

Improvement of Aggressive and Antisocial Behavior After Resection of Temporal Lobe Tumors

Peter Nakaji, MD*; Hal S. Meltzer, MD‡; Søren A. Singel, MD*; and John F. Alksne, MD*

ABSTRACT. Seizures associated with temporal lobe tumors may rarely manifest as episodic aggressive behavior. We describe 2 cases involving pediatric patients who presented with histories of unusually aggressive and antisocial behavior. Magnetic resonance imaging identified right mesial temporal lobe masses in both patients. After craniotomy for tumor removal, both patients were seizure-free and had marked reductions in their aggressive behavior. Tumors in the temporal lobe may be associated with behavioral problems, including aggression and rage attacks, which can be alleviated with surgical intervention. It is important to distinguish this subgroup of pediatric patients from those with alternative diagnoses such as attention-deficit/hyperactivity disorder or oppositional defiant disorder. *Pediatrics* 2003;112:e430–e433. URL: <http://www.pediatrics.org/cgi/content/full/112/5/e430>; *temporal lobe, tumor, behavior*.

ABBREVIATION. MRI, magnetic resonance imaging.

Tumors of the temporal lobe are a well-known cause of complex partial seizures.^{1–3} Ganglioglioma is the prototype of a tumor that presents in this manner. These tumors can be associated with behavioral abnormalities, both ictally and interictally, in addition to overt seizures.^{4,5} Aggressive behaviors, including rage attacks, are one such behavioral manifestation, particularly when the tumors involve the amygdala. When the tumors appear benign on magnetic resonance imaging (MRI), some practitioners attempt to manage these lesions with observation and medical management alone. This strategy may produce acceptable control of seizures; however, it must be considered against the excellent prognosis provided by surgery. Strong indications for surgery in these patients include tumor growth, incomplete seizure control on medication, and good seizure control but with intolerable side effects from therapy. The association of behavioral abnormalities with a temporal tumor is seldom used to influence surgical decision making. We discuss 2 patients who exhibited profoundly aggressive antisocial behavior and had right temporal lobe tumors identified. In 1

case, a conservative strategy was applied initially. After surgical resection of their tumors, both patients' aggressive behavior decreased markedly.

CASE REPORTS

Case 1

A 13.5-year-old boy had a history of complex partial and secondarily generalized seizures since age 5. A right temporal focus was identified on multiple electroencephalograms. At age 5, MRI of the brain revealed a tumor in the right mesial temporal lobe (Fig 1a and b). The tumor was small and not believed to be causing any mass effect or elevated intracranial pressure. Initial neurosurgical primary and confirmatory consultations recommended a nonoperative approach. No tumor growth was appreciated on serial MRI scans. The patient was placed on carbamazepine 600 mg twice a day and valproate 500 mg twice a day, with moderate control of his clinical seizures, although at times he would have 2 to 3 seizures a day. In addition, he exhibited behavior that was so aggressive and antisocial that he was placed on risperidone and ultimately required inpatient psychiatric placement. He was placed in restraints up to 6 hours per day. He made multiple suicide attempts, exhibited bizarre behavior including trying to ride his skateboard on the freeway, and attempted to commit violent acts against others. His violent acts ranged from impulsive physical abuse of other children to an attempt to drop a brick on the head of an adult. After eventual referral to our neurosurgical group, a frontotemporal craniotomy was performed and the lesion was removed without any specific attempt to resect hippocampal structures (Fig 1c and d). The pathologic diagnosis was ganglioglioma. Postoperatively, the patient had no new neurologic deficits and no additional seizures. He has been weaned off of all antiseizure medication. His follow-up MRI showed no significant enhancement and has remained unchanged after 18 months. Postoperative electroencephalography was normal. The patient has experienced complete resolution of his aggressive behavior. He has been able to rejoin his family and is performing much better academically. He has memory of his previous antisocial behavior, but he no longer has aggressive impulses.

Case 2

A 5.5-year-old boy presented with a 22-month history of aggressive behavior characterized by unprovoked screaming fits and episodic attacks of rage and violence against other children, which led to his eventual dismissal from 2 preschools. Over time, he began to complain that his skin was "on fire" and had episodes of nonsensical speech. He received a diagnosis of chronic sinus disease and underwent an adenoidectomy. He subsequently underwent MRI of the brain, which revealed an enhancing right mesial temporal mass (Fig 2a and b). The mass was not causing mass effect or increased intracranial pressure. His guardian strongly preferred that the mass be addressed surgically. The patient was referred for neurosurgical consultation, and a right temporal craniotomy was performed. The mass was removed via a middle temporal gyrus approach (Fig 2c and d). The pathologic diagnosis was meningioma, with features of meningiomatosis. No new neurologic deficits or clinical seizures have been noted in the postoperative period. A genetic/dysmorphic evaluation revealed no evidence of Gorlin syndrome or type 2 neurofibromatosis. Repeat MRI at 18 months' follow-up showed no evidence of residual or recurrent tumor. The patient's behavior improved dramatically, in regard to both his overall disposition and his intermittent out-

