Giant Cell Tumor of the Capitate Treated with Excision and Midcarpal Fusion

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Abstract

Keywords

- giant cell tumor
- carpal bones
- metacarpal arthrodesis

Background Giant cell tumor (GCT) of bone is rare in the carpus, and only 11 cases have been reported in the capitate bone. The problem with this location is the high recurrence rate due to easy extension to the adjacent joint spaces and bones. We describe a case of GCT on the capitate bone and the treatment in comparison with the previously reported cases.

Case Description The case report concerns a 48-year-old woman with a GCT of the capitate diagnosed on curettage. The treatment consisted of large resection with the lunatum and third metacarpal arthrodesis, with a successful union at 2 years follow-up, no recurrence, and an improved function of the wrist.

Literature Review When treated by curettage (alone or with adjuvant procedures), the GCT of the capitate recurred in four out of five cases. All tumors treated with large resection did not recur.

Clinical Relevance Recommended treatment of GCT of the capitate is resection with carpometacarpal arthrodesis.

Giant cell tumors (GCTs) on bone are rare in the carpus. At the wrist, the usual location is the distal radius, and according to Averill et al,¹ only 0.32% occur in the carpus (4/1,228 cases of GCT on bone). Shigematsu et al² reviewed all cases of GCT on carpus published between 1935 and 2005 (29 cases) and found that the hamatum was the most affected bone, followed by the capitate bone, the scaphoid, and the lunatum. The problem with this location is the high recurrence due to easy extension of the tumor to the adjacent joint spaces and bones.

We describe a case of GCT on the capitate bone and discussed its treatments.^{2–10}

Case Report

A 48-year-old woman was referred because of left wrist pain (nondominant hand) lasting for 1 year, with swelling over the dorsum of the wrist. These symptoms worsened after a minor

trauma, with loss of mobility of the wrist. Plain radiographs (►Fig. 1) showed strong lucency in the capitate bone limited by a thin sclerotic rim and lateral cortical effractions. In evaluating the extent of this lesion, computed tomography and magnetic resonance imaging (MRI) revealed preserved joint spaces with the lunatum and the third metacarpal, and a lateral extension to the scaphotrapezoid joint space on MRI (►Fig. 2A, B). The investigations resulted in suspected grade III GCT of the capitate bone according to the grading scale of Campanacci et al⁸ (►Table 1).

An ultrasonography-guided needle biopsy was inconclusive. Two-stage surgery was performed. In the first stage, with a dorsal wrist approach, the exploration revealed a brittle, fawn-colored tumor of the capitate, evoking a GCT of bone (►Fig. 3A). The tumor extended to the subchondral bone of the head and base of the capitate, with lateral extensions to the scaphotrapezoid and hamatotriquetral joint spaces. All

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Fig. 1 Plain radiographs showed strong lucency in the capitate bone limited by a thin sclerotic rim and lateral cortical effractions.

Fig. 2 CT revealed lateral erosions of the capitate walls and a preserved joint space with the lunate and 3rd metacarpal (A). MRI showed the lateral extension to the scapho-trapezoid joint space (B).

Table 1 Campanacci's classification of giant cell tumors of bones⁸

Grade I (quiescent)	Intraosseous lesions with well-marginated borders and an intact cortex
Grade II (active)	More extensive intraosseous lesions having a thin cortex without loss of cortical continuity
Grade III (aggressive)	Extraosseous lesions that break through the cortex and extend into the soft tissue

Fig. 3 In the first stage, surgical exploration revealed a brittle, fawn-colored tumor of the capitate, evoking a GCT of bone (A). In the first stage, all pathological tissue was curetted (B, C).

pathological tissue was curetted, and bone cement was placed in the resection area (►Fig. 3B, C). The wrist was immobilized.

Postoperatively, the pathological analysis confirmed the diagnosis of GCT of bone, and the patient was readmitted for surgical wide resection of the capitate bone 3 weeks

later. No evidence of residual or recurrent GCT was noted. However, biopsies in the adjacent joints were performed again. The bone was then reconstructed with a corticocancellous bone graft from the iliac crest, with luno-metacarpal arthrodesis fixed by a plate (►Fig. 4). The wrist was immobilized for 5 weeks before rehabilitation. The postoperative pathological analysis did not reveal any residual GCT.

In the early postoperative period, a complex regional pain syndrome developed, which progressively resolved over a few months but impaired wrist motion. The bone union was achieved at 2 months. At 2 years after surgery, the patient had no pain and had functional range of motion (30 degrees of extension, 25 degrees of flexion), the grip strength was 50% of that of the unaffected side, and the tumor had not recurred or appeared in another site (►Fig. 5).

Discussion

GCTs of bone account for 4 to 10% of bone tumors. Carpal GCTs are extremely rare, and according to Averill et al,¹ only 0.32% of GCTs occur in carpal bones. Only 11 cases of GCT of the capitate bone were reported.^{2–10} In 9 of 11 cases, the radiographic stage according to the Campanacci et al grading system⁸ was found (►Table 1).

Fig. 4 In the second stage, after wide resection of the capitate bone, a luno-metacarpal arthrodesis with cortico-cancellous bone graft from the iliac crest and plate fixation was performed.

Fig. 5 At 2 years after surgery, the arthrodesis was fused. No recurrence was noted.

Details of age, gender, radiographic stage, treatment, and, when available, evolution of these 11 cases are given in ►Table 2. All patients, except one (patient 1 in ►Table 2), were young, aged between 16 and 30 years. The sex ratio was 2.6:1 (female to male). Most complained of wrist pain after minor trauma and, for some, associated swelling of the wrist. Our 48-year-old patient had identical symptoms. One of the 11 previous cases had a malignant GCT on bone (9%) with a metastatic lung nodule occurring after two local recurrences and radiotherapy. Among 21 cases of GCT of the hand and carpus, Averill et al¹ detected two malignancies (9.5%).

