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Bilateral, Hyperdense Middle Cerebral Arteries Predict Bihemispheric Stroke

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Abstract

The hyperdense vessel sign is a debated topic in terms of its sensitivity and specificity for acute cerebral ischemia. Bilateral, hyperdense middle cerebral artery signs are rare presentations of bilateral cerebral infarction. We describe a 17-year-old boy with a history of cerebral palsy and a repaired atrial septal defect, presenting with lethargy and respiratory failure. Noncontrast computed tomography of the brain revealed bilateral, hyperdense middle cerebral artery signs, and he subsequently demonstrated bilateral cerebral infarctions in the distributions of the middle cerebral arteries. Hyperdense artery signs must alert physicians to evaluate patients for stroke, with an especially high index of suspicion for pediatric patients with hyperdense vessels, who are less likely to present with atherosclerotic disease causing vascular calcifications; rather, hyperdense artery signs could be an early sign of large-vessel thrombosis and cerebral infarction.

Case Report

We describe a 17-year-old African American boy with a history of asthma, a previously repaired atrial septal defect, and spastic quadriplegia secondary to neonatal hypoxic-ischemic encephalopathy. He had been brought to the emergency center for acute-onset lethargy and respiratory distress. He was nonambulatory and nonverbal at baseline, and manifested significant mental retardation. Seven days before presentation, the patient was prescribed β -agonist inhalers for an asthma exacerbation, which he had been using every 4 hours while awake. He presented to the emergency department 8 hours after the time he had last been seen as normal, with shallow breathing progressing to apnea, necessitating emergent intubation. On examination, the patient was obtunded, did not follow commands, and minimally grimaced at pain. His brainstem reflexes were preserved. He withdrew from pain slowly in his right upper and bilateral lower extremities, with no response to pain in his left upper extremity. His muscle tone was increased, with chronic contractures most notable in his lower extremities. Noncontrast computed tomography of the brain revealed hyperdensities in the left (Fig 1A) and right (Fig 1B) middle cerebral arteries. Magnetic resonance imaging of the brain revealed bilateral basal ganglia and frontal hyperintensities in diffusion-weighted imaging, with corresponding hypointensities in apparent diffusion

coefficient sequences, indicating acute strokes. No infarcts were evident in the brainstem area. The bilateral hemispheres were extensively involved in a fluid attenuation inversion recovery sequence. On magnetic resonance angiography, the right middle cerebral artery abruptly terminated, and left internal carotid artery and was occluded as well (Fig 1C). An electrocardiogram revealed atrial fibrillation, and a subsequent transesophageal echocardiogram indicated no thrombus, but an extremely dilated left atrium. These findings were consistent with cardioembolic strokes in both hemispheres, including the right middle cerebral artery and left internal carotid artery territories.

Discussion

Acute, bihemispheric cerebral strokes are rare, and only 2 cases were reported previously [1,2], and one of these patients exhibited bilateral hyperdense middle cerebral artery signs [2]. The hyperdense-vessel sign is a debated topic in terms of its sensitivity and specificity for acute cerebral ischemia [3-5]. It is present in 15-33% patients with acute stroke [4-6], and in 41.2% patients with acute middle cerebral artery stroke ipsilateral to the hyperdense middle cerebral artery sign [5]. Differential diagnoses of a hyperdense middle cerebral artery sign include calcification of the vessel wall and subintimal hemorrhage. Hyperdense middle cerebral artery signs usually disappear within 10 days, and therefore a repeated computed tomography scan can help differentiate thrombus from calcification. A study of 272 patients with a first acute stroke indicated that hyperdense middle cerebral artery signs offered 30% sensitivity but 100% specificity [5]. Clinically, a hyperdense middle cerebral artery sign is associated with higher initial scores on the National Institutes of Health Stroke Scales and less favorable neurologic outcomes [7]. Intravenous tissue plasminogen activator treatment of acute strokes in this subgroup of patients was demonstrated to be effective [7]. Multiple hyperdense arteries on noncontrast computed tomography scans are very rare, and may indicate extensive vessel calcifications rather than thrombi. Although a unilateral, hyperdense middle cerebral artery sign can be predictive of acute thrombus in the artery, Rauch et al. reported on 7 cases with bilateral hyperdense middle cerebral artery signs, and none had bilateral middle cerebral artery strokes [3].

Only 2 articles reported on acute bilateral hemispheric strokes [1,2]. Pascual Castroviejo and Larrauri [1] described a 14-month-old boy with a right middle cerebral artery stroke, as confirmed by angiogram and pneumoencephalogram. Nineteen days later, the child developed a left middle cerebral artery stroke and died. Bihemispheric strokes were confirmed by autopsy, and the cause was proposed to be fibroelastosis of the endocardium [1]. Another patient, a 76-year-old woman with an atrial septal aneurysm, presented with coma and rapid progression to death. Computed tomography of the brain revealed bilateral, hyperdense middle cerebral arteries, indicating acute thrombi, as confirmed by a cerebral angiogram [2]. Our case is unique in several respects. First, this is only the second reported case of acute bilateral hemispheric strokes with bilateral hyperdense middle cerebral artery signs on computed tomography. Second, strokes are a rare occurrence in pediatrics, and may involve atypical clinical presentations, as in our patient. Third, bilateral middle cerebral artery hyperdense signs are not necessarily reliable indicators of acute thrombi [3], but in our patient, they represented the earliest sign of large-vessel cerebral infarctions.

It is crucial for clinicians and neuroradiologists to maintain a high index of suspicion in the presence of hyperdense artery signs on noncontrast computed tomography scans, even when they occur in multiple vessels, and despite atypical signs and presentations of strokes. In pediatric patients, atherosclerotic disease causing vascular calcification is rare. Hence, one must also be alert to the possibility of thrombosis and infarct in the presence of a hyperdense middle cerebral artery sign in a child.

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Figure 1.

Computed tomography scan of brain indicates left (A) and right (B) hyperdense middle cerebral arteries (arrows) without evidence of hyperdensity in basilar artery. (C) Magnetic resonance angiography of brain reveals absence of distal flow in right middle cerebral artery and left internal carotid artery.