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# Uncommon Presentation of Giant Cell Tumor of Tendon Sheath in the Hallux: A Case Report

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**Abstract** | **Case Report**

***Background:*** Giant cell tumor of the tendon sheath (GCTTS) is a benign proliferative lesion arising from the synovium of tendon sheaths, bursae, or joints. While it commonly affects the hand, involvement of the foot particularly the great toe is exceedingly rare. ***Case Presentation:*** We report the case of a 28-year-old patient presenting with a painless, progressively enlarging mass of the right great toe evolving over two years. Clinical examination revealed a firm, bilobed mass measuring 4 cm, adherent to deep planes without inflammatory signs. Radiographs demonstrated a lytic lesion involving the proximal phalanx. Ultrasound showed a hypoechoic, lobulated soft tissue mass. Histopathological examination following biopsy suggested GCTTS. Complete surgical excision was performed, confirming the diagnosis. The postoperative course was uneventful with no recurrence. ***Discussion:*** This case highlights the diagnostic challenges of GCTTS in atypical locations such as the foot, where it may mimic other soft tissue tumors. Bone involvement, although not uncommon, can complicate the diagnostic approach and surgical management. Complete excision remains essential to reduce recurrence risk, particularly in anatomically constrained regions. ***Conclusion:*** GCTTS of the great toe is rare and may mimic other soft tissue tumors. Surgical excision remains the treatment of choice, but recurrence remains a concern. Early diagnosis and complete resection are essential to improve outcomes.

**Keywords:** Giant cell tumor; tendon sheath; great toe; foot tumor; synovial tumor.



## INTRODUCTION

Giant cell tumor of the tendon sheath (GCTTS), also referred to as localized tenosynovial giant cell tumor, is a benign proliferative lesion arising from the synovial lining of tendon sheaths, bursae, and joints [1]. It belongs to a broader spectrum of synovial disorders that includes pigmented villonodular synovitis (PVNS), with which it shares histopathological and molecular similarities [2,3]. Historically, the terminology surrounding these lesions has been confusing, with multiple overlapping designations such as nodular tenosynovitis, fibrous histiocytoma of the synovium, and PVNS, until a more unified classification was proposed [1,4].

GCTTS represents approximately 1–2% of all soft tissue tumors and is considered the second most common tumor of the hand after ganglion cysts [5,6]. It predominantly affects adults between the third and fifth decades of life, with a slight female predominance [7]. Anatomically, these tumors most frequently occur in the hand, particularly in the flexor tendon sheaths of the fingers, whereas involvement of the foot is relatively uncommon, accounting for only 3–5% of cases [6,8]. Localization to the great toe is exceptionally rare, with only a limited number of cases reported in the literature [9].

The etiopathogenesis of GCTTS has long been debated. Earlier theories suggested a reactive or inflammatory origin, possibly related to trauma, chronic irritation, or repeated hemorrhage [10,11]. However, advances in cytogenetic and molecular studies have provided strong evidence supporting a neoplastic origin. Recurrent chromosomal abnormalities, particularly involving chromosome 1p13, have been identified, leading to overexpression of the colony-stimulating factor 1 (CSF1) gene [12,13]. This overexpression results in the recruitment of macrophages expressing CSF1 receptors, which constitute the majority of the tumor mass, a phenomenon described as the “landscape effect” [13].

Clinically, GCTTS typically presents as a slow-growing, painless soft tissue mass, often evolving over

months to years [7]. Due to its indolent nature, diagnosis is frequently delayed. Imaging plays a crucial role in the evaluation of these lesions. Plain radiographs may reveal soft tissue swelling and, in some cases, bone erosion due to pressure effects [14]. Ultrasound can demonstrate a hypoechoic, well-defined mass with variable vascularity [15]. Magnetic resonance imaging (MRI) is considered the imaging modality of choice, as it allows precise characterization of the lesion and often demonstrates low signal intensity on both T1- and T2-weighted images due to hemosiderin deposition [16].

Definitive diagnosis relies on histopathological examination. GCTTS is characterized by a mixture of mononuclear stromal cells, multinucleated giant cells, lipid-laden macrophages, and hemosiderin deposits within a fibrous stroma [2,17]. These features help differentiate it from other benign and malignant soft tissue tumors.

