

## CT and MR Imaging Findings of a Granular Cell Tumor of the Orbit: Report of Two Cases<sup>1</sup>

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We report the computed tomography (CT) and magnetic resonance (MR) imaging findings for two cases of granular cell tumors located in the orbit, a rare benign tumor of neural origin, occurring in a 14-year-old boy and a 35-year-old woman. Although rare, granular cell tumors may be one of the diagnostic inclusions for soft tissue masses of the orbit, especially when the mass shows isointensity in relation to the extraocular muscle on T2-weighted MR images and a homogeneous moderate enhancement, similar to the extraocular muscles, with a greater peripheral enhancement on contrast-enhanced T1-weighted MR images.

**Index words :** Orbital neoplasms  
Orbit, MR  
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Granular cell tumors (GCTs) are a rare, histologically distinct, benign soft tissue tumor, characterized by large granular-appearing eosinophilic cells (1). Although originally thought to be a myogenic tumor, subsequent evidence has indicated that GCTs are most likely derived from Schwann cells from peripheral nerves (2, 3). Various sites can be affected by this tumor, with a 50% rate of occurrence in the head and neck region and the most common location in the tongue and subcutaneous tissue. On rare occasions, GCTs can arise in the orbit. To date only slightly more than 50 GCT cases of the orbit and periorbital region have been reported in the

English literature (2, 4-6). We report the CT and MR imaging findings of two cases of orbital GCTs occurring in a 14-year-old boy and a 35-year-old woman.

### Case Report

#### Case 1

A 14-year-old boy presenting with a 4-month history of left exophthalmos was referred to our hospital after the detection of an orbital mass on CT scans obtained at a local clinic. Upon examination, the uncorrected visual acuity was 20/200 OD and 20/25 OS, improving to 20/20 OU. A Hertel exophthalmometry revealed 5 mm of exophthalmos OS. The patient showed normal ocular movement and good pupillary response to light. Other ophthalmologic examinations, including a slit-lamp biomicroscopy, Goldmann applanation tonometry, color vision test, and fundus examination, were normal.

A review of the CT scans obtained from outside revealed a  $2 \times 1.7 \times 1.7$  cm well-defined, ovoid soft tissue mass in the intraconal space of left orbit. On pre-

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contrast CT scans (Fig. 1A), the mass was isodense in relation to the extraocular muscles, without evidence of intralesional calcification. On post-contrast CT scans, the lesion showed mild homogenous enhancement, similar to the extraocular muscles (Fig. 1B). To further characterize the internal architecture of the lesion and to assess the spatial relationship with the extraocular muscles, MR imaging of the orbit was performed and revealed a well-circumscribed mass abutting the superior and lateral rectus muscles. Compared with the extraocular muscles, the mass showed a homogeneous isointense signal on T1-weighted (Fig. 1C) and T2-weighted (Fig. 1D) images. After contrast enhancement, the mass showed homogeneous moderate enhancement, similar

to the extraocular muscles, with a greater peripheral enhancement (Fig. 1E).

The patient underwent surgery via a lateral orbitotomy. During the operation, a whitish, firm, ovoid soft tissue mass was discovered as well-defined, albeit adherent to the surrounding orbital tissues. Histopathologically, the tumor consisted of clusters of round to oval-shaped cells containing small central, basophilic nuclei surrounded by abundant granular, eosinophilic cytoplasm (Fig. 1F). Immunohistochemical staining using a standard immunoperoxidase technique revealed a positive immunoreactivity for the S-100 and CD 68 proteins. On the basis of these microscopic and immunohistochemical findings, the diagnosis of a GCT was made. A three-year

