Reports in the literature on the clinical outcomes of patients with Hunt and Hess Grade IV and Grade V (poor-grade) acute aneurysmal SAH have shown poor results. These patients account for approximately 25% of all those admitted to hospitals with SAH. Hunt and Hess estimated that mortality rates were 71% for patients with Grade IV hemorrhages and 100% for those with Grade V ones. More than 90% of patients with poor-grade SAH die or become severely disabled when no treatment is given. Early surgical treatment has been generally accepted for patients with Hunt and Hess Grade I, II, or III SAH; however, there is still controversy about early treatment of patients with Grade IV or V SAH. Surgical aneurysm clip placement is usually performed in patients with the potential for clinical improvement. In these patients surgery is challenging and patients have an intrinsic higher risk of surgery-related complications. Recent published data show that early or ultra-early aggressive surgical treatment followed by NICU management may improve the risks of morbidity and mortality in these patients.

Endovascular occlusion of intracranial aneurysms using detachable coils has widely been accepted as a safe and effective alternative to surgical clip placement. It has become particularly attractive in patients with Hunt and Hess Grade IV or V SAH because it does not require brain manipulation. The aim of this paper is to report our

**Contribution of endovascular therapy to the management of poor-grade aneurysmal subarachnoid hemorrhage: clinical and angiographic outcomes**

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**Object.** Treatment of patients presenting with poor-grade (Hunt and Hess Grade IV or V) subarachnoid hemorrhage (SAH) is controversial. Endovascular coil embolization has been considered a valuable therapeutic alternative to surgical clip placement for this kind of patient. The aim of the present study was to evaluate immediate and long-term angiographic and clinical outcomes in patients with poor-grade SAH treated by endovascular embolization.

**Methods.** One hundred eleven patients with Hunt and Hess Grade IV or V SAH were treated with endovascular embolization at the University of California at Los Angeles Medical Center between October 1990 and December 2004. Eighty patients harbored Grade IV hemorrhages and 31 patients had Grade V ones. Immediate and long-term anatomical and clinical outcomes were evaluated in all patients. Long-term clinical outcome assessments were based on follow-up data obtained over an average of 32 months posttherapy.

Technical complications occurred in 15 patients (13.5%). Immediate complete aneurysm occlusion was observed in 51.4% of aneurysms. Angiographic, long-term follow-up review revealed aneurysm recanalization in 16.2% of cases. Thirty-nine patients (35.1%) demonstrated a favorable long-term clinical outcome. The overall mortality rate in this patient series was 32.4%. The mortality rate associated with vasospasm was significantly higher in patients with Grade IV SAHs than in those with Grade V hemorrhages.

**Conclusions.** The results of this study demonstrate a valuable contribution of endovascular therapy of ruptured intracranial aneurysms in patients with Hunt and Hess Grade IV or V SAH. This technique was successful in decreasing repeated aneurysm rupture and in enabling aggressive medical management during the acute phase of SAH. This is particularly important in patients with Grade IV SAH because of their potential for obtaining higher physical and functional recoveries.

**Key Words • poor grade • subarachnoid hemorrhage • cerebral aneurysm • endovascular therapy • embolization • rebleeding**
Endovascular therapy of poor-grade subarachnoid hemorrhage

experience in the endovascular treatment of patients with Hunt and Hess Grade IV or V hemorrhages, highlighting anatomical outcomes, technical and clinical complications, and perioperative and long-term clinical outcomes.

Clinical Material and Methods

Patient Selection and Initial Treatment

We conducted a retrospective analysis in 111 patients with Hunt and Hess Grade IV or V SAH, who were treated with the endovascular technique at UCLA Medical Center between October 1990 and December 2004. All patients were treated with standardized NICU preprocedural protocols: 1) placement of an external ventriculostomy catheter and neurointensive care with medical resuscitation; 2) surgical evacuation of the hematoma to reduce any intracranial mass effect; and 3) urgent cerebral angiography and endovascular coil embolization of and/or surgical clip placement on the ruptured aneurysm. The Hunt and Hess clinical grading was used to categorize the SAH in each patient immediately before the endovascular or surgical treatment. Patients who demonstrated clinical improvement leading to a reclassification of Hunt and Hess Grade III or better during or after preprocedural treatment were removed from this study.

