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Case Report
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Primary Giant Cell Tumors in the Proximal Phalanx of the Left Ring Finger

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Abstract

This is a case report on Giant Cell Tumor (GCT) in the proximal phalanx of the fourth finger of the left hand. The patient is a 58-year-old woman who presented to the orthopedic clinic with two years history of pain in her finger without any previous trauma. The patient was clinically evaluated as an outpatient along with radiographic imaging followed by Computed Tomography (CT) and bone scan, but she did not follow up for two years. Subsequent orthopedic evaluation included a noncontrast hand Magnetic Resonance Imaging (MRI) and CT of the chest which detected multiple lung nodules. The patient then underwent ray amputation of the finger. Histopathological examination confirmed as GCT. The patient was closely followed after the surgical operation since GCT of the hand is known to recur. Postoperatively, the patient was followed for 14 months without evidence of recurrence.

Keywords: Giant cell tumor; Ray resection; Hand surgery; Giant cell pulmonary metastasis

Introduction

Giant Cell Tumor (GCT) is a benign primary neoplasm of bone that is origins of mononuclear cells and osteoclast-like giant cells. They typically occur at the epiphyseal or metaphyseal sites of long bones, but can also involve the small bones of the hands and feet. Globally, GCTs account for 5% of primary skeletal tumors and 21% of benign bone tumors [1]. The tumor is known for its predilection at the site of epiphysis and metaphysis of long bones. Approximately, 2% of giant cell tumors can occur in metacarpal bones, and more rarely in the phalanx [2,3]. GCT of the hand have noted to be more aggressive and associated with a younger age group than in other locations [3,4]. Digit-sparing surgery is associated with high recurrence rates; therefore more aggressive procedures are primary treatment and have been associated with good outcomes [5]. Recurrence mostly occurs within 12 to 18 months after resection [5]. Herein we present a healthy 58 year old female who presented with a primary GCT of the proximal phalanx with multiple lungs nodules treated with ray resection of the fourth digit.

Case Presentation

Our patient is a 58-year-old left-hand dominant female who presented to the orthopedic clinic with a painful, dysfunctional left ring finger with a gross deformity throughout the proximal phalanx for 2 years. Two years prior she had a non-contrast CT scan (CT) of the left ring finger demonstrating lytic destructive abnormality with loss of cortical bone and local soft tissue mass at the base of the phalanx followed by a bone scan with mention of abnormal focal trace accumulation at the base of the left 4th proximal digit without evidence of metastatic disease. At that point she was referred to the orthopedic clinic but did not show up until two years later when the pain and stiffness became unbearable. Upon physical examination, it appeared that the bony structure of the proximal phalanx was hard, enlarged and tumor-like measuring approximately 3 cm × 3 cm circumferentially surrounding the base of the ring ringer. The mass was nontender and there was limited range of motion at the Metacarpophalangeal (MCP) and Proximal Interphalangeal (PIP) joints. Radiographs of the left hand ring finger showed a lytic lesion to the proximal phalanx with cortical erosion and soft tissue swelling (Figure 1). Magnetic Resonance Imaging (MRI) revealed a nonspecific 2.6 cm × 2.6 cm × 2.2 cm expansile osseous lesion in the proximal 4th digit suspicious of chondrosarcoma *vs.* giant cell tumor *vs.* metastatic bone tumor (Figure 2). Chest CT revealed 10 scattered nodules throughout both lungs with the largest nodule measuring 7 mm in diameter (Figure 3). There was a high suspicion of malignancy therefore a ray-resection was indicated. The patient understood

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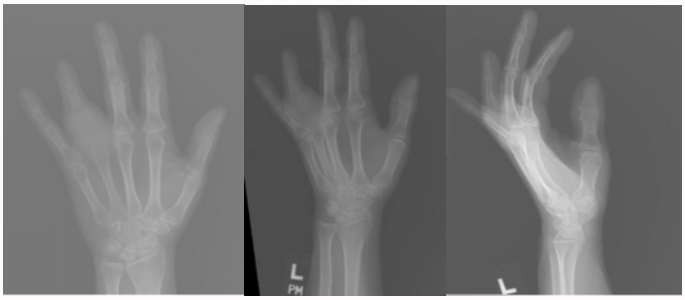

Figure 1: Preoperative (a) AP, (b) lateral, and (c) oblique radiographs showing the circumscribed lytic lesion of the fourth proximal phalanx of the left hand sparing the fourth metacarpal bone.

