

Fatal Aneurysmal Rupture: A Survey of 60 Grade-5 Cases

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Summary

The purpose of the present study was to describe the clinical course of patients with Grade-5 ruptured aneurysms (WFNS grading). Among 250 consecutive cases of ruptured aneurysms, 60 Grade-5 patients were reviewed retrospectively, consisting of 24 males and 36 females with an average age of 58 years. Thirty-two patients were directly transferred to our clinic, while the remaining 28 were referred from other clinics. Duration from rupture to arrival at our clinic was within 1 hour in 25 cases and within 2 hours in 43 cases.

Systolic blood pressure on admission was 186 mmHg on average. Obvious misdiagnoses by primary physicians were made in 7 cases. Ventricular drainage and clipping/trapping of the aneurysms were performed in 7 and 25 cases, respectively. Forty-nine patients died and the remaining 11 survived. One made a good recovery, 1 was moderately disabled, 8 severely disabled, and 1 in a vegetative state.

The prognosis for Grade-5 patients is well known as being extremely poor, which also was the case in our series. Early referral and early surgical intervention have not changed this poor prognosis. Possible improvement of the outcome of this group might be expected by 1) public health and primary physician education on aneurysmal subarachnoid haemorrhage, and 2) control of blood pressure during referral.

Keywords: Aneurysm; grade 5; outcome; subarachnoid haemorrhage.

Introduction

Owing to advances in microsurgical techniques, operative results for selected ruptured aneurysms have been greatly improved. Early operative intervention for ruptured aneurysms in good condition is now being advocated. Furthermore, major efforts are being focused on management of vasospasm together with early operative obliteration of ruptured aneurysms^{3, 5, 11, 16, 20}. Even with the above-mentioned refinements in the management of ruptured aneurysms, the overall outcome is approximately proportional to the clinical grade of the patient on admission^{4, 12, 17, 19}.

In order to describe the clinical spectrum of fatal aneurysmal ruptures, we retrospectively reviewed 60

Grade-5 cases among a consecutive series of 250 cases with ruptured intracranial aneurysms.

Material and Methods

In the past 4 years, 250 patients with ruptured aneurysms have been admitted to Baba Memorial Hospital, Osaka, Japan, excluding traumatic aneurysms, subarachnoid haemorrhages (SAH) without angiographically demonstrable aneurysms, and incidentally discovered unruptured aneurysms. The clinical grades on admission (Subarachnoid Haemorrhage Grading by World Federation of Neurosurgical Societies) and the location of the aneurysms are listed in Table 1. Seventy-nine patients (31%) were Grade-1, 37 (15%) Grade-2, 12 (5%) Grade-3, 62 (25%) Grade-4, and 60 (24%) Grade-5. In cases of multiple aneurysms, only surgically verified ruptured aneurysms or presumably ruptured aneurysms judging from computerized tomography (CT) were listed. CT demonstrated SAH in all cases and cerebral angiography verified intracranial aneurysms in all cases but 11, whose medical status was so poor and unstable that angiography could not be carried out; in these cases, CT showed typical SAH due to the ruptured aneurysms. Among these 11 cases 10 cases were Grade-5 and the remaining cases Grade-4. Sixty cases were grouped into Grade-5 (24%), which meant the clinical state immediately after admission was Grade-5 or deteriorated into Grade-5 within a few hours following admission at the outpatient department (OPD), during CT or angiography. However, we excluded cases from Grade-5 whose clinical grade immediately after admission was Grade-5 but improved within a few hours into a better grade.

We reviewed these 60 cases retrospectively and analyzed the following factors: 1. sex and age, 2. location of the aneurysms and their multiplicity, 3. initial symptoms, 4. time and situation of aneurysmal rupture, 5. duration from a fatal rupture to arrival at our clinic, 6. method of admission, 7. diagnoses at the other clinics, 8. warning signs, 9. hypertensive history and systolic blood pressure on admission, 10. cerebral angiography and extravasation, 11. CT findings, 12. surgical intervention, and 13. outcome.

