Early Treatment for Ruptured Cerebral Aneurysms

Location of Aneurysms and Choice of Treatments

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Key words: GDC, SAH, outcome, location of aneurysms

Summary

The purpose of this study was to evaluate the effect of endovascular treatment with Guglielmi detachable coils (GDC) on the outcomes of subarachnoid haemorrhage (SAH) patients of poor grades and high ages for each location of aneurysms.

Between 1990 and 2003, 529 SAH cases underwent angiography as candidates of early aggressive treatment in our hospital. For the 299 cases in 1990-96 (Group 1), treatment options were early and intensively delayed craniotomy surgery and conservative management, while for the 230 cases in 1997-2003 (Group 2), GDC embolization at acute stage was added to these three treatment options. We compared clinical courses and outcomes of the poor grade (Hunt & Kosnik Grade 4-5) patients and high age (≥ 70 years old) patients between two groups for each location of aneurysms.

Introduction of GDC embolization expanded the indication for early treatment in the poor grade patients with anterior communicating artery aneurysm (A-Comm An), the high age patients with internal carotid artery aneurysm (IC An) and all patients with Basilar bifurcation aneurysm (BA-Top An), and has contributed to improvement of their outcomes. To the poor grade patients with middle cerebral artery aneurysm (MCA An), GDC embolization was hard-

ly indicated, because haematoma evacuation concomitantly performed with aneurysm occlusion would be necessary for those patients.

In conclusion, results of treatment with GDC embolization at an acute stage are desirable for poor grade patients with A-Comm An, aged patients with IC An and all patients with BA-Top An. The indication of GDC embolization for the patients with MCA An is limited.

Introduction

Recently, embolization with GDC has been recognized as a less invasive treatment for cerebral aneurysms and many authors have reported the superiority of GDC embolization to craniotomy surgery especially in the treatment for severe SAH patients¹⁻⁶. However, because the extent of operative insult to the brain largely depends on the location of aneurysms, it is necessary to discuss the superiority of these two therapeutic modalities independently for each location of aneurysms. Since 1997 we have adopted endovascular treatment using GDC as a treatment of choice for the patients with poor grades, high ages, and basilar bifurcation aneurysms. In this study, we compared clinical courses of the cases with poor grade or high ages which treated in 1990-1996 to those treated in 1997-2003 for each location of aneurysms to evaluate the efficacy of changes in treatment strategy.

Figure 1 Bar graph shows the difference in the proportion of early treatments (upper) and GOS (bottom) between two periods in the poor grade cases with A-Comm An. GR indicates good recovery; MD = moderately disabled; SD = severely disabled; V = vegetative state; D = dead.

Patients and Methods

We analyzed 529 patients with ruptured cerebral aneurysms who admitted to our hospital within 72 hours of SAH ictus and under-

went angiography as candidates of early aggressive treatment between 1990 and 2003. Patients were divided into two groups; before (Group 1, 299 cases, 1990-1996) and after (Group 2, 230 cases, 1997-2003) the introduction of GDC

Figure 2 Bar graph shows the difference in the proportion of early treatments (upper) and GOS (bottom) between two periods in the high age cases with A-Comm An.

Figure 3 Bar graph depicting the difference in the proportion of early treatments (upper) and GOS (bottom) between two periods in the poor grade cases with IC An.

embolization. For the patients in Group 1, treatment options were early and intensively delayed craniotomy surgery and conservative management, while for the patients in Group 2, GDC embolization at an acute stage was added

to these three treatment options. GDC treated patients were managed in the intensive care unit using the same protocol as that for craniotomy patients. Ventricular drainage (VD) and/or spinal drainage (Sp-D), decompressive

Figure 4 Bar graph depicting the difference in the proportion of early treatments (upper) and GOS (bottom) between two periods in the high age cases with IC An.

craniectomy, and intrathecal administration of urokinase were performed if necessary.

At first, clinical courses and outcomes of the patients with poor grades (Hunt & Kosnik Grade 4-5) and high ages (≥ 70 -years-old) were compared between two groups for each location of aneurysms. The outcomes were assessed by Glasgow Outcome Scale scores (GOS) at discharge. And the second, the incidence of accompanied intracerebral haematoma (ICH) in the poor grade cases was examined for each location of aneurysm.

Results

Anterior communicating artery aneurysm (A-Comm An)

There were 18 patients with poor grades (17%) and 11 with high ages (10%) in Group 1 (total 105 cases), and 23 patients with poor grades (31%) and 14 with high ages (19%) in Group 2 (total 75 cases). Among the poor grade patients, the percentage of the cases in which aneurysm was obliterated at acute stage (early treated cases) increased significantly from 39% in Group 1 to 78% in Group 2. And the proportion of patients obtained favorable outcome (Good Recovery: GR and Moderately disabled: MD) increased significantly from 6% in Group 1 to 43% in Group 2 (figure 1).

