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Case Report

Joint function preservation by total elbow arthroplasty for giant cell tumor of distal humerus: A case report in Vietnam

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Abstract

Background: Giant cell tumor is a benign bone tumor, but can be malignant, metastatic or recurrent. Giant cell tumors of the distal humerus are extremely rare.

Case presentation: A 57 years old male patient with Campanacci grade III giant cell tumor of the distal humerus who underwent en bloc resection of the tumor and cemented "sloppy-hinged" total elbow arthroplasty. Preoperative Mayo Elbow Performance Score was 25. At the 6-month follow-up, Mayo Elbow Performance Score was 90, the movement has improved significantly with no pain. There were no signs of local recurrence and metastasis.

Conclusion: The en bloc resection of the tumor followed by total elbow arthroplasty surgery has very good results in pain relief and rehabilitation. However, the patient should be monitored further to detect recurrence and metastasis as well as complications related to the elbow components.

Keywords: Total elbow arthroplasty, giant cell tumor, distal humerus

INTRODUCTION

Giant cell tumors (GCT) are benign tumors of the bone that can progress and metastasize [1]. Although rarely fatal, GCT can affect the bone structure and surrounding tissues [2]. GCT accounts for about 5% of primary bone tumors and about 20% of benign bone tumors [3]. GCT of bone commonly occurs at the long bones as the distal femur, proximal tibia, distal radius, and proximal humerus [4]; its occurrence at the distal humerus is quite rare [5].

In the past, surgical treatment of joint invasive GCT often led to the loss of function, even amputation [1]. Recently, with the development of medicine and technology, resection of the tumor followed by joint reconstruction becomes the optimal option for these cases to restore the joint's function, as well as the aesthetic of the patients [6].

We present a case of distal humerus GCT which was treated by surgical en bloc resection of the tumor and total elbow arthroplasty.

CASE PRESENTATION

A 57-year-old man presented with 4 months of pain, swelling, and decreased range of motion of the left elbow without a history of injury. The patient was diagnosed with rheumatoid arthritis at a local hospital and treated with NSAIDs but the symptoms were not relieved.

Clinical examination showed swelling around the distal humerus, with increased temperature and tenderness. The range of motion was 30°-90°. The supination and pronation were 50° and 70°, respectively. His Mayo Elbow Performance Score (MEPS) was 25 [7]. There were no signs of neurovascular damage.

Radiographs, CT scans, and MRI showed an expansible lytic lesion in the distal humerus which extended to and break the articular surface as well as invaded surrounding soft tissue (Fig. 1 and 2). The biopsy results confirmed the GCT of the distal humerus. This lesion was classified into grade III according to the Campanacci staging system [8].

The patient underwent marginal resection of the distal humeral GCT and total elbow arthroplasty. The surgery was performed through a 15 cm posterior approach. The ulnar nerve was exposed, isolated and medially mobilized. It was protected throughout the operation. The tip of olecranon was removed and laterally mobilized with the triceps. The medial and lateral collateral ligaments were released to easily expose the distal humerus and the tumor (Fig. 3).

After marginal resection of the tumor and local adjuvant with hydrogen peroxide and ethanol, we performed a total elbow arthroplasty using cemented semi-constrained sloppy-hinged elbow prosthesis (Biotek, Chetan Meditech, India) (Fig. 4). The radial head was preserved. The olecranon was then fixed by tension band wiring. The incision was closed in layers over a negative pressure drain (Fig. 5).

Postoperative recovery was good. The patient was instructed to rehabilitate. At 6 months follow-up, the range of motion was 10°-125°.

Fig. 1. Preoperative X-rays of patient

Fig. 2. MRI of patient's elbow

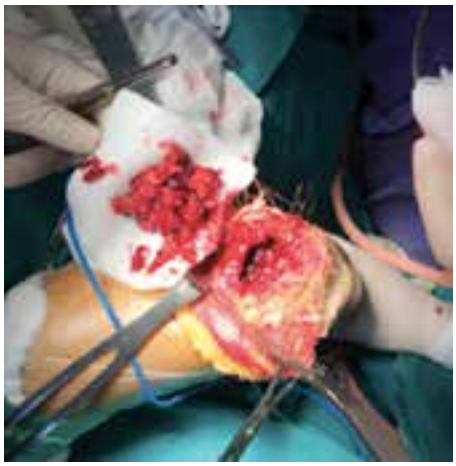

Fig. 3. Intraoperative lesion

Fig. 4. Intraoperative elbow prosthesis

Fig. 5. Postoperative X-ray of patient's elbow

Table 1. Some cases of GCT of distal humerus in literature

Author (year)	Sex- Age (Follow-up)	Treatment method	ROM (MEPS) Pre-op	ROM (MEPS) Post-op	Reoccurrence Metastasis
Hedge [6] (2014)	Male-30 years (18 months)	En bloc tumor Resection+TEA	20°-90° (-)	15°-120° (-)	No
Sait [13] (2012)	Female-32 years (56 months)	En bloc tumor Resection+TEA	40°-90° (30)	20°-110° (90)	No
Rekha [22] (2013)	Male-25 years (24 months)	En bloc tumor Resection+elbow preservation	50°-90° (35)	10°-120° (85)	No
Our Case	**Male-57 years (6 months)**	**En bloc tumor Resection+TEA**	**30°-90° (25)**	**10°-120° (90)**	**No**

The active supination and pronation were 60° and 85°, respectively. There were no signs of recurrence. The postoperative MEPS was 90 (excellent). The patient was very satisfied with the results of the surgery.