Results

1. Sex and Age

There were 24 males (40%) and 36 females (60%), aged 23 to 84 years with an average age of 58 years.

Table 1. *Neurological Grade on Admission (WFNS) and Location of Ruptured Aneurysms*

Grade	ACOM	ACA	MCA	ICA	VBA	?	Total
1	27	5	22	21	4	0	79
2	14	2	9	7	5	0	37
3	4	2	3	3	0	0	12
4	13	6	15	22	5	1	62
5	17	2	11	11	9	10	60
Total	75	17	61	64	22	11	250

Abbreviations: ACOM, anterior communicating artery; ACA, anterior cerebral artery; MCA, middle cerebral artery; ICA, internal carotid artery; VBA, vertebrobasilar artery; WFNS, subarachnoid haemorrhage grading by World Federation of Neurosurgical Societies; ?, without angiographic verification.

The average age of the males was 57 and that of the females was 59. This difference is statistically not significant ($p < 0.05$). They included 1 patient in his 20's, 12 in their 30's, 15 in their 40's, 14 in their 50's, 2 in their 60's, 11 in their 70's and 3 in their 80's. Forty-six patients (77%) were below the age of 70.

2. Location of Aneurysms and Their Multiplicity

The location of the ruptured aneurysms is given in Table 1. Thirty-eight cases (76%) had single aneurysms while 12 cases (24%) had multiple aneurysms: 10 cases had 2 aneurysms and 2 cases had 3 aneurysms.

3. Initial Symptoms

Initial symptoms were disturbance of consciousness in 40 cases, sudden headache in 18 cases, generalized seizures in one case and abnormal behaviour in one case. Fifty-four patients were admitted in a comatose state, i.e., in Grade-5. In the remaining 6 cases, the initial grades on admission were Grade-1 in 1 case, Grade-2 in 1 case and Grade-4 in 4 cases. The clinical grades of these 6 cases quickly declined into Grade-5 within a few hours. Three cases deteriorated during angiography, 1 case in the OPD, and one during CT due to rebleeding.

4. Time and Situation of Aneurysmal Rupture

Initial symptoms due to rupture of aneurysms appeared from midnight to 6 am in 11 cases, from 6 am to noon in 12 cases, from noon to 6 pm in 16 cases, and from 6 pm to midnight in 21 cases. Thus, rupture occurred in 33 cases at night (6 pm–6 am), and in 28 cases in daytime (6 am–6 pm). This difference is statistically not significant ($p < 0.05$). Although our records

on the patient's activities, during which the aneurysm ruptured, were not always completely documented, it was noted that the rupture occurred in 8 cases during sleep, in 5 cases while voiding or defecating, in 8 cases while taking a bath, in 2 cases during work, in 2 cases while driving a car, and in 1 case in a train.

5. Duration from Rupture to Arrival at Our Clinic

All patients were admitted to our clinic within 10 minutes to 11 hours after the major aneurysmal rupture except for 3 cases, which were transferred to our clinic 2 or 3 days after aneurysmal rupture. Ten cases were admitted within 30 minutes, 25 cases within 60 minutes, 43 cases within 120 minutes, and 47 cases within 180 minutes. The average duration was 116 minutes except for the above-mentioned 3 cases.

6. Methods of Admission

Thirty-two cases were directly transferred from the place of aneurysmal rupture to our clinic by public ambulance. The remaining 28 cases were transferred to at least one other clinic before being transferred to our clinic. The average time interval from rupture to arrival at our clinic was 92 minutes for the former group and 147 minutes for the latter group, except for 3 delayed referral cases.

