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Diffuse-Type Tenosynovial Giant Cell Tumor of the Elbow Mimicking a Cystic Bone Lesion: A Multimodality Imaging Case Report

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Abstract

Diffuse-type tenosynovial giant cell tumor (D-TGCT) is a rare, benign but locally aggressive neoplasm arising from synovial tissue. Although magnetic resonance imaging (MRI) is the preferred imaging modality, osseous involvement may obscure the synovial origin of the disease and mimic a primary bone lesion.

We report a 24-year-old man with recurrent left elbow pain and intermittent swelling for approximately two years. Radiographs demonstrated a well-defined osteolytic lesion of the proximal ulna with a large joint effusion. Computed tomography (CT) showed a 1.8 × 1.6 × 1.6 cm fluid-attenuation lytic lesion with sclerotic margins, initially interpreted as a simple bone cyst. MRI subsequently demonstrated diffuse synovial thickening and enhancing proliferative synovium extending toward the proximal ulna, indicating that the apparent bone lesion represented osseous involvement associated with the proliferative synovial process. Histopathological examination after surgical biopsy and curettage showed mononuclear cells, osteoclast-like multinucleated giant cells, foamy macrophages, and abundant hemosiderin, confirming D-TGCT. Follow-up MRI showed marked postoperative regression of the intra-articular component and a small stable residual focus within the curettage cavity.

This case illustrates how D-TGCT of the elbow may mimic a primary cystic bone lesion when osseous involvement dominates the initial imaging appearance. Correlation of radiographic, CT, and MRI findings is important for recognizing the synovial origin of periarticular bone erosions and directing appropriate histopathological confirmation.

Categories: Radiology, Oncology, Orthopedics
Keywords: bone cyst, bone erosion, d-tgct, elbow, magnetic resonance imaging, pigmented villonodular synovitis, tenosynovial giant cell tumor

Introduction

Tenosynovial giant cell tumor (TGCT) is a rare neoplasm arising from the synovial lining of joints, bursae, and tendon sheaths. It is classified into localized and diffuse types; the diffuse type, historically termed pigmented villonodular synovitis, is characterized by infiltrative synovial involvement and greater local aggressiveness [1]. Population-based data confirm that diffuse-type disease is substantially less common than localized TGCT [2].

The knee is the most frequently involved large joint, whereas elbow involvement is uncommon [3-5]. Symptoms are often nonspecific and may include chronic or recurrent pain, swelling, joint effusion, stiffness, and limitation of motion, potentially overlapping with inflammatory or infectious arthropathies [1,3].

MRI is the preferred modality for defining the extent of D-TGCT and its relationship to adjacent bone and soft tissues [1,3]. Hemosiderin-related low signal and blooming on susceptibility-sensitive sequences are well-known features, but classic MRI findings are not universal [6]. Osseous erosion may occur in diffuse disease and, when prominent, can complicate recognition of the synovial origin of the lesion [3,7]. At the elbow, the combination of an uncommon tumor location and a dominant osteolytic lesion may further obscure the synovial origin of the disease, leading to an initial misinterpretation as a primary bone lesion.

We present an unusual case of D-TGCT of the elbow in a young adult in which a well-defined proximal ulnar lytic lesion initially suggested a primary benign bone cyst. Multimodality imaging ultimately demonstrated that the osseous abnormality represented erosion related to a proliferative synovial process.

Case Presentation

A 24-year-old right-handed man presented with recurrent left elbow pain and intermittent swelling.

Subsequent orthopedic history documented symptoms for approximately two years, with episodes occurring about once per month. During these episodes, he reported marked pain, swelling, occasional erythema around the olecranon, and transient limitation of elbow flexion and strength. The episodes generally resolved spontaneously. There was no history of trauma, and he regularly practiced climbing and weight training.

In August 2024, he presented to the emergency department because of an unusually severe episode. Examination demonstrated swelling and joint effusion with local erythema, warmth, and painful limitation of flexion and extension. He was afebrile and had no wound, sensory deficit, or other clinical evidence of infection. The white blood cell count was 7.97 × 10^3/μL (general adult reference range: 4.0-11.0 × 10^3/μL), C-reactive protein was mildly elevated at 26.2 mg/L (general adult reference range: <5 mg/L), and the erythrocyte sedimentation rate was 9 mm/h (general adult reference range: 0-20 mm/h).

Initial radiographs of the left elbow demonstrated a large joint effusion without fracture or periarticular calcification. A well-defined osteolytic lesion was identified in the proximal ulna and was initially interpreted as a cystic bone lesion (Figures *1A*, *1B*). Ultrasound, performed 25 days after the initial radiographs, demonstrated a moderate intra-articular effusion measuring approximately 8 mm in thickness and mild olecranon bursal thickening. The flexor, extensor, biceps, and triceps tendons were unremarkable. No diagnostic hypervascular synovial mass was identified (Figure *1C*).

