Significant Period Between Presentation and Diagnosis in Basilar Artery Occlusion
Five Cases and the Lessons Learned

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Case One
A 37-year-old woman without significant medical history was seen at an outside facility with 7 days of headache and fluctuating right hemiparesis. She had a normal head computed tomography (CT). She was diagnosed with migraine, received analgesics, and was discharged. Her headache and hemiparesis had improved but did not completely resolve. Three days later, she presented to a second facility with the same symptoms of headache and right-sided weakness and more recent onset of nausea and vomiting. She was again treated for migraine but developed worsening hemiparesis and difficulty with secretions requiring intubation. Magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA) revealed basilar artery occlusion (BAO) and left vertebral artery dissection. She underwent successful endovascular recanalization of the basilar artery but severe neurological deficits remained.

Case Two
A 41-year-old was brought to the emergency department where she was poorly responsive but had a nonfocal neurological examination. Urine toxicology showed cocaine and marijuana. Head CT was limited by motion but was otherwise unremarkable. She was initially treated for presumed seizures, but her level of consciousness worsened and she was intubated. She was empirically treated for meningitis/encephalitis. Thirty-six hours after admission when the cerebrospinal fluid was found to be normal and she failed to improve, magnetic resonance imaging and magnetic resonance angiography was performed, which demonstrated BAO with a large pontine infarct. Work-up showed lupus anticoagulant.

Case Three
A 45-year-old woman with lupus presented with 24 hours of nausea/vomiting, intermittent dizziness, dysarthria, and right-sided hemiparesis. Head CT was unremarkable. On admission, neurological examination showed right facial droop, dysarthria, right-sided hemiparesis, hyperreflexia, and a right extensor planter reflex. Non-vascular etiologies were pursued initially. One day after presentation, worsening of right-sided weakness and headache prompted vascular imaging showing proximal BAO. Endovascular recanalization was attempted but was unsuccessful.

Case Four
A 57-year-old man with a history of stent-assisted coiling of a basilar artery aneurysm presented with brief loss of consciousness, transient dysarthria, decreased sensation in his left face, and left upper extremity drift. Head CT showed stent artifact. Intravenous tPA was not given because of his low National Institute of Health stroke scale of 2. He then developed seizure-like activity, deteriorated further neurologically, and required intubation. He was treated for seizures/nonconvulsive status epilepticus and transferred to a tertiary facility. On arrival, he was unresponsive, had absent brainstem reflexes, and extremity movement limited to triple flexion. Repeat head CT demonstrated extensive brainstem hypodensity. Diagnostic angiography demonstrated BAO, but no intervention was attempted because of extensive infarction. It was later learned that he had not taken antiplatelet agents the previous week.

Case Five
A 55-year-old man presented to his primary care physician with intermittent vertigo and was prescribed meclizine and a muscle relaxer. Two weeks later, he came to the emergency department with severe vertigo, vomiting, dysarthria, diplopia, and inability to ambulate. Reports of vertigo among factory coworkers prompted concern for occupational exposure. CT of the head and lumbar puncture were unremarkable. Worsening confusion was attributed to sedatives. Soon after admission, he suffered cardiac arrest and was resuscitated. His examination remained nonfocal except for poorly reactive pupils. Vessel imaging demonstrated left vertebral artery occlusion with thrombus extending into the basilar artery.
He underwent successful thrombectomy but his neurological examination remained unchanged, and comfort measures were initiated.

Discussion
BAO is uncommon, causing ≈1% of all strokes. The resulting strokes can be devastating, resulting in severe disability or death in over 50% of cases. The Basilar Artery International Cooperation Study (BASICS) trial reported that 26 of 27 BAO patients who did not receive any treatment died within 1 month and 1 patient was institutionalized as bedridden and incontinent. Timely diagnosis allows the use of acute interventions to recanalize the vessel, which can include intravenous thrombolysis, intra-arterial thrombolysis, and mechanical endovascular procedure. Recanalization has been shown to improve functional outcomes in these patients. The time window for intervention has not been established for BAO, but endovascular interventions in published series have often been longer than the typical windows used in the anterior circulation. Time to intervention is likely less important than degree of baseline ischemia, which can be assessed on plain CT using posterior circulation Acute Stroke Prognosis Early CT score.

