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Case Report

Giant Cell Tumor of The Proximal Phalanx of The Index Finger of The Hand: A Rare Case Report

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ABSTRACT

Background: Giant cell tumor (GCT) of bone is a relatively common type of benign tumor involving the epiphyseal region of tubular bones, but GCT rarely occurs at hand (1–4% of all GCT). GCT within the hand tends to be more aggressive and recurs more rapidly in hand than in other locations. Most authors prefer curettage or resection with reconstruction to maintain anatomical and functional integrity.
Case Report: A 27-year-old man with a chief complaint of an enlarged lump and pain in the index finger of his left hand. These lumps appeared three months ago. Plain radiographs showed lytic, eccentric, geographic lesions with well-defined borders and narrow transition zones. Magnetic resonance imaging (MRI) showed a primary aggressive bone tumor with extension to the surrounding soft tissue. Fine Needle Aspiration Biopsy (FNAB) revealed the lesion as a Bone Giant Cell Tumor. The patient then underwent local resection and reconstruction using an allograft. Range of movement (ROM) measurements and DASH scores were evaluated.
Discussion: Radiographic and MRI examinations showed characteristic cortical breach, and FNAB showed multinucleated giant cell spread. After treatment, the patient was found to be pain-free, have an improved ROM, and reduced disability. There was no recurrence observed.
Conclusion: Despite the tendency for hand GCT to be more aggressive, local resection and reconstruction using an allograft with adjuvant hydrogen peroxide can reduce recurrence and disability.

Keywords: Giant cell tumors; Neoplasms; Allograft; Hydrogen peroxide; Human and medicine

INTRODUCTION

A giant cell tumor of bone (GCTB) is a benign tumor that is locally aggressive but rarely metastasizes (International Classification of Diseases for Oncology). GCTB represents 5% of primary and 20% of benign bone tumors. Most GCTB occurs between the ages of 30-50 years.[1] In very rare cases, GCTB can occur in the bones of the hand.[2,3]

Radiologic imaging revealed a giant bone cell tumor as a purely lytic mass located eccentrically and geographically. GCTB of the hand tends to damage the cortex focally and invade the surrounding soft tissue. Histopathological examination and fine-needle aspiration biopsy (FNAB) showed a characteristic feature of the distribution of giant multinucleated cells. The surgical approach uses local resection and allograft reconstruction as the main therapeutic choice.[4-6]

In this report, we present a case of a 27-year-old man who complained of a solid mass in the proximal phalanx of his left index finger, which was resected and reconstructed using an allograft. The mass was histologically proven t-o

be a giant cell tumor. Clinical, radiographic, and histological features, as well as currently recommended treatments, are also discussed. The measurement of hand functional disability used the Disabilities of the Arm, Shoulder, and Hand (DASH) scoring system.

CASE REPORT

Male, 27 years old, presented with the chief complaint of a painful lump growing on the index finger of his left hand. These lumps have appeared since three months ago. The patient did not use any medication other than massage therapy. Physical examination revealed a solitary lump with a firm, solid consistency in the proximal phalanx of the left index finger with hyperpigmentation and tenderness to palpation. The patient had no significant past medical history. Upon presentation, the patient's initial DASH score was 67 points.

The plain radiograph showed an eccentric, geographic lytic lesion extending to the diaphysis of the proximal phalanx with a very thin sclerotic cortical margin (Figure 1). The lesion extended to the subchondral bone and the second metacarpophalangeal joint (MCPJ). There was no matrix appearance or signs of periosteal reaction, even though the outward expansion was found entering the surrounding soft tissue. A very thin sclerotic margin indicated a benign tumor with an aggressive nature, although the lesion was geographically lytic with a narrow transition zone. Also, on plain radiographs, especially in the oblique projection, the characteristic view of a soap-bubble appearance of the giant cell tumor of bone can be observed. Figure 1 shows a plain radiograph of the giant cell tumor of the hand bone.

