

Giant Cell Tumor of Third Metacarpal: A Rare Case Report and Review of Literature

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Learning Point of the Article:

GCT of metacarpal bone although rare, can be successfully salvaged by tumor excision and reconstruction by fibular strut graft fixed with mini-recon plate, if detected early by MRI.

Abstract

Introduction: Giant cell tumor (GCT) or osteoclastoma is an osteolytic, mostly benign but locally aggressive tumor occurring in young adults at the meta-epiphyseal region of long bones such as lower end of the femur, upper end of the tibia, and lower end of the radius, and proximal humerus in descending order of frequency. Only 2% of all GCT of bone occur in hand. GCT of metacarpal (MC) has different characteristics than that of other long bones. It has more aggressive behavior with involvement of entire length of MC with soft tissue extension.

Case Report: We are reporting a case of GCT of the 3rd MC in a 19-year-old female. She presented to us with a painful, firm, ovoid, and gradually progressive swelling measuring 4 cm × 3 cm over the dorsum of the left (non-dominant) hand, since past 6 months. Fine-needle aspiration cytology was suggestive of GCT of the tendon sheath. Pre-operative magnetic resonance imaging and computed tomography scan revealed the extent of the lesion with no neurovascular involvement. Although various reconstructive procedures to salvage the affected Ray have been reported in literature, we planned for a surgical resection of the lesion leaving behind 1 cm of healthy MC base which appeared to be normal radiologically and intraoperatively. Reconstruction of the defect was done using non-vascularized contoured fibular strut graft, fixed with 2.5 mm mini reconstruction plate, along with reconstruction of the collateral ligaments of the metacarpophalangeal joint. The histopathological study confirmed the diagnosis of GCT.

Conclusion: GCT of hand is a rare tumor, due to its relatively more aggressive behavior and high chance of recurrence it, nevertheless, provokes quite difficult issue to solve. Prognosis, treatment, and results are directly dependent on early diagnosis and adequate therapy.

Keywords: Giant cell tumor, 3rd metacarpal, surgical resection, fibular strut graft, 2.5mm mini reconstruction plate.

Introduction

Giant cell tumor (GCT) or osteoclastoma of the bone is a benign, locally aggressive osteolytic tumor which is relatively rare and has a high tendency of local recurrence [1]. There is a possibility of mainly pulmonary metastasis or transformation in a malignancy [2]. It usually affects the meta-epiphyseal region of long bones such as lower end of the femur, upper end of the tibia, and lower end of the radius, and proximal humerus in descending order of frequency [3]. GCT of bone accounts for about 4–9.5% of all primary tumors of bone [2]. GCT of hand is

rare, accounting for 2–4% of all GCT [4]. Unni reports an incidence of 1.7% for GCT of metacarpals (MCs). Biscalgia has reported an incidence of 1% for GCT of the MC. Averill et al. reported an incidence of <1.5% in MC bones, while Huvos reported 3.7% and Mirra et al. 4% GCT of the hand, including MC bones [5]. GCT of MC has different characteristics than that of other long bones. It has more aggressive behavior with involvement of entire length of MC with soft tissue extension, due to limited free space and exquisite sensitivity of hand even a small hand produce significant swelling, pain, and dysfunction,

Access this article online

Website:
www.jocr.co.in

DOI:
10.13107/jocr.2019.v09.i06.1566

Author's Photo Gallery



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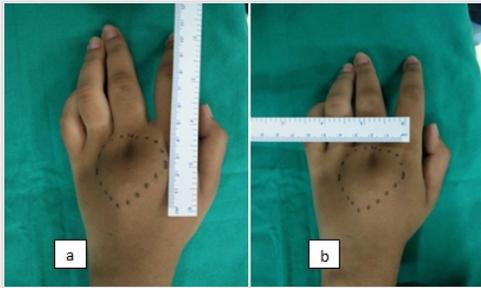


Figure 1: Pre-operative clinical presentation. (a and b) Swelling of size about 4cm x 3cm over 3rd metacarpal bone of the left hand.

and recurrence rate is higher as compared to other long bones even after wide resection and reconstruction [6]. It occurs predominantly in young people with more aggressive courses. It occurs commonly in adults between ages of 20 and 40 years with a female preponderance [2, 3].

In this report, we present a case of GCT of the 3rd MC of the left hand, which we treated with enbloc resection of tumor and reconstruction with autologous fibula strut graft, fixed with 2.5 mm mini reconstruction plate.

Case Report

A 19-year-old female presented with pain and swelling over dorsum of the left hand (non-dominant) overlying the 3rd MC for 6 months. The pain was spontaneous, insidious in onset, dull aching in nature; the swelling was ovoid in shape with well-defined margins and progressively increasing in size. There was also a painful restriction of movement of the 3rd metacarpophalangeal (MCP) joint. There were no H/O trauma, weight loss, and loss of appetite. There were no significant medical comorbidities.

