D I F F E R E N T I A T I N G between infectious and neoplastic leptomeningeal disease on gadolinium–diethylene-triamine penta-acetic acid bismethylamine (Gd-DTPA-BMA)–enhanced magnetic resonance (MR) imaging may pose a diagnostic challenge. Nodular leptomeningeal enhancement occurs more frequently in neoplastic disease than in infectious meningitis. Despite the sensitivity of MR imaging in revealing such lesions, a definitive diagnosis cannot be established based on MR imaging findings alone. The present case illustrates how an infectious process can mimic neoplastic disease on MR imaging and underscores the importance of a complete evaluation, including cerebrospinal fluid (CSF) examination, in establishing a definitive diagnosis and planning treatment.

Case Report

History. This 16-year-old boy initially presented with signs and symptoms suggesting a posterior fossa tumor. Hydrocephalus and a mass lesion arising from the inferior aspect of the fourth ventricle, which extended through the foramen of Luschka, were demonstrated by Gd-DTPA-BMA–enhanced MR imaging. Metastatic lesions were distributed throughout the brain (Fig. 1 left). Magnetic resonance imaging of the spine demonstrated diffuse linear and nodular enhancement coating the entire surface of the spinal canal, consistent with diffuse leptomeningeal disease.

The patient underwent a posterior fossa craniotomy and subtotal resection of the mass. The pathological diagnosis was Stage T4 M3 desmoplastic medulloblastoma. The patient’s postoperative course was complicated by the development of an epidural hematoma, which required surgical drainage and the subsequent placement of a ventriculoperitoneal shunt. He was treated with 39.6 Gy of craniospinal irradiation with boosts to the cranium and posterior fossa of 54 Gy and 59.6 Gy, respectively, over the course of 6 weeks. After a 6-week rest period, the patient received four courses of dose-intensive chemotherapy consisting of vincristine, cisplatin, and moderately high dose cyclophosphamide every 4 weeks. Peripheral blood stem cell support accompanied each course. The duration of therapy from the time of diagnosis was 8 months. On completion of therapy, MR imaging of the brain (Fig. 1 center) and spine and the cytological examination of the lumbar and shunt CSF samples demonstrated no evidence of disease.

On a routine follow-up visit 4 months following completion of therapy, the patient was doing well, with no complaints, fever, or other constitutional symptoms except mild weight loss. The physical examination was unremarkable except for persistent mild seventh cranial nerve palsy.
Radiological Evaluation. As part of routine surveillance MR imaging of the brain and spine, lumbar puncture, and a ventriculoperitoneal shunt puncture were performed 4 months following completion of all therapy. Magnetic resonance Gd-DTPA–BMA–enhanced images demonstrated a new 5 × 10–mm area of leptomeningeal enhancement in the right preptontine cistern (Fig. 1 right); this lesion coincided with the site of prior metastatic tumor seen on images obtained at the time of diagnosis (Fig. 1 left). Magnetic resonance imaging of the spine revealed new foci of leptomeningeal nodular enhancement within the subarachnoid space, at the T-1, T-3, T-4, T-7, and T-12 levels (Fig. 2).

Laboratory Results. The patient’s peripheral white blood cell (WBC) count was 13.4/mm³ with an absolute neutrophil count of 10,450. Examination of the lumbar CSF revealed a WBC count of 1680/mm³, with 66% neutrophils, 20% lymphocytes, and 14% monocytes; a protein level of 169 mg/dl; and a glucose level of 35 mg/dl. The CSF samples obtained from the lumbar puncture and the ventriculoperitoneal shunt contained no tumor cells. The results of CSF cultures obtained from both the ventriculoperitoneal shunt and lumbar fluid were positive for Staphylococcus epidermidis. The results of blood cultures were negative.

Treatment. The patient received a 14-day course of intravenously and intraventricularly administered vancomycin for S. epidermidis meningitis. His ventriculoperitoneal shunt was removed. He remained afebrile throughout the course of his hospital stay.

Repeated MR imaging of the brain (Fig. 3) and spine (Fig. 4), performed 4 weeks after the completion of antibiotic therapy, revealed no evidence of disease. The results of a repeated lumbar puncture revealed a CSF WBC count of 10/mm³, a protein level of 87 mg/dl, and a glucose level of 43 mg/dl. Cerebrospinal fluid cultures revealed no bacteria and the results of cytological examination remained negative for tumor cells. On the patient’s most recent follow-up visit 8 months postinfection, he was well with no evidence of disease on routine MR images.

Discussion

This unique case is a sobering reminder that new lesions detected on MR imaging in patients with brain tumors are not necessarily diagnostic of recurrent disease. Although MR imaging is the imaging modality of choice for identifying central nervous system tumors, the interpretation of resulting images must always reflect a well-considered evaluation that includes assessment of the patient’s clinical status as well as the examination of CSF cytological findings, chemistry, and cultures. Histologically proven gliosis, radiation necrosis,
Inflammatory changes, and arteriovenous malformations may present as new, enhancing lesions on MR imaging, which can easily be misinterpreted as tumor.1,4,6,9,17 When Gd-DTPA–enhanced MR imaging was first introduced, Phillips, et al.,13 reported a modest correlation between nodular patterns of involvement with tumor and diffuse leptomeningeal involvement with inflammatory processes. A subsequent, comprehensive review of a decade’s experience with imaging techniques in neoplastic meningitis demonstrated that the character of leptomeningeal or pachymeningeal enhancement in the presence of infection is not uniform; inflammatory, neoplastic, or reactive processes often look alike, thereby limiting the specificity of MR images.14

The examination of CSF is important in attempting to determine the origin of leptomeningeal disease detected on MR images. Although the level of protein in the CSF may be elevated in both infectious and neoplastic disease, the presence of tumor cells in the CSF confirms neoplastic disease. Even so, a negative result from CSF cytological examination, by itself, is insufficient to rule out recurrent disease. The sensitivity of cytology in confirming a positive MR image is only 70%;2 40%7 of patients found to have neoplastic meningismus at autopsy had negative CSF cytological results premortem.

Culturing the CSF is essential in the evaluation of a new central nervous system lesion, especially in a patient with a ventriculoperitoneal shunt. Staphylococcus epidermidis, once considered avirulent, is now frequently implicated in infections involving central venous catheters and CSF shunts.11,12 Infections caused by S. epidermidis are usually more indolent than those caused by S. aureus. However, fatal infections with S. epidermidis that involve prosthetic devices have been reported, especially in immunocompromised hosts.8

The diagnosis of true infection caused by S. epidermidis compared with that of a contaminated specimen is difficult6,13 and depends on the patient’s clinical status and the isolation of identical organisms on repeated cultures. In our patient, despite the lack of symptoms, the CSF WBC count was significantly elevated, and cultures obtained from both the shunt and the lumbar puncture yielded the same organisms and sensitivities on two consecutive daily evaluations. Furthermore, response to antibiotic therapy was demonstrated by repeated, negative CSF culture results, normalization of CSF WBC, and resolution of MR imaging findings. The possibility of spontaneous remission of an occult, recurrent medulloblastoma cannot be excluded in our patient; however, the likelihood is small and can be effectively ruled out in light of his continued disease-free status, almost 9 months after treatment for S. epidermidis meningitis.

The present case illustrates the grave potential for error in assuming that a new lesion revealed by MR imaging, in a patient previously treated for a brain tumor, represents recurrent disease. Only by combining the clinical data, results from laboratory tests, and, especially, findings from a complete examination of the CSF can a pathological process be definitively diagnosed and an appropriate treatment strategy determined.

References


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