The diagnosis of BAO is complicated not only by its relative infrequency, and therefore, limited exposure among clinicians, but also by variability in clinical presentation. We have described 5 cases of BAO treated between 2010 and 2013, in which there was a significant time period between presentation and diagnosis and ultimately poor neurological outcome. These cases of diagnosis of BAO have several things in common. All patients were young, ranging from 37 to 57 years, and none of these patients had atherothrombotic disease of the posterior circulation. Although less common at these ages, strokes including BAO occur at all ages. In 1946, Kubik and Adams described the first known case series describing BAO in 18 patients with a pathological diagnosis of BAO, and these patients ranged in age from 32 to 70 years old. More recently, the BASICS group described baseline characteristics of 619 adult patients from 48 centers around the world with radiologically confirmed BAO, and these patients ranged in age from 19 to 95 years of age. Not only does BAO occur in young people but this subset of patients with BAO has been shown to have better outcomes. This may be due in part to higher rates of embolic occlusion in younger patients. Emboli tend to occlude the top of the basilar artery, a location that has been associated with higher recanalization rates. The improved outcomes in younger patients with BAO emphasize the importance of diagnosis and treatment in this age group.

In the cases detailed above, all but one patient originally had mild transient symptoms and presented for medical care as many as 2 weeks before the catastrophic worsening. Though coma, tetraplegia, and the locked-in syndrome remained the feared clinical presentation of BAO, patients with BAO often present with mild, transient neurological symptoms, which if left untreated may decompensate significantly. In a case series of 85 patients with basilar artery (or bilateral distal vertebral artery) occlusion, 53 patients were later documented to have had prodromal symptoms ultimately attributed to the BAO. The most common prodromal symptoms in their angiographically proven cohort were vertigo and nausea followed by headache and neck ache. A notable portion of their patients also developed early diplopia, dysarthria, and hemiparesis. Most commonly, these patients had symptom onset about 2 weeks before formal diagnosis. Prodromes, minor strokes, or fluctuating symptoms have been described in 40% to 50% of patients in other series, as well. In addition, all of the cases described above had an early head CT, which was unremarkable. None of these patients had early vessel imaging. Unenhanced head CT is commonly performed with acute neurological signs and symptoms, but early imaging is relatively insensitive in detecting early signs of ischemia, especially in the posterior fossa where imaging artifact limits its usefulness. In the correct clinical context, the hyperdense basilar artery sign is associated with basilar thrombus, but it is not always present and can be easily overlooked. Ultimately in patients with clinical neurological findings suggestive of a posterior circulation event, further assessment with angiography via CT angiogram, magnetic resonance angiography, or conventional angiography is required to visualize the basilar artery and rule out filling defects consistent with BAO.

Summary
Basilar artery occlusion remains a challenging pathological process. Time delay between presentation and diagnosis and treatment can be associated with poor outcome, but the low frequency and variable presentation in BAO makes rapid diagnosis difficult. Clinicians should maintain an index of suspicion for basilar artery occlusion in patients of any age who present with focal neurological symptoms that could be referable to the basilar artery. Timely vessel imaging is critical for the diagnosis and initiation of treatment in these patients.

TAKE HOME POINTS
• Syndromes from basilar artery occlusion can begin with focal neurological symptoms that occur days to weeks before deterioration.
• Basilar artery occlusion is associated with poor outcome.
• Computed tomography of head is not a sufficient imaging modality to evaluate for basilar artery occlusion, and imaging of vessels is required.
• Basilar artery occlusion should be considered even in patients who are young or have no history of atherothrombotic disease.

Disclosures
None.

References
Delay in Diagnosis of Basilar Artery Occlusion


**Key Words:** acute stroke ■ basilar artery ■ diagnosis ■ prognosis
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