

Subarachnoid Hemorrhage—the Initial Manifestation of Bacterial Endocarditis

Report of a Case with Negative Arteriography and Computed Tomography

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The case of a patient who suffered a nontraumatic subarachnoid hemorrhage (SAH) associated with normal angiography is reported. Three weeks later he developed an embolic stroke secondary to a nonhemolytic *Staphylococcus epidermidis* endocarditis of the mitral valve; thus, the SAH was the initial manifestation of bacterial endocarditis. Bacterial endocarditis should be considered a possible cause of SAH, especially in the 7% of patients with angiographically negative SAH. (*Neurosurgery*, 7: 488–490, 1980)

Key words: Bacterial endocarditis, Cerebral aneurysm, Cerebral angiography, Cerebral embolism, Embolic stroke, Mitral valve, Subarachnoid hemorrhage

Neurological complications remain a significant problem in bacterial endocarditis (BE), although rarely will patients present with nervous system (NS) complications (4, 10). We are presenting the clinical features of a patient with a nontraumatic subarachnoid hemorrhage (SAH) associated with negative pan-cerebral arteriography and computed tomography (CT); 3 weeks after the SAH he developed an embolic stroke secondary to a nonhemolytic *Staphylococcus epidermidis* endocarditis of the mitral valve.

CASE REPORT

A 24-year-old, right-handed man developed the sudden onset of headache, nausea, and transient right upper extremity paresis. There was no history of trauma, and he was not receiving any medication. His past history was unremarkable except for an episode of rheumatic fever at age 11, which had left him with a persistent heart murmur. There was no history of antecedent infection or dental work. His general examination was normal except for the presence of a pansystolic heart murmur. He was afebrile, and his neurological examination was normal, except for mild nuchal rigidity. A CT scan was normal and a lumbar puncture revealed bloody cerebrospinal fluid (CSF) with 70,000 red blood cells (RBCs)/mm³ and 37 white blood cells (WBCs)/mm³; the protein content was 48 mg/dl, the glucose content was 46 mg/dl, and the CSF was xanthochromic after centrifugation; routine smears for bacteria and fungi were normal, as were cultures. A diagnosis of SAH was made and the patient was treated with bedrest, fluid restriction, phenobarbital, and epsilon-aminocaproic acid (36 g/day). Six days after admission pan-cerebral arteriography was performed and was normal. The patient was discharged from the hospital 6 days later without any complaints.

Three days after his discharge from the hospital he acutely developed right arm paresis and numbness, dysphasia, and partial seizures involving the right upper extremity. On examination he was afebrile with normal vital signs, and his neck was supple. Osler's nodes were present on the fingers and his spleen was enlarged. A Grade IV/VI pansystolic murmur was heard at the apex with radiation to the axilla; it was louder than on previous examination. A mild right hemiparesis and hemianesthesia were present; muscle stretch reflexes were increased on the right, and a right Babinski sign was present. He

also had a slight expressive dysphasia. CT revealed a hemorrhagic infarct in the left parietal area. His hemoglobin value was 11.8 g, and his WBC count was 8400 with 73% polymorphonuclear leukocytes. An erythrocyte sedimentation rate was 44 mm/hour. Because of the evidence of an embolic stroke, a heart murmur that had increased in intensity, and evidence of systemic emboli, the diagnosis of BE was considered strongly. Eleven blood cultures were obtained and the patient was then started on treatment with tobramycin, 90 mg tid, and oxacillin, 12 g/day. Echocardiography of the heart revealed left atrial enlargement, but no evidence of vegetations or tumor. Seven days after being drawn, the blood cultures (10 of 11) became positive, as did a culture obtained at the time of biopsy of an Osler's node; the offending organism was a coagulase-negative *Staphylococcus epidermidis*. Ten days after admission, the patient developed left upper quadrant pain; a liver-spleen scan was positive for an infarct in the spleen, which had not been present on the study performed on admission to the hospital. He remained afebrile throughout his hospital stay and was discharged after 6 weeks of intravenous antibiotic therapy. A CT scan at this time was normal, except for a slight lucency where the hemorrhagic stroke had occurred. Blood cultures made after the discontinuation of antibiotics revealed no growth of organisms. The following laboratory tests gave normal results during his hospital stay: antinuclear antibody test, monospot, cryoglobulins, rheumatoid factor, creatine phosphokinase, lactic dehydrogenase, serum glutamic-pyruvic transaminase, prothrombin time, partial thromboplastin time, blood urea nitrogen, antistreptolysin O titer, CSF analysis (including cultures), bone scan, and gallium scan. The patient remains well 1½ years later, without recurrent NS symptoms or signs.

DISCUSSION

Fifteen to 30% of patients with BE will develop neurological signs at some time during their illness, and 6 to 15% will present with a neurological chief complaint (4, 5, 10). In Osler's series the incidence of neurological signs was 12.5%; 3% of his patients presented with primary neurological problems (8). A higher percentage of patients with BE with NS complications will die than will those without NS involvement (5, 6, 10). In a review of 218 patients with BE by Pruitt et al., 84 of them (39%) had neurological complications; 49 (58%) of these patients died, in

contrast to 27 (20%) of those who did not suffer NS complications (10). Of these 218 patients with BE, 36 (16.5%) presented initially with NS manifestations, and a SAH was the initial manifestation of BE in 0.6% (10). Jones et al. found that the mortality rate in their patients with NS complications was 50%, with an overall mortality rate of 14% among all of their patients with BE (6). Harrison and Hampton noted mortality rates of 67% in their patients with NS complications and 44% in patients with BE without NS involvement (5).

