Treatment Policy for Grade IV and V Patients

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Abstract

To settle the controversy over optimum management strategy for patients with poor-grade (Hunt and Hess grade IV and V) aneurysmal subarachnoid hemorrhage (SAH), the medical records of 50 patients admitted with poor Hunt and Hess grade have been examined retrospectively with literature review. Initial findings such as better neurological condition (Hunt and Hess grade IV) and presence of intracerebral hemorrhage were indicators of good prognosis. Patients with intraventricular hemorrhage and uncontrollably increased intracranial pressure (>40 cm H₂O after extraventricular drainage) resulted in severe morbidity or mortality. Regarding the timing of surgery, early intervention led to a better outcome with less morbidity because of the marked decrease of the severity of vasospasm and the incidence of rebleeding. The frequency of intraoperative premature rupture and the overall mortality were not significantly influenced by the timing of surgery.

It is concluded that, for patients in poor Hunt and Hess grade without a definite evidence of irreversibility such as brainstem failure signs or uncontrollably increased intracranial pressure, early surgery followed by aggressive treatment to prevent cerebral vasospasm is the treatment of choice.

(Received & accepted September 12, 1994)

Key words : aneurysm, subarachnoid hemorrhage, grade IV and V patients, early aneurysm surgery
Jpn J Neurosurg (Tokyo) 4 : 219-224, 1995

Introduction

Usually, we decide the management plan for patients with aneurysmal subarachnoid hemorrhage (SAH) according to their clinical condition. Hunt and Hess¹⁵⁾ categorized patients with SAH into grades according to their clinical status to standardize the treatment planning and prognostication, and presently this grading system is widely applied to diagnosis and treatment of aneurysmal SAH patients. With the advances in microneurosurgical techniques and improved preoperative and postoperative medical care, early surgery in low risk patients (Hunt and Hess grade I to III) is considered as a routine procedure with excellent results¹⁾²⁾⁶⁾⁹⁾¹¹⁾¹³⁾¹⁴⁾²⁷⁾. Yet, for those patients with Hunt and Hess grade IV and

V, there are still many controversies over the principle of management. The outlook for these patients has been dismal with the management mortality of 50% to 79%³⁾⁴⁾¹⁵⁾¹⁷⁾²³⁾ and they have been excluded from active treatment categories, including early surgery⁷⁾²⁴⁾. Nevertheless recent advances in the microsurgical technique and postoperative management prompted us to reconsider the management principle for these poor grade patients.

Determination of reversibility

In the management of grade IV and V patients, the first and most important step is to determine if the harmful effect of SAH is reversible or not. Of course, only those patients with expected rever-

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Table 1 Hunt and Hess grade and outcome

Hunt-Hess grade	Outcome scale			Total
	G. R.	Morb.	Mort.	
IV	12(32)	9(23)	17(45)	38(100)
V	1(8)	2(17)	9(75)	12(100)
Total	13(26)	11(22)	26(52)	50(100)
G. R. : good result Morb. : morbidity				
Mort. : mortality () : %				

sibility can possibly benefit from active treatment, consisting of early surgery for aneurysmal neck clipping and aggressive postoperative management to prevent cerebral vasospasm.

Many authors agreed to that poor grade patients with significant intracerebral hematoma (ICH) have chances of good recovery by aggressive management⁵⁾²⁶⁾²⁹⁾³⁰⁾. In addition to this simple rule, a systematic approach to determine the reversibility was suggested by Dr. Bailes and Spetzler⁴⁾. They managed patients with poor grade SAH based on radiographic and intracranial pressure (ICP) criteria rather than neurologic conditions. They utilized brain CT scanning to evaluate the brain status such as signs of irreversible brain destruction; massive cerebral infarction with midline shift, dominant basal ganglia or brain stem hematoma. Poor or absent intracranial vascular filling on CT or cerebral angiography and increased intracranial pressure (ICP) above 30 cm H₂O without an intracranial clot or above 50 cm H₂O in the presence of a clot after extraventricular drainage were also regraded as a predictor of irreversibility. In their report, only those patients without an evidence of irreversible damage underwent craniotomy for aneurysmal neck clipping and hematoma removal followed by aggressive postoperative triple H's (hypertensive, hypervolemic and hemodilutional) therapy, and 54.3% of them resulted in good recovery. Another unpublished series also utilized CT scanning and ICP to determine reversibility²²⁾. In that series, destruction of vital structure and ICP above 20 cm H₂O were regarded as indicators of irreversibility.

Other possible means to determine reversibility includes measurement of cerebral blood flow and somatosensory and/or auditory evoked potentials¹⁰⁾¹²⁾³¹⁾, whether or not they are practical in the management of poor-grade patients.

Our data also showed that the presence of ICH and controllable ICP are good indicators of reversibility. Especially, all patients with ICP above 40 cm H₂O died regardless of any treatment modalities.

