

Uncovering an Uncommon Diagnosis in a Child - Granular Cell Tumor in the Left Leg

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Abstract

Granular cell tumor (GCT) is a rare benign tumor of Schwann cell origin that typically impacts adults and frequently occurs in the head and neck. Its manifestation in the pediatric population, particularly within the lower extremities, is exceedingly rare and may pose diagnostic challenges. We present a unique case involving a 12-year-old girl with an insidiously enlarging, non-tender swelling on the anterior aspect of the left leg. Preliminary imaging and fine-needle aspiration cytology (FNAC) failed to provide conclusive evidence, prompting surgical biopsy for definitive evaluation. Histopathological examination revealed abundant granular eosinophilic cytoplasm and small, centrally located nuclei, characteristic of GCT. Immunohistochemical analysis demonstrated strong S100 protein positivity. Further substantiating the diagnosis, with a Ki-67 proliferation index of 5% indicating a low mitotic rate. This example highlights the essential requirement of using GCT in the differential diagnosis of pediatric soft tissue lesions, especially those arising in atypical anatomical locations. Early recognition and histological confirmation are essential for appropriate management and to avoid over-treatment.

Keywords: Granular Cell Tumor, Lower Extremity Tumor, Immunohistochemistry, Pediatric Soft Tissue Neoplasm, S100 Positivity.

Introduction

The rare neuroectodermal neoplasm known as granular cell tumor (GCT), was first discovered by Abrikossoff in 1926, believed to arise from Schwann cells due to its characteristic immunohistochemical profile including S100 protein positivity [1]. Although benign in most cases, GCTs can mimic malignant lesions both clinically and radiologically, making accurate diagnosis challenging. “The head and neck region, particularly the tongue, is where” such tumors have been most frequently found in adults among the ages of 3 and 6 [2]. Pediatric presentations are rare, accounting for fewer than 10% of all GCT cases [3]. Even more exceptional is the occurrence of GCTs in the lower extremities of children, where the clinical suspicion is generally low, and differential diagnoses often lean toward more common soft tissue pathologies such as fibromatoses or vascular anomalies. Given their nonspecific radiological appearance and inconclusive fine-needle aspiration cytology (FNAC), histopathological examination supplemented by immunohistochemistry is critical for definitive diagnosis [4].

Despite being histologically benign, GCTs have a potential for local recurrence and rare malignant transformation, particularly if not adequately excised. Hence, awareness of their possible occurrence in unusual locations and among younger populations is essential to avoid transdiagnosis and overtreatment [5]. This case report aims to “emphasize the importance of utilizing GCT in the differential diagnosis of” soft tissue cancers in children and to include to the limited research on pediatric lower extremity GCTs.

Case Presentation

A 12-year-old female patient is currently admitted to the female surgical ward for swelling over the anterior aspect of the left leg, persisting for 2 years. The swelling was insidious in onset and gradually progressive in nature. Ultrasound examination showed a well-defined heteroechoic lesion measuring 1.3 x 0.5 cm was noted in the anterior shaft of the left leg. No internal vascularity was seen. Mild subcutaneous edema was present, but the underlying muscles and bone were normal. Microscopic analysis (Fig.1&Fig.2) demonstrated “a tumor in the dermis, extending into the subcutis. Large” cells with numerous eosinophilic granular cytoplasm were observed, and spindle-shaped cells have been observed in the focal areas. While vesicular nuclei with big nucleoli were seen in particular locations, most of the nuclei were small and bland. “The mitotic rate is 2 per 10 high-power fields (HPF). Tumour” margins cannot be assessed as the specimen was received in fragments. There was no necrosis. Immunohistochemistry (Fig.3&Fig.4) demonstrated significant

cytoplasmic and nuclear staining for S100 protein. The Ki67 proliferation index was measured at around 5% on average, resulting to a histological diagnosis of granular cell tumors.