Patient Demographics

Four hundred eighty-eight patients with aneurysmal SAH were treated with endovascular coil embolization between October 1990 and December 2004 at our institution; 111 (22.7%) of these patients had poor-grade SAHs. In 80 patients the hemorrhage was designated Grade IV and in 31 patients Grade V; the mean ages of the patients were 56.3 and 55.3 years, respectively.

Aneurysm Location and Configuration

Of the 111 ruptured aneurysms, 70 (63.1%) were located in the anterior circulation and 41 (36.9%) in the posterior circulation (Table 1). Forty-five aneurysms (40.5%) were small (≦10 mm) with a small neck (≦4 mm), 38 (34.2%) were small with a wide neck (>4 mm), 23 (20.7%) were large (11–25 mm), and five (4.5%) were giant (>25 mm) aneurysms (Table 2).

Timing of and Indications for Procedure

Thirty-seven patients (33.3%) were treated within 24 hours after admission to the hospital. In 81 patients (72.9%), the endovascular treatment was performed within 3 days, and in 102 (91.9%) endovascular treatment occurred within 5 days following SAH. Nine patients (8.1%) were treated between 6 and 10 days after SAH because there was a delay in patient transfer from another facility or a delay before the patient could be medically stabilized prior to the procedure. The indications for endovascular therapy included anticipated surgical difficulty in six patients (5.4%), failed aneurysm clip placement in 15 patients (13.5%), and poor neurological grade or medical condition in 90 patients (81.1%).

Technical Points of Endovascular Coil Embolization

All endovascular coil embolization procedures were performed by two interventional neuroradiologists in a dedicated neurointerventional angiography suite. All patients were in a state of general anesthesia. Systemic heparinization was achieved by intravenous administration of a bolus injection of 3000 to 5000 IU heparin followed by an intravenous injection of 1000 IU of the drug every hour. Heparin was administered after the first couple of coils had been placed for aneurysm protection. In some patients in whom treatment took place longer than 1 week after SAH onset, heparin was given before coil embolization. Systemic anticoagulation was routinely reversed by administering protamine sulfate immediately after the procedure. In patients in whom there was a possible risk of rebleeding during the procedure, anticoagulation therapy was delayed or not used. In a small number of patients, the aneurysm body and dome were occluded with coils, and a neck remnant was purposefully left. In these patients, a second coil embolization was performed in the following days. All patients were transferred to the NICU, where hemodynamic parameters and intracranial pressure were monitored, in addition to close clinical observation. Daily transcranial Doppler examinations were performed for early detection of vasospasm. Nimodipine was routinely administered to all patients. When appropriate, aggressive hypertensive, hypervolemic, and hemodilution therapy (also known as triple-H therapy) was used for arterial vasospasm. Endovascular pharmacological or mechanical treatment of symptomatic vasospasm was indicated in cases of severe arterial vasospasm unresponsive to triple-H therapy.

Angiographic and Clinical Outcomes

Data regarding the patients’ clinical and angiographic follow-up examinations were acquired from their medical records at UCLA Medical Center, referring physicians’ reports, neuroimagining studies, and follow-up phone communications with patients or family members. An mRS score was used to evaluate clinical outcomes. An early clinical outcome was assessed when the patient was discharged or transferred to another facility. Long-term clinical outcomes were assessed in surviving patients by clinical visits, phone communication, or during follow-up cerebral angiography examinations. The mean duration of the hospital stay was 19 days (range 1–65 days), and the mean long-term follow up of outcomes was 32 months (range 2–120 months).

Immediate angiographic findings were classified as evidence of complete occlusion of the aneurysm, an aneurysm neck remnant, and aneurysm body filling. Mid- and long-term follow-up angiography examinations were performed between 1 and 24 months with an average of 7 months after acute onset of the SAH. Multiple angiographic projections with selective contrast injections were performed to identify recanalization of the aneurysms. We used the classification of angiographic results posited by Roy, et al., and recanalization was defined as opacification of the aneurysm sac or an increase in the size of the residual neck.

Statistical Analysis

Data on periprocedural complications, such as aneurysm rupture, angiographic evidence of vasospasm, and thromboembolic complications as well as head computed tomography findings classified according to the Fisher grading system were collected.
The Fisher exact probability test was applied to determine whether the proportion of each category differed by group, such as mortality rates in patients with vasospasm in Hunt and Hess Grade IV and V groups.

