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# Problem of dural tail sign in glioblastoma multiforme?

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*Abstract*

*A dural tail, which is a linear enhancement along the dura mater on contrast T1-weighted resonance images, is considered as a common and useful sign for distinguishing meningioma from other intracranial lesions. However, the specific nature of dura tail signs is still controversial. To the best of our knowledge, only seven cases of glioblastoma multiforme have been described with dural tail signs. Here, we report a case of glioblastoma multiforme with a dural tail sign and cerebrospinal fluid cleft sign and review the relevant literature.*

*Key words*: Dural tail sign; magnetic resonance imaging; glioblastoma multiforme.

## Introduction

A "dural tail" is considered to be a common and useful sign for distinguishing meningiomas from other intracranial lesions (Guermazi *et al.*, 2005). However, there have been rare descriptions in the literature of the dural tail sign in glioblastoma multiforme (Wilms *et al.*, 1991; Gupta *et al.*, 1993). We report a rare case of glioblastoma multiforme in which there was a dural tail sign and cerebrospinal fluid (CSF) cleft sign on magnetic resonance imaging (MRI).

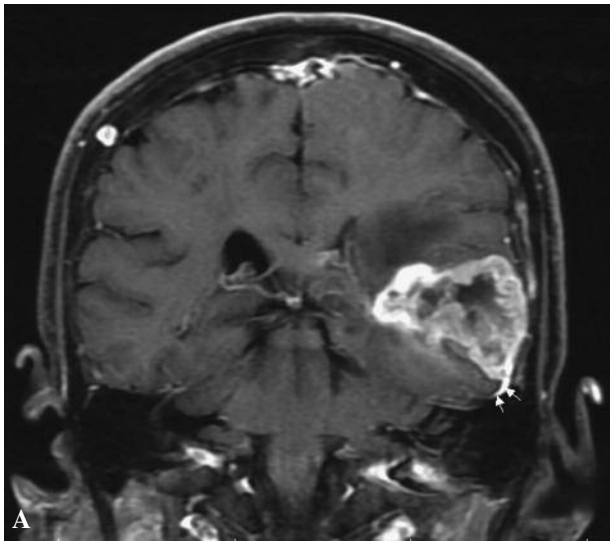
## Case report

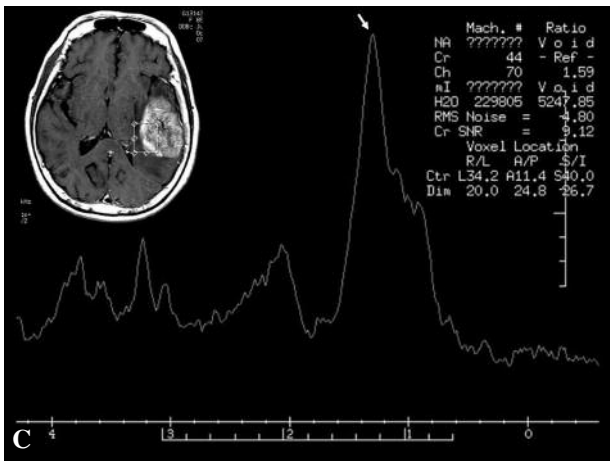
An 85-year-old female presented with difficulty in naming familiar things and people one month before admission. The neurological examination was normal except for agnosia. A computed tomographic scan of the brain without contrast revealed increased cortical density with possible necrotic lesions and apparent white matter edema in the left hemisphere. Subsequent MRI showed a large, central necrotic tumor measuring $4.3 \times 5.6 \times 4.2$ cm in size. The tumor appeared as heterogeneous hyperintensity on T1-weighted sequences and heterogeneous hyperintensity on T2-weighted images. After administration of gadolinium, the heterogeneously enhanced tumor was seen abutting the dura laterally with an enhanced dural tail around the tumor (Fig. 1A). The images also showed a CSF cleft separating the tumor from the temporal lobe medially (Fig. 1B). Meningioma was suggested preoperatively and the patient underwent a craniotomy. At the operation, the dura mater had a normal appearance and was noted invaded by tumor. The tumor appeared grey in color and soft in consistency. Central necrosis was also found. During removal of the tumor, the tumor was prone to bleeding and was found to have invaded the adjacent parenchymal tissue. The tumor was completely removed. Microscopically, the tumor cells had pleomorphic nuclei with some mitoses, mixed with marked pseudo-palisading necrosis and proliferative blood vessels (Fig. 2A and 2B). Immunohistochemical stains of the tumor cells were positive for glial fibrillary acidic protein and p53 overexpression (Fig. 2C). Glioblastoma multiforme was confirmed by the pathologic examinations.