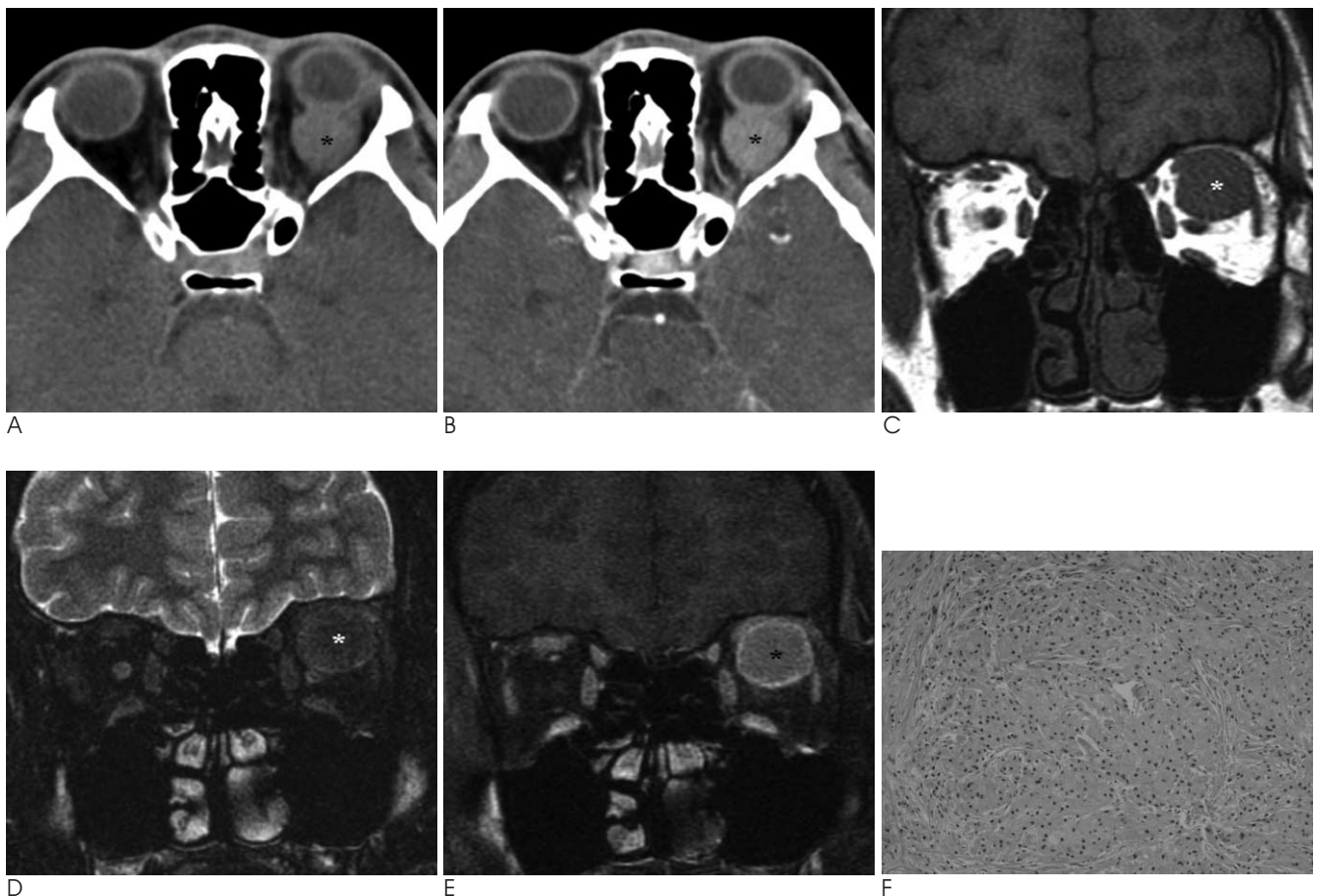


Fig. 1. Granular cell tumor of the left orbit in a 14-year-old boy.

A, B. Axial pre- (A) and post-contrast (B) CT scans show a well-defined, ovoid, homogeneously enhancing soft tissue mass in the superior aspect of the intraconal space of the left orbit (asterisks). The mass is isodense in relation to the extraocular muscles without evidence of intralesional calcification. The ipsilateral globe is displaced anteriorly without invasion.

C-E. Coronal T1-weighted (C), fat-suppressed T2-weighted (D), and contrast-enhanced fat-suppressed T1-weighted (E) MR images show a well-circumscribed mass (asterisks) which abuts the superior and lateral rectus muscles. The lesion is homogeneously isointense in relation to the extraocular muscles on both T1-weighted (C) and T2-weighted (D) images. After contrast, the mass demonstrates homogeneous moderate enhancement, similar to the extraocular muscles, but with greater peripheral enhancement (E).

F. A photomicrograph shows the tumor composed of sheets of polygonal tumor cells having centrally located, round nuclei with abundant granular cytoplasm (hematoxylin-eosin, original magnification  $\times 100$ ).