Fig 1 - granular cell tumour - haematoxylin and eosin -100x

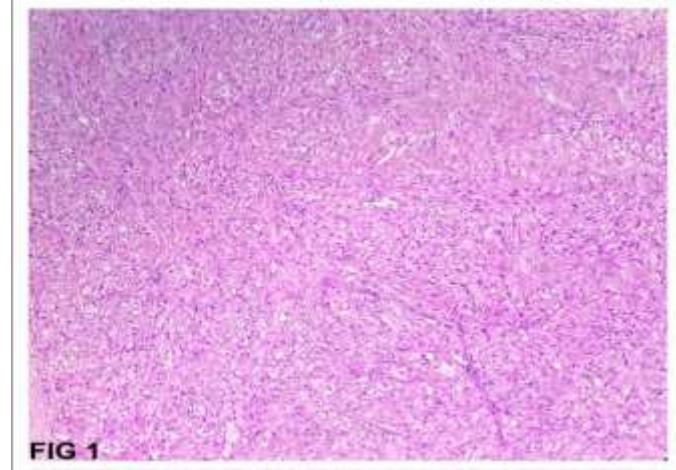


Fig 2 - large cells within abundant cytoplasm - haematoxylin and eosin-400x

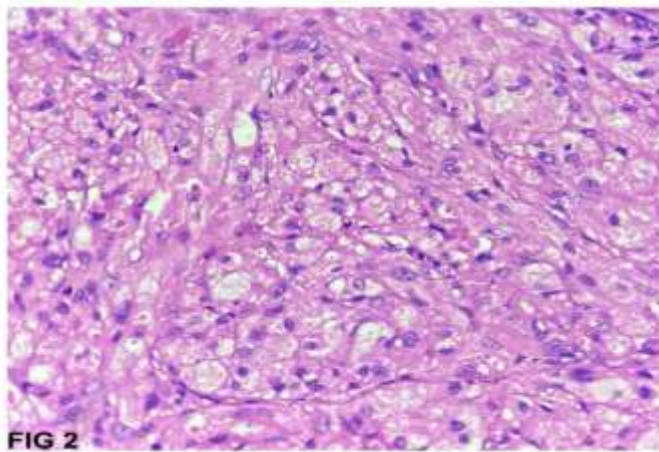


Fig 3- tumour cells illustrate diffuse nuclear and cytoplasmic positivity of s-100 -IHC 100x

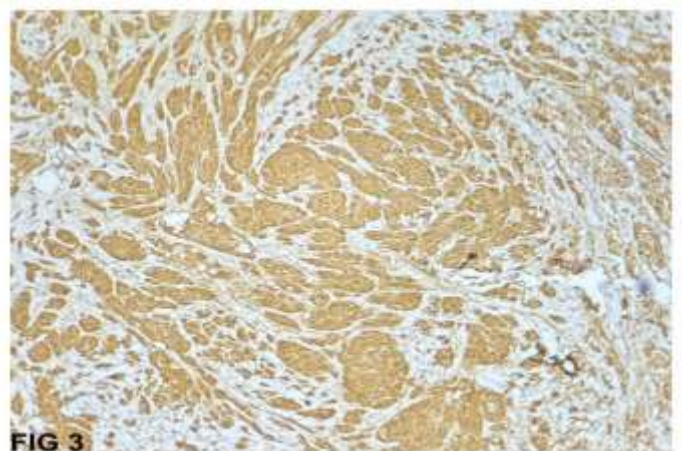
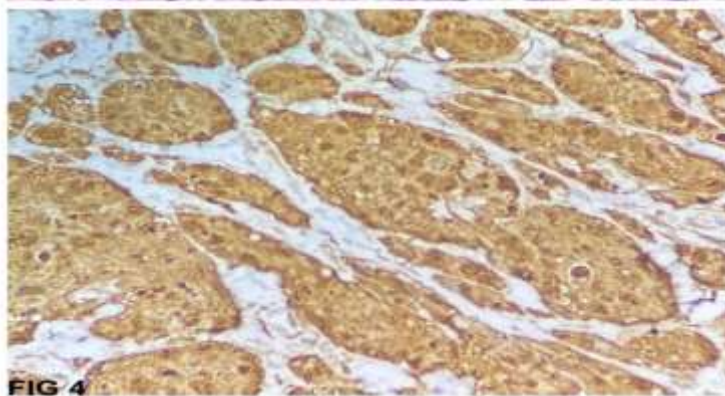


