Conservative Treatment of Campanacci Grade III Proximal Humerus Giant Cell Tumors

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Abstract Management of large giant cell tumors of the proximal humerus is controversial because wide resection with reconstruction results in a poor functional outcome for most patients. We retrospectively reviewed the cases of six patients with Campanacci Grade III giant cell tumors of the proximal humerus to determine the feasibility of avoiding en bloc resections for large giant cell tumors in this location. We evacuated the tumor through curettage and then used burring (unless the remaining cavity was thinned and at risk for fracture) and phenolization, followed by packing of the defect with allograft cancellous bone. The mean age of the patients at surgery was 30 years, and the minimum followup was 2.5 years (mean, 5.6 years; range, 2.5–9.7 years). One of the six patients had local recurrence 1.2 years postoperatively and was treated with repeat intralesional surgery with no additional recurrence 5 years later. No other patient required additional treatment, had pulmonary metastases develop, or had progression to osteoarthritis. The mean Musculoskeletal Tumor Society and Toronto Extremity Salvage Score functional scores at last followup were 26 of 30 (range, 21–30) and 95% (range, 90%–100%), respectively. These functional scores are higher than reported scores for

patients with segmental resection and reconstruction of the proximal humerus.

Level of Evidence: Level IV, therapeutic study. See the Guidelines for Authors for a complete description of levels of evidence.

Introduction

Giant cell tumor (GCT) of bone is a benign, aggressive tumor that typically is located in the epiphysis of long bones. Although GCTs are considered benign, their ability to destroy bone and metastasize makes surgery the standard treatment. The goals of surgery are to prevent recurrence by completely removing the tumor and to maintain adjacent joint function. Treatment options include intralesional surgery with bone grafting or cement or segmental resection and reconstruction with an osteoarticular allograft, endoprosthesis, or allograft-prosthetic composite. Resection and reconstruction minimize tumor recurrence, but this is associated with poor functional outcomes in this anatomic location [12, 14, 15, 31, 32, 34]. Intralesional procedures have a higher reported recurrence rate but ideally preserve shoulder anatomy and function. Campanacci Grades I and II GCTs [7], which are defined as having no extraosseous extension, routinely are treated with curettage and bone grafting. Grade III lesions involve obliteration of the cortical bone and extension into the soft tissue and often are treated with segmental resection owing to concerns about recurrence [14, 16, 37, 38].

GCTs of the proximal humerus make up a minority of reported cases [6, 14, 32, 34, 37, 38]. Deciding how to treat GCTs at this site is more complicated when the tumor is large because wide resection with reconstruction results in a poor functional outcome for many patients [1, 4, 12, 22, 28].

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In light of this evidence, we were not willing to continue performing resection and reconstruction for benign GCTs in this location. Recent studies suggested the risk of recurrence after intralesional curettage is similar in Grades II and III GCTs [17, 37].

Therefore, we asked whether intralesional curettage with burring, phenolization, and bone grafting would provide (1) adequate local control and (2) maintenance of normal shoulder function for patients with Campanacci Grade III tumors in the proximal humerus.

Materials and Methods

We retrospectively reviewed six consecutive patients with Campanacci Grade III proximal humerus GCTs who underwent intralesional curettage and allograft bone packing between 1997 and 2005. During this time, we used no other forms of treatment for these patients. There were four women and two men with a mean age of 30 years (range, 18–44 years) at the time of initial surgery. From the medical records, we determined dates of surgeries, adjuvant treatments, complications, revisions, reasons for revisions, and instances of local recurrence and metastasis. Functional outcomes were assessed at the latest followup. All patients had shoulder pain on presentation, with an

average duration of 4.2 months (range, 1–13 months). One patient also had shoulder weakness. The mean tumor volume was 24.3 cm^3 (range, 4–67 cm^3). Three patients (Patients 2, 3, 6) had a pathologic fracture on presentation, and one additional fracture (Patient 4) was diagnosed intraoperatively. Minimum followup was 2.5 years (mean, 6.1 years; range, 2.5–9.7 years). Five of the six patients were seen in the clinic for a functional evaluation. One patient (Patient 2) could not be reached but had 4 years followup in the medical records. We had prior Institutional Review Board approval.

