MR Spectroscopy-Aided Differentiation: "Giant" Extra-Axial Tuberculoma Masquerading as Meningioma

P.C. Khanna, S. Godinho, D.P. Patkar, S.A. Pungavkar and M.A. Lawande

AJNR Am J Neuroradiol 2006, 27 (7) 1438-1440
http://www.ajnr.org/content/27/7/1438
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**SUMMARY:** Tuberculosis is common in the developing world and in developed nations secondary to increasing immunocompromise in the population. It commonly causes meningitis and parenchymal tuberculomas. We present a case of an unusual masslike “giant” extra-axial tuberculoma during pregnancy. Unusual morphology and size at imaging made meningioma a close differential. MR spectroscopy served to complement MR imaging, providing diagnostic confirmation and depicted findings characteristic of a tuberculoma.

Tuberculosis, an important public health problem compounded by the upsurge of the human immunodeficiency virus usually results from *Mycobacterium tuberculosis* infection, though *Mycobacterium bovis*, a frequent pathogen of the past, and *Mycobacterium avium* complex (*M avium* and *M intracellulare*) are infrequently encountered. Central nervous system (CNS) tuberculomas typically result from hematogenous dissemination and, upon histologic examination, are granulomas with central caseous necrosis.

Although intra-axial tuberculous granulomata are the more common variety, extra-axial lesions are rarely encountered1-6 and may present diagnostic dilemmas that need to be resolved by imaging and allied techniques, so as to circumvent unnecessary chemotherapy, biopsies, and surgery. MR spectroscopy is one such technique that we used.

**Case Report**

A 25-year-old pregnant patient (gravida 1, para 0) presented at 27 weeks’ gestation with severe headaches and focal right-sided convulsions of 3 months’ duration without fever, papilledema, or elevated blood pressure. Elevated erythrocyte sedimentation rate (ESR) was noted. Postpartum lumbar puncture and CSF analysis after imaging studies revealed mild lymphocytic predominance and positive polymerase chain reaction (PCR) for tuberculosis. Antituberculous therapy was begun after suspending breast-feeding.

Two MR examinations (1.5T EchoSpeed; GE Medical Systems, Milwaukee, Wis) obtained at 27 weeks and postpartum revealed an unchanged 3.8 × 2.75 × 3.0-cm left frontal extraparenchymal mass lesion that appeared hypointense on T1-weighted images (T1WI; Fig 1A), with a thick, isohypointense rim. On T2-weighted images (T2WI; Fig 1B) and fluid-attenuated inversion recovery (FLAIR), it appeared predominantly hypointense with central hyperintensity, consistent with necrosis. The lesion appeared dark on diffusion-weighted images (DWI; Fig 2A). Contrast (gadolinium-diethylene-triaminepentaacetic acid [Gd-DTPA]) enhanced MR (Fig 2B) depicted prominent homogeneous central enhancement with a thick, peripheral nonenhancing wall and peripheral rim-enhancement. Adjoining meningeal enhancement (“dural tail”), adjacent CSF cleft, mass-effect, and vasogenic edema were noted.

MR angiography and venography revealed no abnormal vascularity or occlusion. MR perfusion revealed no changes in cerebral blood volume or flow. A differential diagnosis of inflammatory granuloma (with leptomeningitis and cerebritis) versus meningioma was considered.

A volume of interest of 8.0 mL was selected from the center of the lesion on T2WI and image-guided, single-voxel, point-resolved MR spectroscopy (PRESS; repetition time [TR]/echo time [TE] = 1500ms/35ms) was used, because with this technique, lipid contamination in volumes abutting fat structures is negligible.

Multivoxel MR spectroscopy was obtained as well. Findings were consistent with necrotic inflammatory granuloma/tuberculoma, revealing elevated lipid-lactate and choline (Cho) peaks with barely detectable N-acetylaspartate (NAA) and creatine (Cr). No abnormal peak was detected corresponding to alanine. Follow-up MR spectroscopy (Fig 3A,B) remained unchanged. Long TE (144 ms; Fig 3B) MR spectroscopy sequence obtained from an identical location did not suppress the 1.33-ppm peak, confirming predominance of lipid. Findings were more conspicuous with multivoxel spectroscopy.

Based on imaging, spectroscopic, and clinical features, a diagnosis of giant extra-axial tuberculoma was made. Surgical excision biopsy confirmed the diagnosis.

**Discussion**

Although intraparenchymal tuberculomas are common, solid extra-axial tuberculous masses are extremely uncommon.1 We believe our case is unique in that our patient was pregnant and immunocompetent, MR findings mimicked those of a similarly located isolated meningioma, and we were able to successfully use spectroscopy to confirm our diagnosis.

Extra-axial tuberculomas simulating meningiomas may be located in the frontoparietal areas2 and pontine, pericallosal,4 and suprasellar cisterns. Cystic3 and en-plaque meningioma5 mimics and those caused by *M avium* (noted in patients with systemic lupus erythematosus)7 can be encountered. Most appear hypointense to isointense to gray matter1-6 on T1WI and T2WI and variable on DWI, often with a hyperintense rim; those with hyperintense centers on T2WI are usually hyperintense on DWI.7 Meningiomas typically appear isointense to gray matter on T1WI and T2WI and DWI, unless atypical or aggressive.8 Signal intensity is a function of intraleSIONAL lipids, macrophages, fibrosis, and cellular infiltrates.9

In vivo proton MR spectroscopy has been studied extensively in this context. Tuberculomas are characterized by a prominent decrease in NAA/Cr and slight decrease in NAA/Cho.10 Lipid-lactate peaks are usually elevated (86% of tuberculomas11). Paradoxically, lipid/Cr may occasionally be decreased relative to normal cerebral parenchyma, probably resulting from small dimensions of most tuberculomas rela-

Received July 11, 2005; accepted after revision August 31.

From the Department of Magnetic Resonance Imaging, Nanavati Hospital, Mumbai, India.

Address correspondence to Paritosh C. Khanna, 2200 Columbia Pike, Apt # 418, Arlington, VA 22204; e-mail: paritoshkhan@hotmail.com

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3D multivoxel proton spectroscopy with 2D chemical shift imaging interrogates relatively small voxel volumes and overcomes this paradox. Meningiomas invariably have elevated alanine. A high lipid/Cr ratio may also be noted. “Finger-printing” of *M. tuberculosis* cell-wall bio-chemicals in tuberculomas is now possible, facilitating their detection. T1-weighted magnetization transfer MR imaging is a useful adjunct to MR spectroscopy and shows promise in tissue characterization of CNS tuberculomas.

**Conclusions**

When diagnostic dilemmas present themselves, MR spectroscopy considered in perspective with MR imaging and clinicopathologic features can be useful in certain situations. Rare as
they are, extra-axial tuberculomas may masquerade as meningiomas. To our knowledge, ours is the first report of an extra-axial “giant” tuberculoma that bore a striking resemblance to meningioma and in which diagnostic confirmation was obtained using proton MR spectroscopy that was later corroborated by surgical biopsy and histopathology.

References