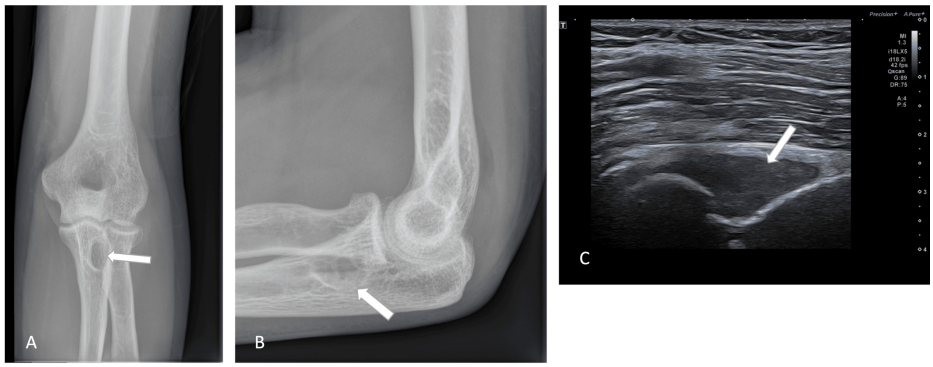


FIGURE 1: Initial radiography and ultrasonography of the left elbow

(A-B) Anteroposterior and lateral radiographs demonstrate a well-defined osteolytic lesion of the proximal ulna (arrows) with associated joint effusion. (C) Ultrasound demonstrates an intra-articular effusion (arrow).

CT of the left elbow, performed on the same day as ultrasonography, demonstrated a 1.8 × 1.6 × 1.6 cm osteolytic lesion at the proximal ulnar metaphyseal-diaphyseal region. It had mildly irregular but sclerotic margins and fluid attenuation. On the basis of this appearance, it was initially interpreted as a simple bone cyst. A small associated intra-articular effusion was considered reactive (Figure *2*).

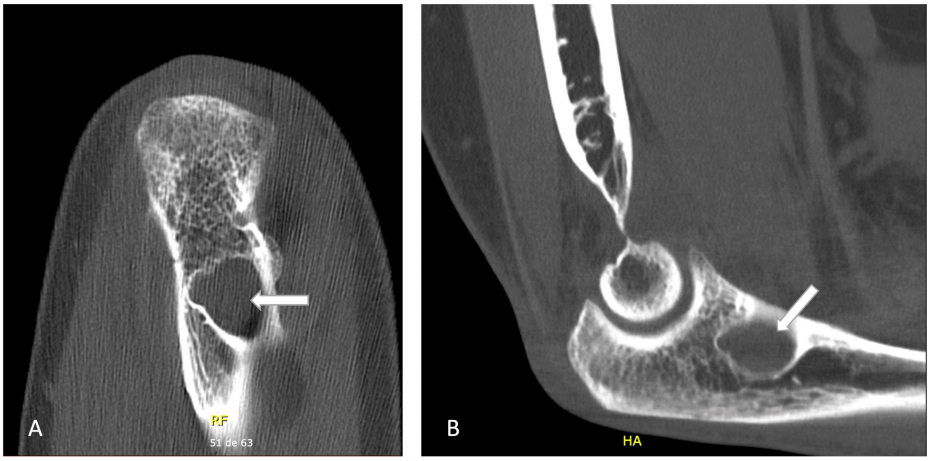


FIGURE 2: Computed tomography of the left elbow

(A-B) Coronal and sagittal multiplanar reformatted images (3-mm slice thickness) demonstrate a well-defined osteolytic lesion of the proximal ulna with sclerotic margins and fluid attenuation (arrows), initially interpreted as a simple bone cyst.

Although the recurrent episodes of pain, swelling, and joint effusion suggested an underlying joint disorder, the well-defined osteolytic lesion on radiographs, together with its sclerotic margins and fluid attenuation on CT, initially favored the interpretation of a simple bone cyst.

MRI was obtained 12 days after CT because the origin of the lesion remained uncertain. It demonstrated marked diffuse synovial thickening with proliferative synovium extending toward the proximal ulna and associated osseous involvement. Fat-suppressed T1-weighted post-contrast images showed enhancement of the synovial proliferation. The apparent cystic bone lesion was therefore reinterpreted as an osseous erosion associated with the proliferative synovial process, rather than a primary bone cyst (Figure *3*).

