MR Imaging in Pretruncal Nonaneurysmal Subarachnoid Hemorrhage
Is It Worthwhile?

Eelco F.M. Wijdicks, MD; Wouter I. Schievink, MD; Gary M. Miller, MD

Background and Purpose—The cause of pretruncal (perimesencephalic) nonaneurysmal subarachnoid hemorrhage is not known. MRI of the brain or spine is often performed to exclude any other vascular abnormalities. Its diagnostic value is not known.

Methods—We used MR imaging of the brain with routine sequences, gadolinium enhancement, and additional thin T1-weighted axial sections following a triple dose of contrast.

Results—We performed MR imaging of the brain in 18 patients with a pretruncal nonaneurysmal subarachnoid hemorrhage. The focal nature of the subarachnoid hemorrhage exclusively in front of the brain stem was confirmed in 14 patients studied within 7 days of the ictus. No vascular abnormalities were found in 17 cases, including 14 patients with gadolinium enhancement. An incidental capillary telangiectasia was found in 1 patient. Fluid-attenuated inverse recovery MR additionally documented blood in the sulci due to cerebrospinal fluid recirculation of blood. Five patients underwent MR imaging of the spine, and no arteriovenous malformations were found.

Conclusions—MR imaging did not reveal a source of pretruncal subarachnoid hemorrhage. The cost of MR imaging probably outweighs the benefit in the evaluation of this variant of subarachnoid hemorrhage. (Stroke. 1998;29:2514-2516.)

Key Words: subarachnoid hemorrhage ■ angiography ■ magnetic resonance imaging

Many patients with a spontaneous subarachnoid hemorrhage of unknown origin have CT scan findings that are compatible with a so-called pretruncal (previously called perimesencephalic) hemorrhage. This variant of subarachnoid hemorrhage was first described by van Gijn and coworkers1 and initially labeled “perimesencephalic nonaneurysmal subarachnoid hemorrhage.” We recently coined the more anatomically correct term “pretruncal nonaneurysmal subarachnoid hemorrhage,” because in most published series of patients cisternal blood was located predominantly in front of the entire brain stem (truncus cerebri).2

After the initial cerebral angiogram is performed, it is common practice to exclude an arteriovenous malformation or venous angioma in the brain stem or cervical spine by MR imaging. No large series of MR imaging in this subset of subarachnoid hemorrhage have been reported since a preliminary study with 4 normal MRIs involving only axial images.3 We report a review of MR imaging in pretruncal subarachnoid hemorrhage. Our study indicates that MR imaging probably is not a cost-effective diagnostic test in the evaluation of this benign clinical entity.

Subjects and Methods
Between 1992 and 1998, 24 patients were admitted to Mayo Medical Center with a pretruncal nonaneurysmal subarachnoid hemorrhage. The diagnosis was suggested on the basis of hemorrhage restricted to the cisterns in front of the brain stem and suprasellar cistern on third generation, high-resolution CT scan (General Electric) and at least 1 normal 4-vessel cerebral angiogram. MR imaging was performed in 14 patients within the same admission period, with an interval of 2 to 7 days (median, 4 days) after the ictus. In the remaining 4 patients, MRI was performed at least 3 months after the initial presentation. Routine sequences included 5-mm T1-weighted sagittal and T2-weighted images. Gadolinium was administered in 14 of 18 patients with 4-mm T1-weighted axial or coronal images. In 7 consecutive patients we additionally performed thin (1.5- to 3-mm) T1-weighted axial sections through the brain stem following a (single or triple) dose of gadolinium contrast. In 1 patient an additional 2-dimensional MRA/MRV was performed, and in 1 patient a phase contrast MRA with velocity encoding of 5 cm/s and 10 cm/s. Three-dimensional time of flight MRA, which included the circle of Willis, was performed in 11 patients. Five patients underwent an MRI of the cervical spine. Gadolinium was administered in 4 of these patients.