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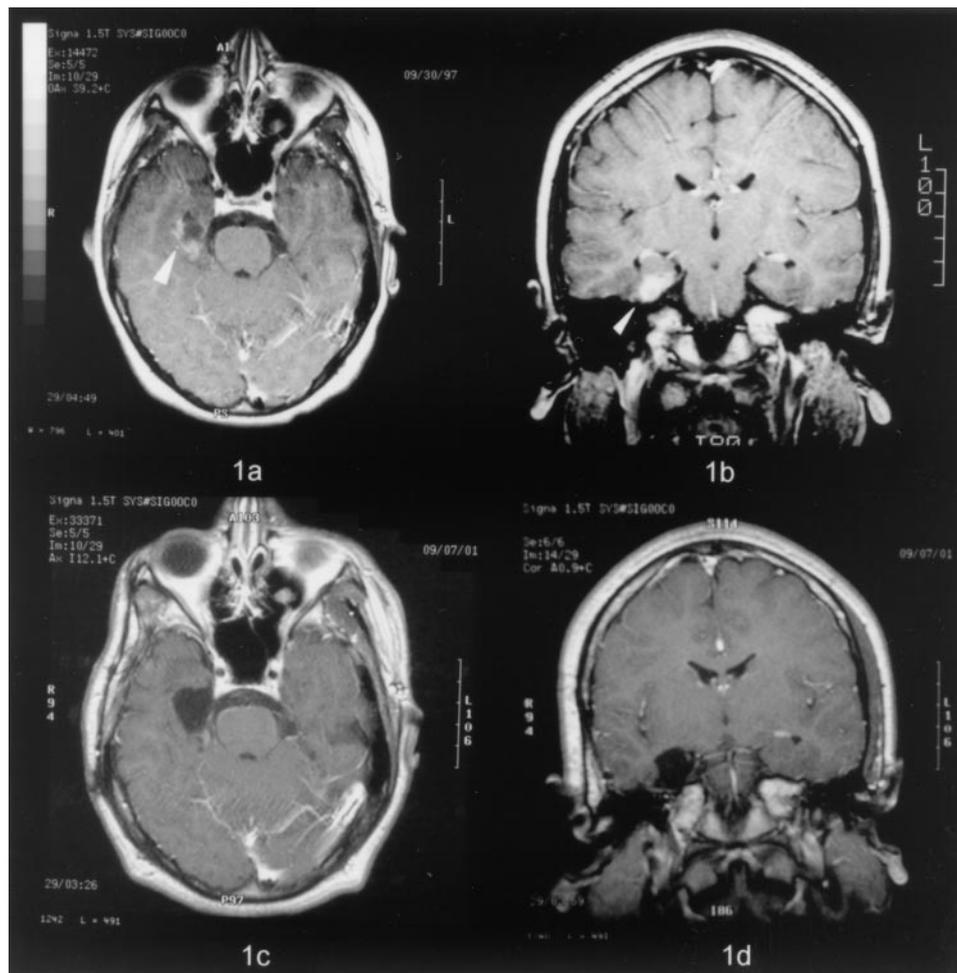


Fig 1. Preoperative axial (a) and coronal (b) MRI with gadolinium shows the right mesial temporal mass discussed in case 1. Postoperative axial (c) and coronal (d) MRI with gadolinium shows the area of resection from case 1.

bursts. He performed well in a modified kindergarten setting with a special education “pull-out” for math and reading and has graduated to a regular first-grade class.

DISCUSSION

When a brain tumor is identified in a patient with behavioral abnormalities, the possibility of a link between the 2 should be considered. Surgical therapy is usually undertaken both to biopsy or remove the tumor for oncologic reasons and to treat any associated seizure disorder. Our cases are significant because they illustrate that surgery can also improve associated rage behaviors. Surgical therapy was perhaps delayed in the first patient because his seizure disorder responded to medical therapy, but certainly improvement in his behavior was at least as important to his ultimate outcome as was control of his seizures.

Reports of similar cases are sporadic. Kaplan et al⁵ described a 13-year-old boy who had episodes of rage, confusion, and spitting and was found to have an epileptic focus associated with a right temporal ganglioglioma. After resection, these events resolved. Caplan et al⁶ described a 10-year-old girl who had intractable complex partial seizures and exhibited aggressive acts as a feature of her epilepsy. Her behavior improved after a left anterior temporal ganglioglioma was resected. There are other reports of

behavioral abnormalities associated with temporal lobe seizure activity but not specifically involving temporal tumors in children. There is conflicting evidence as to whether aggressive behaviors are more likely to arise from the right or the left temporal lobe. Lesions on both sides have been implicated.⁵⁻⁷

