

Our report documents the second and third cases of postinfectious myasthenia gravis in children and the first case of pediatric myasthenia gravis associated with herpes varicella-zoster. Although our cases and other reports of postinfectious myasthenia gravis are rare, the onset of symptoms soon after an infectious illness and the gradual improvement over time argue more for a causative than an incidental association. However, detailed immunologic studies will be needed in the future before a causative association can be firmly established. Based on our cases and related reports, we recommend that myasthenia gravis be included in the differential diagnosis of postinfectious weakness, along with other disorders, including Guillain-Barré syndrome. In comparison with noninfectious cases, myasthenia gravis precipitated by an infectious agent appears to be relatively mild and, in most instances, self-limiting.

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## A 9-Year-Old Boy With a History of Large Perinatal Stroke, Infantile Spasms, and High Academic Achievement

### ABSTRACT

The prognosis for intellectual development in children with symptomatic infantile spasms is usually poor. We report a 9-year-old boy with a history of a large, presumed perinatal, left middle cerebral artery infarct discovered when he developed infantile spasms at 6 months of age. The infantile spasms responded to treatment with adrenocorticotrophic hormone. He attained cognitive milestones at normal times, requiring only speech therapy for dysarthric speech. At 9 years of age, he has seizures and a severe right hemiparesis but is an articulate honor roll student in advanced English classes. The development of infantile spasms after large-branch middle cerebral artery stroke does not always predict future mental retardation. (*J Child Neurol* 2005;20:444-446).

Mental retardation occurs frequently after infantile spasms, and children with symptomatic infantile spasms are at particularly high risk. We describe a child with symptomatic infantile spasms associated with a large, presumed perinatal, left middle cerebral artery stroke who at 9 years of age is an honor roll student in regular and advanced age-appropriate classes.

### Case Report

This child was born to a 30-year-old gravida 3 mother with one previous miscarriage. The full-term gestation was complicated only by fifth disease at the beginning of the second trimester and one nonfunctional kidney in the mother. Delivery was spontaneous and vaginal, with no complications. His birthweight was 7 pounds 2 ounces.

At 6 months of age, he developed infantile spasms. Both upper extremities would jerk outward, and his head would drop to his chest several times in succession. He was noted to have mild motor delay at this point. He could roll only to his side and could not sit. His mother reported slightly decreased right arm use in the weeks before the spasms started. Physical examination at that time showed a head circumference of 44 cm (50th percentile), decreased movement, and increased tone of the right side, the arm more than the leg, with a tendency to fist with the right hand. Strength and tone in the left arm and leg were normal. Reflexes were slightly brisker on the right. An electroencephalogram (EEG) demonstrated asymmetric background, left lower than right, with generalized disorganization and episodic polyspike-wave activity. Cerebral magnetic resonance imaging (MRI) demonstrated a large area of cystic encephalomalacia in the left middle cerebral artery territory (Figure 1). The spasms did not respond to initial treatment with phenobarbital but ceased on adrenocorticotrophic hormone (ACTH) at 60 units per day. However, ACTH gel became unavailable after 2 weeks of therapy, and he was switched to prednisone 5 mg three times daily. He continued to do well, and a prednisone taper was started after 2 weeks. He was referred to physical and occupational therapy.

Motor development was delayed; he took his first steps at 26 months. He continued to have a significant right hemiparesis. He said "dada" and "mama" at 12 months of age but required speech therapy because he was difficult to understand. He did well in regular classes from kindergarten through third grade and in his first semester of third grade achieved "A" grades in all areas except handwriting, physical education, and art. In English class, he has been placed in the Indiana State Personal Excellence Through the Achievement of Knowledge program, an enrichment program for gifted students. He passed his Indiana Statewide Testing for Educational Purposes in all areas, with particularly high scores in reading comprehension