Results
No vascular abnormalities were found in 17 of 18 patients with MR imaging of the brain. In 1 patient, a vascular abnormality was found after gadolinium enhancement and interpreted as a capillary telangiectasia. Details have been reported in a separate publication.4 Routine MR imaging showed increased T1 signal intensity only in front of the brain stem in all 14 MR scans performed within 1 week of the ictus.
The distribution of blood was prepontine and interpeduncular cisterns in 7 patients, additional extension into the premedullar cistern in 3, prepontine cistern only in 3, and interpeduncular cistern only in 1 patient. Additional findings on MRI were hyperintense lesions in the cerebellum and thalamus in 1 patient. Additional fluid-attenuation inverse recovery (FLAIR) images were available in 6 patients and showed cerebrospinal fluid signal abnormality along the sulci in 2 patients (Figure 2). Fifteen patients (63%) underwent an additional 4-vessel cerebral angiograms but were all normal (except for junctional dilatation at the top of the basilar artery and an infundibular widening of the posterior communicating artery in 1 patient each). MRI of the cervical spine was normal in all 5 patients.

**Discussion**

This subset of subarachnoid hemorrhage is defined by acute or gradual onset of severe headache, normal level of consciousness, absent localizing neurological signs, a limited amount of blood in front of the brain stem, and a normal 4-vessel cerebral angiogram. Serious concern remains about an undiagnosed vascular malformation in patients with an angiogram-negative subarachnoid hemorrhage. A second cerebral angiogram is usually performed only after review of the first study when there is uncertainty about its quality. We have recently emphasized the possibility of missing a cerebral aneurysm in pretruncal subarachnoid hemorrhage. This concern is further fostered by a recent report showing that cervical medullary arterial venous fistulas are a frequently unrecognized cause of subarachnoid hemorrhage. Therefore, MRI of the brain and cervical spine is performed in many academic institutions to exclude any other vascular abnormalities.

Our series is the first large study of MR imaging in pretruncal nonaneurysmal subarachnoid hemorrhage. Axial and sagittal views demonstrated the extension of the hemorrhage in the cisterns exclusively in front of the brain stem but failed to show a vascular lesion in 17 of 18 patients. Our previous finding of a capillary telangiectasia on MRI in 1 case suggested a venous etiology of this disorder. However, we were unable to confirm this finding, which strongly suggests that this abnormality has been incidental. FLAIR images additionally showed recircula-

*Figure 1.* Composite of T1-weighted MR images (sagittal view) of different patterns of pretruncal subarachnoid hemorrhage. Left, interpeduncular cistern; middle, prepontine cistern; right, involvement of all pretruncal cisterns.

*Figure 2.* MR image (axial views; FLAIR images) of a patient with a pretruncal subarachnoid hemorrhage with an increased signal in the prepontine cistern and sulci.
tion of subarachnoid blood over the sulci. To our knowledge, this is a new observation in this subset of subarachnoid hemorrhage, but it should not be mistaken for a more diffuse pattern of subarachnoid hemorrhage indicating a possible aneurysmal source. Small lesions were found in the cerebellum and thalamus, likely representing emboli associated with repeated vertebral angiograms.

Our study sample consisted of only 18 MR brain scans. Thus, the 95% confidence interval by the binomial distribution for 1 of 18 (5.6%) is relatively wide (0.1% to 27.3%). Nonetheless, we believe that routine MRI of the brain and spine unnecessarily adds to the cost of evaluation. Perhaps MRI of the spine should be performed only in patients with clinical leads of a ruptured spinal arteriovenous malformation. MRI of the brain may also be useful only to confirm subarachnoid hemorrhage in patients with ambiguous CT scans, such as blood predominantly in the prepontine cisterns, but in all our patients imaged with high-resolution CT scans, the subarachnoid hemorrhage was clearly identified. Nonetheless, over time, newer technologies of MRI will be developed; therefore, MRI as a research tool to investigate the cause of this puzzling but benign variant of subarachnoid hemorrhage may remain useful.

References
MR Imaging in Pretruncal Nonaneurysmal Subarachnoid Hemorrhage: Is It Worthwhile?
Eelco F. M. Wijdicks, Wouter I. Schievink and Gary M. Miller

*Stroke*. 1998;29:2514-2516
doi: 10.1161/01.STR.29.12.2514

*Stroke* is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1998 American Heart Association, Inc. All rights reserved.
Print ISSN: 0039-2499. Online ISSN: 1524-4628

The online version of this article, along with updated information and services, is located on the
World Wide Web at:
http://stroke.ahajournals.org/content/29/12/2514

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in *Stroke* can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to *Stroke* is online at:
http://stroke.ahajournals.org/subscriptions/