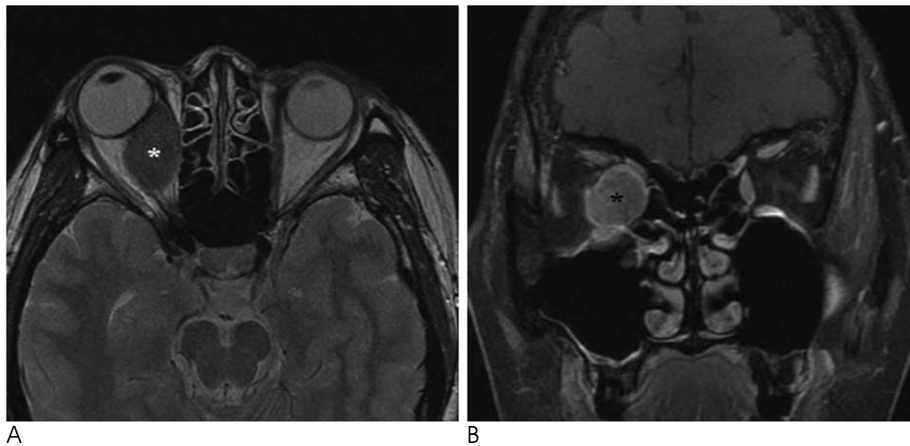


Fig. 2. Granular cell tumor of the right orbit in a 35-year-old woman.

Axial T2-weighted (A) and coronal contrast-enhanced fat-suppressed T1-weighted (B) MR images show a well-defined soft tissue mass in the medial aspect of the intraconal space of the right orbit (asterisks), which is inseparable from the medial rectus muscle. Similar to the mass shown in Fig. 1, the signal intensity on the T2-weighted image is isointense in relation to the extraocular muscles (A). After contrast, the mass demonstrates homogeneous moderate enhancement, similar to extraocular muscles, but with a greater peripheral enhancement (B).

post-surgical follow-up examination, which consisted of post-operative CT scans, found that the patient remained asymptomatic with no evidence of tumor recurrence.

### Case 2

A 35-year-old woman presented with a 3-month history of right exophthalmos and diplopia. At the time of symptom onset, the patient visited an outside hospital and underwent CT and MR examinations which demonstrated a right orbital mass. The pathology of the specimen obtained from an incisional biopsy at that hospital was reported to be a GCT. Upon a physical examination at the time of the patient's visit to our hospital revealed a limitation of the movement of the right eye during lateral, medial, and upward gaze. The uncorrected visual acuity was 20/25 OD and 20/20 OS. A Hertel exophthalmometry revealed 3 mm of exophthalmos OD. Other ophthalmologic examinations were unremarkable.

A review of the CT and MR images obtained from the outside hospital revealed a  $3 \times 1.9 \times 1.9$  cm ovoid soft tissue mass, located primarily in the medial aspect of the intraconal space of the right orbit. Although the mass looked well-defined, discrimination between the mass and the medial rectus muscle was difficult. As seen in case 1, the density on pre-contrast CT scans and signal intensities on T1-weighted and T2-weighted MR images were similar to those of the extraocular muscles (Fig. 2A). After contrast enhancement, the mass showed homogeneous moderate enhancement, similar to the extraocular muscles, with a greater peripheral enhancement (Fig. 2B). A histopathologic review of the outside slides revealed the sheets of tumor cells showing abun-

dant granular cytoplasm, which was consistent with a GCT.

Because of the fear for the possible complications of open surgery and conventional radiation therapy, such as muscle injury or optic nerve damage, the patient underwent fractionated stereotactic gamma knife surgery (GKS) with a mean of 5 Gy in four daily fractions. At a 3-month follow-up after the GKS, the patient remained stable without progression of the subjective symptoms.

### Discussion

The histogenesis of a GCT has been an issue of much debate, which can be substantiated by the diversity of names used to describe the tumor, including myoblastoma, granular cell myoblastoma, myoblastic myoma, granular cell neurofibroma, lipoid granular cell fibroblastoma, granular cell schwannoma, and granular cell histiocytoma (1, 2). Although a myoblastic, fibroblastic, histiocytic, or undifferentiated mesenchymal cell origin had been contemplated, the more recent belief is that a GCT arises from Schwann cells. This determination is based on the electron microscopic and immunohistochemical findings (1, 3, 7).

GCTs can occur in any part of the body, including the breast, extremities, gastrointestinal, respiratory and urogenital tracts, as well as the pituitary stalk (8). However, they have a propensity to occur in the head and neck region with the approximately 30% of lesions occurring in the tongue. Typically, GCTs present as a small, solitary, slow-growing, painless nodule in the subcutaneous, intradermal, or submucosal regions (7). They occur in patients of any age, but are most common in those in the

4th to 6th decades of life. Moreover, women are about twice as likely to be affected by a GCT. Approximately 10–15% of all GCTs have multiple satellite nodules (1, 7). Although usually benign, malignancies are described in approximately 1–3% of cases and mostly occur in lesions larger than 4 cm at presentation (6). Rarely, GCTs can exhibit spread through the perineural lymphatic channels (8).