Results

Immediate Angiographic and Anatomical Results

Fifty-seven aneurysms (51.4%) were completely occluded. A small neck remnant was observed after treatment in 48 aneurysms (43.2%). Incomplete occlusion of six aneurysms (5.4%) was shown on angiograms as contrast agent filling the aneurysm body and dome (Table 3). Three of these lesions were treated again with embolization during the patients' hospital stay. In the rest of the cases, the patients died without additional treatments.

Immediate Technical and Clinical Complications

Fifteen intraprocedural technical complications (13.5%) were observed. Aneurysm perforation was observed in six patients (5.4%). Four of these six patients died during the hospital stay. Of the two surviving patients, one had cognitive dysfunction and the other patient continues to have a moderate disability. In four patients (3.6%) parent artery thrombotic occlusion or stenosis developed. One patient with a basilar tip aneurysm experienced P1 segment thrombosis, which was successfully treated by an intraarterial injection of urokinase. Two patients with small anterior communicating artery aneurysms experienced A2 thrombosis. One patient with a large basilar tip aneurysm had a clot at the P1 segment that was partially recanalized by an intraarterial injection of abciximab (ReoPro; Lilly Co., Indianapolis, IN). Of these four patients, two died while in the hospital. The two survivors had long-term mild disabilities. In three patients (2.7%) there was an untoward cerebral clot embolization. One of these patients, who had a small posterior communicating artery aneurysm, received an intraarterial injection of urokinase immediately after successful aneurysm occlusion. Rebleeding in this patient developed and led to death. Two patients, one with an anterior communicating artery aneurysm and the other with a middle cerebral artery aneurysm, survived with moderate neurological deficits. Dissection of the carotid artery occurred in one patient (0.9%). Coil herniation with subsequent ICA occlusion was observed in one patient with an ophthalmic artery aneurysm (Table 4).

Rebleeding and Hematoma

There were no cases of aneurysm rebleeding after endovascular occlusion of the ruptured aneurysm. However, repeated aneurysm rupture occurred in four patients before endovascular therapy. Three of these patients had a Hunt and Hess Grade IV SAH and one had a Grade V hemorrhage. Only one of these patients survived with a severe neurological disability.

Computed tomography scans of the head performed on admission revealed an intracranial hematoma with a mass effect in 14 patients. Eight of these patients underwent surgical evacuation of the hematoma. Seven of these patients underwent hematoma evacuation after coil embolization and one before the endovascular procedure.

Arterial Vasospasm

Angiographic evidence of vasospasm was found in 57
Endovascular therapy of poor-grade subarachnoid hemorrhage

TABLE 3
Immediate angiographically determined outcomes of endovascular treatment in 111 patients with Hunt and Hess Grade IV or V SAH*

<table>
<thead>
<tr>
<th>Hunt &amp; Hess Grade</th>
<th>IV (%)</th>
<th>V (%)</th>
<th>Total (%)</th>
</tr>
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<tbody>
<tr>
<td>complete occlusion</td>
<td>41 (51.2)</td>
<td>16 (51.6)</td>
<td>57 (51.4)</td>
</tr>
<tr>
<td>incomplete dome occlusion</td>
<td>4 (5.0)</td>
<td>2 (6.5)</td>
<td>6 (5.4)</td>
</tr>
<tr>
<td>neck remnant</td>
<td>35 (43.8)</td>
<td>13 (41.9)</td>
<td>48 (43.2)</td>
</tr>
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</table>

* Values represent numbers of aneurysms (%).

patients (51.4%). Forty-one patients (36.9%) required endovascular treatment with an intraarterial injection of a vasodilator and/or balloon angioplasty. The combination of both techniques was used in eight patients (7.2%); intraarterial injection of a vasodilator alone was used in 29 patients (26.1%) and balloon angioplasty alone was used in four patients (3.6%) (Table 5). The relationship between early death and vasospasm is shown in Table 6. In patients who harbored Hunt and Hess Grade V SAH, the mortality rate (p = 0.002, Fisher exact probability test).