The standard treatment for GCTTS is complete surgical excision with preservation of surrounding structures [18]. However, despite its benign nature, the tumor is associated with a relatively high rate of local recurrence, reported between 10% and 30%, particularly in cases of incomplete excision or diffuse involvement [6,19]. Therefore, early diagnosis and meticulous surgical technique are essential to reduce recurrence risk.

In this report, we describe a rare case of GCTTS involving the great toe and discuss its clinical, radiological, and therapeutic features in the context of current literature.

## CASE PRESENTATION

A 28-year-old patient with no significant past medical history presented to our orthopedic department with a progressively enlarging mass involving the right great toe. The lesion had been evolving insidiously over a period of approximately two years. The patient reported no history of trauma, infection, or inflammatory disease affecting the foot. The swelling was painless throughout its course and had gradually increased in size, leading to aesthetic discomfort and mild functional inconvenience when wearing shoes.

On physical examination, inspection revealed a visible tumefaction located over the proximal segment of the right hallux. The overlying skin was intact, without erythema, ulceration, or signs of inflammation. Palpation demonstrated a firm, well-defined, bilobed mass measuring approximately 4 cm in its greatest dimension. The lesion was non-tender, with no local warmth. It appeared adherent to the deep structures while remaining mobile relative to the overlying skin (figure 1). No pulsatility or bruit was detected, and there were no signs suggestive of neurovascular compromise. Regional lymph nodes were not palpable.

The range of motion of the metatarsophalangeal and interphalangeal joints of the great toe was preserved, although slight mechanical discomfort was reported at extreme flexion due to the mass effect. No motor or sensory deficits were identified.

Initial imaging with plain radiographs of the foot (anteroposterior view) revealed a well-circumscribed lytic lesion involving the proximal phalanx (P1) of the great toe, without periosteal reaction or calcifications. The cortical bone appeared thinned but not overtly destroyed, suggesting a slow-growing process (figure 2).

Further evaluation with soft tissue ultrasound demonstrated an oval, hypoechoic mass with lobulated contours, oriented parallel to the skin surface. The lesion appeared relatively homogeneous, with no obvious cystic component. Internal vascularity was not prominently described, and there were no signs of adjacent fluid collection.

Given the imaging findings, a diagnostic biopsy was performed. Histopathological examination revealed a proliferation of mononuclear stromal cells associated with multinucleated giant cells, consistent with a tenosynovial giant cell tumor.

The patient subsequently underwent surgical management. The procedure was performed under regional anesthesia. A longitudinal “orange-segment” incision was made, centered over the previous biopsy scar to allow adequate exposure while minimizing soft tissue disruption. Careful dissection was carried out to identify and isolate the tumor. The mass was found to be intimately related to the tendon sheath, with adherence to the surrounding synovial structures (figure 3).

A meticulous marginal excision was performed, ensuring complete removal of the lesion along with the biopsy tract to reduce the risk of recurrence. Particular attention was paid to preserving adjacent tendinous and neurovascular structures. The excised specimen (figure 4) was sent for definitive histopathological analysis.

Macroscopically, the lesion appeared as a well-circumscribed, lobulated mass. Histological examination confirmed the diagnosis of giant cell tumor of the tendon sheath, showing a characteristic mixture of mononuclear cells, osteoclast-like multinucleated giant cells, and hemosiderin-laden macrophages within a fibrous stroma.

The postoperative course was uneventful. The surgical wound healed without complications, and no infection or delayed healing was observed. The patient was allowed progressive weight-bearing as tolerated. At follow-up, the patient demonstrated good functional recovery with preservation of toe mobility.

No evidence of local recurrence was noted during the follow-up period, and the patient remained asymptomatic.

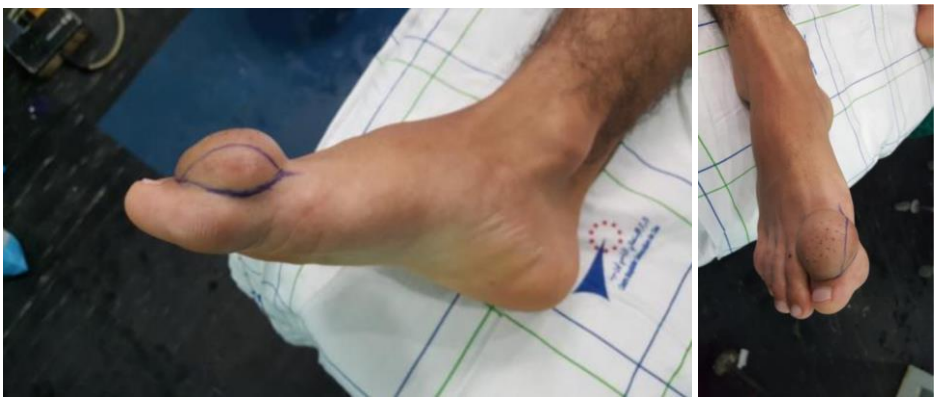

**Figure 1: Preoperative clinical photograph illustrating a voluminous, rounded mass involving the proximal aspect of the right great toe, consistent with a slow-growing soft tissue tumor**