Preoperative evaluation of the lesions consisted of plain radiographs of the affected shoulder, occasionally with advanced scanning such as CT, MRI, or angiography, depending on presentation (Fig. 1). These studies were performed to characterize the extent of the lesion, determine soft tissue involvement, and identify tumors with a high risk of intraoperative bleeding.

A deltopectoral incision was used for all procedures. The proximal humerus was exposed and a large bone window was made to facilitate observation and evacuation of the tumor. Curettage then was performed to remove the GCT, and phenol was used in the remaining cavity. Burring was limited by a thin cortex and large cortical defects. The bone defect was packed with allograft bone chips in all cases. A fibular strut was placed in one patient (Patient 4)

Fig. 1A–C (A) A preoperative radiograph shows cortical destruction (arrows) caused by the GCT. (B) A T1-weighted coronal MR image and (C) a T2-weighted axial MR image show cortical destruction and soft tissue extension of the GCT.

Fig. 2 A postoperative radiograph of the proximal humerus 1.5 years after curettage and bone grafting shows good cortical healing and filling of the defect.

for additional support. No internal fixation was performed at the time of curettage and bone grafting despite the large size of the defects that were grafted. The wound was closed with deep drains in place.

Postoperatively, patients wore a shoulder immobilizer and were allowed early motion as tolerated. Self-supervised physical therapy to regain shoulder range of motion was initiated immediately after surgery, with the addition of strengthening exercises after 6 weeks.

We followed patients clinically and radiographically every 3 months for 2 years, then every 6 months for 5 years, and annually thereafter. During the first 5 years of

followup, patients had radiographs and MRIs of the humerus to assess for local recurrence (Fig. 2) and radiographs of the chest to monitor for lung metastases. Thereafter, patients were monitored with yearly radiographs of the humerus. One of the authors (JJK) determined functional outcomes by the Musculoskeletal Tumor Society 1993 rating scale (MSTS) [11] and the Toronto Extremity Salvage Score (TESS) [10].

Results

Five of six patients had no evidence of recurrence at last followup (Table 1). One patient (Patient 4) had local recurrence 1.2 years postoperatively that was treated successfully with repeat intralesional surgery with adjuvant burring, phenol, and cement. This patient had no additional recurrence during the remaining 5.1 years of followup. No metastases were seen at last followup. One patient (Patient 3) had excessive intraoperative bleeding that required us to abort the procedure before tumor evacuation. The tumor was embolized twice, followed by definitive curettage 2 months after the initially attempted procedure. This patient had no recurrence after the definitive curettage.

The average MSTS pain score was 4 (mild) of 5. The mean overall MSTS score was 26 of 30 (range, 21–30). The mean TESS score was 95% (range, 90%–100%). Four of the five patients believed they were not disabled and one (Patient 3) believed she was mildly disabled. No patient had radiographic evidence of shoulder osteoarthritis or subchondral collapse. No patient required additional stabilization or had an infection.

Table 1. Summary of patients with Campanacci Grade III proximal humerus giant cell tumors

Patient	Gender	Age (years)	Fracture	Treatment	Intraoperative adjuvant therapy	Recurrence and treatment	MSTS/TESS scores	Followup (years)
1	Female	18	No	Curettage and packing with bone graft	Burring, phenol	None	25/93%	9.7
2	Female	28	Yes	Curettage and packing with bone graft	None	None	NA	4.0
3	Female	21	Yes	Embolization x 2 then curettage and packing with bone graft	Phenol*	None	21/90%	7.8
4	Female	34	Yes	Curettage and placement of a fibular strut followed by packing with bone graft	Phenol	Once (1.2 years) repeat curettage, burring, phenol, and bone cement	26/95%	5.1
5	Male	44	No	Curettage and packing with bone graft	Phenol	None	30/100%	4.4
6	Male	32	Yes	Curettage and packing with bone graft	Electrocautery of defect	None	27/98%	2.5

* Patient also treated with embolization; MSTS = Musculoskeletal Tumor Society; TESS = Toronto Extremity Salvage Score; NA = not available.

