Early cerebral angiography after aneurysm rupture

Analysis of 197 cases

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Although many patients with aneurysm rupture have undergone re-rupture during angiography, this event seldom occurs in the early period after the original hemorrhage. The authors review 197 cases of ruptured cerebral aneurysms that had received cerebral angiography within 1 week of rupture. With the exception of one case of re-rupture during angiography, no complications were noted in any of the patients. The criteria used for early cerebral angiography after aneurysm rupture are described.

KEY WORDS: cerebral aneurysm • cerebral angiography • aneurysm rupture • subarachnoid hemorrhage

By establishing surgical techniques for the acute treatment of ruptured cerebral aneurysms, we have endeavored to obtain better surgical results.15-19 Cerebral angiography is an indispensable preoperative test, but many cases of re-rupture during angiography have been reported.1-3,6,7,9,10,12 In this study, we have analyzed angiography-related repeat ruptures and other complications observed in our department over the past 5 years among patients subjected to cerebral angiography within the 1st week after cerebral hemorrhage.

Clinical Material and Methods

During the 5-year period from January, 1981, to October, 1985, a total of 197 individuals received cerebral angiography in our department within 1 week after the last rupture of a cerebral aneurysm. These 197 cases are the subject of this study. Patients who had received cerebral angiography at other hospitals were excluded from this review. The method used for cerebral angiography during this acute stage after cerebral aneurysm rupture is as follows: 1) Cerebral angiography is performed immediately after admission. 2) Adequate blood pressure management is started immediately after admission; the pressure is generally kept below 120 mm Hg and, in a patient with vascular spasm, it is maintained at about 140 mm Hg. To achieve hypotension, perilingual administration of 10 mg nifedipine followed by an intravenous microdrip of 250 mg of trimethaphan (dissolved in 250 ml of physiological saline or 5% glucose) is carried out. 3) Before angiography, the patient is sedated and relieved of pain with diazepam and pentazocine. In general, intubation is avoided so as not to exert stress on the patient. 4) Angiography is performed by an experienced neurosurgeon using a No. 19 Teflon needle; the puncture is direct and manual. 5) As contrast medium, meglumine diatrizoate was used until 1983. Metrizamide has been used since 1984.

Results

The time between rupture and angiography was less than 24 hours in the majority of cases (134 cases or 68%) as shown in Fig. 1. Of these 134 cases, 82 (61%) underwent cerebral angiography within 6 hours after the rupture (Fig. 2). Applying the classification of Hunt and Hess,4 the status of lesions upon admission was assessed as Grade 1 in 36 cases, Grade 2 in 85 cases, Grade 3 in 47 cases, Grade 4 in 23 cases, and Grade 5 in six cases. Of these cases, 160 were subjected to corrective surgery.

During cerebral angiography, aneurysm re-rupture occurred in only one (0.5%) of the 197 cases. This patient was a 59-year-old man admitted because of the sudden onset of occipital pain. Upon admission, he was
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![Graph showing the time interval between the last rupture of cerebral aneurysms and cerebral angiography in 197 cases in this series. In 134 patients (68%) the interval was less than 24 hours.](image1)

![Graph showing the time of performing cerebral angiography within 24 hours after the aneurysm rupture. Of the 134 cases in this group, 82 (61%) received cerebral angiography within 6 hours.](image2)

evaluated as having a Grade 2 lesion and had a blood pressure of 200/100 mm Hg. Computerized tomography (CT) scanning revealed the presence of marked subarachnoid hemorrhage in the basal cisterns. His blood pressure was reduced to 100 mm Hg with trimethaphan, and cerebral angiography was performed 2 hours after the onset of symptoms. The patient was sedated and given diazepam and pentazocine for pain, then periaxillary right vertebral angiography was performed manually with metrizamide. The anterior and lateral views indicated the presence of an aneurysm at the top of the basilar artery. Immediately after the second picture was taken, the patient showed deterioration in respiratory function and fell into a coma, accompanied by elevated blood pressure up to 190 mm Hg. Surgery was not indicated and he died 4 days later.

No angiography-related complications were seen in any other cases.

Discussion

The risk of rupture of a cerebral aneurysm during cerebral angiography has long been noted in the literature, with about 100 such cases having been reported to date. Koga, et al., for example, reported the occurrence of rupture in six (5.6%) of 107 cases, and Ito, et al., reported it in 13 (4.4%) of 295 cases. Recently, surgery for cerebral aneurysm is often performed within 24 hours after rupture. It has been observed that re-rupture of a cerebral aneurysm occurs mainly on the 1st day and particularly within 6 hours after the first rupture. This means that angiography is performed at the stage when the risk of re-rupture is greatest. Therefore, re-rupture during angiography could present a serious problem. To study this, we reviewed the patients treated at our institution during the past 5 years and found that, of 197 cases, rupture during angiography occurred in only one case, a patient who underwent angiography 2 hours after onset. Our method of angiography differs little from the usual technique, except that hypotension and sedation are induced in the patient before the study.

Possible etiological factors in the rupture of cerebral aneurysm during angiography include mechanical stimulation in the course of angiography, transient intracranial hypertension caused by injection of the contrast medium, elevation in intravascular pressure, and accidental rupture. We believe that mechanical stimulation can be reduced to a minimum if an experienced neurosurgeon performs angiography after sufficient sedation of the patient. According to Niizuma, et al., who analyzed angiography-related complications in the 939 patients with cerebral aneurysm who underwent angiography in our department up to 1975, the most prevalent complication was intramural injection (15 cases or 1.6%). This complication is now rare due to the use of the Teflon needle. Although it is preferable to perform a four-vessel angiographic study (Seldinger’s method), we think our technique is suitable for use in this acute period to meet an urgent need and to minimize harmful effects on the patient. Furthermore, when CT scanning presents a clear difference between the right and left sides, angiography may be carried out on the side of the lesion. When the lesions cannot be localized, however, left carotid angiography is generally performed first, occasionally followed by additional right vertebral angiography. Imaging of the opposite side by means of compressing the carotid artery is not usually done. We do not think a four-vessel study is necessary in this acute period, rather, so long as the ruptured cerebral aneurysm has been localized, angiography of the remaining vessels can be postponed to the postoperative period.

Concerning techniques of contrast medium injection, it is our practice to inject manually at a relatively slow rate. We do not use an automatic injector, but this instrument is suitable as long as careful attention is
paid to the injection pressure. In the case of carotid angiography, the standard practice is to inject 10 ml of contrast medium at a rate of 8 ml/sec. Injection at a lower volume or rate will cause imaging capability to deteriorate.

Concerning the kinds of contrast medium, metrizamide has been used for cerebral angiography in Japan in recent years. In contrast to the conventionally used meglumine diatrizoate, metrizamide is characterized by its non-ionic nature and low osmotic pressure and the fact that it causes little pain and heat sensation during injection. Thus, this contrast medium seems to be the most suitable for ruptured aneurysm cases.

We believe that control of blood pressure and sedation are most important for preoperative management of patients in the acute period following rupture of an aneurysm, and cerebral angiography in the acute stage of subarachnoid hemorrhage should be performed by a physician who understands the pathophysiology of cerebral aneurysms.

References