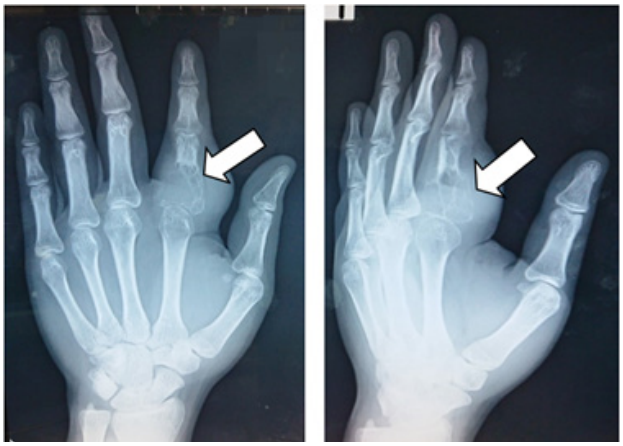

Figure 1. Pre-operative radiograph (posteroanterior and oblique views). The white arrow shows a lytic, eccentric, and geographic destruction type of lesion at the base of the proximal phalanx of the ring finger. The ill-defined margin of the lesion shows a focal destruction which suggested an aggressive behavior.

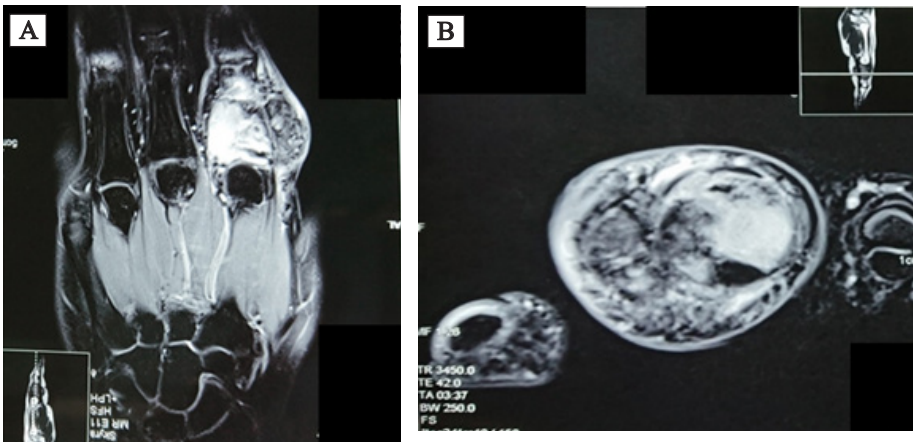

Figure 2. (A) Coronal and (B) Axial view of the MRI showed an expansive mass of the proximal phalanx resembling an aggressive nature of the GCT of the hand bones.

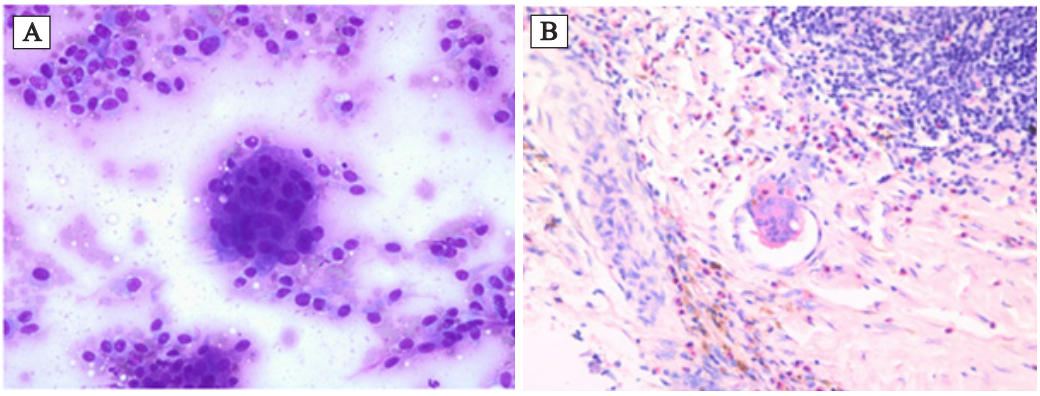

Figure 3. (A) Cytological examination showed giant cells with abundant cytoplasm with more than 10 nuclei. (B) A multinucleated oval giant cell as the pathognomonic sign of GCT.