DISCUSSION

Giant cell tumor is a benign tumor that can develop locally and usually seen in the ages of 20-40 [9]. It can metastasize or malignant, but with low rates [10,11]. GCT is usually located in the epiphyseal part of long bones. The most common sites are the proximal tibial, distal femur and distal radius [9,12]. Although about 6% of GCT is located in the humerus, most of these are in the proximal part. Thus, the GCT of the distal humerus is extremely rare [13].

In 1987 Campanacci introduced a radiographic grading system for GCT [8] based on Ennekin's staging classification for benign bone tumors [14]. Campanacci classified giant cell tumors into 3 grades depending on radiographic appearance: Grade 1 lesion has an intact cortex and a well-defined margin (latent phase); Grade 2 lesion has a relatively well-defined margin but no radiopaque rim (active phase), the bone cortex is thinned and expanded; and Grade 3 lesion has indistinguishable margins and cortical destruction (aggressive phase) [15].

MRI should be assigned to assess the tumor inhomogeneity, intra-articular spread and soft tissue extensions [13]. A preoperative biopsy is essential to confirm the diagnosis of GCT as well as to help distinguish benign GCT from primary malignant GCT. This lesion is very similar to conventional GCT in clinical appearance and radiography but it has a very poor prognosis [16].

There are many methods of GCT treatment depending on the location and the extent of the tumor [7]. Surgery is the most common treatment option for GCT. Depending on the articular surface damage, the tumor can be removed by en-bloc resection, wide resection of intralesional curettage.

Treatment results are very good if the tumor is completely removed, with no complications and acceptable functional results [15]. Grade I and grade II lesions can be treated with intralesional curettage. This procedure has good functional outcomes and fewer complications, but the rate of recurrence is high (12%-65%) [15,17]. After the tumor resection, the bone defect can be filled with the cancellous bone graft (allograft or autograft) or cement. Cancellous bone graft has biological advantages, a bone graft can be permanently healed to the defective site. However, the number of bone autografts is limited, and the bone allograft is more expensive and requires a tissue bank. Cement provides stability, weight-bearing can be allowed on the day after surgery. Besides, the thermal effect of cement increases the ability to kill tumor cells. However, cement is not a biological material, structural incompatibility can lead to problems such as articular cartilage degeneration or fracture [18].

When the lesion has invaded the joint, en bloc resection of the tumor followed by joint reconstruction is the treatment of choice [13]. There are many options to reconstruct the removed joint bone such as joint replacement, autografting or allografting [19,20]. In this case, total elbow arthroplasty was the optimum and safe option, helping to restore elbow stability and function after removal of the tumor [21].

Since GCT of the distal humerus is quite rare, only a few clinical cases have been reported in the literature. Some other cases of GCT in the distal humerus are presented in Table 1.

According to other authors, surgical resection of the tumor followed by total elbow arthroplasty had satisfactory results. At the 6 months follow-up, our patient showed a significant improvement in the range of motion and the MEPS score compared to that before the surgery. Although there are no signs of recurrence or metastasis of the tumor, the patient should be a longer follow-up [22].

In 1925, Robineau was the first to perform an elbow replacement, with an anatomical elbow prosthesis made of metal and vulcanized rubber. In 1941, Boerema used a non-anatomic hinged type elbow prosthesis made of metal [23].

The disadvantage of anatomical elbow prosthesis is the instability. The anatomical elbow component requires the ligaments and muscles to be intact. However, these structures are often not intact in the case of chronic osteoarthritis or after the removal of large tumors. Therefore, this type of elbow prosthesis often leads to a high rate of dislocation [24,25].

When the elbow is flexed and extended, a little bit of varus and valgus is normal [26]. However, the first generation of the hinge-type elbow does not allow this movement, resulting in the component loosening. This problem was solved by the "second generation" of hinged TEA, which allows a little valgus and varus, such as a semi-constrained design.

After the tumor resection, some chemical adjuvants such as phenol, ethanol, and hydrogen peroxide can be used. Many studies have demonstrated the effects of these chemicals in reducing the incidence of GCT recurrence [27-30]. Among them, phenol was the most common use. However, it is corrosive and causes burns in contact with skin [31]. In this case, we used ethanol and hydrogen peroxide. Ethanol causes tumor necrosis by degenerating cellular proteins and cytoplasm and creating a thromboembolic effect in the small vessels that supply the tumor with blood [32]. Lin et al. reported a study comparing the effects of phenol and ethanol adjuvant in GCT treatment. According to these authors, there was no significant difference between the phenol group and ethanol group in the recurrence rate and postoperative function [31].

CONCLUSION

Giant cell tumor of the distal humerus is very rare. A patient with grade III GCT of the distal humerus was treated by surgical resection of the tumor and total elbow arthroplasty. The results of the treatment were very encouraging. But the patient should be a longer follow-up to assess the recurrence, metastasis as well as the complications associated with the prosthesis.

DECLARATION

CONSENT

Written informed consent was obtained from the patient for

publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request. The patient received an explanation of the procedures and possible risks of the surgery and gave written informed consent.

COMPETING INTERESTS

The authors declare that there are no competing interests regarding the publication of this paper.

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AUTHOR CONTRIBUTION

DTT contributed to operating, data collection, analysis and interpretation, manuscript drafting, revising, and approval for publishing; MNH, SNTQ, TLK contributed to operating, data collection, analysis and interpretation, manuscript drafting, revising, and approval for publishing; TLK contributed to assist the operation, data collection, analysis and interpretation, manuscript drafting, revising, and approval for publishing.

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