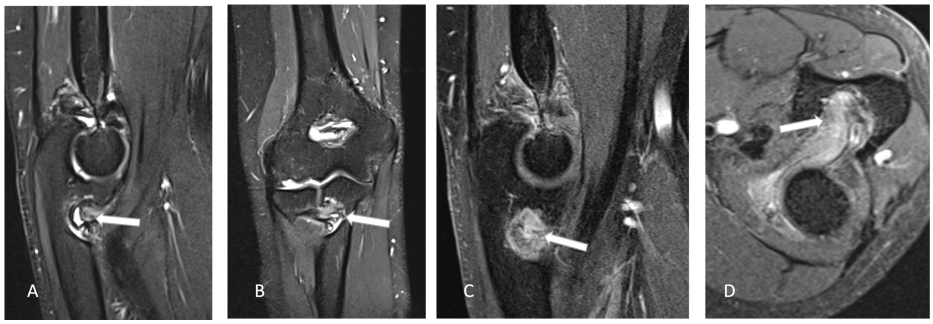


FIGURE 3: Magnetic resonance imaging of the left elbow

(A-B) Sagittal and coronal fat-suppressed T2-weighted images demonstrate joint effusion and marked synovial thickening associated with the proximal ulnar erosion (arrows). (C-D) Sagittal and axial contrast-enhanced fat-suppressed T1-weighted images demonstrate enhancing proliferative synovium in relation to the adjacent osseous defect (arrows).

A sagittal gradient-echo sequence was acquired, without conspicuous susceptibility blooming being identified on the available images. Biopsy was recommended for definitive diagnosis.

The patient was referred to a specialized orthopedic oncology center. Chronic inflammatory or infectious synovitis was initially considered, although there were no clinical signs of infection. A maternal family history of rheumatoid disease was noted. Surgical biopsy and curettage of the proximal ulnar lesion were planned.

Approximately eight weeks after the diagnostic MRI, the patient underwent biopsy, curettage, and partial excision through a posterior ulnar cortical osteotomy. Histopathological examination demonstrated an ill-defined villous lesion composed of histiocytes, intermediate-sized mononuclear cells, and osteoclast-like multinucleated giant cells, with abundant hemosiderin deposits and aggregates of foamy macrophages. These findings established the diagnosis of D-TGCT. Histopathological images were not available for

inclusion in this report.

The postoperative course was uncomplicated. At the 13-day postoperative visit, the patient was asymptomatic with an almost complete range of motion and no neurovascular deficit. At the three-month follow-up, he had recovered full elbow function and resumed climbing with virtually no limitation.

According to the follow-up imaging reports, MRI performed at three months demonstrated marked regression of the diffuse synovial thickening, with no definite residual intra-articular tumor and only a small suspected residual focus within the previous ulnar curettage cavity. At approximately nine months, follow-up MRI showed no significant interval progression of this residual focus or the associated osseous changes. The patient remained clinically well with normal elbow mobility and no significant recurrent symptoms. These follow-up examinations were performed at another oncology center, and the corresponding images were not available for inclusion in this report.

Discussion

D-TGCT is a benign but locally aggressive synovial neoplasm. Compared with localized TGCT, diffuse disease has an infiltrative growth pattern, greater potential for joint damage, and a higher risk of recurrence [1,3]. Histologically, TGCT is characterized by a mixture of mononuclear cells, osteoclast-like giant cells, macrophages, and hemosiderin-laden cells [8].

The clinical presentation is frequently nonspecific. Chronic monoarticular pain, recurrent swelling, effusion, stiffness, and mechanical symptoms may precede diagnosis, and the differential diagnosis can include inflammatory arthritis and chronic infection [1,3]. This diagnostic challenge is amplified at uncommon sites such as the elbow. In our patient, the recurrent episodes of pain and swelling may have been partly related to a hemorrhagic component, as suggested by the abundant hemosiderin deposits identified on histopathological examination, although intra-articular hemorrhage was not directly documented.

Elbow D-TGCT is rare but has been described in young and middle-aged patients, with MRI typically demonstrating synovial proliferation and helping to define disease extent [4,5,9]. In our patient, however, the dominant initial finding was a well-defined proximal ulnar lytic lesion, which shifted the early diagnostic reasoning toward a primary bone abnormality.

Radiographs in D-TGCT may show joint effusion and pressure erosions, while CT is useful for characterizing cortical and osseous involvement [3]. In this case, the fluid attenuation and sclerotic margins of the proximal ulnar lesion led to an initial interpretation of a simple bone cyst. MRI provided the decisive information by demonstrating the relationship between the osseous defect and the proliferative synovium. Recent reports similarly emphasize that TGCT-associated cortical erosion can mimic a primary osseous lesion [7].