Among high age patients, there was no significant difference in the percentage of early treatment between Group 1 (55%) and Group 2 (64%). Though the proportion of the patients obtained favorable outcomes did not change in total, the ratio of GR to MD increased apparently (figure 2)

Internal carotid artery aneurysm (IC An)

There were 12 patients with poor grades (17%) and 13 with high ages (19%) in Group 1 (total 69 cases), and 14 patients with poor grades (29%) and 12 with high ages (24%) in Group 2 (total 49 cases). Among the poor grade patients, there was no significant difference in the percentage of early treatment between Group 1 (50%) and Group 2 (93%). Though the proportion of the patients obtained favorable outcomes did not change, the patients of GR increased and those of dead decreased apparently (figure 3).

Among high age patients, the percentage of

early treated cases increased significantly from 54% in Group 1 to 100% in Group 2. And the proportion of patients obtained favorable outcome increased from 31% in Group 1 to 67% in Group 2 (figure 4).

Basilar bifurcation aneurysm (BA-Top An)

There were three patients with poor grades (38%) and three with high ages (38%) in Group 1 (total eight cases), and four patients with poor grades (29%) and two with high ages (14%) in Group 2 (total 14 cases). The percentage of early treated patients increased significantly from 38% (three patients) in Group 1 to 86% (12 patients) in Group 2. Among early treated cases in Group 2, GDC embolization was chosen in 92% (11 patients). The proportion of the patients obtained favorable outcomes increased from 25% in Group 1 to 71% in Group 2 (figure 5). In fact, all the patients with poor grades and high ages in Group 1 terminated in poor outcome, while two of the four poor grade patients and both of the two high age patients in Group 2 achieved favorable outcomes.

Middle cerebral artery aneurysm (MCA An)

There were 25 patients with poor grades (28%) and 10 with high ages (11%) in Group 1 (total 89 cases), and 22 patients with poor grades (35%) and 11 with high ages (17%) in Group 2 (total 63 cases). Only one patient with MCA An in this series was treated with GDC embolization. The percentage of early treated cases among poor grade patients was 76% in Group 1 and 64% in Group 2, and that of favorable outcome patients was 32% in Group 1 and 29% in Group 2. The percentage of early treated cases among high age patients was 60% in Group 1 and 64% in Group 2, and that of favorable outcome patients was 33% in Group 1 and 57% in Group 2.

Accompanied intracerebral haematoma (ICH) in poor grade patients

In the poor grade patients, ICH was accompanied much more frequently in the case of MCA An (79%) than in the case of A-Comm An (31%) and IC An (20%) (figure 6).

Figure 5 Bar graph shows the difference in the proportion of early treatments (upper) and GOS (bottom) between two periods in the cases with BA-Top An.

Discussion

Recent technical advances in neurosurgery have allowed early surgical intervention for ruptured cerebral aneurysms. By obliterating aneurysms, rebleeding is prevented and intensive management of delayed vasospasm becomes possible. However, the use of early craniotomy surgery for patients with poor grades,

high ages, poor general conditions, and basilar artery aneurysms is still controversial considering the additional brain damages caused by brain retraction, small vessel injury and over-aspiration of CSF during the direct surgery⁷⁻⁹. For the SAH patients with such conditions, embolization with GDC has been recognized as a suitable treatment. However, because the extent of operative insult to the brain largely de-

Figure 6 Location of aneurysm and incidence of accompanied intracerebral haematoma in the case with H&K Grade IV and V.

depends the location of aneurysms, it is necessary to discuss the superiority of these two therapeutic modalities independently for each location of aneurysms.

In our series, the introduction of GDC embolization has significantly expanded the indication for early treatment in the poor grade cases with A-Comm An and has improved outcomes for those patients. Because A-Comm aneurysms are usually located in the deeper region than other anterior circulation aneurysms, additional brain damages may be stronger especially in poor grade patients and, therefore, early direct surgery has been avoided. Most of these problems have been solved by the introduction of GDC embolization. The ratio of GR to MD increased after the introduction of GDC embolization in the high age patients with A-Comm An. This may suggest that GDC embolization affects the higher brain function much less than craniotomy surgery.

As for the patients with IC An, introduction of GDC embolization has significantly expanded the indication for early treatment in the high age patients and has improved the outcome of these patients. Although it also expanded the indication for early treatment in the poor grade patients and mortality of these cases decreased, the proportion of the cases obtained favorable outcomes did not change.

In the patients with BA-Top An, the percentage of early treated cases increased significantly with the introduction of GDC embolization in all H&K Grades and ages, which may have contributed to improvement of their outcomes. Considering technical difficulty and probable brain damages caused by craniotomy surgery to BA-Top An, this may be a natural transition.

We considered two reasons why only one MCA An case was treated with GDC embolization in these series. Firstly, a structure of aneurysmal complex of MCA An was anatomically not suitable for GDC embolization. And secondly, the poor grade cases with MCA An were accompanied with large ICH at a high rate (79% in this study).

Since the deterioration of neurological conditions of those patients is due to mass effects of ICH, haematoma evacuation concomitantly performed with aneurysm occlusion would be necessary.

Conclusions

Results of treatment with GDC embolization at an acute stage are desirable for poor grade patients with A-Comm An, aged patients with IC An and all patients with BA-Top An. The indication of GDC embolization for the patients with MCA An is limited.

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