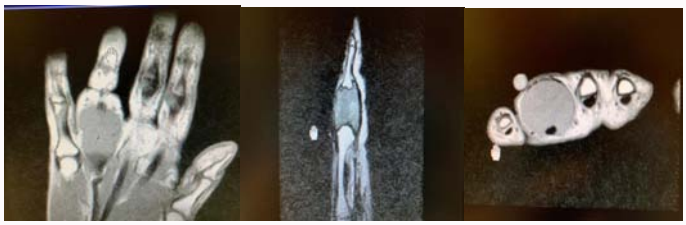

Figure 2: MRI of the left hand showing nonspecific 2.6 by 2.6 by 2.2 cm expansile osseous lesion in the proximal 4th digit.

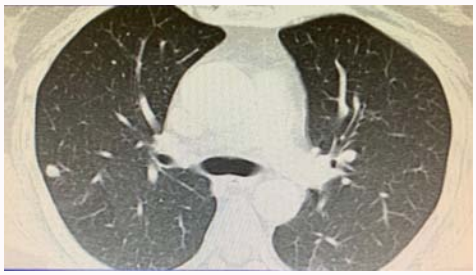

Figure 3: Axial cut from noncontrast CT of the chest showing multiple nodules in bilateral lungs.

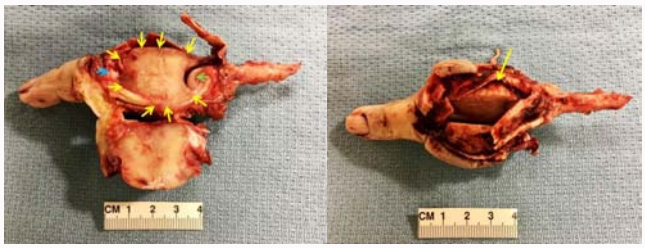

Figure 4a: Gross appearance of Giant Cell Tumor atypically involving the proximal phalanx of the left ring finger. Sagittal dissection shows that the tumor cells have completely replaced the normal bone.
Figure 4b: The lesion involving the entire proximal phalanx of the ring finger after ray resection.

the potential risk of recurrence of the tumor mass, dysfunction of the hand, risk of anesthesia included. Vital signs were stable and all pre-operative labs were within normal limits.

Under general sedation and anesthesia, the patient was laid in supine position on the surgical table with a tourniquet placed on the left arm. After preparing and draping the patient in a regular fashion, we proceeded to make a longitudinal incision on the dorsal aspect of the left ring finger on the top of the mass at the junction of the normal and abnormal region. The incisional biopsy was harvested and submitted for pathological evaluation. We further continued dissection following the mass and noticed that all of the bone structure in the entire proximal phalanx had been replaced with what appeared to be an aggressive invasion of a mass that involved the surrounding soft tissue extending to the base of the phalanx leaving the metacarpophalangeal joint capsule intact. In order to maintain metacarpal stability, we preserved the carpometacarpal joint, but immediately distal to the carpometacarpal joint of the ring finger, the entire fourth ray was completely removed while preserving the intrinsic muscles (Figure 4a, 4b). Further margins were resected until clean, healthy looking tissue was noticed. Hemostasis was achieved and the intrinsic muscle layers were repaired with primary intention using 2-0 and 3-0 Vicryl sutures. Further, the skin was approximated with a 4-0 nylon suture. Finally, the wound was wrapped with a dry, sterile dressing and a short-arm splint was applied to maintain the wrist and finger joints at a functional position. The patient tolerated the procedure well with no complications and was discharged on the same day.

