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Change of Management Results in Good-grade Aneurysm Patients

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Objective : The present study attempts to address the change of management results over time during the past 13 years in good-grade patients with intracranial aneurysm.

Methods : Six hundred twenty five (Hunt-Hess grade I to III) out of 826 patients with ruptured intracranial aneurysms operated by the same operator within 3 days after the attack from 1990 to 2002 were selected. Since 1998, endovascular aneurysmal occlusion was done in selected cases of 21 patients. The change of management results over time, including rebleeding rate, delayed ischemic neurologic deficit(DIND) as a cause of morbidity and mortality, and surgical outcome were examined.

Results : The ratio of poor-grade patients in all patients tended to decrease over the years. The early rebleeding rate declined from 5.0% to 1.2% with the use of tranexamic acid and computed tomography angiogram DIND as a cause of mortality and morbidity has decreased from 12.5% in 1990 to approximately 0% currently. Surgical outcome began to improve significantly in 1994 (poor outcome : 25% in 1990, 12.2% in 1994, 6.8% in 2002).

Conclusion : These results suggest that the advances in care and increased experience of the operator significantly affect the change of overall outcome, and early detection of the aneurysm is needed for reducing the ratio of poor-grade patients.

KEY WORDS : Aneurysm · Good-grade · Results.

Introduction

It has recently become possible for a beginner of aneurysm surgery to shorten the learning curve of surgical technique owing to several advances in the management of aneurysmal subarachnoid hemorrhage[2,5,7].

Successful treatment requires three-dimentional anatomic conceptualization, slackening of the brain, thorough understanding of the anatomic features, meticulous surgical technique including vascular control and the preservation of perforators, a full array of clips, and cosmetics[4,17]. The present study attempts to address the change of management results in good-grade aneurysm patients over the past 13 years.

Materials and Methods

Six hundred twenty-five good grade (Hunt-Hess grade I to III) out of 826 patients with ruptured intracranial aneurysms operated by the same operator within 3 days after the attack from 1990 to 2002 were selected to reduce selection bias.

We excluded poor grade patients whose vasospasm was difficult to define because of severe insults by subarachnoid hemorrhage(SAH) and the resulting ischemic or hyperemic brain. All patients were managed according to a uniform perioperative policy that included aggressive intensive care, prophylactic antiischemic treatment (hypervolemic hemodilution, induced hypertension, and nimodipine therapy), and the same anesthetic technique. Pterional craniotomy without keyhole to supratentorial aneurysm has been performed since 2001. Briefly, only one burr hole was placed on the superior temporal line 3 to 4cm posteriorly from the frontal base. After clipping the aneurysm, the bone flap was fixed using a titanium clamp (CranioFix®) for a burr hole and 2 miniplates[9]. Since 1998, endovascular aneurysmal occlusion has been done for 21 patients, particularly in circumstances in which the patients were in poor medical health or had posterior circulation aneurysms[8]. Short-term antifibrinolytic therapy with

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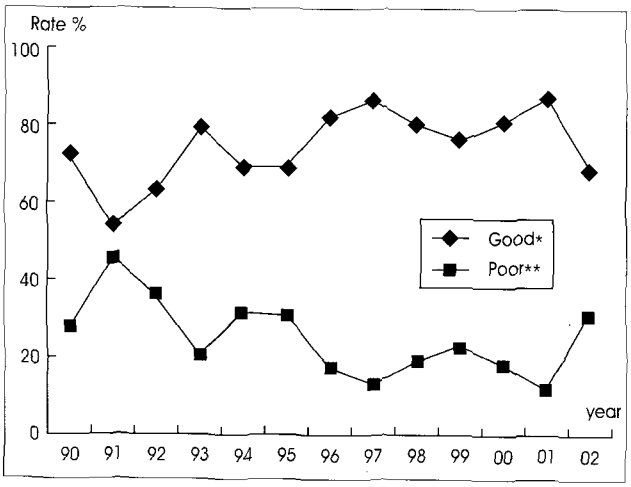

Fig. 1. The ratio of poor-grade patients comparing with good-grade. The graph shows a declining trend over the years in poor grade. *Good : Hunt-Hess Grade 1-3, **Poor : Hunt-Hess Grade 4-5.