Two (18%) patients had multifocal GCT of the carpus. All 11 cases of capitate GCT were locally advanced at the time of diagnosis; their radiographic stage was grade III when documented. This finding may have been due to the aggressiveness of this tumor when located in the hand and wrist^{1,2,9} or due to delayed diagnosis because GCTs of the carpal bones are asymptomatic in the early stages.

Compared with GCTs in other locations, GCTs of the hand and carpal bones have a high rate of recurrence: 86.6% according to Averill et al¹ and 79% for Athanasian et al⁹; therefore, the usual treatment (curettage with bone graft) is unsuitable for this site. This situation may be due to locally advanced tumor at the time of diagnosis or the small size of carpal bones, which limits the healthy bone margin taken by curettage.

Adjuvant procedures have been associated with curettage in GCTs of bones in other sites and seem efficient in reducing the recurrence rates. In a series of 118 GCTs of bone, Klenke et al¹⁰ found significantly reduced recurrence rates with the addition of methyl methacrylate after curettage as compared with curettage and bone grafting. Phenol application had no

significant effect, and the only risk factor for recurrence, in addition to treatment, was young age (<25 years).¹⁰ Local adjuvant therapy such as liquid nitrogen, acrylic cement, phenol, hydrogen peroxide, locally delivered chemotherapy, or radiation therapy is useful in controlling recurrence. Recurrence rates were 6 to 25% for GCT treated with curettage and local adjuvant therapy.¹¹ Studies of denosumab, a monoclonal antibody that specifically binds to RANKL (receptor activator of nuclear factor-kappa B ligand), were positive, which led to its approval by the U.S. Food and Drug Administration.¹¹

For GCTs of the capitate bone, four out of five cases treated with curettage, alone or with adjuvant procedures (phenol in one case, burring in one case, cryotherapy in another) recurred 3 to 42 months after surgery. The fifth case treated with curettage did not recur after 1 year. The seven cases treated with large resection (three cases primarily and four cases secondarily after GCT recurrence) did not recur after 1 to 5 years. Only five case reports mentioned functional results after wide resection of the capitate bone (primarily or after GCT recurrence). All these patients recovered a useful range of motion. After wide resection, authors reported no need for reconstruction with excellent function (patient 3 in ►Table 2),⁶ or carpo-metacarpal arthrodesis with iliac corticocancellous bone graft^{3,4,7}. One patient recovered good function (patient 5 in ►Table 2), and one patient recovered 60% of the wrist motion (patient 2 in ►Table 2)⁷; other patients recovered 90 degrees of flexion and extension of the wrist, with normal pronosupination (patients 9 and 10 in ►Table 2).^{3,4}

In view of the recurrence rates after curettage and the functional results after wide resection of the capitate bone, the recommended treatment for Campanacci grade III GCT of

Table 2 Characteristics of 11 cases of GCT on the capitate bone in the literature

Year	Authors	Patient no.	Age (y)	Gender	Campanacci grade	Pre- or perioperative histology	Primary treatment	Reconstruction	Recurrence	Secondary treatment	Final condition	Follow-up
1984	Brooks and Pascal ²	1	23	F	III	Anterior curettage histology: GCT	Radiotherapy (no response), large surgical excision	Iliac bone graft	In < 6 mo	Arm amputation (below elbow)	Metastatic lung nodule resected	NA
1984	Howard and Lassen ⁷	2	16	F	III	Frozen section examination: aneurysmal bone cyst	Curettage	Cancellous bone graft	3.5 y after surgery	Total resection of the capitate + intercarpal fusion with a bone block from the ilium	60% of wrist motion	3 y
1992	McDonald and Schajowicz ⁶	3	28	F		Biopsy: GCT	Complete resection of the capitate	No			Excellent function	5 y
1994	Lane et al ²	4	61	F			Curettage	No	At 3 mo	Partial resection	No recurrence	5 y
1995	Gupta et al ²	5	30	M	III (capitate) Distal row of carpus	Biopsy: GCT	Distal row carpectomy	Bicortical iliac bone graft and carpometacarpal arthrodesis			Good hand function	18 mo
1997	Murray et al ²	6 7	17 24	F M	NA	NA	NA	NA	NA	NA	NA	NA
2001	Wilson et al ²	8	27	M	III		Curettage, burring, and cryotherapy	Cancellous bone graft			No recurrence	1 y
2006	Moreel and Le Viet ³	9	24	F	III		Curettage, burring	Corticocancellous graft	At 11 mo after surgery	Large resection + corticocancellous graft	Function—E, 45 degrees; FI, 45 degrees; UD, 15 degrees; RD, 15 degrees; PS, 0/180 degrees	4.5 y
2009	Tamg et al ⁴	10	29	F	III Scaphoid, capitate, trapeze, trapezoid	Percutaneous biopsy	Large resection of the carpus preserving the proximal pole of the scaphoid and the proximal row	Bicortical iliac graft			Function: E 40°, FI 50°, PS normal	1 y
2011	Angelini et al ⁵	11	21	F	III	Frozen section examination: GCT	Curettage + phenol	Morcellized corticocancellous bone allograft	At 5 mo after surgery	Large resection, carpometacarpal arthrodesis + iliac autograft	No recurrence	18 mo

Abbreviations: E, extension; F, female; FI, flexion; GCT, giant cell tumor; M, Male; NA, not available; PS, pronosupination; RD, radial deviation; UD, ulnar deviation.

the capitate bone seems to be wide resection with partial wrist arthrodesis.

Note

This work was performed in the Hand and Upper Extremity Surgery Unit, Lapeyronie University Hospital, Montpellier, France.

Conflict of Interest

None.

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