Clinical Outcome

Early clinical outcomes were assessed by applying the mRS at the time of patient discharge. Eighty-one patients (73%) survived and 30 patients (27%) died. At discharge, 79 patients (71.2%) remained moderately or severely disabled and two patients (1.8%) only had a slight disability (Table 7).

Long-term clinical outcomes were obtained in 105 patients. Thirty-nine patients (35.1%) had a favorable functional outcome with an mRS score of 2 or less. Thirty patients (27%) continued to have a moderate or severe disability. Six additional patients died as a result of the SAH. Four of these patients died in another healthcare facility within 2 months after discharge. Two patients died of complicated infections 4 months after discharge.

The overall long-term mortality rate was 32.4%. The subgroup comparative analysis of Hunt and Hess Grades IV and V demonstrated that the early mortality rate was 20% in patients with Grade IV and 45.2% in those with Grade V SAH. The long-term mortality rate was 25% in patients with Grade IV and 51.6% in those with Grade V SAH. A favorable long-term clinical recovery was more apparent in patients with Grade IV hemorrhage. Thirty-five (43.8%) of those patients had a favorable outcome. There was a significant difference in the proportion of favorable (mRS Scores 0, 1, and 2) and poor (mRS Scores 3, 4, 5, and 6) outcomes between the Hunt and Hess Grade IV and Grade V groups (p < 0.002, Fisher exact probability test).

Long-Term Angiographic Outcome

Long-term follow-up angiographic examinations were performed in 37 patients at a mean interval of 7 months after the primary SAH. In addition to patients who died, those with moderate or severe disabilities were difficult to schedule for follow-up angiography after discharge from the hospital. In this group, follow-up angiograms were obtained in only 11 patients (29.7%). Reasons for the lack of follow-up data were patients’ refusal and also geographical difficulties in returning for tests. In contrast, in patients with mRS scores of 3 or less, follow-up angiograms were obtained in 26 patients (70.3%). In six patients (16.2%) recanalizations of the treated aneurysms developed. In three of these patients there was “opacification of the sac” and in the others “increasing size of the residual neck.” The first three patients were treated with repeated embolization. The other patients were observed with follow-up angiography, which demonstrated no significant interval changes. Therefore, repeated embolization was not a treatment option in these patients. Two patients (5.4%) demonstrated progressive aneurysm thrombosis. In 29 patients (78.4%), the aneurysms remain anatomically unchanged.

Discussion

We report immediate and long-term anatomical and clinical outcomes in 111 patients (22.7%) with Hunt and Hess Grades IV or V SAH from 488 patients who consecutively presented with acute aneurysmal SAH at the UCLA Medical Center.

Endovascular treatment of intracranial aneurysms was revolutionized in the early 1990s with the introduction of GDCs (Target Therapeutics, Inc., Fremont, CA). The GDC technique has been widely accepted as a valid alternative to surgical clipping of the aneurysm.20,29 In the ISAT, investigators compared the safety and efficacy of endovascular...
coil embolization and neurosurgical clip placement in patients presenting with acute aneurysmal SAH. The risk of death or dependence was 23.7% for the endovascular group and 30.6% for the surgical group. Therefore, the absolute risk reduction in dependence or death for the endovascular treatment, compared with surgical treatment, was 6.9% (95% confidence interval 2.5–11.3%). Based on statistically significant data, the trial was halted prematurely. The ISAT (95% confidence interval 2.5–11.3%). Based on statistically significant data, the trial was halted prematurely. The ISAT was a prospective randomized trial, but it has elicited some criticism.7 The patients represented a subgroup in which 97% of the aneurysms were located in the anterior circulation, 93% were 10 mm or smaller, and 88% were associated with a good clinical status. Most patients in the ISAT had Grade I, II, or III SAH, and only 94 (4.4%) of the 2143 randomized patients (1070 assigned to neurosurgical clip placement and 1073 assigned to endovascular coil embolization) were classified as WFNS Grade IV or V, grades equivalent to Hunt and Hess Grades IV and V, respectively.