7. Diagnoses at Other Clinics

Among 28 cases who were transferred from other clinics, the diagnoses of the primary physicians were as follows: cerebral disease in 1 case, hypertensive encephalopathy in 1, ventricular haemorrhage in 1, intracerebral haemorrhage in 4, and SAH in 9 cases. We could not get any diagnostic information in 12 cases

and were told simply that „the patient was unconscious due to unknown aetiology“. Obvious misdiagnoses were made in 7 cases, which were hypertensive encephalopathy in 1 and simple headache in the remaining 6 cases. Among these 6 cases, two patients had already been admitted to other hospitals due to severe headache without any definite diagnosis, but immediately after fatal rebleeding they were transferred to our clinic.

8. *Warning Signs*

Probably due to our incomplete records on the clinical history on warning signs and rapid deterioration of consciousness in most cases, warning signs were noted in only 13 cases. Chest discomfort or nausea was experienced in 2 cases, general fatigue in 1 case, and sudden headache in the remaining 10 cases.

9. *Hypertensive History and Systolic Blood Pressure on Admission*

A history of hypertension was noted in 22 cases (37%), and the remaining 38 cases (63%) had no history of hypertension. Systolic blood pressure immediately after admission ranged from 90 to 270 mmHg, with an average of 186 mmHg. Twenty-five patients had a blood pressure above 200 mmHg, and 41 patients above 170. There were 3 dead-on-arrival cases for whom blood pressure was not measurable. Excluding these 3 dead-on-arrival cases, the systolic blood pressure of patients admitted to our clinic directly from the place where rupture occurred was 188 mmHg, while that of patients referred from other clinics was 185 mmHg. This difference is statistically not significant ($p < 0.05$). Most of the latter group were referred without control of blood pressure.

10. *Cerebral Angiography*

Cerebral angiography was carried out in 51 cases, but in the 9 remaining cases it could not be performed due to the patient's poor medical condition. Angiographically demonstrable extravasation was observed in 9 cases even with strict control of blood pressure, usually with trimetaphan camsilate and sedatives during angiography.

11. *CT Findings*

Severe SAH was noted in 26 cases. Massive intracerebral haematoma (ICH) was noted in 6 cases. Massive ICH plus severe SAH was noted in 3 cases. Massive ICH and ventricular haematoma was noted in 5 cases.

Massive ventricular haematoma alone was noted in 3 cases. Severe SAH and massive ventricular haematoma was noted in 10 cases. Massive ICH, ventricular haematoma and severe SAH was observed in 1 case. Moderate SAH was noted in 6 cases.

12. *Surgical Intervention*

Ventricular drainage was performed in 7 cases. Direct clipping of aneurysms was carried out in 25 cases and trapping was done in one case. In these cases, the time interval from admission to clipping/trapping was from 2 to 20 hours and averaged 8 hours, except for 3 delayed cases which had intervals of 3, 26 and 28 days. In one case, balloon occlusion of an ICPC aneurysms with preservation of the internal carotid artery by using a detachable balloon was carried out following angiography.

13. *Outcome*

Forty-nine patients died and the remaining 11 were alive after a mean follow-up period of 20 months. The interval from admission to death was 1 day to 11 months, with an average of 18 days. Nine patients died within 1 day, 16 patients within 2 days, 23 patients within 3 days, and 33 cases within a week.

In 11 surviving cases, one had a good recovery, one was moderately disabled, 8 severely disabled, and 1 remained in a vegetative state.

Discussion

It is vitally important to prevent rebleeding and vasospasm after the initial rupture in patients in good grades and to bring them to medical attention at an early stage, in order to ensure a better overall outcome for patients with ruptured aneurysms.

