
The recent advance of 3D CT angiography has allowed us precisely to diagnose cerebral aneurysms.\(^1\) The diagnostic accuracy of 3D CT angiography has been reported to be equal or superior to that of catheter angiography including digital subtraction (DS) angiography.\(^2\) Especially in surgical cases of cerebral aneurysms, 3D CT angiography provides useful and practical information for surgery. In some institutions, ruptured aneurysm surgery has been performed on the basis of 3D CT angiography findings alone.\(^3\)\(^,\)\(^4\)

In our study of 60 patients with ruptured aneurysms evaluated prospectively both with 3D CT angiography and catheter angiography, we detected all the ruptured aneurysms with 3D CT angiography that we did with catheter angiography and demonstrated a 100% diagnostic accuracy on ruptured aneurysms. In the diagnosis of associated unruptured aneurysms, 3D CT angiography allowed us to visualize a 0.8-mm aneurysm of the anterior communicating artery, which was confirmed during the operation but catheter angiography had failed to demonstrate.\(^5\) Hashimoto, et al.,\(^1\) reported on six small (2–3 mm) ruptured aneurysms that were not revealed on DS angiography but were on 3D CT angiography.\(^6\)

There have been several reports that 3D CT angiography detected aneurysms that catheter angiography did not.\(^6\)\(^,\)\(^8\)\(^,\)\(^9\) Furthermore, Villablanca, et al.,\(^4\) evaluated the diagnostic accuracy of 3D CT angiography in identifying 41 very small cerebral aneurysms (\(<\) 4 mm in diameter) and reported that the sensitivities of 3D CT angiography and DS angiography were from 98 to 100%, and 95%, respectively, and the specificity of 3D CT angiography and DS angiography was 100% in both. The 41 very small aneurysms consisted of 33 aneurysms that were 4 mm in maximal diameter, 13 aneurysms that were 3 mm, and 4 aneurysms that were 2 mm. The smallest aneurysm was 1.9 mm in diameter. A number of articles have proven that 3D CT angiography has a high and excellent diagnostic accuracy for small aneurysms. The authors reported, however, that repeated catheter angiography visualized four aneurysms that could not be detected on 3D CT angiography. The size of the aneurysms was 3 mm in two aneurysms, 2 mm in one, and 1 mm in one. According to previous reports, including ours,\(^1\)\(^,\)\(^2\)\(^,\)\(^8\)\(^,\)\(^9\) we believe that 3D CT angiography can consistently demonstrate aneurysms that are 2 mm in size.

The usefulness of 3D CT angiography for detecting aneurysms depends on technical differences. First, the high detectability of 3D CT angiography requires at least the following parameters: 1-mm slice thickness, 1-mm/second table speed, and 0.5-mm reconstruction pitch.\(^2\)\(^,\)\(^8\)\(^,\)\(^9\) The authors did not indicate the parameters for helical scanning. Second, neurosurgeons and radiologists who have extensive experience with 3D CT angiography also might improve the diagnostic accuracy. With greater experience and practice, the diagnostic sensitivity for smaller aneurysms can be improved. Third, the images we use are important. We have used the 3D images of the basic 11 projected 3D CT angiographies to avoid missing possible aneurysms sites, making it possible to check the artery from all directions.\(^3\) In the suspected aneurysm locations, the use of targeted 3D CT angiography facilitates the depiction. Unfortunately, the authors used maximum intensity projection (MIP) images in Fig. 2. An MIP image is basically a two-dimensional image that does not provide high detectability of small aneurysms. A small aneurysm is obscured by overlying its parent and surrounding vessels on the MIP image. The 3D CT angiography images might be able to demonstrate aneurysms that the authors could not diagnose on MIP images.

Finally, the repeated angiography and 3D CT angiography studies were performed on different dates. If the 3D CT angiography was performed in a closer time frame to catheter angiography, the aneurysms might have been revealed. The authors conclude that the invasive imaging technique of 3D CT angiography provided little diagnostic yield. To address the conclusions, however, the authors should include more precise information.

Our strategy for evaluation of an SAH is that 3D CT angiography should be performed first. When 3D CT angiography does not reveal aneurysms, catheter angiography should then be undertaken to detect nonaneurysm lesions or aneurysms at special sites, such as the skull base. After this, the repeated neuroimaging modality should be 3D CT angiography. If an aneurysm is detected, the surgery can be performed using only 3D CT angiography without catheter angiography. We believe that catheter angiography should be omitted because of procedure-related complications such as rebleeding\(^2\) of the ruptured aneurysms or cerebral infarct.\(^2\)

Finally, we wondered whether the authors performed the operation with 3D CT angiography alone. Do they still believe that catheter angiography is essential in any case? If the authors still need catheter angiography for aneurysm surgery, we believe that the repeated modality should be catheter angiography. If so, the authors must add catheter angiography even if a ruptured aneurysm was detected on 3D CT angiography.

