 22. No patient had malignant transformation.
Conclusion: Intralesional curettage, use of phenol, and reconstruction with allograft, gel foam, and cement (the sandwich technique) for GCT of bone achieved good functional outcome and a low recurrence rate.

Keywords: Curettage; giant cell tumor of bone; phenol

Introduction
Giant cell tumour (GCT) of bone is one of the most common benign bone tumours occurring around the knee in those aged 30 to 40 years. It is locally aggressive and prone to recurrence and malignant transformation [1]. Treatment by curettage alone has a high risk of recurrence [2, 3]. Use of adjuvants (phenol, cement, cryosurgery, or a combination of these) is recommended, followed by reconstruction with auto-graft, allograft, cement, and/or hydroxyapatite. In our hospital, the treatment of GCT of bone has been intralesional curettage followed by the use of phenol and reconstruction using the sandwich technique [4], in which the allograft in the subchondral region is overlaid with a layer of gel foam, and the rest of the cavity is filled with cement. This study evaluated outcome of 12 patients who underwent curettage, use of phenol, and reconstruction using the sandwich technique for GCT of bone around the knee.

Materials and Methods
Between January 2017 and December 2020, 7 women and 5 men aged 19 to 46 (mean, 28.5) years underwent intralesional curettage, use of phenol, and reconstruction using the sandwich technique for GCT of the proximal tibia (n=7) or distal femur (n=5). Two of the cases were recurrences.
According to the Campanacci grading system [4], 2 tumours were classified as grade I (with a well-defined margin and an intact cortex), 9 were grade II (with a relatively well-defined margin but no radiopaque rim, and the thinned and moderately expanded cortex), and 3 were grade III (with indistinct borders with cortical destruction). Five of the grade III tumours were associated with an extra- articular pathological fracture of the femur (n=1) or tibia (n=4).

Postoperatively, non-weight-bearing crutch walking was started immediately. After 12 weeks, weight bearing was allowed as tolerated. Intravenous zoledronate (4 mg) once monthly was given for 6 months, along with oral supplementation of vitamin D3 (800 IU) and calcium (1–2 g) once daily for 6 months. In 7 of the 12 patients, a temporary spanning trans articular external fixator was put on for 8 weeks and then gradual weight bearing was started. Five patients with pathological fracture underwent internal fixation with an angle-blade plate in the distal femur and a buttress plate in the proximal tibia. Two patients had loss of the tibial tuberosity in which the tumour abutted the patellar tendon; the tibial tuberosity was reconstructed with bone graft and fixed with Kirschner wire. One patient had trochlear reconstruction with bone grafting.

Functional outcomes were evaluated using the Musculoskeletal Tumor Society (MSTS) score [5], 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.

Results

The mean follow-up period was 2 years. The mean MSTS score was 28.7 out of 30 (standard deviation, 3; range, 16–30). One patient with a grade III tumour in the proximal tibia had a recurrence detected elsewhere after 2 years. Her MSTS score at 2 years was 26. No patient had malignant transformation.

Discussion

Treatment for GCTs around the knee include curettage alone, curettage with adjuvant therapy (liquid nitrogen, hydrogen peroxide, phenol, argon laser photocoagulation, bone cement, or bone graft), and marginal/wide resection, followed by reconstruction, arthrodesis, or mega-prosthetic joint replacement. Intralesional curettage alone has a high recurrence rate of 65% [6], whereas marginal/wide resection is associated with functional disability. Preservation of joint function is an advantage of intralesional curettage compared to wide resection. In our study, intralesional curettage and reconstruction with the sandwich technique achieved a low recurrence rate (3%) and good functional outcome (94%).

Care must be taken to prevent inadvertent cortical breach or removal of the posterior fibro periosteal pseudo capsule during curettage. The posterior periosteum acts as a biological barrier, preventing the escape of bone graft or cement filled in the cavity. The risk of neurovascular injury by phenol increases if the posterior periosteum is deficient. Intact posterior periosteum is crucial for the reconstitution of the posterior cortex, especially after bone grafting [11]. The small crevices within this layer, potentially containing tumour cells, were treated with 5% phenol for 10 minutes.