On physical examination, the swelling was of size 4cm x 3cm overlying left 3rd MC bone, firm in consistency, and painful on palpation. The overlying skin was normal (Fig. 1). The movement of MCP was painful and restricted. Routine lab parameters were within normal limits. The radiograph and magnetic resonance imaging (MRI) showed expansile lytic lesion involving the distal part including the head of the 3rd MC bone. Erosion of both anterior and posterior cortex with soft



Figure 3: Pre-operative magnetic resonance imaging. (a) T1 coronal image showing isointense expansile lesion over distal two-third of 3rd metacarpal. (b) T2 coronal image showing expansile lesion with mixed-signal intensity. (c) Sagittal short tau inversion recovery image showing hyperintense expansile lobulated lesion subluxating the metacarpophalangeal joint.



Figure 2: Anteroposterior (a) and oblique (b), radiographs of the left hand, showing a large expansile lesion involving 3rd metacarpal with a characteristic soap bubble appearance.

tissue component displacing the flexor and extensor tendon, but a periosteal reaction was lacking. The X-ray of the expansile lesion showed characteristic soap bubble appearance (Fig. 2 and 3).

The patient underwent surgical excision of the mass under general anesthesia. The skin incision was given over the dorsal aspect longitudinally along the 3rd MC

bone, meticulous soft tissue dissection was done, and underlying GCT mass was exposed in total. GCT mass was excised with margins along with partial osteotomy of the MC bone, leaving behind about 1cm healthy base of MC bone, which appeared normal both intraoperatively and radiologically (Fig. 4). Reconstruction of the defect was done using non-vascularized contoured fibular strut graft taken from ipsilateral middle one-third of fibula, fixed with 2.5 mm mini reconstruction plate, along with reconstruction of the collateral ligaments of the MCP (Fig. 5). Separate instrumentation was used for graft harvesting.

The excised mass was sent for histopathological study, which confirmed the diagnosis of GCT.

The microscopic features showed circumscribed nodular neoplasm composed of diffusely scattered multinucleated osteoclastic giant cells, closely intermingled with plump fibroblast, and delicate blood vessels. The peripheral area showed mature bony trabeculae (Fig. 6).

Postoperatively, the patient was given below elbow functional volar slab supporting upto the distal interphalangeal joint for 2 weeks followed by wrist splint for 2 more weeks with the initiation of range of motion exercises of fingers as per tolerance.

The patient was followed up at regular intervals and at latest follow-up of 2 years that there was complete union of fibular



Figure 4: (a and b) Intraoperative location of the tumor (c) excised tumor.



Figure 5: (a) Reconstruction by 2.5 mm mini plate. (b) C-arm view showing the fibular strut graft fixed with 2.5 mm mini plate.

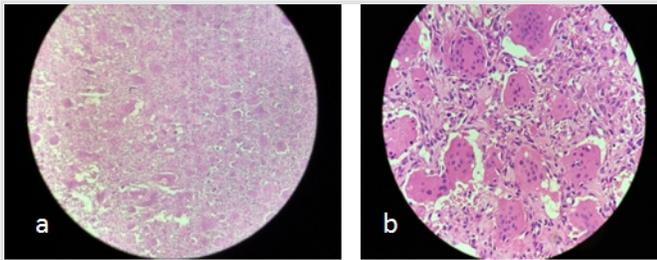


Figure 6: H and E stain microscopic image showing. (a) $\times 10$, numerous osteoclastic giant cells dispersed throughout the entire stroma. (b) $\times 40$, the giant cells contain 20–100 nuclei and the nuclear morphology is similar to the nuclei seen in the stroma.

autograft with no evidence of local recurrence, with an esthetically acceptable and functional hand (Fig. 7 and 8).

Discussion

GCT of bone affecting the hand is a rare lesion and is usually diagnosed at an advanced stage with a high rate of recurrence [2]. GCT is described as a predominantly osteoclastogenic stromal cell tumor of mesenchymal origin [7]. It is composed of three cell types, mainly neoplastic giant cells (tumor stromal cell), mononuclear monocytic cell, and multinucleated giant cell [7,8].

GCT of bone affecting the hand is a rare lesion and usually diagnosed in advanced stages and that of the 3rd MC is even a rarity. It recurs more rapidly in hand than at other locations. The metaphyseal region of MC and phalanges is a common site of origin in hand. The hand has limited free space and more sensitive so even a small mass can cause significant swelling, pain, and disability [3]. In 18% of cases of GCT of the hand, it is multicentric [3].

The radiological finding of GCT includes well-defined lytic lesion, eccentrically located in the metaepiphyseal region of long bones, but in the hand, it tends to be more often central. The cortex is usually thinned without any periosteal reaction [9]. Campanacci et al. classified GCT of bones into three grades: Grade 1 has minimal cortical involvement; Grade 2 presents with thinned and bulged cortex; and Grade 3 has cortical breach with soft tissue involvement [2].