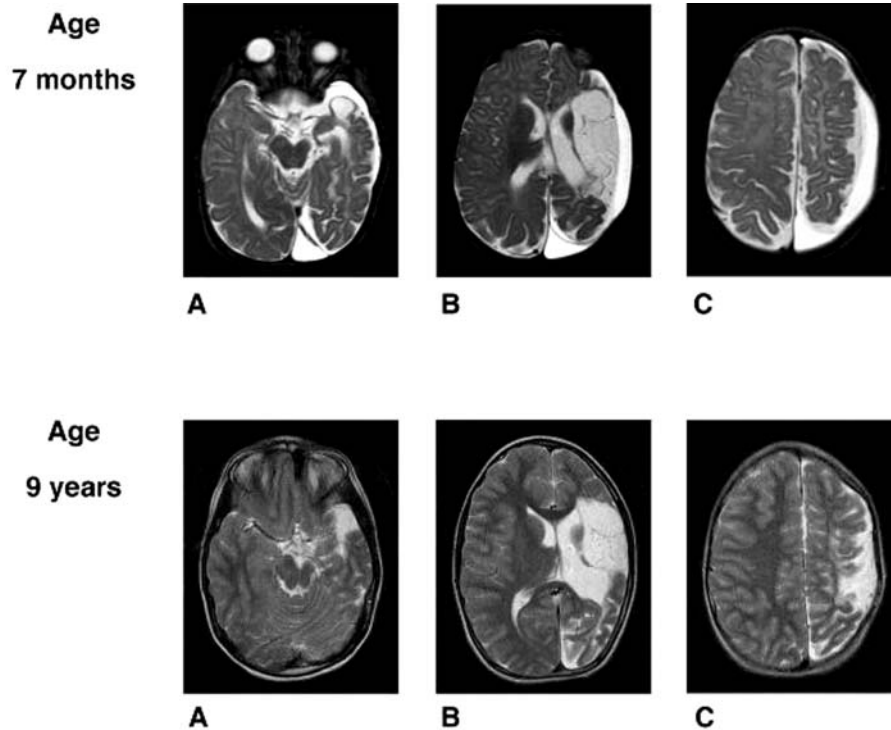


Figure 1. T<sub>2</sub>-weighted axial magnetic resonance images of the patient at 7 months and at 9 years of age demonstrating encephalomalacia in the left middle cerebral artery territory and wallerian degeneration in the left cerebral peduncle. The relative volume of the encephalomalacia appears to be slightly less on the later scan. Scans are compared at similar levels (A, B, C). Head position varies slightly between the scans.

(score = 85, passing = 66), literature response and analysis (score = 90, passing = 72), algebra and functions (score = 93, passing = 60), and problem solving (score = 91, passing = 48); he was classified as "high-achieving" in mathematics.

He developed episodes of staring and shaking at 9 years of age. His EEG showed mild generalized slowing with left hemisphere focal slowing and left temporal epileptiform discharges. He was started on oxcarbazepine and became seizure free. He had some episodes of angry behavior at home and school, but his family thought that these were due more to his increasing frustration with his physical limitations than to the medication.

Physical examination in the clinic at 9½ years of age was most notable for right hemihypotrophy. His head circumference was 50.2 cm (10th percentile), height was 131.5 cm (15th percentile), and weight was 24.8 kg (10th percentile). Cardiac, pulmonary, and skin examinations were unremarkable. On mental status examination, he was a pleasant, articulate young man in third grade who read a seventh grade paragraph with good comprehension and did fourth grade-level math problems accurately, including subtracting and multiplying in his head and adding change correctly. Cranial nerve examination was remarkable for a right lower quadrantanopia, a slightly smaller right eye and right pupil (5 mm vs 5.5 mm on the left), slight flattening of the nasolabial fold, and a weaker right shrug (3+/5). He had a right hemiparesis, with 4-/5 strength in the biceps, triceps, and grip; 5-/5 strength in the right leg; and slightly decreased sensation to sharp and light touch over the right arm and leg. On laboratory evaluation, protein C activity, protein S activity, antithrombin III, activated protein C resistance, methylenetetrahydrofolate reductase C677T mutation, prothrombin gene defect, and homocysteine level were unremarkable. He did have an elevated level of antiphosphatidyl serine IgM of 8 multiples of the mean (normal ≤ 4 multiples of the mean) and was homozygous for the methylenetetrahydrofolate reductase A1298C mutation. Repeat MRI showed encephalomalacia in the area of the old stroke, smaller than on the previous MRI (see Figure 1).

## Discussion

We describe a child who developed symptomatic infantile spasms associated with a large perinatal stroke and is high-achieving in all academic areas

at 9 years of age. Previous studies suggest that our patient's degree of intellectual achievement is unusual in children with symptomatic infantile spasms. Several large studies have reported a rate of mental retardation after infantile spasms of over 75%<sup>1-3</sup>; perinatal etiology,<sup>3</sup> abnormal neurologic examination at the time of presentation,<sup>2-4</sup> and cerebral abnormalities on radiographic imaging<sup>2-4</sup> have all been described as predictors of poor cognitive outcome. Our patient had all of these poor prognostic signs and still had an excellent cognitive outcome.