The cavity can be reconstructed with allograft, bone cement, or calcium phosphate. The advantage of allograft is that if it is successfully incorporated, the reconstruction is permanent, but its disadvantages include difficulty in detecting recurrence and the requirement of a bone bank. The benefits of bone cement include immediate weight bearing and its cytotoxic and thermal effects to minimize the risk of recurrence, but it is associated with degeneration of articular cartilage in the subchondral region of the weight bearing area.[12] Applying a layer of bone graft and gel foam not only protects the underlying articular cartilage from the thermal effect of the curing.

Conventionally, grade III lesions are treated with wide resection to prevent local recurrence [2]. The recurrence rates for grade III lesions after intralesional curettage are reported to range from 4.5% to 52% [13-18]. In our study, only one (6.3%) of the 16 patients with grade III GCT of bone had a recurrence. Thus, the sandwich technique appears to be a viable alternative to wide resection.

The use of intravenous zoledronate as an adjuvant specifically targets the osteoclasts and the GCT cells. Bisphosphonate treatment reduces tumour size and recurrence rate in GCT of bone [19-22]. Bisphosphonates bind to bone and inhibit bone resorption by osteoclasts [20]. Multinucleated giant cells in GCT of bone and osteoclasts are similar, as they both resorb bone and express markers such a tartrate-resistant acid phosphatase and cathepsin K. Bisphosphonates not only induce apoptosis of osteoclasts and neoplastic stromal cells, but also possess a direct anti-tumour and anti-angiogenesis activity. Bisphosphonates do not have any adverse effect on osteoblasts or reparative mechanisms of bone.

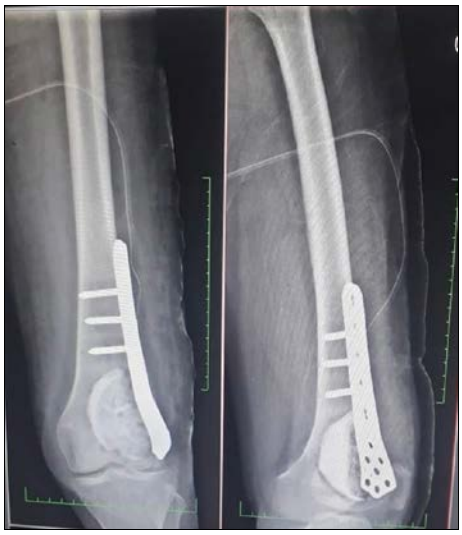

Fig 1: Post-operative X-ray

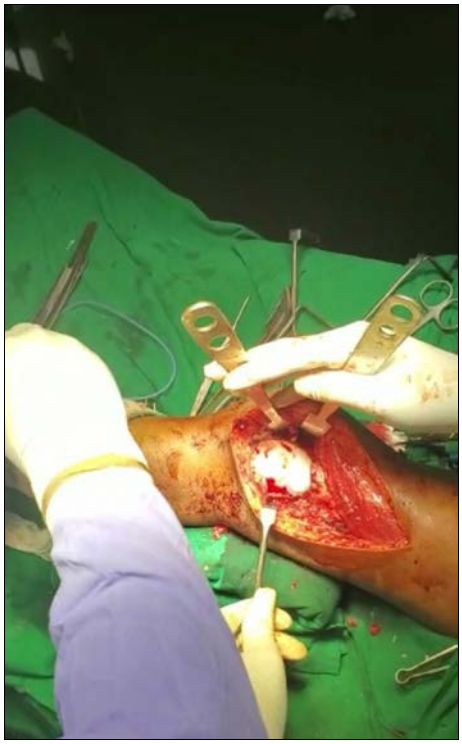

Fig 2: Intraoperative Procedure

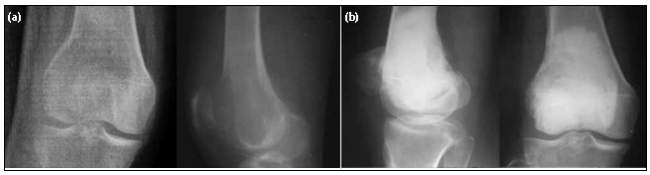

Fig 3: (a) Pre- and (b) post-operative radiographs showing a giant cell tumour of the distal femur treated with curettage, use of phenol, and reconstruction with allograft, gel foam, and cement (the sandwich technique).

Conclusion

Intralesional curettage, use of phenol, and reconstruction with allograft, gel foam, and cement (the sandwich technique) for GCT of bone achieved good functional outcome and a low recurrence rate.

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Conflict of Interest

None

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