J Neurosurg 91:517, 1999

Beating aneurysm sign: angiographic evidence of ruptured aneurysm tamponade by intracranial hemorrhage

Case illustration

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KEY WORDS • subarachnoid hemorrhage • intracerebral hemorrhage • tamponade • transmural pressure

Aneurysms can exhibit small changes in volume occurring with the heart cycle as a result of systemic pressure variation. Cine phase-contrast magnetic resonance angiography has revealed that intracranial aneurysms can undergo increases of up to 1.5 mm in diameter and 51% in volume between systole and diastole.[1]

A 72-year-old woman presented with subarachnoid hemorrhage. A computerized tomography scan (Fig. 1A) revealed intraventricular and intraparenchymal blood (Fisher Grade 4); digital acquisition angiography performed 15 minutes later identified a ruptured right middle cerebral artery bifurcation aneurysm (Fig. 1B and C) that exhibited extreme cyclic volume excursions coinciding with the patient's cardiac rhythm of 90 beats per minute. Reflux of contrast material into the external carotid artery (Fig. 1B) showed an internal carotid artery circulation time that was delayed compared with that of the external carotid artery; this was consistent with elevated intracranial pressure (ICP). High frame-rate acquisition (15 frames/second) followed by quantitation of aneurysm filling showed a 2.52-fold pulse-synchronous projected area increase (Fig. 1D), corresponding to an approximately fourfold volume increase between the end systole (Fig. 1C) and end diastole (Fig. 1B). We postulate that elevated ICP caused by the aneurysm rupture and high interstitial pressure caused by the hematoma surrounding the aneurysm decreased the transmural pressure gradient and led to partial collapse of the compliant aneurysm wall.[3,4] In addition to absent cerebral perfusion when ICP approaches systolic pressure,[2] we propose that a beating aneurysm is an angiographic sign suggestive of a markedly increased ICP and that its appearance portends poor patient outcome. Although we did not measure ICP, we hypothesize that it may have approached systemic diastolic pressure to unmask the compliant nature of the aneurysm wall. Six hours after completion of the angiogram the patient died of uncontrolled intracranial hypertension and a herniation syndrome.

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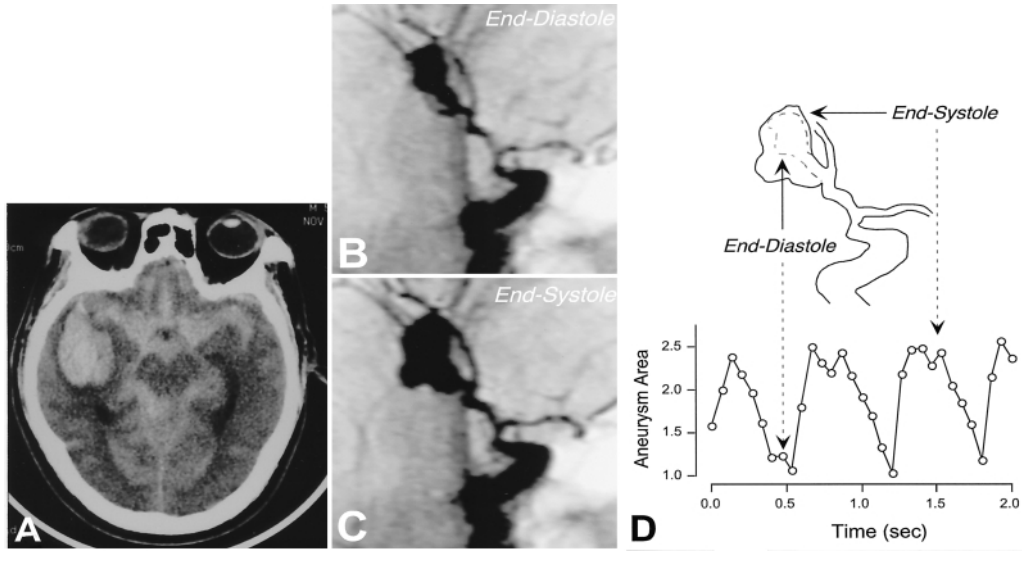


FIG. 1. A: Axial computerized tomography scan demonstrating subarachnoid and intraparenchymal hemorrhage. B and C: Digital subtraction angiograms of the right internal carotid artery revealing the ruptured middle cerebral artery bifurcation aneurysm at the end diastole (B) and end systole (C). D: Quantitative image analysis of the aneurysm outline illustrating the pulse-synchronous aneurysm filling.

Manuscript received December 22, 1998; accepted in final form May 3, 1999.

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