Fig 4 - tumour cells illustrate diffuse nuclear and cytoplasmic positivity of s-100 -IHC 400x



Discussion

GCTs are rare neoplasms of presumed Schwann cell origin, first described through Abrikossoff in 1926 as "myoblastic myomas" due to their granular appearance and initial misinterpretation as being of myogenic origin [6]. Subsequent immunohistochemical and ultrastructural studies, particularly their consistent expression of S 100 protein, have since confirmed their derivation from peripheral nerve sheath elements, most likely Schwann cells [7,8].

GCTs predominantly affect adults in the third to 6th decades and show a slight female predilection [9]. "They most frequently occur in the head and neck area (particularly the tongue), comprising about 45-65% of all cases" [10]. Occurrence in the lower extremities is exceptionally rare, and reports of such tumors in pediatric patients are exceedingly scarce in literature. In a retrospective series via Lack et al., only a minority of GCTs involved the extremities, and even fewer occurred in patients under the age of 20[11].

The present case is noteworthy for multiple reasons: the young age of the patient (12 years). The unusual site of the tumor (anterior leg) often leads to diagnostic delays, especially when initial imaging and cytology are inconclusive [12]. Histopathology remains the cornerstone of diagnosis. Classic features include "large polygonal cells with rich granular eosinophilic cytoplasm and centrally placed nuclei, and" absence of significant atypia. The granularity is attributed to lysosome accumulation within the cytoplasm [13]. Immunohistochemical staining with S100, neuron-specific enolase (NSE), and CD68 helps confirm the diagnosis [14]. In this case, strong S100 positivity and low Ki-67 index (5%) were consistent with benign GCT behavior.

Although the majority of GCTs are benign, around 1-2% may exhibit malignant development. "Fanburg-Smith et al. established six histological criteria to categorize GCTs into benign, atypical, or malignant subtypes: necrosis, spindling of tumor cells, vesicular nuclei with prominent nucleoli, higher mitotic activity (>2 mitoses/10 high-power fields), high nuclear-to-cytoplasmic ratio, and pleomorphism [15]. The" current case's lack of these features. Low proliferative index suggests a benign diagnosis.

Surgical excision with negative margins remains the treatment of choice. Complete removal typically results in excellent prognosis, with recurrence rates under 2% for benign lesions [16]. Malignant GCTs, however, are aggressive behavior with significant rate of recurrence and metastasis, necessitating wide excision and close follow-up. In the current case, the complete surgical resection led to favorable short-term outcomes, and no recurrence has been noted at follow-up.

Such case demonstrates how crucial it is to take GCTs into consideration when making a differential diagnosis for pediatric soft tissue masses, especially those that are painless, slow-growing, and arise in atypical anatomical locations. A high index of clinical suspicion, combined with histological and immunohistochemical confirmation, is critical for timely and appropriate management.

Conclusion

Granular cell tumors (GCTs), though benign and rare, pose a diagnostic challenge when presenting in atypical anatomical sites and in pediatric populations. This case underscores the importance of maintaining a broad differential diagnosis for slow-growing soft tissue masses in children, particularly when initial imaging is inconclusive.

Histopathological examination supplemented by immunohistochemistry, particularly S100 positivity and low Ki-67 index, remains pivotal for diagnosis or grading.

Given their potential—albeit low—for malignant transformation, timely recognition and complete surgical excision with clear margins are essential to ensure favorable outcomes and minimize the risk of recurrence. This case adds to the limited body of literature on pediatric lower extremity GCTs and emphasizes the need for increased awareness among clinicians and pathologists to avoid misdiagnosis and unnecessary aggressive interventions.

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