Histopathology examination showed numerous proliferation of osteoclast-like multinucleated giant cells that are uniformly distributed among mononucleated polygonal cells (Figure 5a, 5b). Microscopically, the specimen showed high cellularity with focal mitoactive activity, which was aberrant from normal bone tissue histology consistent with GCT (Figure 5c). A CT of the chest, abdomen, and pelvis postoperatively revealing several nodules in bilateral lungs which doubled in size from previous CT done 3 months prior (Figure 6); however there are no pathologically enlarged lymph nodes or aggressive bony lesions. The patient was followed by an oncologist and pulmonologist postoperatively, but chose not to proceed with the lung biopsy to evaluate the multiple lung nodules since she was asymptomatic although it was strongly recommended. She was started on bisphosphonate therapy to reduce GCT recurrence. Her function improved to baseline with 3 months of Occupational Therapy (OT) followed by a home exercise program. At 14 months postoperative radiograph showed status post ray resection of the left 4th digit with no evidence of recurrence (Figure 7). The patient was pleased with the results aesthetically and was able to

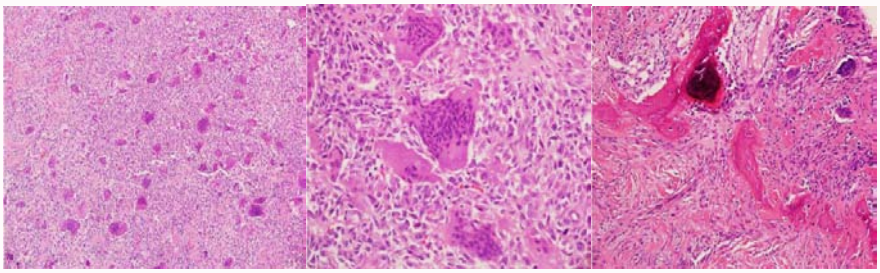

Figure 5a: Left: Microscopic photo showing high cellularity and numerous multinucleated giant cells interspersed among polygonal, mononuclear cells with dense stromal hyalinization. H&E Stain, 10X
Figure 5b: Giant cell tumor of the fourth proximal phalanx showing multinucleated giant cells with focal mitotic activity. H&E Stain, 40X.
Figure 5c: Whorling fascicle of spindle-shaped mononuclear cells create pattern with spotty calcification after the tumor had completely replaced entire fourth proximal phalanx. H&E Stain, 20X.

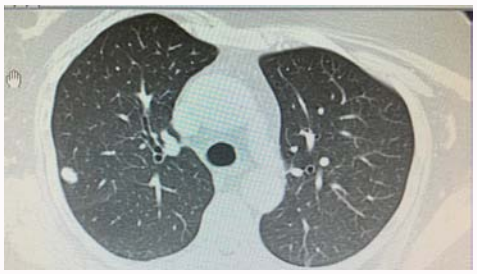

Figure 6: Axial cut from CT chest showing multiple nodules in bilateral lungs which have increased in size from previous CT (Figure 3).

maintain good function of her hand.

Discussion

Two-percent of all GCTs occur in the hand, but a primary tumor in the proximal phalanx has seldom been reported. Although surgery is the gold standard treatment, surgical techniques have varied in the literature. Management of GCTs is challenging due to the aggressive nature of the tumor and its ability to recur, while trying to preserve functionality and maintain an aesthetic results. Most GCTs in the phalanx have been treated with conservative, digit-sparing techniques such as curettage and bone grafting, but has been found to have recurrence rates up to 79% [4-6]. Other cases reported were treated with curettage; curettage and bone graft, en bloc resection and reconstruction, distal amputation, and ray resection. Ray resection and distal amputation has shown the best results due to the lower recurrence rates, but compromises functionality and aesthetics [4,5,7,8].