Postoperatively, there was good recovery of her general condition. Concurrent radiotherapy chemoradiation therapy (whole brain radiotherapy plus temozolomide) was administrated during the follow-up period. However, the patient died 3 months after discharge because of aspiration complicated with septic shock.

## Discussion

The dural tail sign, also known as "dural thickening", "dural flare" and meningeal sign", was first described by Wilm *et al.* in 1989. It is a linear enhancement of dura mater adjacent to a meningioma on contrast-enhanced T1-weighted images (Wilms *et al.*, 1989). In series studies, a dural tail sign has been reported in 52-72% of meningiomas



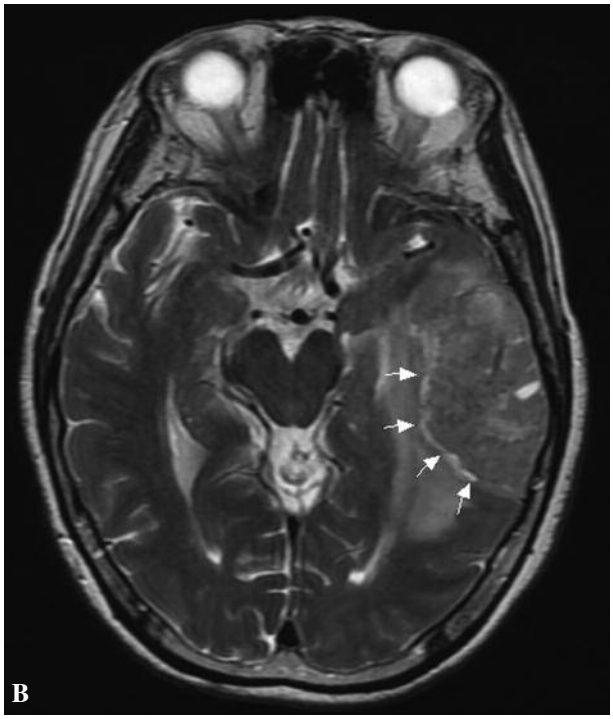




FIG. 1. — (A) Coronoral view of T1-weighted magnetic resonance images with injection of gadolinium revealed the dural tail sign (white arrows) adjacent to the heterogeneously enhanced tumor. (B) Sagittal view of T2-weighted magnetic resonance images showed a cerebrospinal fluid cleft (white arrows) separating the tumor from the temporal lobe medially. (C) The proton magnetic resonance spectroscopy revealed the large resonance of lipid/lactate (white arrow) and no increase level of alanine.

on MRI (Aoki *et al.*, 1990; Goldsher *et al.*, 1990; Schorner *et al.*, 1990; Nagele *et al.*, 1994; Wallace 2004; Rokni-Yazdi *et al.*, 2006). Although it has been considered as an important and common sign of meningiomas, the significance of a dural tail is still controversial. To the best of our knowledge, only seven cases of glioblastoma multiforme associated with dural tail signs on MRI have been reported in the literature (Wilms *et al.*, 1991; Gupta *et al.*, 1993; Guermazi *et al.*, 2005).

The exact histological nature of a dural tail is still controversial. Some authors believe that it originates from the tumor extension within or at the surface of the dura membrane (Wilms *et al.*, 1989; Goldsher *et al.*, 1990). Others suggested that the dural tail may be attributed to fibrous tissues with loose connective tissue proliferation, hypervascularity and vascular dilatation (Goldsher *et al.*, 1990; Tokumaru *et al.*, 1990). In the reported seven cases of glioblastoma multiforme, the appearance of dura mater was normal in all cases and the histological examination revealed no tumoral invasion within the dura mater (Wilms *et al.*, 1991; Gupta *et al.*, 1993). Otherwise, because glioblastoma multiforme is rarely fed by the vessels of dura mater, the enhanced dural tail sign is not likely to develop from vascular congestion or proliferation (Guermazi *et al.*, 2005). It is considered highly likely that the tumor spreading into the subarachnoid or subdural space is the possible cause of a dural tail in glioblastoma multiforme on MRI.