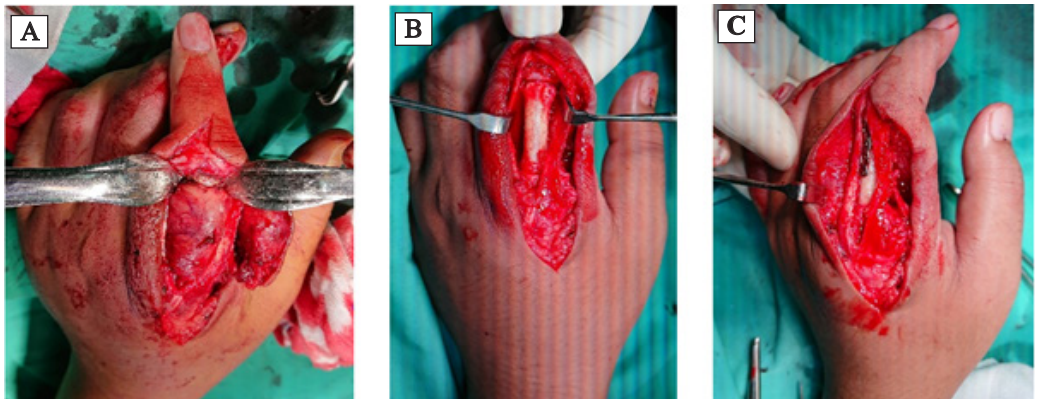

Figure 4. (A) The steps of proximal phalanx of the left index finger resection and reconstruction started with an exposure to the bone tumor; (B) Bony gap reconstruction using allograft; and (C) Allograft fixation using a miniplate.

Magnetic Resonance Imaging (MRI) in Figure 2 shows an image suggestive of a primary aggressive bone tumor at the base extended to the diaphysis of the proximal phalanx of the index finger of the left hand with cortical expansion and destruction, which allows the extension to the soft tissue. This expansion enclosed the superficial flexor digitorum tendon, extensor indicis tendon, and the extensor digitorum tendon of the index finger. The mass also extended into the second metacarpophalangeal joint space, with the second metacarpal cortex intact.

Chest X-ray and laboratory tests were within normal limits. At this stage, the differential diagnosis was giant cell tumor, enchondroma, and aneurysmal bone cyst. Specimens were sent for cytologic and histopathological examination. The results showed a uniformly distributed proliferation of osteoclast-type giant cells with the spread of multinucleated giant cells without signs of malignancy. The results of these examinations are displayed in Figure 3.

After giving written informed consent, the patient underwent local resection of the lesion with chemical augmentation of hydrogen peroxide, and the bony gap was filled with allograft for reconstruction. The steps are described in Figure 4. In the postoperative period, re-evaluation was carried out using DASH scores after 1, 6, and 12-month periods with 67, 51, 35, and 34, respectively.

From our one-month, six months, and 12 months postoperative follow-up, as shown in Figure 5, we noticed a significant increase in ROM, especially from one month to six months, with the patient finally able to flex and extend the metacarpophalangeal joint without pain. The proximal interphalangeal joint (PIPJ) motion was still relatively limited, and we did not see a significant improvement thereafter until 12 months postoperatively. This is most likely due to soft tissue contractures.