Discussion

GCTs are considered benign bone neoplasms despite their local aggressiveness and ability to recur and occasionally even metastasize. The rate of metastasis is approximately 1% in patients without recurrence and 6% in patients with recurrence, and metastatic disease is rarely fatal [27]. This unique behavior of GCTs has led to controversy regarding optimal surgical treatment. Wide resection offers a theoretical advantage of lower recurrence risk by removing the entire tumor but is associated with worse functional outcomes, especially in the context of the proximal humerus. Intralesional surgery tends to have better functional results but has been associated with higher recurrence rates [14, 30, 34]. Numerous experts favor wide excision for Campanacci Grade III GCTs to reduce the risk of recurrence and biomechanical failure [14, 16, 37, 38]. Other situations for which wide excision with endoprosthetic reconstruction often is preferred include GCTs associated with pathologic fracture [3, 16, 18] and GCTs in expendable bones such as the fibula [14, 37]. Because of the poor functional outcomes associated with wide resection, we routinely perform intralesional curettage for Campanacci Grade III GCTs. We found the recurrence rate was no different for Grades II and III GCTs after intralesional excision [17]. This finding prompted us to specifically investigate GCTs of the proximal humerus, in which resection and reconstruction historically have produced poor functional results [1, 12, 22, 28] to determine the recurrence rate and functional scores after intralesional curettage.

Limitations of our study include its small sample size and lack of a control group. However, this is a relatively uncommon tumor when limited to this location and large numbers cannot be readily accumulated from one institution. Furthermore, one of our patients was lost to followup and not available for a current functional evaluation. By reporting the results of this initial study, we hope to encourage appropriate use of this procedure for Campanacci Grade III GCTs so that a larger multicenter study can be conducted. Longer followup also would substantiate the results, but the current mean followup of 6 years goes well beyond the 2- to 3-year period when most recurrences occur [9, 13, 21, 30]. Another potential source of bias is the MSTS functional assessment, which is subjective and administered by the physician. To offset this, we also used the TESS functional score, which patients complete themselves to reduce the possibility of physician bias.

One of our six patients had local recurrence 1.2 years postoperatively. Older studies report recurrence rates of 27% to 45% after intralesional curettage [6, 9, 15, 21, 29, 32], but more recent studies using adjuvant techniques report lower recurrence rates of 8% to 19% [2, 3, 13, 24, 26, 31, 36]. The decrease in recurrence rates in recent years

is attributed to the use of adjuvant treatments such as burring, electrocautery, phenol, liquid nitrogen, and methyl methacrylate, although a definitive cause-and-effect relationship is lacking [3, 23, 26, 30, 34, 35]. When GCTs do recur after intralesional curettage, repeat curettage is often successful. Most recurrences occur within the first 18 months after surgery and rarely after 3 years [9, 13, 21]. In one large series, 87% of patients with recurrent GCTs achieved local healing with repeat curettage(s) without the need for segmental resection or internal fixation [33].

Functional outcomes in our patients were improved compared with reported outcomes in studies of proximal humerus resections and reconstructions for bone tumors. Although our patients had a mean MSTS score of 26 of 30, two series that treated proximal humerus bone tumors with resection and endoprosthetic reconstruction reported scores of 18.5 and 23.6, respectively [22, 28]. Other studies that used segmental resection and endoprosthetic reconstruction had satisfactory function in only 44% to 78% of patients [5, 20]. Packard [25] reported seven cases of proximal humerus endoprostheses for bone tumors had “limited” shoulder function (60° abduction and forward flexion at best), although distal function was preserved. When osteoarticular allografts were used for the proximal humerus reconstructions, mean MSTS scores were 21.0 to 22.2 [12, 22, 28], and 65% to 83% of patients had satisfactory function [1, 19]. Chen et al. [8] reported MSTS scores for wide resection of malignant bone tumors and reconstruction with an allograft-prosthetic composite. Only two patients in their study had tumors of the proximal humerus with mean MSTS scores of 24 and 27 [8].

We believe the findings confirm Campanacci Grade III GCTs of the proximal humerus are amenable to intralesional curettage and bone grafting. Only one in this series of six patients had a recurrence that was treated successfully with repeat curettage and cementation. All of the evaluated patients at final followup (mean, 6 years) had excellent functional outcomes. Given the poor functional outcomes and higher complication rates historically associated with segmental resection and reconstruction of the proximal humerus, we believe intralesional curettage is a valuable alternative for advanced proximal humerus GCTs.

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