Granular cell tumors (GrCTs) of the spinal cord are rare benign tumors with a high rate of local recurrence. Only 6 cases of spinal GrCTs have been reported. GrCT is difficult to distinguish from other benign tumors such as schwannoma using imaging. A radiological “speckled dots” sign may be a useful differentiating feature of GrCT based upon experience with two cases and a review of the literature.

Key Words: Granular cell tumor · Intradural extramedullary tumor · Spinal cord · Magnetic resonance imaging · Schwannoma.
Case 2
A 21-year-old woman presented with a 3-month history of right arm pain and tingling. The sensory changes had been present for 10 years, but she had not received any treatment. Her symptoms were aggravated after a minor car accident. She had no relevant medical or family history. Physical examination revealed intact motor power and normal reflexes. Computed tomography (CT) showed bony erosion at the right C5 and C6 foramina, and the right vertebral artery was displaced anteriorly. MR images demonstrated a 3.5×2.3 cm dumbbell-shaped IDEM mass at C5-6 that extended to the right extraforaminal space. The tumor showed isointensity with respect to the spinal cord on T1-weighted images and homogeneous gadolinium-enhanced T1-weighted images. Speckled dots were also observed on the T2-weighted images and gadolinium enhanced T1-weighted images. As in Case 1, the tumor showed low signal speckled dots especially on the T1 enhanced images. Complete tumor resection was performed. The histological findings showed lymphocytic infiltration around granular cells (Fig. 2). The tumor cells were strongly immunoreactive with S-100 protein on the immunohistochemical analysis. The postoperative course was uneventful, and the patient experienced significant relief of her tingling sensation.

DISCUSSION
Radiological differential diagnostic points
Our two GrCTs showed speckled dots in the tumor characterized by low signal dots, especially on enhanced T1-weighted images. We reviewed all of the published literature on GrCTs and found that the majority of published cases that included MR images also revealed this feature (Table 1). We have not observed such a pattern in other similar tumors, such as schwannoma and meningioma, nor has it been reported. Based on these results, speckled
dots potentially are a characteristic for the differential diagnosis of GrCT.

The physical reason behind the low signal speckled dots may be hyalinizing fibrosis of GrCTs. By histology, GrCTs consist of clusters and sheets of large rounded, polygonal or elongated cells with indistinct cellular borders. The tumor clusters consist of small, hyperchromatic to vesicular nuclei and background fibrous connective tissue. The islands of the tumors are separated by delicate fibrovascular tissue. Case 1 showed fibrosis and vacuole changes, and Case 2 demonstrated hyalinizing fibrosis and lymphocytic infiltration. Other reported cases are summarized in Table 2. Fibrosis of GrCT is well described in 6 of 8 patients. The other 2 cases did not show fibrosis, but this was uncertain. Previous researchers have reported that GrCTs in the appendix and skin also demonstrate a telangiectatic portion with a fibrotic or hyalinized wall, stromal area and lymphoid infiltration. Fibrosis may be a common factor correlating with the low signal intensities in MR. Therefore, speckled dots may be observed in GrCT as a result of the fibrosis.

**Similarities and differences between GrCT and Schwannoma**

It is believed that GrCT arises from Schwann cells\(^1\). This is...
supported by positive reactions to various neural markers, including S-100 protein, neuron-specific enolase, and inhibin-alpha. One of our cases had a dumbbell-shaped tumor that appeared to have an intradural extramedullary origin, possibly from a spinal root. Both GrCT and schwannoma tended to occur more frequently at thoracolumbar junctions. These features would seem to indicate a close relation between GrCT and schwannoma. On the other hand, GrCTs can show malignant characteristics: rapid growth, large size, necrosis, and the involvement of adjacent tissue. In addition, up to 7% of both malignant and benign cases recur after incomplete resection. Although it has been proposed that radiation therapy successfully stabilizes recurrent disease in intradural extramedullary tumors, complete surgical resection is recommended as the initial treatment of choice. If a significant morbidity rate is anticipated, as with spinal cord tumors, adjuvant radiotherapy after tumorectomy may lead to better outcomes.

CONCLUSION

GrCT in the spinal cord is very rare. GrCT should be distinguished from other benign tumors such as schwannoma and meningioma because of its relatively high recurrence rate. Our cases and literature review suggest that the low signal intensity speckled dots may be a differential diagnostic point on MR images.

References