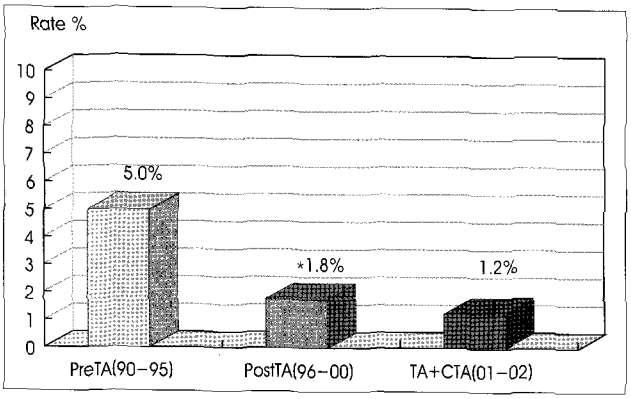

Fig. 2. Rebleeding rate in all patients. Rebleeding rate significantly decreased from 5.0% to 1.8% after use a tranexamic acid(TA) since 1996 (*Fisher's exact test, $p<0.05$) and more decreased to 1.2% after introduction of computed tomography angiogram(CTA).

tranexamic acid has been performed since 1996. This study was conducted to examine the change of management results over time including rebleeding rate, delayed ischemic neurologic deficit(DIND) as a cause of mortality and morbidity, and surgical outcome in patients good-grade with aneurysms. Outcomes were assessed at last follow-up intervals according to the Glasgow Outcome Scale(GOS) with "good" or "moderate disability" classified as a good outcome (GOS 1-2) and "severe disability", "vegetative" or "death" classified as a poor outcome (GOS 3-5). The statistical significance of observed differences between the variables were assessed by Fisher's exact test. A p value of 0.05 or less was considered significant.

Results

There was no significant difference in patient distribution according to age, Fisher's grade, aneurysm size, and aneurysm location over the years. The ratio of poor-grade patients

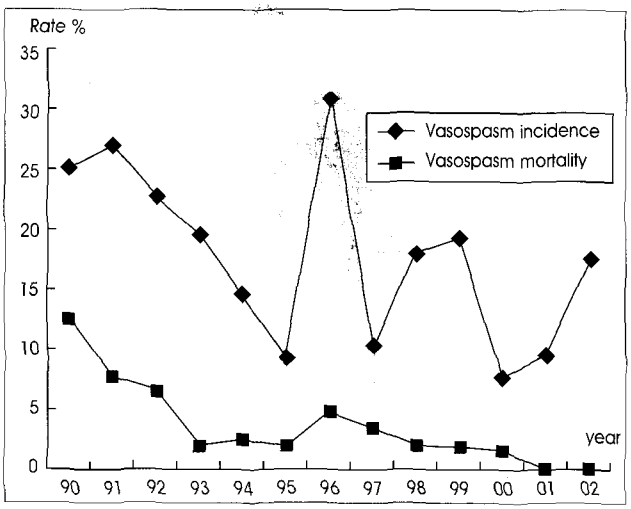

Fig. 3. Delayed ischemic neurologic deficit(DIND) as a cause of mortality and morbidity in good-grade patients. Although the incidence of vasospasm did not decrease statistically significant (average 17.8%), DIND as a cause of mortality and morbidity in good-grade patients decreased from 12.5% in 1990 to approximately 0% currently.

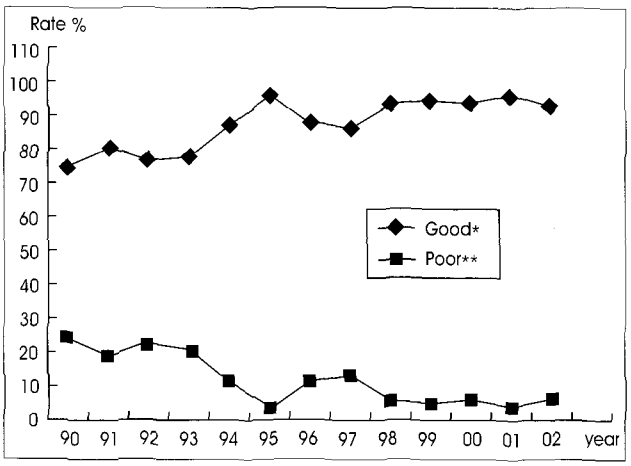

Fig. 4. Surgical outcome in good-grade patients. The rate of poor outcome is markedly decreased to 25% in 1990, 12.2% in 1994, and 6.8% in 2002. *Good : Glascow Outcome Scale(GOS) 1-2, **Poor : GOS 3-5.