Historically, the surgical treatment of poor-grade SAH has only been performed in patients in whom there was the potential for a clear clinical recovery.1,15 Recent advances in the technique of microneurosurgery as well as those in neuroradiology and postoperative management have allowed vascular neurosurgeons to perform earlier surgery in patients with poor-grade SAHs.17,18,21 Bailes and colleagues1 reported a 50% rate of mortality and a 35% rate of good neurological outcome for patients with Hunt and Hess Grade IV or V. Spetzger and Gilsbach25 reported a 54% rate of favorable neurological outcome and a 28% rate of mortality for selected patients with Grade IV or V aneurysmal SAH. Le Roux and associates18 treated all patients with poor-grade aneurysmal SAH aggressively, resulting in a 38% rate of favorable outcome and a 43% rate of mortality. Although there are unavoidable selection biases that prohibit a direct comparison, our present report in similar patients treated endovascularly shows an overall 32.4% rate of mortality and a 35.1% rate of favorable outcome (mRS Score ≤ 2) during long-term clinical follow up (average 32 months). In previous smaller clinical patient series in which endovascular treatment of poor-grade aneurysmal SAH was performed, similar long-term mortality and morbidity rates have been demonstrated. Kremer, et al.,16 evaluated data in 40 patients with Hunt and Hess Grade IV or V, and reported a 40% mortality rate and a 6 months’ favorable outcome (GOS Score 4 or 5) in 40% of patients. Bracard and colleagues5 reviewed the cases of 80 patients with Hunt and Hess Grade IV or V, and reported a 37.5% rate of mortality and a 52.5% rate of favorable outcome (GOS Score 4 or 5) at the 1-year follow up. Bergui and Bradac3 demonstrated a 44.4% mortality rate and a 48.9% “favorable” clinical outcome rate with, at most, moderate disability at the 6-month follow up. The differences between the rates of mortality and favorable outcome reported in previous surgical or endovascular series and the rates in our study are probably related to patient selection and application of a different clinical outcome scale. The mRS is stricter and more detailed than the GOS in the assessment of long-term clinical outcomes. If our long-term clinical outcome is reevaluated using the GOS, the favorable outcome rate increases to 47.7% (53 of 111 patients).

These results show that a substantial proportion of patients with poor-grade aneurysmal SAH may survive after being treated with a combination of endovascular aneurysm embolization and aggressive NICU medical management. Many of these patients demonstrated substantial functional improvement following intense physical and occupational therapy.

Only two patients (1.8%) showed a favorable outcome at the time of hospital discharge. However, 39 patients (35.1%) had a good long-term clinical outcome. This clini-

### TABLE 6

<table>
<thead>
<tr>
<th>Vasopasm and mortality in patients with Hunt and Hess Grade IV or V SAH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. of Deaths for</strong></td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td><strong>Vasopasm w/ or w/o treatment</strong></td>
</tr>
<tr>
<td>vasopasm w/o treatment</td>
</tr>
<tr>
<td>no vasopasm</td>
</tr>
<tr>
<td>total</td>
</tr>
</tbody>
</table>

* p < 0.03. Fisher exact probability test.

### TABLE 7

<table>
<thead>
<tr>
<th>Clinical outcomes and disease evolution in 111 patients with Hunt and Hess Grade IV or V SAH*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modified Rankin Scale Score</strong></td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td>favorable outcome</td>
</tr>
<tr>
<td>0, no symptom</td>
</tr>
<tr>
<td>1, no significant disability</td>
</tr>
<tr>
<td>2, slight disability</td>
</tr>
<tr>
<td>moderate or severe disability</td>
</tr>
<tr>
<td>3, moderate disability</td>
</tr>
<tr>
<td>4, moderately severe disability</td>
</tr>
<tr>
<td>5, severe disability</td>
</tr>
<tr>
<td>death</td>
</tr>
<tr>
<td>unknown</td>
</tr>
</tbody>
</table>

* Values represent numbers of patients (%); 80 patients harbored Grade IV SAH and 31 Grade V SAH.
cal improvement was more apparent in patients with Hunt and Hess Grade IV SAHs.

A subgroup analysis of patients with Grade IV and V SAH revealed statistically significant differences with a more favorable clinical outcome in those in the Grade IV group. In patients in the Grade V group a favorable outcome was seen in 12.9% and death in 51.6%. This finding confirms that most patients with Grade V SAH suffer profound and irreversible brain damage from the initial SAH.