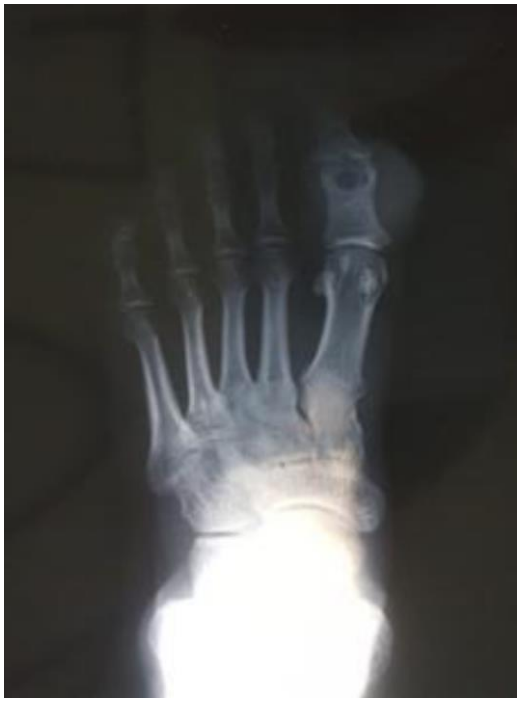

**Figure 2: Standard anteroposterior radiograph of the forefoot showing a lytic lesion involving the proximal phalanx (P1) of the great toe**

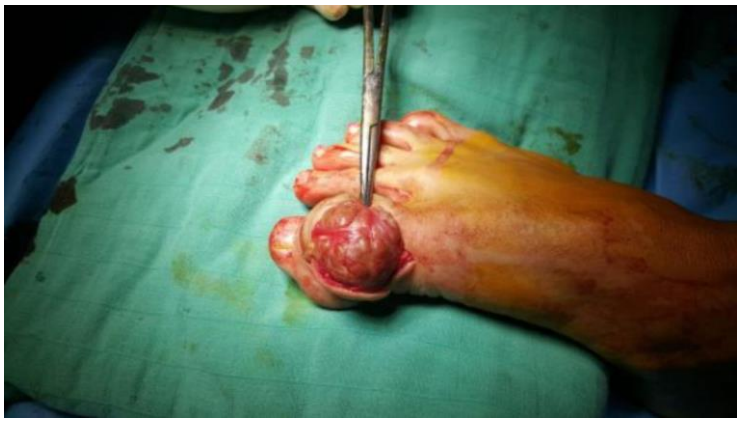

**Figure 3: Intraoperative view of the tumor of the hallux**

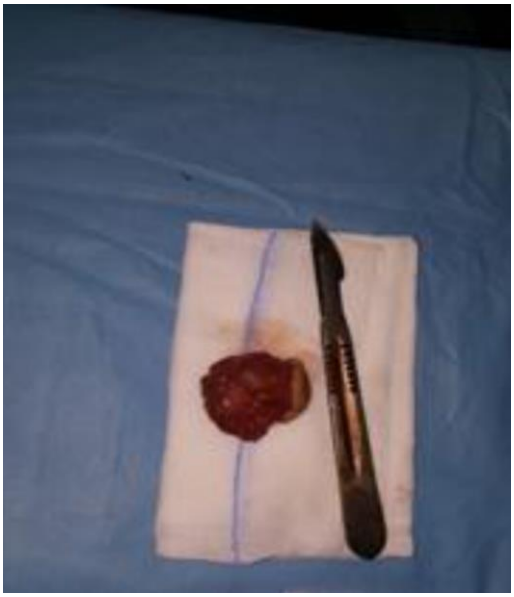

**Figure 4: Intraoperative view showing the tumor and the surgical excision specimen**

## DISCUSSION

Giant cell tumor of the tendon sheath (GCTTS) is generally considered a benign entity; however, its clinical behavior is often unpredictable, particularly in atypical locations such as the foot. While most studies emphasize its indolent nature, increasing evidence suggests that certain anatomical sites especially confined regions like the toes may predispose to more aggressive local behavior, including bone involvement and higher recurrence rates [1,2].