Fig. 1 Intracerebral hematoma and outcome
Patients with intracerebral hematoma demonstrate better outcome.

ICH : intracerebral hemorrhage

Prognostic factors

There are several clinical factors that are helpful in predicting the outcome of treatment in patients with poor grade⁵⁾⁸⁾²⁰⁾²⁶⁾²⁹⁾³⁰⁾. Reported poor prognostic factors include poor neurologic condition (especially consciousness level), old age, high initial systolic blood pressure, large aneurysm size, deep location of aneurysm (anterior communicating and posterior circulation aneurysms), repeated bleeding, intraventricular hemorrhage (IVH) and severe SAH (especially in perimesencephalic cistern). Meanwhile, ICH or acute hydrocephalus, that causes poor neurological condition by mass effect and are amenable to surgical treatment, have been considered as good prognostic factors.

To confirm the prognostic effects of these factors, we performed retrospective analysis of 50 poor-grade patients, consisting of 38 grade IV and 12 grade V patients. From the data presented here (Table 1) and in most reports, it is obvious that a distinct difference exists in regards to the overall morbidity and mortality between patients admitted in grade IV and those in grade V⁸⁾²³⁾²⁵⁾. In our series of grade V patients, the outcome was disappointing with either severe morbidity or mortality in 92%, which is in good agreement with other reports.

On admission, 17 case of our series showed ICH, and they resulted in better outcome with higher good results and less morbidity and mortality than those without ICH (Fig. 1). Other authors also agreed to that the presence of ICH is related to chances of good recovery⁵⁾²⁶⁾²⁹⁾³⁰⁾. Yet, some other report failed to demonstrate such a positive association between ICH and good outcome⁸⁾. Probably, this reflects that the effect of

Fig. 2 Intraventricular hemorrhage and outcome

Intraventricular hemorrhage was a predictor of poor prognosis.

IVH : intraventricular hemorrhage

Table 2 Location of aneurysm and outcome

Result	ACA*	ICA	MCA	Post. Circ.
G. R.	2(18)	6(35)	4(44)**	1(33)
Morb.	4(36)	5(30)	1(11)	1(33)
Mort.	5(45)	6(35)	4(44)	1(33)
Total	11(100)	17(100)	9(100)	3(100)

*9 cases (81%) with IVH **All with sylvian hematoma
 ACA : anterior communicating artery
 ICA : internal carotid artery
 MCA : middle cerebral artery Post. Circ. : posterior circulation () : %

ICH on outcome may change depending on its location and mode of management, which may vary from one series to the other.

Intraventricular hemorrhage (IVH) was present in 60% of the patients. It served as a bad prognostic factor (Fig. 2), leading to higher morbidity and less good results, in accordance with other reports⁸⁾²¹⁾. Acute hydrocephalus, which was shown in 29 cases (58%) on initial CT scan, demonstrated no definite correlation with outcome in our series.

Regarding the location of ruptured aneurysm, middle cerebral artery aneurysms showed higher good result and mortality compared with those in other locations (Table 2). This means that poor-grade patients with ruptured middle cerebral artery aneurysm tend to have large sylvian hematoma and/or IVH which may be fatal¹⁸⁾, but it can also indicate higher chances of good recovery with less morbidity if the hematoma is evacuated promptly²⁸⁾.

The effect of initial ICP on outcome was definite in our series. The initial ICP after extraventricular drainage was above 40 cm H₂O in

Table 3 Management mode and outcome

Management mode	Outcome Scale			Total
	G. R.	Morb.	Mort.	
Early Op.	5(42)	1(8)	6(50)	12(100)
Delaying	8(21)	10(26)	20(53)	38(100)
{ Op. (+)	8(38)*	10(48)	3(14)	21(100)
{ Op. (-)	—	—	17(100)	17(100)
Total	13(26)	11(22)	26(52)	50(100)

*Including 2 coil embolizations : 1BBAA, 1 giant OphAA G. R. : good result
 Morb. : morbidity Mort. : mortality
 () : % op. : operation

Fig. 3 Management mode and outcome

Early surgery group shows higher good result with less morbidity.

5 patients. One patient was managed by early surgery, another one with delayed surgery, and the other 3 underwent no operation. All of these 5 patients died regardless of management modality.

Other factors such as patients' age, sex, usage of nimodipine and initial blood pressure showed no definite influence on outcome.

Timing of surgery and outcome

Patients with poor-grade SAH show higher rebleeding rate in acute stage¹⁶⁾ and higher risk of clinical vasospasm¹⁹⁾, which together with severe initial brain damage lead to poor outcome. For these patient group with dismal outlook, there still remains controversy over the optimum timing of surgery^{4) 7) 11) 24) 25)}.