A number of recent functional studies have helped to elucidate the mechanism by which aggressive behaviors are produced. There is evidence that these behaviors arise from activation of limbic structures and loss of frontal lobe control. Juhasz et al⁸ examined with positron emission tomography 6 children who had a history of intractable partial epilepsy and aggressive behavior. They found that in aggressive children with epilepsy, the temporal and prefrontal areas showed interictal glucose hypometabolism versus both normal control subjects and nonaggressive children with partial epilepsy. Moreover, they found that temporal and bilateral prefrontal glucose metabolism was inversely correlated with aggressiveness. Because loss of these areas' normal function is associated with aggression, this supports a role for these cortical areas in normal children in the suppression of aggressive limbic activity. Woermann et al⁹ showed in a volumetric MRI study that the left frontal lobe was smaller in aggressive children with epilepsy versus nonaggressive children. van Elst et al¹⁰

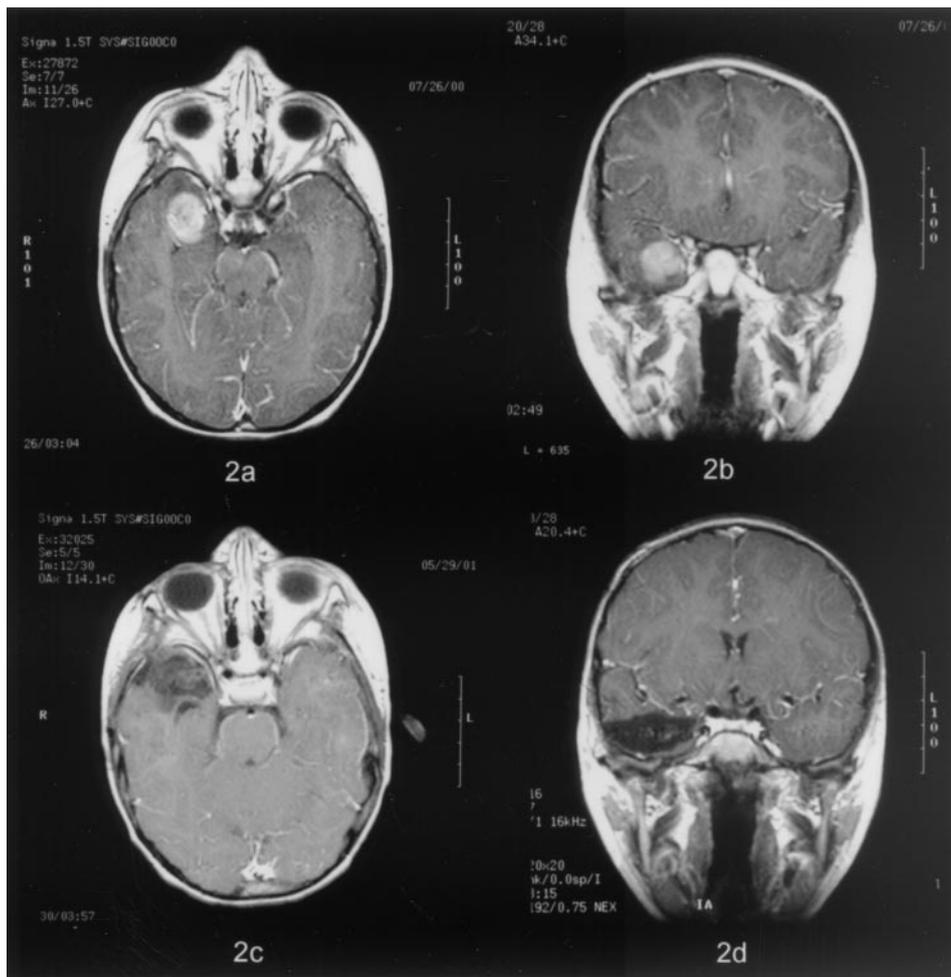


Fig 2. Preoperative axial (a) and coronal (b) MRI with gadolinium shows the right mesial temporal mass discussed in case 2. Postoperative axial (c) and coronal (d) MRI with gadolinium shows the area of resection discussed in case 2.

further examined a group of 25 children with epilepsy and aggressive interictal behavior. They found that compared with nonaggressive children with epilepsy, aggressive children were more likely to have left-sided or bilateral abnormalities on the electroencephalogram and MRI. However, they were no more likely to have lesions in the amygdala.

Gangliogliomas are benign-appearing tumors with well-differentiated neuronal and glial elements. Presenting most frequently as a new diagnosis of seizure disorder, gangliogliomas are usually located in the cerebral hemispheres and are frequently calcified.^{11,12} Malignant transformation is uncommon, and the overall prognosis with surgery is excellent.^{11–16}

Meningiomas are benign tumors that are thought to arise from the arachnoid layer of the meninges of the brain. Meningioma is a rare diagnosis in a young child except in the context of dysgenetic syndromes such as neurofibromatosis type 2 or Gorlin's syndrome,^{17–19} neither of which is present in our patient. To our knowledge, this is the first report of a meningioma in the pediatric age group causing uncontrollable rage attacks.

Temporal lobe tumors are a rare cause of severe behavioral abnormalities in children. In addition to more common indications such as evidence of

intracranial hypertension, focal neurologic findings, and/or seizures, neuroimaging should be considered in behaviorally abnormal patients, especially in the setting of extreme or atypical clinical findings. For this subgroup of patients, neurosurgical intervention can be curative.

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