(average 22.7%) in 826 patients showed a decline over the years, but it was not statistically significant (Fig. 1). Tranexamic acid therapy appears to have reduced the rate of rebleeding from 5.0% to 1.8% since 1996[12] (Fisher's exact test, $p<0.05$) and the introduction of CT angiogram decreased it more to 1.2% (Fig. 2). Although the incidence of vasospasm did not decrease statistically significant (average 17.8%), DIND as a cause of mortality and morbidity in good-grade patients decreased from 12.5% in 1990 to approximately 0% currently (Fig. 3). The rate of poor outcome markedly decreases from 25% in 1990, 12.2% in 1994, to 6.8% in 2002, resulting in improved surgical outcomes in good-grade patients as time passed (Fig. 4). The patients who received one burr hole craniotomy without key hole craniotomy had excellent cosmetic results without scalp deformity (Fig. 5).

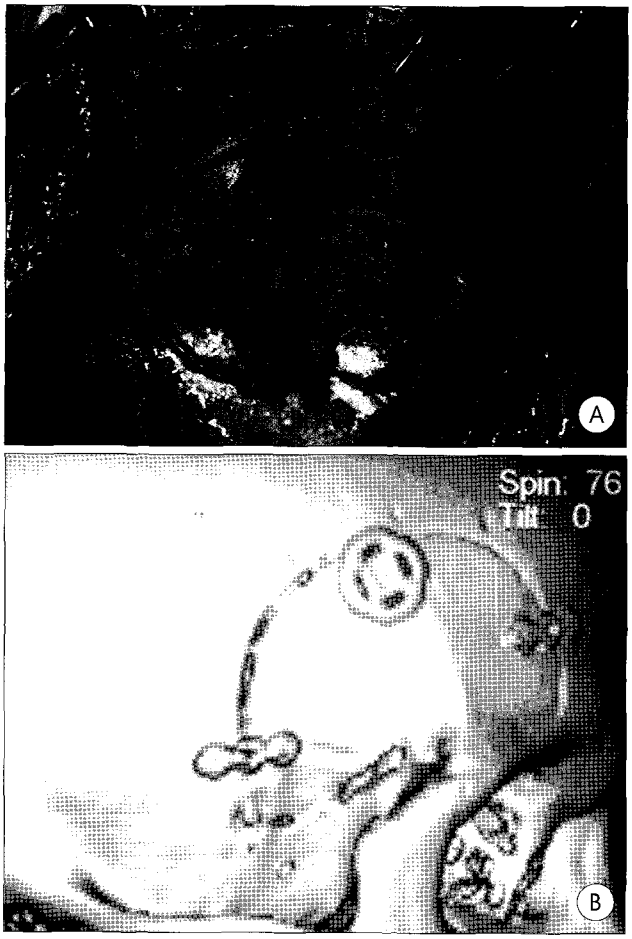

Fig. 5. Intraoperative photograph illustrating a technique for right pterional craniotomy without keyhole. A : The location of a burr hole at just inferior side of the superior temporal line 3 to 4cm posteriorly from the frontal base. B : Postoperative three dimentional computerized tomogram scan, lateral view, demonstrating satisfactory reconstruction of bone flap.

Discussion

Good-grade patients are inversely associated with poor grade ones. Much of the recent accelerated decline in poor-grade patients may have been stimulated by the recognition of the fact that stroke has become a major public health problem. There is now increased public awareness of the aneurysm and earlier visit to the hospital before significant deterioration. Lee et al[13] reported their surgical experience of 1,000 cases of intracranial aneurysm of which poor grade patients were 13.4%. However, there is still a high ratio of poor-grade patients in this province, suggesting severe SAH by the delayed visit to the hospital due to the relatively poor economic state and a lack of knowledge of SAH.

