Comprehensive Case Report Of A Giant Cell Tumor Involving The Proximal Phalanx Of The Left Great Toe Managed With Fibular Grafting

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Citation

Abstract
Giant cell tumors (GCT) involving the phalangeal bones of the foot are very rare: only 1-2% cases of GCT occur in the foot and are more common in females. We present a rare case of a benign giant cell tumor involving the proximal phalanx of the left great toe in a 23 year old male. The patient presented with a 3 month history of pain and gradually increasing swelling over the great toe of the left foot following trivial trauma to the foot while playing cricket. This case report aims to highlight the conventional radiographic, ultrasound and color Doppler, computed tomography and magnetic resonance imaging (MRI) findings in a rare case report of a giant cell tumor involving the proximal phalanx of the left great toe managed with fibular grafting.

CASE REPORT
A 23 year old male patient presented with a 3 month history of pain while walking and gradually increasing swelling over the left great toe following trivial trauma to the foot while playing cricket. He had been treated with analgesics in the local hospital before coming to the orthopedics department in our college. He was referred for radiography to our department. Routine Serological Tests Showed Hb% 16.3gm, Esr-3mm/Hr, Rbc-5.2 Million/Cc, Wbc-7400cells, Rbs-91gm, Urea-17mgm, Na+ 142 (mEq/L), K+ 4.4 (mEq/L) ,Chloride-102 (mEq/L), Ca+ 9gm. The serological tests were within normal limits. Gross examination revealed bulbous swelling of the proximal phalanx region of the left great toe (Figure 1).
23 year old male patient with a giant cell tumor involving the proximal phalanx of the left great toe managed with fibular grafting. The Picture shows a bulbous swelling of the proximal phalanx region of the left great toe.

The plain radiography showed a fairly defined expansile soft tissue opacity lytic lesion replacing the entire proximal phalanx of left great toe causing cortical thinning and breach in the cortex (Figure 2).

A series of anteroposterior and oblique radiographs of the fore foot show a fairly defined expansile soft tissue opacity lytic lesion replacing the entire proximal phalanx of left great toe.

The lesion appeared iso to hyperechoic and showed increased vascularity with biphasic waveforms in Ultrasound and Color Doppler study (Figure 3).

Ultrasound and Color Doppler study of the left forefoot using a High Resolution ultrasound linear transducer 17 – 5 MHZ shows the lesion to be iso to hyperechoic and with increased vascularity, with biphasic waveforms visible on the spectral Doppler.

Computed tomography showed a well-defined, heterogeneously enhancing soft tissue density lesion replacing the proximal phalanx of left great toe, which then causes cortical breach and thinning. The central nonenhancing hypodense areas suggested necrotic changes within the lesion (Figure 4).
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Figure 4

Figure 4

Contrast enhanced Computed tomography images (sagittal reconstruction, axial and coronal reconstruction) of the left forefoot (6 slice helical ct scanner) show a well-defined, heterogeneously enhancing soft tissue density lesion replacing the proximal phalanx of the left great toe, which then causes cortical breach and thinning. The central nonenhancing hypodense areas suggested necrotic changes within the lesion.

MRI showed heterogeneously enhancing lesion with central non-enhancing hypointense areas on T1W gad+ and heterogeneous lesion with central hyperintense areas on T2W suggestive of cystic / hemorrhagic and necrotic changes within the locally aggressive tumor (Figure 5).

Figure 5

Figure 5

Coronal MRI of foot (a) T1WI pre gadolinium(1.5 Tesla, TR/TE = 515 msec/15 msec, slice thickness=3 mm); (b) T1WI post gadolinium (1.5 Tesla , TR/TE = 515 msec/15 msec, slice thickness=3 mm); (c) T2WI (1.5 Tesla, TR/TE = 4000 msec/77 msec, slice thickness = 2.5 mm ); (d) T1 FS post gadolinium (1.5 Tesla, TR/TE = 1960 msec/10 msec, slice thickness = 3 mm , Magnevist™ = 0.17 ml/kg)

And (c) show a well-defined fairly homogenous hypointense lesion involving the proximal phalanx of the left great toe with infiltration into surrounding soft tissues of the dorsal and plantar aspects of the foot. A few central hyperintensities in (C) may represent cystic / hemorrhagic areas.

And (d) show the lesion to be exhibiting significant contrast enhancement with a few non-enhancing, hypointense areas probably representing necrosis. The proximal phalanx is completely cloaked and replaced by the tumor.

The chest radiography and CT study were normal indicating no metastasis to the lung, which is seen in 3% of the aggressive GCT (Figure 6).

Figure 6

Figure 6

The CT study and chest radiography were normal, indicating no metastasis to the lung.

The differential diagnosis of giant cell reparative granuloma was also considered. The lesion did not show periosteal reaction, and the left first metatarsophalangeal joint was within normal limits. True cut wedge biopsy was done to confirm the GCT. The patient underwent excision of the tumor with incision on the lateral border of left great toe. The tumor was removed with the surrounding infiltrated soft tissue and proximal part of the head of the first metatarsal, after which functional reconstruction was done via fibular graft (Figure 7).
Intraoperative photograph of the left foot shows excision of the tumor with incision on the lateral border of left great toe. The tumor was removed with surrounding infiltrated soft tissue, and functional reconstruction was done with fibular graft (post operative radiograph confirms the grafted bone with a k nail in situ).

The postoperative histopathology report showed multinucleated giant cells whose nuclei were dissimilar with the stromal nuclei- consistent with a locally aggressive GCT (Figure 8).

The postoperative histopathology images showing multinucleated giant cells whose nuclei are dissimilar with the stromal nuclei- consistent with locally aggressive GCT

The patient has to be followed up or 3 years because most GCTs (80%–90%) reoccur within the first 3 years after initial treatment.