The present case highlights several noteworthy aspects. First, the location in the great toe is exceptional. Most published series report a clear predominance in the hand, with only a small minority of cases affecting the foot [6,8]. This unusual localization has important diagnostic implications. In fact, soft tissue masses of the foot are more frequently attributed to other etiologies such as ganglion cysts, epidermoid cysts, or even malignant tumors, which may lead to diagnostic uncertainty or delay [9]. In our case, the long evolution (two years) without alarming symptoms illustrates how such lesions may remain clinically underestimated.

Another key feature in our patient is the presence of osseous involvement, evidenced by a lytic lesion of the proximal phalanx. Although GCTTS is classically described as a soft tissue tumor, bone erosion is not uncommon and is thought to result from chronic pressure rather than true invasive growth [14]. Nevertheless, distinguishing between pressure erosion and aggressive bone infiltration remains challenging, particularly on conventional imaging. This distinction is crucial, as it may influence both surgical planning and prognosis.

From a diagnostic standpoint, the absence of advanced imaging such as MRI in our case deserves discussion. MRI is widely regarded as the most informative modality for evaluating GCTTS, particularly for assessing tumor extent, satellite lesions, and relationship to surrounding structures [16]. However, in resource-limited settings or when clinical and initial imaging findings are strongly suggestive, management decisions may rely on a combination of ultrasound and histological confirmation. This reflects real-world clinical practice and underscores the importance of adapting diagnostic strategies to available resources.

Histopathologically, our findings were consistent with classical descriptions, confirming the diagnosis. However, beyond diagnosis, recent advances have shifted the focus toward understanding the biological behavior of these tumors. The identification of CSF1 overexpression and its role in macrophage recruitment has provided a unifying explanation for the cellular composition of these lesions [12,13]. More importantly, this molecular insight has redefined GCTTS as a neoplastic process rather than a purely reactive condition, which has implications for both classification and treatment.

The cornerstone of treatment remains complete surgical excision, but this is often technically demanding in anatomically constrained areas such as the toes. Incomplete excision is the main risk factor for recurrence, which can reach up to 30% in some series [6,19]. In our case, particular attention was paid to performing a meticulous marginal excision, including removal of the biopsy tract. This approach is supported by several authors who emphasize the importance of eliminating all potentially contaminated tissues to minimize recurrence risk.

An important point of discussion is the lack of standardized surgical margins in GCTTS. Unlike malignant tumors, where wide excision is recommended, the optimal margin for GCTTS remains debated. Some

authors advocate for marginal excision, while others recommend more aggressive resection in cases with bone involvement or suspected satellite lesions. Our favorable outcome supports the effectiveness of careful marginal excision in localized forms.

Another emerging aspect is the role of adjuvant and targeted therapies. While not indicated in localized forms such as ours, these treatments are gaining importance in diffuse, recurrent, or unresectable cases. In particular, inhibitors of the CSF1/CSF1R pathway have shown promising results, representing a paradigm shift in the management of advanced disease [13]. Although these therapies were not relevant in our case, their development highlights the evolving understanding of GCTTS biology.

Finally, the issue of follow-up deserves emphasis. Even in cases with apparently complete excision, recurrence may occur several years after surgery. This justifies prolonged clinical surveillance, particularly in atypical locations where complete resection may be more challenging.

Overall, this case illustrates the diagnostic and therapeutic challenges posed by GCTTS in rare locations. It also underscores the importance of integrating clinical, radiological, and pathological data to achieve optimal management.

## Conclusion

Giant cell tumor of the tendon sheath of the great toe is a rare presentation that may lead to diagnostic delay due to its non-specific clinical features. Bone involvement, although not uncommon, can complicate both diagnosis and surgical management.

Complete surgical excision remains the treatment of choice and is essential to minimize recurrence risk. However, meticulous surgical technique is particularly important in anatomically constrained regions such as the toes.

Advances in the understanding of the molecular pathogenesis of GCTTS have redefined its nature as a neoplastic process and opened new therapeutic perspectives, especially for advanced or recurrent forms. Long-term follow-up is mandatory given the risk of recurrence, even after apparently complete resection.

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