This distinction is clinically important because an isolated lytic lesion of the proximal ulna in a young adult has a different differential diagnosis from an erosion contiguous with diffuse synovial disease. A simple bone cyst typically appears as a well-defined, centrally located intramedullary osteolytic lesion, usually without an associated proliferative synovial mass. In contrast, D-TGCT primarily involves the synovium and may cause secondary osseous erosions. Although both conditions may produce well-defined osteolytic abnormalities on radiographs or CT, recurrent joint pain and swelling, persistent effusion, and enhancing synovial proliferation on MRI should favor a synovial process rather than an isolated bone cyst. In the present case, inflammatory and infectious synovitis also remained considerations before histopathological confirmation, particularly given the recurrent inflammatory clinical episodes and mildly elevated C-reactive protein. Although the imaging findings demonstrated osseous involvement contiguous with the synovial proliferation, the precise mechanism of bone involvement (pressure erosion versus direct intraosseous extension) could not be definitively established.

MRI is the imaging modality of choice for evaluating D-TGCT, mapping its extent, and assessing postoperative or treatment-related change [1,3]. Typical findings include synovial thickening or mass-like proliferation, heterogeneous low-to-intermediate signal related to hemosiderin, and enhancement after gadolinium administration. Blooming on gradient-echo imaging is classically associated with hemosiderin; however, its absence does not exclude TGCT, as classic MRI findings are variably expressed [6]. This is relevant in our case because histology demonstrated abundant hemosiderin despite the absence of conspicuous blooming on the available gradient-echo sequence.

Histopathological confirmation remains important when imaging is atypical. The combination of villous synovial architecture, mononuclear cells, osteoclast-like giant cells, foamy macrophages, and hemosiderin in our patient was characteristic of D-TGCT [8].

Management is individualized according to symptoms, anatomic extent, expected surgical morbidity, and resectability. Surgery remains a central treatment option for resectable symptomatic disease, while active surveillance or systemic therapies targeting the colony-stimulating factor 1 receptor may be considered in

selected patients with diffuse, recurrent, or difficult-to-resect disease [9-11]. Recent advances in targeted therapy include the CSF1R inhibitors pexidartinib and vimseltinib, which have demonstrated clinically meaningful antitumor activity in patients with symptomatic TGCT for whom surgery is not an appropriate option [12,13]. Their use requires consideration of potential adverse effects, particularly hepatotoxicity with pexidartinib. In this patient, curettage and partial excision were performed because of the prominent osseous component, followed by MRI surveillance. The small suspected residual focus remained stable during subsequent follow-up.

This report has limitations. It describes a single patient, and the imaging appearance cannot be generalized to all elbow TGCTs. In addition, the initial interpretation as a benign bone cyst reflected the radiographic and CT appearance before MRI clarified the synovial origin. Finally, no histopathology image was available for publication; therefore, pathological findings are described from the diagnostic report. Although sagittal gradient-echo imaging was performed, detailed acquisition parameters, including field strength and echo time, were unavailable for retrospective verification.

The main teaching point is that an apparently cystic or lytic periarticular bone lesion should not automatically be considered a primary osseous lesion when recurrent monoarthritis and joint effusion are present. Careful MRI assessment of the adjacent synovium may reveal an underlying proliferative synovial process such as D-TGCT.

Conclusions

Diffuse-type tenosynovial giant cell tumor should be included in the differential diagnosis of chronic monoarticular pain and recurrent joint effusion when an adjacent well-defined osteolytic lesion is present. In this case, radiography and CT suggested a benign cystic lesion of the proximal ulna. In contrast, MRI demonstrated that the osseous abnormality was associated with enhancing proliferative synovium and was interpreted as secondary osseous involvement. In patients with recurrent joint symptoms and an apparently benign periarticular lytic lesion, further evaluation with MRI should be considered to investigate a possible underlying synovial process.

Recognizing the relationship between synovial disease and adjacent bone may reduce the risk of misclassifying secondary osseous involvement as a primary bone lesion. Multimodality imaging, particularly MRI, can contribute to diagnostic assessment, while histopathological examination provides definitive confirmation of D-TGCT, including at uncommon sites such as the elbow.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Erika De Smet, Mieke Cannie, Arnaud Devriendt

Acquisition, analysis, or interpretation of data: Erika De Smet, Mieke Cannie, Arnaud Devriendt

Drafting of the manuscript: Erika De Smet, Mieke Cannie, Arnaud Devriendt

Critical review of the manuscript for important intellectual content: Erika De Smet, Mieke Cannie, Arnaud Devriendt

Supervision: Erika De Smet, Mieke Cannie, Arnaud Devriendt

Disclosures

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