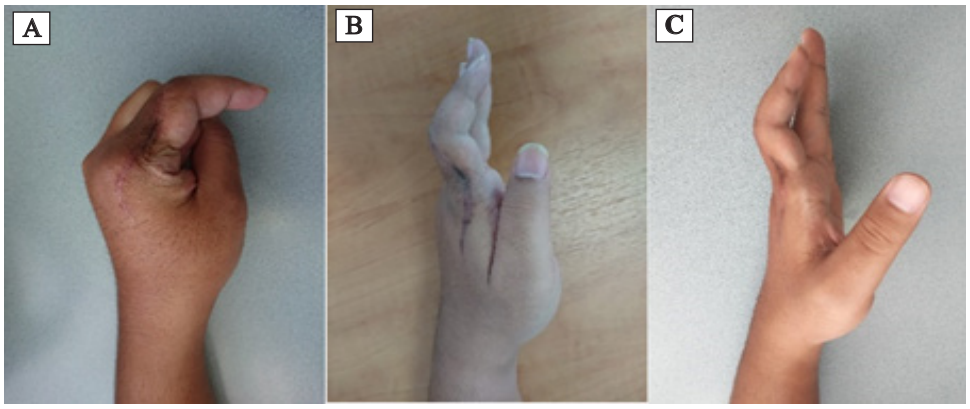

Figure 5. (A) Clinical pictures showing the postoperative condition; (B) 6 months; and (C) 12 months post-operatively. Note the ability to extend the metacarpophalangeal joint is increased, but the proximal interphalangeal joint extension was still limited.

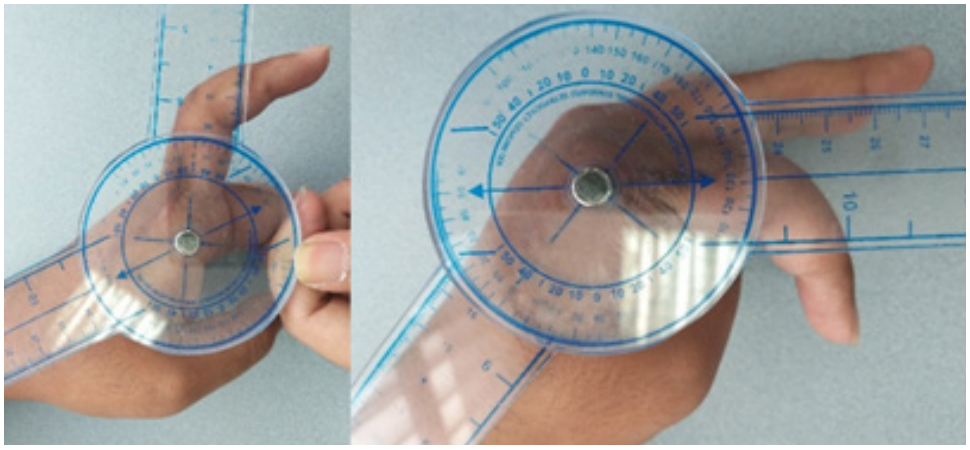

Figure 6. Clinical evaluation the MCP joint's range of motion in extension (left) and in flexion (right).

Table 1. Passive and Active ROM

	ROM	6 months	12 months
MCPJ	Active ROM	0-80	0-90
	Passive ROM	0-110	0-130
PIPJ	Active ROM	0-30	0-45
	Passive ROM	0-50	0-70

MCPJ = Metacarpophalangeal Joint; PIPJ = Proximal Interphalangeal Joint

Functionally, the patient experienced decreased hand function, especially in pinching and keying, with no decrease in the tactile or sensation aspects, but this had no significant impact considering that the patient's right hand is the preferred hand. The patient's ROM was also found to improve, both actively and passively, on MCPJ and PIPJ at six months compared to 12 months, as described in Table 1. The clinical evaluation of the patient's MCP movement is as shown in Figure 6.

DISCUSSION

We report a 27-year-old male patient who suffered from GCTB. The age of this patient, who was classified as a young adult, was in accordance with the literature, which states that most GCTB events occur in 20-40 years.[7] This is also in line with several studies which state that the male sex has a higher incidence than females.

The patient had GCTB in the proximal phalanx of the left index finger. Among the report-

ed incidences of bone GCT, only about 2% occur in hands.[8] On the other hand, GCTB in hand looks different from GCTB in general because it has a relatively higher recurrence rate and grows faster than GCTB in other bones.[9] This means that the patient suffers from rare GCTB in terms of predilection; this is following the literature considering that the lump grows relatively quickly, which takes its toll in only one month.