It is well known that early surgery for patients with aneurysmal SAH has several advantages over delayed one. It can immediately eliminate some factors contributing to poor neurologic condition (such as ICH and hydrocephalus) and prevent rebleeding, allowing the removal of subarachnoid hemorrhage (so-called "cisternal toilet") and aggressive postoperative management to prevent cerebral vasospasm. Meanwhile, early

Table 4 Causes of mortality

Management mode	Initial damage	Symptomatic vasospasm	Rebleeding	Others	Total
Early operation	4(67)	1(17)	—	1(17)	6(100)
Delaying	7(35)	5(25)	7(35)	1(5)	20(100)
{ operation (+)	—	2(66)	1(33)	—	3(100) }
{ operation (—)	7(41)	3(18)	6(35)	1(6)	17(100) }
Total	11(42)	6(23)	7(27)	2(8)	26(100)

() : %

Table 5 Causes of morbidity

Management mode	Initial damage	Symptomatic vasospasm	Rebleeding	Others	Total
Early operation	—	1(100)	—	—	1(100)
Delaying	1(10)	7(70)	1(10)	1(10)	10(100)
{ operation (+)	1(10)	7(70)	1(10)	1(10)	10(100) }
{ operation (—)	—	—	—	—	— }
Total	1(9)	8(73)	1(9)	1(9)	11(100)

() : %

Table 6 Incidence of vasospasm

Management mode	Symptomatic vasospasm	Severe* vasospasm
Early Operation	6(50)	3(25)
Delaying	21(55)	14(37)
{ operation (+)	16(76)	11(52) }
{ operation (—)	5(29)	3(18) }
Total	26(52)	17(34)

*Symptomatic vasospasm leading to morbidity or mortality () : %

Fig. 4 Recommended treatment protocol for patients with poor-grade SAH

surgery also has some drawbacks, especially in the cases of poor-grade SAH. It may cause additional damage to the brain by surgical manipulation and increase the incidence of premature rupture and cerebral vasospasm.

We analyzed 50 consecutive patients with Hunt and Hess grade IV–V to evaluate the effect of early surgery (operation within 72 hours of SAH) on outcome. The patients were divided into two groups: those with early surgery and the others without early surgery. The latter group was called “delaying operation group” in our study. Management morbidity and mortality, the incidence of vasospasm, rebleeding and intra-operative aneurysm rupture were compared between these two groups. The outcomes of treatment were classified into three categories according to the Glasgow Outcome Scale on discharge, that is, good result (good recovery or moderately disabled), morbidity (severely disabled or vegetative) and mortality.

Twelve patients (24%) underwent early surgery and, 19 patients (38%) were treated by delayed

surgery, while the remaining 19 (38%) received no operation. After aneurysmal neck clipping, all patients were managed by active triple H’s therapy. The management outcome demonstrated higher good result and lower morbidity in early surgery group compared with those managed by delaying operation (Table 3, Fig. 3). Both groups resulted in nearly equal mortality rate of about 50%. All patients managed without surgery died.

According to the mode of management, the causes of mortality and morbidity were analyzed (Table 4, 5). In early operation group, the major cause of death was initial brain damage by aneurysmal rupture. Meanwhile, in delaying operation group, nearly half of the patients died of rebleeding or vasospasm. Regarding morbidity, 70% of morbidity came from vasospasm in delaying operation group. These results indicated that vasospasm or rebleeding are major causes of mortality and morbidity in delaying operation group.

As to vasospasm, the overall incidence of symptomatic vasospasm was not significantly different between those two management groups (Table 6).

Nevertheless, the incidence of severe vasospasm, leading to mortality or morbidity, was higher in the delaying operation group. In addition to severe vasospasm, 11 patients (29%) of the delaying operation group suffered from rebleeding, and 10 of them died or resulted in serious morbidity.

In delaying operation group, the Hunt and Hess grade improved during supportive management in only 4 patients (11%). The incidence of intraoperative premature rupture was about 10%, and it was not significantly different between the two management groups.

In summary, our analysis revealed that the management mortality was similar in both management groups, but the morbidity was higher in the delaying operation group mainly due to vasospasm. With regard to symptomatic vasospasm, the overall incidence was similar in both groups, but it was more severe in the delaying operation group. The overall management mortality was 52% and the morbidity was 8% in early surgery group and 26% in delaying operation group.

Conclusion and treatment protocol

With the above analysis, we could conclude that early surgery for poor-grade SAH patients improves outcome with less morbidity by decreasing the severity of vasospasm and preventing rebleeding. The incidence of symptomatic vasospasm, intra-operative premature rupture and mortality were not significantly different between early surgery group and those managed by delaying operation.

Therefore, for patients with poor Hunt and Hess grade, early surgery and aggressive treatment to prevent cerebral vasospasm may be the choice of treatment, except those cases with definitely unmanageable factors, such as the destruction of vital structure or uncontrollably increased intracranial pressure.

Fig. 4 shows recommended protocol of treatment for poor-grade SAH patients based on the analysis of our series.

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