Cerebral embolism is the most common NS complication of BE, having been reported in 6 to 31% of patients with BE (4, 6, 10, 16). Cerebral emboli occur more commonly in patients with mitral valve infections and in those with infections caused by more virulent organisms. Microscopic emboli may occur in approximately 11% of patients with BE and may be detected only at postmortem examination of the brain (10). Some 3% of all patients who develop cerebral emboli will have an infected heart valve as a source. The morbidity and mortality rates are significantly increased in patients with BE who suffer embolic stroke. Thirty of the 37 patients (80%) of Pruitt et al. with an embolic stroke from BE died (10). Pearce and Guze noted an early mortality rate of 67% in their patients with BE with embolic strokes (9), and Rabinovitch et al. noted that the early mortality rate for their patients with embolic strokes was 30%, with a late mortality rate of 50% (11).

Focal seizures occur more commonly in endocarditis patients with acute embolic disease; generalized seizures are usually secondary to metabolic derangements or are medication-related (e.g., lidocaine or penicillin toxicity) (4, 10). Cerebral mycotic aneurysm has been noted to occur in 2 to 10% of patients with BE (1, 10, 12, 14). Three to 6% of all intracerebral aneurysms are mycotic in origin; they tend to occur more frequently during the course of acute BE, rather than late in the course of subacute BE (10).

SAH not of aneurysmal or embolic origin apparently occurs rarely in patients with BE. No mention is made in the Cooperative Study of Intracranial Aneurysms and SAH of nonmycotic aneurysm-related SAH in BE (7). Five of the 218 patients reported by Pruitt et al. suffered a SAH during their bout with BE, although only 2 (0.6%) presented with a SAH apparently not related to an aneurysm or embolism (10).

In the past, 18 to 27% of patients with verified nontraumatic SAH have had a normal cerebral arteriogram (7, 15). However, with modern angiographic techniques (femoral catheter studies allowing easier and better visualization of the cerebral arteries and subtraction and magnification techniques), the incidence of angiographically negative SAH is about 7% (15).

The etiology of our patient's SAH is a bit obscure. A likely explanation is that it was caused by a ruptured aneurysm that spontaneously occluded after the hemorrhage. This may well be a significant factor in those 7% of cases with negative arteriograms. However, focal vasculitis has been reported as a cause of SAH (3), and in BE a proliferative endarteritis can occur, which can lead to vessel rupture and occlusion. Angiographically negative SAH has been reported after streptococcal glomerulonephritis in children, and a focal vasculitis (infectious or immune complex-related) is a likely cause of the hemorrhage in these patients (2).

The patient reported here had transient right-sided weakness at the time of his SAH, and this recurred at the time of the embolic stroke. Thromboembolism can occur from arterial cerebral aneurysms (13) and it is possible that, if he did have an aneurysm that clotted spontaneously, an embolus could have arisen from it and caused symptoms in the same arterial distribution. However, in our patient there was evidence of systemic embolization at the time of his embolic stroke, so a new embolus from the heart to the brain likely occurred. Two of the patients reported by Pruitt et al. who had mycotic

aneurysms experienced transient neurological symptoms consistent with an embolism to the cerebral vessel in which the aneurysm was located (10).

The importance of this case lies in the fact that BE is a rare but treatable cause of SAH. In the 7% of cases of SAH with a normal arteriogram, BE should be considered as a possible cause of SAH, especially if a heart murmur is present. Prompt recognition of this disorder will lead to the appropriate therapy and, although the prognosis is worse in those patients with NS complications of BE, favorable results will hopefully be obtained.

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COMMENTS

This is a neat and scholarly review of an increasingly rare cause of subarachnoid hemorrhage. To our knowledge, we have not seen this mechanism, and it is interesting to speculate as to the precise pathogenesis of hemorrhage falling upon an embolic event and, in particular, a septic embolic event. The possibility of an aneurysm formation with rupture and subsequent thrombosis is attractive, but equally likely is a possibility of direct ischemic and infectious damage to the wall by the embolus, which then breaks up and moves along, allowing high

pressure arterial blood to leak from the damaged segment. This paper is a valuable reminder for all to search for and identify the cause of every subarachnoid hemorrhage.

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The authors have presented an interesting case of subarachnoid hemorrhage in a patient with subacute bacterial endocarditis. They have called our attention to yet another unusual cause of bloody spinal fluid and one that should be kept in

mind. I would differ in managing the case in that I think a repeat angiogram, when the patient again presented with neurological deficit, should have been carried out. The possibility of finding an aneurysm at that time would probably be greater. Even though the patient has done well for the past year and a half, if an aneurysm is still present, it should be dealt with on an elective basis, rather than awaiting another subarachnoid hemorrhage.

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