

TEACHABLE
MOMENT

When Medical Care Leads to Harm— Difficulty Finding Words A Teachable Moment

Erin Chamberlain, MD
Department of
Medicine, Oregon
Health and Science
University, Portland.

Matt DiVeronica, MD
Veterans Affairs
Portland Health Care
System, Portland,
Oregon.

Renee Segura, MD
Veterans Affairs
Portland Health Care
System, Portland,
Oregon.

Story From the Front Lines

A 66-year-old man with diabetes, hypertension, and peripheral vascular disease presented with complaint of fevers, rigors, and malaise along with a mild frontal headache of 7 days' duration. He was febrile and hypotensive though alert and oriented. Examination findings were consistent with cellulitis in his right lower extremity. Blood cultures grew group G *Streptococcus*, with cellulitis as the presumed source for sepsis. Infectious disease specialists were consulted.

Given the indolent time course of symptoms, and a grade I/VI diastolic murmur not auscultated at presentation, endocarditis was considered, and a transthoracic echocardiogram was recommended. Despite a lack of documented abnormalities on neurologic examination, a computed tomographic (CT) angiogram of his head and neck was also recommended to evaluate for mycotic aneurysm out of concern for the history of headache. Findings of the echocardiogram were negative for valvular regurgitation or vegetation. The CT angiogram revealed stenosis of various segments of the intracerebral arteries and a 4-mm aneurysm of the left posterior cerebral artery without evidence of infectious cause.

After recovery and discharge, a neurosurgery consult was obtained regarding management of the incidental discovery of cerebral aneurysm. The neurosurgeon believed that because the aneurysm was asymptomatic, it did not require intervention; however, further evaluation of the stenotic intracerebral arteries with cerebral angiography was recommended to better understand the pattern of blood flow in these areas. Cerebral angiography did not show an aneurysm.

Three days following cerebral angiography, the patient presented with acute-onset confusion, word-finding difficulty, and short-term memory defects. Magnetic resonance imaging of the brain revealed multiple foci of acute ischemic lesions in different vascular territories consistent with embolic stroke. Further evaluation determined the source to be iatrogenic due to cerebral angiography. At last follow-up, patient was undergoing physical and speech therapy to aid his recovery.

Teachable Moment

The patient described herein experienced harm as a result of overutilization of available health care services, specifically unnecessary diagnostic imaging modalities. His initial testing with head CT angiography led to a cascade of further unnecessary imaging studies, most notably the cerebral angiography that resulted in significant patient harm in the form of iatrogenic stroke. With a more judi-

cious approach to testing, this patient's stroke may have been prevented.

The modified Duke criteria¹ used to assist in the diagnosis of infective endocarditis require presence of 2 major, 1 major and 3 minor, or 5 minor criteria. They incorporate consideration of the offending microorganism as well as evidence of endocardial involvement on echocardiogram.¹ This patient's blood cultures grew an atypical organism that cleared after 1 day, and the echocardiogram findings were negative for intracardiac involvement. He met only 1 major criterion (auscultation of a regurgitant murmur) and 2 minor criteria (fever and bacteremia with an atypical microorganism). Despite his lacking evidence for endocarditis, the patient underwent CT angiography to rule out one of its neurologic complications. This revealed both incidental and asymptomatic segmental cerebral artery stenosis and aneurysm, which by size carried less than a 1% chance of enlargement or bleeding per year and should not have merited further evaluation by cerebral angiography.² This patient experienced the unfortunate 2.6% risk of neurologic complication from this procedure, which led to a further cascade of preventable diagnostic imaging to confirm its iatrogenic source.³

The physicians involved in this case demonstrated concern for the potential outcome of a ruptured mycotic aneurysm resulting in stroke. However, the available clinical data that ruled out endocarditis and its complications were overlooked, ultimately resulting in the very same feared complication but caused iatrogenically.

An alternative approach would have been to first rule in or out the diagnosis of endocarditis using the modified Duke criteria.¹ If endocarditis was ruled in, the next step would have been to consider potential complications. Intracranial mycotic aneurysms are relatively rare, comprising less than 10% of all neurologic complications of endocarditis.⁴ In a study of patients with infective endocarditis, the negative predictive value of absent focal neurologic deficits for the presence of mycotic aneurysm was 99%. Notably, the absence of altered mental status alone conferred a negative predictive value for mycotic aneurysm of 94%.⁵ In patients not meeting criteria for endocarditis, such absent examination findings should be especially reassuring. This evidence suggests that CT angiography should be used only when focal neurologic deficits are present.

We work in a medical system that allows us to provide excellent care of patients, though when advanced diagnostic tools or treatments are overused, they can result in grave harm. With evidence-guided care, we will not be left struggling to find words to explain how an unnecessary procedure cost a patient his own words.

Corresponding

Author: Erin Chamberlain, MD, Department of Medicine, Oregon Health and Science University, Mail Code VA P-3-GP1, 3181 SW Sam Jackson Park Rd, Portland, OR 97239 (chambeer@ohsu.edu).

Published Online: June 8, 2015.
doi:10.1001/jamainternmed.2015.2334.

Conflict of Interest Disclosures: None reported.

Additional Contributions: We thank the patient described in this article, who has read the submitting draft and permitted publication of this information.

1. Li JS, Sexton DJ, Mick N, et al. Proposed modifications to the Duke criteria for the diagnosis of infective endocarditis. *Clin Infect Dis.* 2000;30(4):633-638.

2. Wiebers DO, Whisnant JP, Huston J III, et al; International Study of Unruptured Intracranial Aneurysms Investigators. Unruptured intracranial aneurysms: natural history, clinical outcome, and risks of surgical and endovascular treatment. *Lancet.* 2003;362(9378):103-110.

3. Kaufmann TJ, Huston J III, Mandrekar JN, Schleck CD, Thielen KR, Kallmes DF. Complications of diagnostic cerebral angiography: evaluation of 19,826 consecutive patients. *Radiology.* 2007;243(3):812-819.

4. Novy E, Sonnevile R, Mazighi M, et al. Neurological complications of infective endocarditis: new breakthroughs in diagnosis and management. *Med Mal Infect.* 2013;43(11-12):443-450.

5. Monteleone PP, Shrestha NK, Jacob J, et al. Clinical utility of cerebral angiography in the preoperative assessment of endocarditis. *Vasc Med.* 2014;19(6):500-506.