**DISCUSSION**

Giant cell tumor of bone (GCT) is a relatively common, locally aggressive, osseous neoplasm of variable biological activity. The lesion is composed of sheets of ovoid mononuclear cells interspersed with uniformly distributed, large, multinucleated osteoclast-like giant cells. It is this multinucleated, osteoclast-like giant cell that initially suggested an osteoclastic lineage to JAFFE et al in their classic description of the tumor in 1940, in which they separated this distinct lesion from other giant cell-containing tumors and tumor-like lesions.

GCT represents approximately 4–9.5% of all primary bone tumors and about 18–23% of benign primary tumors.

Patients with GCT of bone present most often in the third decade of life, with approximately 80% of lesions occurring in patients between 20 and 50 years of age. Giant cell tumors (GCTs) in children and adolescents are generally considered to be rare, but have been reported with an incidence of 1.7-10.6% of all GCTs.

GCT affects all races; however, there is an unusually high prevalence in China and southern India (state of Andhra Pradesh).
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Pradesh) of 20 and 30%, respectively. Unlike the majority of osseous neoplasms, benign GCT has been shown to affect women more commonly than men in many series, with ratios ranging from 1.1:1 to 1.5:1, although many researchers believe that there is no gender predilection.

Clinical symptoms are nonspecific and include (in order of decreasing frequency) pain, local swelling, and limited range of motion of the adjacent joint. Pain is usually present for several months and is reduced by rest. Associated pathologic fracture, which may cause the acute onset of pain, is present in about 10%–12% of patients. Neurological symptoms may be associated with spine lesions.

GCTs are most common in long bones (75%–90%), where they are characteristically found at the ends of bones, with approximately 84%–99% of lesions extending to within 1 cm of subarticular bone.

GCTs are most commonly found around the knee, with this location accounting for 50%–65% of cases. The single most common site of occurrence is in the distal femur (23%–30% of cases), followed by the proximal tibia (20%–25%), distal radius (10%–12%), sacrum (4%–9%), and proximal humerus (4%–8%). Other, less frequent sites of involvement include the proximal femur (4% of cases), innominate bone (3%), vertebral bodies (3%–6%), distal tibia (2%–5%), proximal fibula (3%–4%), hand and wrist (1%–5%), and foot (1%–2%).

GCTs occurring in other anatomic sites are rare, but can also occur in sesamoid bones, particularly the patella (the largest sesamoid bone) and apophyses (e.g., the greater trochanter), which are considered to be epiphyseal equivalents in terms of bone neoplasm origin.

Giant cell tumour of the foot is a locally aggressive tumour that predominates in the hind foot, typically in the head/neck of the talus, and in tuberosity and subarticular portions of the calcaneus. It has a similar female predominance (2:1) to more proximal giant cell tumours, but appears to present in slightly younger patients in the third decade. Lesions tend to display more aggressive features than lesions in large bones.

The majority of lesions have an ill-defined geographic pattern of bone destruction, but up to a third have a more aggressive moth-eaten pattern with cortical destruction and soft tissue infiltration. Involvement of more than one bone is not uncommon. Lesions in the metatarsal bones are often expansile and involve most of the bone. Aneurysmal cyst components and haemorrhage are noted in up to 24% of giant cell tumours.

While the tumor is considered to be locally aggressive, occasional distal metastases are identified. Pulmonary metastases are seen in about 2–5% of patients, an average of 3–4 years after primary diagnosis.

On plain radiographs, GCT almost invariably presents as a geographic lytic lesion with a well-defined, non-sclerotic margin (80%–85% of cases). As with other musculoskeletal neoplasms, CT and MR imaging allow superior delineation and local staging of GCTs. CT is particularly useful for the identification of cortical thinning, pathologic fracture, periosteal reaction, assessing the degree of osseous expansile remodelling, and confirming the absence of matrix mineralization. CT is generally superior to MR imaging in assessing these features.

MR imaging frequently reveals a relatively well-defined lesion with a low-signal-intensity margin, representing either osseous sclerosis or a pseudocapsule. In our experience, in the vast majority of cases, the solid components of GCT show a low to intermediate signal intensity at T1- and non-fat-suppressed T2-weighted MR imaging.

Bone scintigraphy demonstrates increased radionuclide uptake in the vast majority of GCTs. Increased radionuclide uptake peripherally with photopenia centrally, termed the “donut sign,” was seen in 57% of cases.

Angiography is rarely performed in patients with GCT, and when done, is typically in conjunction with preoperative, therapeutic, transcatheter, arterial embolization used to reduce blood loss during surgical resection.

In the differential diagnosis, the aneurysmal bone cyst can have similar appearances, but tends to occur in younger patients. It also has a less aggressive pattern, lacks solid enhancing components, and is not associated with soft tissue extension. Giant cell reparative granuloma may be indistinguishable from giant cell tumour, but is suggested if the patient is in the second decade and the lesion involves the forefoot.

More aggressive giant cell tumours in the second decade
could mimic an Ewing’s sarcoma, although expansion would favour giant cell tumour. Aggressive lesions in an older patient could mimic osteosarcoma, but the presence of matrix mineralization excludes giant cell tumour. Giant cell tumour in the foot may recur more frequently than in long bone lesions and has the potential to undergo malignant transformation. Spontaneous malignant transformation is very rare.  

GCT of the bone is a benign lesion, and curettage is generally the preferred treatment.  

Surgical resection is currently associated with a lower recurrence rate (2%–25%).  

Local recurrence rates vary widely and have been previously reported to be as high as 41% in patients treated with curettage only, and as low as 2% in patients treated with curettage, followed by burring of the tumor walls and liquid nitrogen cryotherapy.  

References  
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