The advanced neuroimaging technique of proton MR spectroscopy has been considered as a useful tool for categorizing brain tumors. In comparisons of meningiomas and glioblastoma multiforme tumors on magnetic resonance spectroscopy, a large lipid/lactate resonance has been found to be characteristic of glioblastoma mutliforme,tumors whereas a large alanine resonance is characteristic of meningiomas (Majos *et al.*, 2003). In our case, there was a high peak resonance of lipid/lactate and no increased

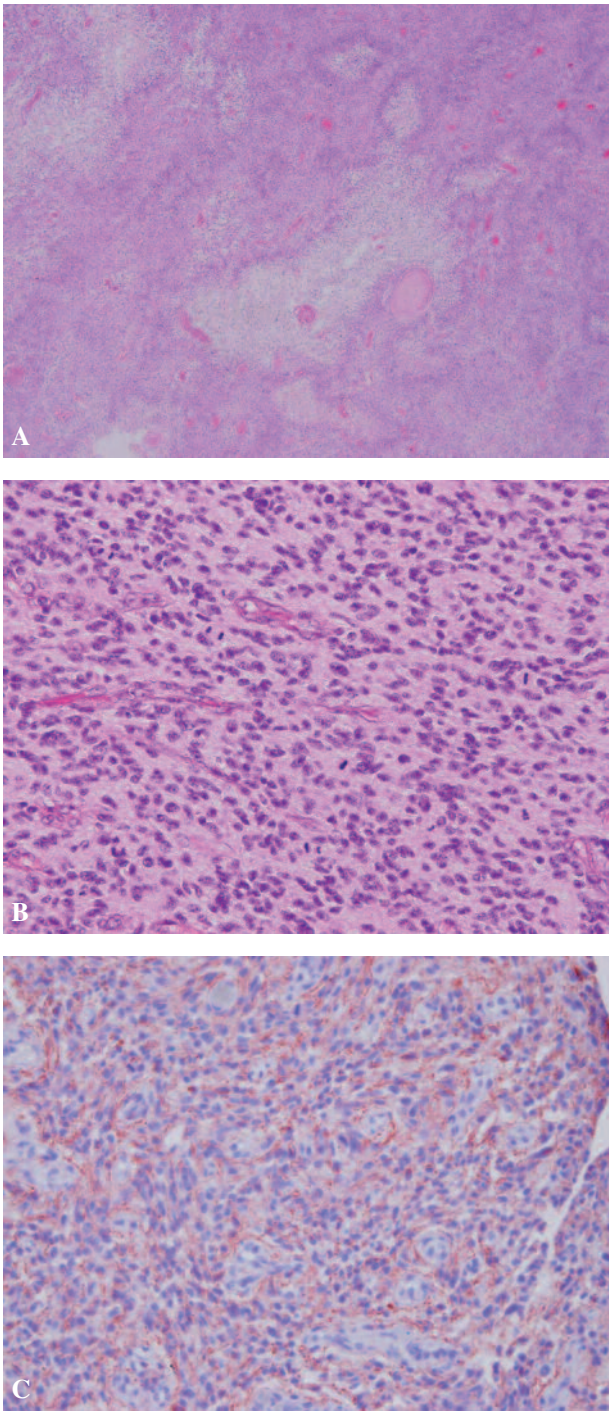



FIG. 2. — Pathological images. (A) Low-power view showed hypercellularity and pseudo-pallisading necrosis (H&E, 40×). (B) High-power view revealed frequent mitoses and vessels proliferation (H&E, 400×). (C) The immunostain of GFAP expressed in the tumor cells (GFAP, 400×).

resonance of alanine (Fig. 1C). This indicated that glioblastoma multiforme should be highly considered as the preoperative diagnosis. In our opinion, even when there are dural tail and CSF cleft signs, proton MR spectroscopy can provide a more accurate assessment of the diagnosis in radiologically atypical cases.

In conclusion, although dural tail is a common and specific sign of meningioma on MRI, other intracranial lesions such as glioblastoma multiforme also can represent the same radiological findings. MR spectroscopy can provide more information for preoperative diagnosis in radiologically atypical cases.

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