Our patient's quick response to ACTH could have been an early favorable prognostic sign. Riikonen found that a good response to ACTH predicted a better outcome.<sup>2</sup> However, several other studies have found no correlation between the initial response to ACTH and eventual cognitive outcome.<sup>3,5</sup>

Many children with large unilateral perinatal strokes in the middle cerebral artery territory who do not have infantile spasms go on to develop normal intelligence with near-normal language skills; studies vary as to whether the side of infarction affects language outcome.<sup>6,7</sup> The percentage of children with a "normal" cognitive outcome after perinatal stroke varies among studies. Twenty-seven of 46 children (59%) studied by Sreenan et al had normal cognitive outcomes; they had a mean of 42.1 months of follow-up and included children with both unilateral and bilateral strokes in varying territories.<sup>8</sup> Twenty-nine of 33 children (88%) with arterial ischemic neonatal stroke (unilateral and bilateral) studied by deVeber et al had normal expressive speech; 32 (97%) had a normal cognitive outcome.<sup>9</sup> Trauner et al administered intelligence tests to 18 children with unilateral perinatal ischemic or hemorrhagic infarctions, and all (100%) had IQs within the normal range.<sup>10</sup> Interestingly, our patient's stroke appeared to be slightly smaller on follow-up imaging over 8 years later, even after adjusting for slightly different positioning in the scanner (see Figure 1). This has been described in other children with perinatal stroke.<sup>11</sup> It is possible that this brain growth contributed to his recovery.

Our patient did suffer from other sequelae of his stroke. He has significant hemiparesis and now has complex partial seizures with motor manifestations. His initial MRI was predictive of this; children with perinatal large-branch infarcts that involve the cortex, internal capsule, and basal ganglia have a high likelihood of developing hemiplegia.<sup>12</sup> However, these

impairments have not kept our patient from participating in age-appropriate activities. He plays basketball on a local junior team that encourages all members to play. We have suggested constraint-based therapy (restraint of the strong arm to force use of the plegic arm) to increase his use of his right side<sup>13</sup> and referred him to our botulinum toxin clinic.

Our patient demonstrates that it is possible for a child with symptomatic infantile spasms associated with a large unilateral perinatal stroke to have an excellent cognitive outcome.

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## Electroencephalography, Doppler Vascular Scanning, and Single Photon Emission Computed Tomography in a Child With Hydranencephaly and Intractable Seizures

### ABSTRACT

In a child with hydranencephaly and refractory seizures, the electroencephalogram showed a flat isoelectric pattern with no significant slow waves or epileptiform activity; cranial computed tomography, magnetic resonance imaging, Doppler vascular scanning, and single photon emission computed tomography (SPECT) were done to define the pathogenesis of the seizures. The investigations were suggestive of a lack of significant cortical, subcortical, or thalamic structures with hypoplasia of the vermis and cerebellum. SPECT showed little activity in the base of the brain and cerebellum. The cause of the seizures remained unclear in spite of the investigations. (*J Child Neurol* 2005;20:446–449).

Hydranencephaly is a condition in which most of the brain mantle, including the cortex and the hemispheric white matter, is severely damaged, liquefied, and replaced by cerebrospinal fluid-filled sacs lined by a thin membrane lying against the dura mater.<sup>1,2</sup> Seizures are not uncommon in infants with hydranencephaly and can originate in the small islands of relatively preserved cortex or in the brain stem; they can also be a form of brainstem release phenomenon.<sup>1,3–5</sup> However, there are no reports of these children developing intractable seizures. To find the origin of seizures in this infant, we performed several investigations, including single photon emission computed tomography (SPECT), Doppler vascular scanning, and brain imaging studies. We report the results of these tests in an infant with hydranencephaly.

### Case Report

A female baby was born at term with a birth weight of 2800 g to a 21-year-old Arab woman. The parents were nonconsanguineous. Antenatally, sonograms were suggestive of hydranencephaly, but the parents chose to continue with the pregnancy in accordance with their religious and cultural beliefs. The Apgar scores were 7, 8, and 9 at 1, 5, and 10 minutes, respectively. The body weight was 2.8 kg, the head circumference was 33 cm, and the length was 47 cm (all on the 10th percentile). The anterior fontanel was wide, and coronal and sagittal sutural separation was evident. She had low-set ears and a broad, depressed nasal bridge. There were fixed contractures of the hips and knees. Neurologically, the baby was lethargic, with a poor cry and a poor suck, and hypertonic, with depressed deep tendon reflexes. Occasional jerky movements of the face and limbs, unassociated with eye movements or automatisms, were noted within the first 24 hours after birth. There was no visual fixation or following. The pupils were pinpoint, and the optic disks were pale, although the vessels looked normal. There was no response to sounds. Cardiovascular, respiratory, and abdominal examinations were normal.

Computed tomography of the brain showed total replacement of cerebral hemispheres with cerebrospinal fluid. At the level of the posterior fossa, extremely hypoplastic structures were detected; the posterior fossa was predominantly filled with cerebrospinal fluid. It was possible to differentiate individual structures such as the brain stem, fourth ventricle, bilateral cerebral peduncles, vermis, and cerebellar hemispheres (Figure 1). At the level of incisura and slightly above, extremely hypoplastic thalami were detectable.

The electroencephalographic (EEG) tracing showed an isoelectric pattern with no significant activity over any of the leads. Brain SPECT was per-