It is now generally accepted that the peak of aneurysmal rebleeding occurs within the first 24 hours after SAH, with a rebleeding rate of approximately 4%⁸. Thus, neurosurgical attention is required for SAH patients as soon as possible after initial bleeding. In this sense, it is obvious that early referral to neurosurgical units is of the utmost importance, where the appropriate treatment (medical and/or surgical) is always readily available for such patients¹⁵. In our series, owing to rapid referral and the transferral system in Japan, 25 cases arrived within 1 hour and 43 cases within 2 hours. Although most of the patients were referred to our clinic shortly after the aneurysmal rupture, their outcome was mostly fatal. This means that early referral is not likely to improve the outcome for cata-

strophic aneurysmal ruptures and patients with an already severe neurological status. However, it might improve the general outcome of cases with ruptured aneurysms which are in good condition and are mainly endangered by the risks of rebleeding and vasospasm.

The most common misdiagnoses were made in patients who were less acutely ill than those who most obviously required prompt diagnosis. Misdiagnoses included systemic infection, migraine headache, hypertensive encephalopathy, meningitis, ischaemic infarction, myocardial stroke, tension headache, sinusitis^{1,9}.

Almost half of the aneurysmal patients had „warning signs“ prior to the major attack, such as headache, nausea, vomiting, dizziness, transient motor weakness^{10, 18}. Early recognition of these „warning signs“ before catastrophic major attacks is essential for accurate early diagnosis to improve the outcome for aneurysmal patients. Mortality and morbidity rates were higher in the group without warning signs than in the group with them, due to the greater likelihood of the latter group seeking medical care. Only 13 of the 60 cases (22%) in this series showed warning signs and most other cases lost consciousness without prior warning. In order to prevent misdiagnoses and overlooking of „warning signs“ and to ensure that patients receive early medical attention, public health and primary physician education on aneurysmal SAH are of vital importance^{9, 15}.

Many prognostic factors have been reported as to what patients are most likely to suffer from aneurysmal rupture^{4, 7, 12, 13, 14, 17}. They include age, sex, systolic blood pressure, diastolic blood pressure, neurological status, especially consciousness level, vasospasm, presence of haematoma, site of aneurysm, size of aneurysm, shape of aneurysm, direction of aneurysm, interval from major bleeding to treatment, frequency of bleeding, medical condition, pre-existing hypertension, and hydrocephalus. Phillips *et al.*¹² reported that clinical grade on admission, the presence of haematoma, and a history of hypertension were the most useful variables in predicting 30-day survival. Interestingly, Torner *et al.*¹⁷ reported that the shorter the interval from the onset of SAH to admission and treatment, the worse the prognosis for survival and rebleeding during the 2-week period. This was probably due to more rapid referral for more severely ill patients.

With regard to management of ruptured aneurysms in the acute stage, what physicians can do to improve the patients' outcome is to control blood pressure, provide rapid referral of the patients to neurosurgical units, and use of antifibrinolytic drugs. Both systolic and

diastolic blood pressure on admission were related to death during the 2-week period¹⁷. Patients admitted with a systolic blood pressure of 170 mmHg or higher had a 2.9 times greater risk of dying than those admitted with a systolic blood pressure less than 140 mmHg¹⁷. With antifibrinolytic therapy, the mortality and frequency of rebleeding have been reduced during the initial critical two-week period². However, it is unlikely that antifibrinolytic therapy is useful for reducing rebleeding during the very early period immediately after the initial major rupture. Thus, in cases of early referral, the most promising medical means for minimizing rebleeding is pharmacologically-induced arterial hypotension⁸.

Hijdra and Gijn classified fatal aneurysmal haemorrhages into 4 groups, who died within 24 hours after the initial rupture or rebleeding⁶. Group A had tentorial herniation due to intracerebral or Sylvian haematoma. Group B had ventricular bleeding, especially into the fourth ventricle, without evidence of tentorial herniation. Group C was the combined picture of Groups A and B. Group D had only subarachnoid haemorrhage without herniation or ventricular haemorrhage. Among Group D, most patients suffered initial apnea and circulatory arrest, resulting in secondary brain damage. In our series, 6 cases showed moderate SAH. These cases might have been reversible and had a chance to survive if proper management, including prompt referral, had been provided immediately after aneurysmal rupture.

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