A case series of Osteoclastoma around knee with pathological fracture-treated with joint salvage surgery using sandwich technique augmented with locking plate: A prospective study

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Research Article

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Abstract

This study is done to evaluate outcomes of 18 patients who underwent curettage, use of phenol, and reconstruction using the sandwich technique for Giant Cell Tumour (GCT) with pathological fracture of the bone around the knee. 12 men and 6 women aged 19 to 46 (mean-30.7 years) years underwent intralesional curettage, use of phenol, and reconstruction using the sandwich technique for GCT augmented with locking plates of the proximal tibia (n=6) or distal femur (n=12). 10 and 8 tumours were classified as grade II, and grade III, respectively. 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: The follow-up period was 2 years. The mean MSTS score was 28 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 1 year. Her MSTS score at 2 years was 26. No patient had a malignant transformation. Intralesional curettage, use of phenol, and reconstruction with allograft, gel foam, and cement (the sandwich technique) for GCT of bone achieved good functional outcomes and a low recurrence rate.

Keywords: curettage; giant cell tumour 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 20 to 40 years. It is locally aggressive and prone to recurrence and malignant transformation. Treatment by curettage alone has a high risk of recurrence. Use of adjuvants (phenol, cement, cryosurgery, or a combination of these) is recommended, followed by reconstruction with autograft, 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, 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 the outcome of 18 patients who underwent curettage, use of phenol, and reconstruction using the sandwich technique for GCT of bone around the knee augmented with a locking plate for a pathological fracture.

MATERIAL AND METHODS

Between January 2019 and June 2021, 12 men and 6 men aged 19 to 46 years underwent intralesional curettage, use of phenol, and reconstruction using the sandwich technique for GCT of the proximal tibia (n=6) or distal femur (n=12). Two of the cases were recurrences (Table 1).

According to the Campanacci grading system, tumours were classified 8 were grade II (with a relatively well-defined margin but no radiopaque rim, and the thinned and moderately expanded cortex), and 10 were grade III (with indistinct borders with cortical destruction). All the tumours were associated with an extra-articular pathological fracture of the femur (n=12) or tibia (n=6) (Tables 2 and 3).

Through a large cortical window, the tumours were curetted until the normal-appearing bone was seen. The cavity was then enlarged in all directions using a high-speed burr, with care to avoid contamination of the surrounding soft tissues. The cavity was cleaned with pulsatile lavage of 5% phenol, and phenol-soaked gauze was placed inside the cavity for 2 minutes. Care was taken not to spill the phenol to the surrounding tissues. Phenol was not used in cases with pathological fractures. Structural allografts of 3 mm to 5 mm thickness were packed adjacent to the subarticular surface as a 5 mm to 8 mm thick layer. A layer of gel foam was laid over the allograft, and the remaining cavity was packed with cement, and locking plates were used for augmentation.

Postoperatively, non-weight-bearing crutch walking was started immediately. After 12 weeks, weight-bearing was allowed as tolerated. After 16 weeks-patients can carry out their daily activities and walking full weight-bearing.

Intravenous zoledronate (4 mg) once monthly was given for 6 months, along with oral supplementation of vitamin D3 (800 IU) and calcium (12 g) once daily for 6 months.

Functional outcomes were evaluated using the Musculoskeletal Tumor Society (MSTS) score, 5 which involves 6 parameters (pain, function, and emotional acceptance, use of walking aids, walking ability, and gait). Scores for each parameter range from 0 to 5; higher scores indicate better outcomes.

Recurrence was defined as progressive lysis of >5 mm at the bone-cement interface or absence of the sclerotic rim at the bone-cement interface

RESULTS

The mean follow-up period was 2 years.

Pre- and post-operative radiographs showing a giant cell tumor of the distal femur treated with curettage, use of phenol, and reconstruction with allograft, gel foam, cement (the sandwich technique) and augmented with locking plates (Figures 1-5).

At the one-year follow-up, the integrity of the subchondral bone is restored (Figure 6).

The mean MSTS score was 27.7 out of 30 (standard deviation, 3; range, 1630). After 16 weeks -the patient is carrying out his daily activities and walking full weight-bearing (Figure 7).

One patient with a grade III tumour in the proximal tibia had a recurrence detected after 15 months, her MSTS score at 2 years was 26. No patient had malignant transformation recurrence in our case series.

DISCUSSION

Treatment for GCTs around the knee includes 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 60%, 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 (5.5%) and good functional outcome (92.3%).

To ensure thorough curettage, adequate exposure through a wide cortical window is necessary, followed by breaking the bony ridges in the tumor using a high-power burr. The use of 5% phenol decreases recurrence, as phenol causes protein coagulation and necrosis and damages DNA. Structural allograft is laid in the subchondral region and overlaid with a layer of gel foam, and the rest of the cavity is filled with polymethylmethacrylate bone cement and augmented with locking plates. The heating effect of cement destroys remaining tumour cells. The bone graft in the subchondral region helps maintain joint function and prevents articular degeneration.

Care must be taken to prevent inadvertent cortical breach or removal of the posterior fibroperiosteal 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. The intact posterior periosteum is crucial for the reconstitution of the posterior cortex, especially after bone grafting. 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 an 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. Applying a layer of bone graft and gel foam not only protects the underlying articular cartilage from the thermal effect of the curing cement but also supports the weakened subchondral area. Conventionally, grade III lesions are treated with wide resection to prevent local recurrence. The recurrence rates for grade III lesions after intralesional curettage are reported to range from 4.5% to 52%. In our study, only one (5.5 %%) of the 18 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. Bisphosphonates bind to bone and inhibit bone resorption by osteoclasts. Multinucleated giant cells in GCT of bone and osteoclasts are similar, as they both resorb bone and express markers such as tartrate-resistant acid phosphatase and cathepsin K. Bisphosphonates not only induce apoptosis of osteoclasts and neoplastic stromal cells but also possess a direct anti-tumor and anti-angiogenesis activity. Bisphosphonates do not have any adverse effect on osteoblasts or reparative mechanisms of bone.

CONCLUSION

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

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None

Disclosure

No conflicts of interest were declared by the authors

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