The clinical symptoms observed in our patient were following the literature of Adulkasem et al., including lumps that appear with an insidious onset, gradually increasing pain severity, and with unknown causes.[10] Pain and swelling are usually the initial symptoms experienced by people with GCTB, especially if the tumor occurs in the hand because it is located close to the skin's surface. The plain radiograph of the left hand showed a GCTB lesion, an eccentrically located, locally destructive lytic lesion that penetrated the bony cortex aggressively. Cortical damage was seen from the cortical break that compressed other structures such as surrounding tendons. This was supported by the literature, which states that GCTB has a characteristic radiographic appearance of eccentric location with expansive nature and manifests in the form of lytic lesions with a thinning of the bone cortex. However, these features were not accompanied by internal calcification, sclerosis at the tumor margins, or a periosteal reaction.[11,12]

We also carried out further investigations using MRI, considering that MRI is the best modality in determining tumor expansion, especially to observe tumor development within the cortex which eventually invaded the surrounding soft tissue.[13] In this patient, we observed that the tumor aggressively pushed adjacent structures such as tendons to reach the second metacarpophalangeal joint space, which was again in line with the literature stating that hand GCTB is usually more aggressive and locally destructive.[14]

Macroscopically, GCTB is red-brown and dense, with areas of necrosis and hemorrhage. Histologically, this neoplastic tissue exhibits a vascularized stroma with scattered oval or fusiform cells of the osteoclast-type, double-nucleated giant cell.[7] Our findings were in line with the literature, from which, after resection, we found a dense, reddish tumor mass with multiple bleeding points. Histopathological examination also showed the distribution of several nucleated giant cells resembling osteoclasts, with nuclei reaching more than 20. The oval shape of the cells with extensive cytoplasm also supported the literature.[13] Subsequently, a standard gold examination was performed using a fine needle aspiration biopsy (FNAB) with findings consistent with the literature, namely the distribution of stromal cells interspersed in the distribution of many nucleated giant cells with abundant cytoplasm.[15]

We did not perform curettage because many studies have shown a high recurrence rate with curettage. The research of Athanasou et al. stated that the recurrence after curettage reached 65% of cases.[7] In contrast, cases of resection and reconstruction were found to have a recurrence rate of <20% but with relatively limited finger movement compared to curettage.[16,17] We performed resection and reconstruction using hydrogen peroxide as an adjuvant to reduce the incidence of recurrence. The use of hydrogen peroxide as an adjuvant has been investigated by several previous studies. A review by Lopez-Pousa et al. found mountable evidence that exposure to hydrogen peroxide is toxic to tumor cells with multiple tumor cell lysis but without significant damage to healthy cells and nearby soft tissues.[18] Meanwhile, a study conducted by Gortzak et al. stated that hydrogen peroxide could suppress metabolic activity, protein content, and the number of GCTB cells, which further reduced the GCTB recurrence rate to the range of only 5-13%.[19]

Furthermore, the use of allograft, in this case, aims to restore the function of motion. As evidenced by the clinical ROM and DASH score with the patient, the functional return stated that

there were no lumps, the pain was no longer felt, and the patient was quite satisfied with the results. The decrease in DASH score was directly proportional to the increase in ROM, especially in the first six months, but the decrease in DASH after the sixth month was not significant. Evaluation at 12 months found no recurrence of GCT.

A study conducted by Benevenia et al. stated that using allografts could reduce the risk of postoperative osteoarthritis that can occur if the reconstruction is performed using certain biomaterials, such as polymethylmethacrylate (PMMA). Osteoarthritis is associated with thermal reactions in the use of PMMA. The study also stated that allografts did not harm GCTB patients undergoing resection and reconstruction.[20]

CONCLUSION

Only 2% of all reported GCTB are found in the hands, but it should be noted that they tend to be more aggressive than other GCTB and have a higher recurrence rate. This resection and reconstruction method has been proven to limit any GCTB recurrence, although with ROM limitation on the PIP joint. A more comprehensive understanding requires more in-depth research to understand the aggressive nature of hand GCTB and find ways to improve postoperative hand function and quality of life.

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