The "International Cooperative Study in the Timing of Aneurysm Surgery" reported a rebleeding rate of 5.7% in patients assigned to the early surgery group[6,10,11]. Leipzig[14] and the authors[11] reported that a short course of antifibrinolytic therapy was beneficial in diminishing the risk of rebleeding without an elevation of the incidence of DIND prior to early surgical intervention. In the present study, the early rebleeding rate was 5.0% but it was decreased to 1.8% with the treatment of a brief course of tranexamic acid. Intra-arterial cerebral angiography is, at present, the definitive neuroradiological procedure for aneurysms. Although the incidence of rebleeding from intra-arterial angiography is quite low, central nervous systemic complications of 0.1% to 2.6% in healthy patients[3] and an even higher risk in ill patients[16] can occur. In contrast, CT angiography is less invasive and quicker than conventional angiography for the patient, and it is useful for screening in asymptomatic persons who are at risk for cerebral aneurysms. We used CT angiography for almost all aneurysms since 2001 except those of which lies in close proximity to the bone, especially at the skull base, and are located distally. Only 1.2% of patients suffered a recurrent hemorrhage with the use of CT angiography.

The incidence of vasospasm did not change significantly over the years in this study. DIND as a cause of mortality and morbidity in good-grade patients has declined from 12.5% in 1990 to 0% currently. During the 13-year period we observed a gradual improvement of surgical outcome, especially marked improvement since 1994, and the reduction of poor outcome was directly proportional to the decrease of poor outcome due to DIND. The distribution and characteristics of other possible significant factors influencing outcome were similar in each year. Several controversial issues remain regarding the surgical manipulation and the development of vasospasm. There are reports that vasospasm is precipitated or aggravated by surgical dissection and manipulation of cerebral arteries that are already irritated by SAH[1,15,18]. Based on our results, although the relationship between surgical techniques and poor outcome due to DIND could not be compared directly, we believe that improved surgical outcome reflecting advances in surgical techniques, may be associated with poor outcome due to DIND on the decrease.

Conclusion

Improvement of surgical outcome by a vascular neurosurgeon depends on the number of experienced cases and case qualities such as distributions of aneurysm size, location, and clinical grade etc.

The present study suggests that proper surgical management strategy significantly affects the change in the rebleeding rate, DIND as a cause of mortality and morbidity, and consequently surgical outcome. Earlier detection of the aneurysm is needed for reducing the ratio of poor-grade patients.

Considering the usual level of surgical technique, a more

careful approach with the assistance of an experienced vascular neurosurgeon will be necessary for the first 4 to 5 years of aneurysm surgery.

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Commentary

This article presents an instructive clinical analysis of a large series of surgically managed good-grade patients with ruptured intracranial aneurysms located at the anterior circulation.

Short-term pre-operative administration of tranexamic acid and early surgery have contributed to the reduction of the rebleeding rate. Improving surgical skill of the neurovascular neurosurgeon, vigilant cares for the post-SAH vasospasm to prevent and manage DINDs, and the medical team with increasing experience in managing ruptured intracranial aneurysms probably have played important roles in achieving much better clinical outcome recently.

I have several unanswered questions concerned with the conclusion of this article. 1) It seems unproved whether CT angiography replacing transfemoral cerebral angiography played major role in reducing the rebleeding rate of ruptured intracranial aneurysms. 2) Gradual decline in the proportion of poor grade patients, if true, is a good news. But, is the statement applicable nationwide? Can any social or geographic bias be ruled out? 3) The authors reported that mortality and morbidity due to post-SAH DINDs had decreased from 12.5%(1990) to 'approximately zero'(currently). Was the morbity caused by DINDs really zero in recent years?

Vascular neurosurgeons do their best to avoid unfavorable results particularly in initially good-grade patients after SAH. No one would argue against the assertion that much surgical experience and good surgical skill of the operator are very important to achieve better surgical outcome. However, such features of ruptured intracranial aneurysms as giant size, complex anatomic configuration, and the location difficult to access surgically are still difficult problems that should be managed by judicious treatment plans.

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