Saikia et al. retrospectively reviewed 64 cases of GCT treated with curettage with or without bone grafting, showing a recurrence rate of 75% *vs.* thirty-eight patients treated with ray resection or amputation showing a recurrence rate of 24% [6]. Patel and colleagues reviewed 5 cases of GCT in the phalanges, which two out of three cases that originally were treated with curettage and bone grafting had recurrence [7]. They were then treated with ray resection and had no recurrence. The other two were treated with primary ray resection and had no recurrence and 1 and 2 years follow up. Daniel and colleagues reported on a GCT of the middle phalanx with recurrence at 9 months status post curettage and bone grafting, requiring excision and allograft [9]. Ropars et al. [5] retrospectively reviewed a study on 3 phalanx GCTs had no recurrence after distal amputation after ten years. However, one GCT in the metacarpal recurred twice after curettage and grafting necessitating resection and replacement

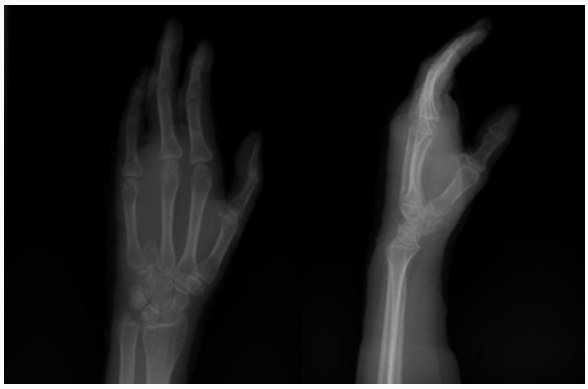

Figure 7: Postoperative AP and lateral radiographs at 14 months after ray resection, demonstrating no recurrence.

with a non-vascularized fibular graft and silicon implant replacement of the metacarpophalangeal joint [5]. Ansari et al. had similar results with performing a primary en bloc resection with fibular autograft and silicone implant arthroplasty on a 32 year old female with GCT of the proximal phalanx index finger [8]. Resection with bone grafting and silicon joint implant is able to preserve function of the hand with lower recurrence rates. In the present case GCT was highly suspected preoperatively due to the aggressive local invasion on radiographs and MRI along with the possibility of pulmonary metastasis. Ray resection was the best option to prevent recurrence without sacrificing dexterity considering the location of the tumor.

Soni et al. [10] reported on a proximal phalanx GCT treated with curettage and phenol application, which showed no recurrence at 2 years follow up. A retrospective study on GCTs with a 61 month follow up, showed only 9.1% (n=1) treated with curettage and adjuvant phenol recurred, *vs.* 42.9% (n=3) treated with curettage alone recurred [11].

The addition of bisphosphonates as an adjunct has shown to significantly reduce the recurrence rate of GCTs (p=0.05) [12]. A retrospective study of 44 GCTs treated with curettage or wide excision with cementation or bone grafting with the addition to bisphosphonates to 24 patients [12]. At a follow up of 48 months, only 1 of the patients (4.2%) treated with bisphosphonates had local recurrence. In the control group, 30% of patients (n=6) developed local recurrence at 115 months follow up.

Approximately 3% of GTCs metastasize to the lungs [13]. They are mostly associated with recurrent disease. Metastases are usually found within 3 years from the initial treatment, but can occur

within months are greater than 10 years [13]. Most patients are asymptomatic, therefore chest radiograph and CT are recommended at the time of diagnosis and after surgery [14]. Radiographs will show homogenous opacity with peripheral calcification occurring at the base and periphery of the lungs. CT is more sensitive and is used for surgical planning. Medeiros et al. [14] reported on a 25 year old female with GCT of proximal phalanx of left 3rd finger treated with amputation and transposition of index finger to resection site. Although, there was no local recurrence, the patient developed benign pulmonary metastasis requiring a thoracotomy.

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