Computed tomography (CT) and MRI are essential in evaluating and staging of GCT. CT is useful in the evaluation of cortical bone, especially the thinning of cortex, pathological fracture, periosteal reaction, and absence of matrix mineralization. In case of cortical breach and soft tissue involvement, MRI is superior to CT. MRI also helps detect the fluid-fluid level typical for aneurysmal bone cyst



Figure 8: Anteroposterior (a) and lateral (b), radiographs of the left hand, showing complete union of fibular autograft and no signs of local recurrence.



Figure 7: (a-c) Follow-up at 2 years showing the functional status of the left hand.

(ABC) as a differential diagnosis [2].

The macroscopic appearance is usually soft, fleshy, and light brown colour. On histologic examination, giant cells are seen uniformly distributed within a bland mononuclear round to oval stromal cell background. The detection of giant cells is not specific for the diagnosis of GCT [9]. Giant cells can also be found in ABC, chondroblastoma, brown tumors of hyperparathyroidism, non-ossifying fibroma, and giant cell granuloma [9,10,11].

Various treatment modalities of GCT of bone in the hand have been described such as curettage alone, curettage with or without different adjuvants, followed by packing the cavity with bone graft or methylmethacrylate bone cement; wide margin resection and reconstruction; amputation; and disarticulation [2]. According to the National Comprehensive Cancer Network Clinical Practice Guidelines in Oncology for bone cancer recommendations, for localized GCT of bone, if the tumor is resectable, excision of tumor is the primary option. If the tumor is resectable with unacceptable morbidity or unresectable, the options include serial embolization (primarily for tumors of the pelvis), denosumab, interferon, pegylated interferon, and/or radiotherapy [12]. In Stage 1 or 2 of GCT of bone, the standard treatment traditionally has been intralesional excision/curettage and autograft reconstruction by packing the cavity with morselized bone graft. Intralesional excision, however, carries the risk of leaving microscopic disease regardless of precised procedure. The reported incidence of local relapse with this technique is almost 40–60%. Chemicals such as phenol or cytotoxic agents like clorproctin have been instilled in the tumor bed to decrease the relapse. On the other hand, cryosurgery technique using liquid nitrogen to extend the curettage has a high incidence of local wound and bone complications. Cases in which the tumor bed is packed with methylmethacrylate have shown to decrease the relapse rate by generating local hyperthermia, which again induces necrosis of any neoplastic tissue left behind; also, the polymerization of methylmethacrylate may produce a local chemical cytotoxic effect. However, there is a risk of degeneration of the articular cartilage by placing the cement in the subchondral region. There are a limited studies and outcomes with the use of CO₂ laser for cauterizing the tumor bed [3]. In Stage 3 GCT of bone, en bloc resection of the involved region of bone is the recommended treatment to avoid recurrence. The reconstructive methods include: Prosthetic

replacements, bony grafts placement harvested from non-vascularized or vascularized fibula and from the iliac crest [2].

However, a high recurrence rate has been reported even after en bloc resection. In such cases, amputation of the entire X-ray of the hand is preferred. Rarely, in cases, when surgery is not feasible, radiotherapy could also be an alternative option [2]. GCT of bone could rarely metastasize in up to 10% of patients [13]. Most commonly, the metastases occur after repetitive local recurrences [2].

Conclusion

GCT of the hand is a rare tumor with isolated involvement of MCs, even rarer. Prognosis, treatment, and results directly depend on an early diagnosis and adequate therapy. Various treatment modalities have been described in literature, starting from the finger salvaging by different reconstruction techniques to Ray amputation. Reconstruction of the defect using non-

vascularized fibular strut graft, fixed with 2.5 mm mini reconstruction plate, along with reconstruction of the collateral ligaments of the MCP joint is a viable option which preserves an aesthetically acceptable and functional hand but requires long-term follow-up for chances of recurrence.

Clinical Message

GCT of the MC bone is an extremely rare entity. Due to its higher propensity for recurrence and aggressive behavior, early diagnosis using CT and MRI helps in choosing a proper line of the management and is the key for any salvage options. Of the various reconstructive modalities, our method of tumor excision, along with reconstruction with non-vascularized fibular strut graft fixed with mini recon plate, offers a viable option to preserve a functionally and esthetically acceptable hand, especially in a young female.

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Conflict of Interest: Nil
Source of Support: Nil

Consent: The authors confirm that Informed consent of the patient is taken for publication of this case report

How to Cite this Article

Gachhayat A K, Patnaik S, Sahoo A K, Karthik R R. Giant Cell Tumor of Third Metacarpal: A Rare Case Report and Review of Literature. *Journal of Orthopaedic Case Reports* 2019 Nov-Dec;9(6): 11-14.