Conservative Management of Presumed Low-Grade Gliomas in the Asymptomatic Pediatric Population

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Key words
- Conservative
- Incidentaloma
- Low-grade gliomas
- Nonsurgical
- Pediatric brain tumors

Abbreviations and Acronyms
LGG: Low-grade glioma
MRI: Magnetic resonance imaging
MRS: Magnetic resonance spectroscopy
NAA: *n*-acetylaspartic acid

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OBJECTIVE: **The optimal management of asymptomatic children with small, nonenhancing intracranial lesions presumed to be low-grade gliomas (LGGs) is not entirely clear in the literature. However, surgical intervention via resection or biopsy is not without risk and is of questionable long-term benefit in children with stable lesions. We present a series of 12 patients with incidentally detected, small, nonenhancing, intracranial lesions that were managed with watchful waiting and serial magnetic resonance imaging (MRI) scans.**

METHODS: **We retrospectively reviewed a series of 12 children (eight boys, four girls) with T1 hypointense and T2 hyperintense intracranial lesions <2 cm without enhancement or surrounding edema.**

RESULTS: **Most patients (n = 5, 41.7%) received MRI studies after suffering a traumatic injury with evidence of an abnormality seen on computed tomography scan. Others received MRI scan as part of headache work-up (n = 4, 33.3%). The majority of lesions were located infratentorially (n = 8, 66.7%), whereas other locations included the frontal lobe and thalamus. The median age of the patients upon identification of the intracranial abnormality was 10 years (range, 1–19 years of age). Patients were followed for a median of 16.7 months (range, 2.7–59.5 months). The most common diagnosis based on clinical and radiographic features of these lesions consisted of LGG. No patient underwent surgery, radiation therapy, or chemotherapy except one patient, in whom the lesion grew in size. Surgical pathologic diagnosis in this case confirmed World Health Organization grade II astrocytoma.**

CONCLUSIONS: **Our case series suggests that conservative management and close follow-up of incidental radiographic lesions consistent with LGGs is a safe and effective initial strategy in the pediatric population. In cases in which lesion size or quality changes, surgical resection may be necessary to confirm diagnosis. Further studies that include a larger number of patients and longer follow-up period are required to compare outcomes between this approach and initial surgical, radiation, or chemotherapy management strategies.**

INTRODUCTION

Advanced diagnostic imaging, especially magnetic resonance imaging (MRI), has led to the detection of incidental intracranial abnormalities in the pediatric population (9). Most of these intracranial lesions, suggestive of low-grade gliomas (LGGs), are nonenhancing, <1.5 cm in diameter, and do not have surrounding edema. The management of patients with these lesions requires an interdisciplinary approach because treatment algorithms for these patients are not well defined and no universal protocol exists (8, 11). Therefore, a thorough examination of the various treatment modalities used and their associated outcomes compared with conservative strategies will help establish the optimal management paradigm in these patients.

Treatment options vary from conservative "watchful waiting" with serial clinical and radiographic assessments, to gross total resection and adjuvant radiation and/or chemotherapy. The Joint Section on Tumors of the American Association of Neurological Surgeons/Congress of Neurological Surgeons has provided practice guidelines that suggest that biopsy should be standard practice regardless of whether observation or further treatment is pursued (2). However, in the pediatric population, biopsy of these lesions puts children at risk for surgical and anesthetic complications. In addition, significant limitations of diagnostic biopsy exist, including sampling error, particularly with small lesions in the posterior fossa, which puts patients at risk for additional surgeries (9).

We present a series of 12 patients with incidentally detected, small, nonenhancing, intracranial lesions that were treated conservatively with watchful waiting and serial MRIs. To the best of our knowledge, similar reports are not documented in the pediatric brain tumor literature. Our findings provide insight into the natural history of these lesions and

Table 1. Patient Characteristics: Demographic Data on All Patients Included in the Study

	Number (%)
Patients	12
Male	8 (66.7)
Female	4 (33.3)
Age, years	
Mean	11.3
Median	10
Range	1–19
Presenting signs and symptoms	
Incidental finding after trauma/ concussion	5 (41.7)
Headache workup	4 (33.3)
Other (developmental abnormality workup, neck pain)	2 (16.7)
Febrile seizures	1 (8.3)

Table 2. Lesion Location Characteristics

Location	Number of Patients	Percent
Frontal	2	16.7
Temporal	0	0
Parietal	0	0
Occipital	0	0
Thalamus	1	8.3
Cerebellar	8	66.7
Brainstem	1	8.3

offer a safe and effective alternative to invasive management.