Microscopically, a GCT is composed of round or polygonal cells with an eosinophilic, coarse, granular cytoplasm and small, dense nuclei (1, 3, 8). It is often circumscribed, but not encapsulated. The immunohistochemistry findings indicate that GCTs are positive for the S-100 protein, a marker for neural tissue, and negative for actin, a marker of muscular tissue (1, 2). In addition, the characteristic eosinophilic granular cytoplasm is thought to represent lysosomal structures and results in positive immunoreactivity for CD68, a lysosome-associated glycoprotein (1, 7). The histological features of malignancy include a spindle pattern, cellular and nuclear pleomorphism, presence of necrosis, wide cellular sheets, and high mitotic indexes. It is important to recognize that up to 30% of GCTs are reported to be associated with overlying pseudoepitheliomatous hyperplasia that may lead to confusion with squamous cell carcinomas (8).

Only a few studies report on the CT and MR imaging features of GCTs, because the tumor usually measures less than 3 cm in diameter and thus tends to be easily removed (8–10). In general, because of the tendency to infiltrate as well as a lack of a capsule, GCTs are usually seen as an ill-defined soft tissue mass with frequent attachments to the adjacent muscle on imaging. On CT scans, GCTs are isodense or slightly hypodense in relation to muscle, and enhance homogeneously or heterogeneously. No previous cases of GCTs report tumor calcification. On MR imaging, the signal intensity on T1-weighted images is low to intermediate compared with muscle, whereas it ranges from low to intermediate to high on T2-weighted images. The low signal intensity on the T2-weighted images may be caused by interstitially abundant collagen fibers and lower cellular components (8, 9). Sometimes, GCTs are reported to show a central low signal surrounded by a peripheral rim of high signal on T2-weighted images (10). After contrast, most GCTs exhibit homogeneous enhancement.

The occurrence of GCT in the orbit and periorbital region is a rare event, with only slightly more than 50 cases reported in the English literature (2, 5, 6). Various oph-

thalmic sites can be involved including the orbit, periorbital skin and eyelid, lacrimal sac, extraocular muscles, conjunctiva, caruncle, anterior uvea, and ciliary body (6). GCTs of the orbit appear to have identical demographic, histopathologic, and radiologic findings to those involving other locations (2, 4–6). However, in contrast to GCTs in other locations, which are often incidental findings during routine physical examination, those in the orbit are often symptomatic, causing exophthalmos, diplopia, or decreased visual acuity due to optic nerve involvement (2, 6).

There are many other orbital lesions that share the same clinical manifestations of orbital GCTs, including cavernous hemangiomas, schwannomas, neurofibromas, fibrous histiocytomas, hemangiopericytomas, solitary fibrous tumors, lymphomas, and pseudotumors (4, 6). As shown in our cases, the signal characteristics on MR imaging, especially on T2-weighted images, may help narrow the differential diagnosis. Unlike GCTs which are hypointense in relation to cerebral gray matter on T2-weighted images, cavernous hemangiomas, schwannomas, fibrous histiocytomas, hemangiopericytomas, and solitary fibrous tumors usually appear as hyperintense on T2-weighted images. Although neurofibromas can display a similar signal on T2-weighted images, the enhancement pattern is frequently heterogeneous rather than homogeneous. The greater peripheral enhancement seen in both of our cases may be ascribed to the slow growing nature of the tumor, which causes compression of the adjacent tissues, resulting in the formation of pseudocapsules.

The optimal treatment for GCTs is complete surgical resection with tumor-free margins (7). The recurrence rate after adequate local excision is 8%, and that with a positive excision margin is 21–50% (8). In one of our cases, a GKS was performed for the palliation of diplopia, because damage of the medial rectus muscle was very likely during open surgery. Although adjuvant postoperative radiotherapy and chemotherapy have been used for malignant GCTs, limited clinical experience exists for the treatment of orbital GCTs using GKS, which makes it difficult to further discuss the utility of GKS at this moment.

In conclusion, although rare, the diagnosis of GCTs may be considered if one sees a homogeneously enhancing orbital mass with greater peripheral enhancement, which is isointense in relation to extraocular muscles on T2-weighted MR images.

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## 안와의 과립세포종의 CT 및 MRI 소견: 증례 보고<sup>1</sup>

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이 증례보고는 14세 남자와 35세 여자의 안와에서 발생한 신경조직 기원의 드문 양성종양인 2예의 과립세포종의 CT 및 MRI 소견에 관한 것이다. 비록 드문 종양이지만, MRI의 T2 강조영상에서 외안근과 등신호강도를 보이고, 조영증강 후 외안근과 비슷한 정도의 균질한 내부 조영증강과 함께 뚜렷한 변연부 조영증강을 보이는 안와의 연부조직종양이 관찰될 때 과립세포종의 가능성을 고려하여야 할 것으로 생각한다.