The multidetector row CT scan by which volumetric data with superior resolution in the z axis can be obtained will eventually surpass, and may replace, catheter angiography as the gold standard imaging for cerebral aneurysms.\(^4\)

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angiographic studies. Moreover, these three patterns of MR imaging. By contrast, 10% of patients with a nonperimesencephalic pattern of bleeding did not show any cause for the bleeding on subsequent examinations with angiography, CT angiography, and/or repeated cerebral angiography. No Shinkei Geka 28: 237–243, 2000 (Jpn)


To The Editor: We have read with great interest the article published by Topcuoglu, et al. (Topcuoglu MA, Ogilvy CS, Carter BS, et al: Subarachnoid hemorrhage without evident cause on initial angiography studies: diagnostic yield of subsequent angiography and other neuroimaging tests. J Neurosurg 98:1235–1240, June, 2003). The authors classify their patients depending on the initial CT scan pattern of bleeding into three subgroups (for example, normal CT scan, perimesencephalic bleeding, and nonperimesencephalic bleeding, as was originally done by Rinkel, et al., and later on by van Calenberg, et al. This CT scan classification seems crucial as it is shown in this paper that patients with either normal CT scans or a perimesencephalic pattern of bleeding with completely normal four-vessel angiography did not show any cause for the bleeding on subsequent examinations with angiography, CT angiography, and/or MR imaging. By contrast, 10% of patients with a nonperimesencephalic pattern showed an aneurysm on subsequent angiographic studies. Moreover, these three patterns of bleeding also allow the separation of patients on the basis of the initial severity and the clinical course of their illness. In the authors’ series, patients with nonperimesencephalic patterns showed higher percentages of clinical Hunt and Hess Grades IV to V at admission, Fisher Grades 3 to 4 on the initial CT scan, vasospasm, and symptomatic ischemia. The authors, however, do not provide information regarding the rebleeding rate at follow up and the final outcome in their patients. Another point of interest that was not addressed was when to repeat cerebral angiography in the subgroup of patients showing the nonperimesencephalic pattern of bleeding.

Based on our own experience acquired during the last 10 years and that reported by other authors, we developed and applied a similar algorithm for the diagnostic management of patients suffering from SAH without evident cause on the initial cerebral angiography. Patients were classified according to the same three CT scan patterns described by Topcuoglu, et al., and angiography was repeated if the first exam was either incomplete or believed to be of poor quality, when vasospasm was present, and in those patients showing a nonperimesencephalic pattern of bleeding in the initial CT scan. On the other hand, we also believe that it is mandatory to perform initial angiography in all cases of SAH, because the perimesencephalic pattern of bleeding is not completely sensitive and specific in diagnosis of a nonaneurysmal SAH. It should be noted that the likelihood of finding an aneurysm in a patient with a perimesencephalic SAH pattern reaches 8.9% and that ruptured posterior circulation aneurysms presented with an early perimesencephalic pattern in 16.6% of the cases in our series.

Our experience with this algorithm confirms the data presented by Topcuoglu, et al., given that vascular lesions responsible for the bleeding in our total series of 122 patients with idiopathic SAH were found in only 6% of the cases, and always in patients showing the nonperimesencephalic pattern of bleeding (eight aneurysms, 14%) in the subgroup of 54 patients with this pattern. Rebleeding occurred in only four patients and always during an initial hospital admission; two of these last patients had a nonperimesencephalic pattern, one had a perimesencephalic pattern, and another had a normal CT scan. Control angiography did not disclose any vascular lesion in three of these; the remaining patient, who had a nonperimesencephalic pattern of bleeding, died because of rebleeding that occurred before control angiography could be performed. Follow up during a median interval of 5.8 years reveals that no patient has suffered further bleeding; thus, this algorithm seems appropriate to rule out possible lesions responsible for repeated hemorrhage.

In our experience, the pattern of bleeding has also enabled us to separate patients according to the severity of the illness and prognosis. Patients with the nonperimesencephalic pattern showed worse clinical grades at admission and higher frequencies of both Fisher Grades 3 and 4 on initial CT scans in addition to symptomatic ischemia. In addition, they presented with more complications during the hospital stay and needed longer admission times and more frequent CSF shunt placement for symptomatic hydrocephalus. Final prognosis of idiopathic SAH seems to be good in general, although several reports on prognosis following perimesencephalic idiopathic SAH show that patients continue complaining of headaches and a substantial proportion do not return to their previous jobs because of various neuropsychological problems. Our data show that although patients with both normal CT scans and the perimesencephalic pattern of bleeding achieved a good outcome (more than 90% with GOS scores of 4 or 5), patients with the nonperimesencephalic pattern fared worse (percentages with GOS scores of 4 and 5 decreasing to 80%) probably because of the more severe clinical status and the higher incidence of systemic complications, cerebral ischemia, and hydrocephalus that occurred in this subgroup.

References
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