METHODS

Study Design and Subjects

A neurosurgical database of patients who had intracranial lesions that were not surgically treated was queried to identify all patients who presented to two senior neurosurgeons between 2007 and 2011 at the Children's Hospital of Philadelphia. A retrospective analysis of these patients was performed.

Clinical Data

Patient data, including demographic information, clinical presentation, radiologic films and reports, and management decision analysis were abstracted from inpatient hospital records, neurosurgical outpatient clinic charts, and neuro-oncology outpatient clinic charts. All intracranial lesions were managed conservatively with serial MRIs requested within 3 months of the initial abnormal MRI. Imaging studies that remained stable were then repeated at 6 months, and annually, or as determined by the same senior neurosurgeon. All patients underwent imaging on a 1.5- or 3-Tesla MRI scanner with and without contrast. Two subjects also underwent magnetic resonance spectroscopy (MRS). Measurement of lesion size, presence of contrast enhancement or surrounding edema was obtained from neuroradiology reports. Neurological function was determined by clinical examination by the neurosurgeon and neuro-oncologist.

RESULTS

Patient Characteristics and Presentation

From 2007 to 2011, 12 patients presented to the pediatric neurosurgery clinic with radiographic evidence of an intracranial lesion less than 2 cm in diameter with minimal to no enhancement. Table 1 summarizes the patient demographics. Two-thirds of the patients were boys (n = 8) and one-third were girls (n = 4). Median age at the time of abnormal imaging was 10 years (range, 1 to 19 years). The most common clinical presentation prompting neuroimaging was trauma (41.7%), followed by persistent headaches (33.3%). Seizures were not a common presentation in our patients, except in the youngest patient in the series, who presented with febrile seizures at age 1 year. All patients were neurologically intact upon examination in neurosurgery or neuro-oncology clinic. No patient demonstrated clinical signs of neurofibromatosis-1, a disorder in

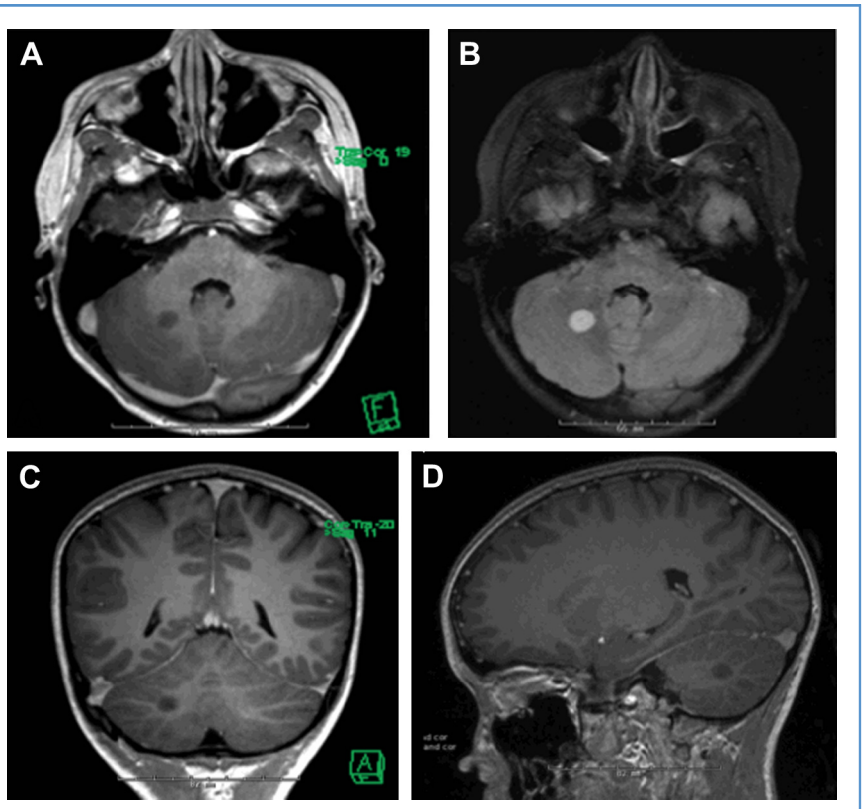

Figure 1. Ten-year-old female who presented after trauma (Patient 6: Table 3). Axial T1 with contrast (**A**), T2 fluid-attenuated inversion recovery (**B**), coronal T1 with contrast (**C**), and sagittal T1 with contrast (**D**) magnetic resonance imaging at initial diagnosis demonstrate a T1 hypodense and T2 hyperdense nonenhancing 1-cm lesion in the right cerebellum.