Angiographically evident arterial vasospasm was observed in 57 patients (51.4%). In the subgroup analysis, a significant difference was found in the rate of arterial vasospasm between the Grade IV and V groups. However, the mortality rate related to severe vasospasm was higher in patients in the Grade IV group. This finding suggests that patients with Grade V SAHs may die as a result of the substantial initial hemorrhage and brain injury that occur before vasospasm develops.

Patients in the Grade IV group also showed a higher incidence of aneurysm rebleeding. In our study, rebleeding occurred in four patients prior to endovascular therapy. Of these four patients, three were in the Grade IV group and one in the Grade V group. Three of these patients died and severe neurological complications developed in one patient. Juvela reported a mortality rate of 74% due to repeated hemorrhage. Fujii et al. reported that 17.3% of cases of acute aneurysmal SAH had ultra-early rebleeding within 24 hours after hospital admission. More recently, Laidlaw and Siu reported a series of 132 consecutive patients with poor-grade SAH (WFNS Grade IV or V) who were surgically treated within 12 hours after SAH. These investigators reported presurgical rebleeding in 20% of all patients with poor grades. These facts stress the importance of performing early endovascular or surgical aneurysm exclusion followed by appropriate NICU management. In this patient series we did not identify cases of rebleeding after endovascular occlusion of the ruptured aneurysm with GDCs.

The main advantage of using the endovascular approach on ruptured aneurysms with patients in poor neurological status is that it allows aneurysm occlusion without brain manipulation. The early coil embolization of a ruptured aneurysm prevents aneurysm rebleeding and allows aggressive medical and/or endovascular management of symptomatic vasospasm. This becomes particularly important in patients with Hunt and Hess Grade IV hemorrhages. These patients may obtain a substantial clinical recovery if the dangers of aneurysm rebleeding and symptomatic vasospasm are aggressively treated.

Direct surgical clipping has often been withheld in patients with Grade V SAH because of the very poor prognosis even after aggressive resuscitative management. Nevertheless, rebleeding from an unprotected aneurysm continues to be an important cause of death during the observation period. Inamasu and associates reported that the use of endovascular techniques in patients with WFNS Grade V reduced the rate of aneurysm rebleeding. In their series, a significant improvement in the survival rate, but not in the rate of favorable clinical outcome, was demonstrated in patients with Glasgow Coma Scale score 6. Van Looon et al. undertook aggressive management with early endovascular treatment in 11 patients with WFNS Grade V and reported a 55% favorable outcome rate and a 36% mortality rate. Our findings show a high mortality rate and a low rate of favorable outcome in most patients in the Grade V group. A small number of these patients showed a long-term favorable clinical outcome.

Many investigators have attempted to define indices at hospital admission that can be predictive of who will recover or who will remain in very poor condition. The inability to predict clinical outcomes within several hours after acute SAH onset led surgeons to initiate aggressive management in the poor-grade group. Baltas and colleagues evaluated the effect of treatment timing on clinical outcome in 327 patients with aneurysmal SAH who were treated with endovascular coil embolization; these authors reported that the interval between SAH and endovascular treatment did not affect outcome. Our results confirm the belief in prompt initiation of endovascular treatment to prevent rebleeding and aggressive management to prevent vasospasm in patients with very poor grades.

The procedural complications of endovascular treatment in poor-grade aneurysmal SAH has been reported to be between 5% and 15%. In our series the technical complication rate was 13.5%. These technical complications have decreased in the last 4 years. Periprocedural complications occurred in 10 (18.2%) of 55 patients between October 1990 and December 2000 and in five (8.9%) of 56 patients between January 2001 and December 2004. The success or failure of endovascular treatment of aneurysms depends more on the shape of the aneurysm than on its location. Other important factors include recent technical advancements and the skills of the particular neurointerventionalist.

These patients need to be treated under the umbrella of a multidisciplinary team including vascular neurosurgeons, stroke neurologists, neurointensivists, interventional neuroradiologists, and neurological rehabilitation experts. In this study, nearly 50% of aneurysms were not completely occluded, although there were no cases of repeated rupture of the aneurysm postembolization, either immediately or in the long term. Three of the surviving patients underwent additional procedures for coil embolization. Follow-up angiography studies and additional embolization or surgical clip placement procedures could be performed after patients passed the acute critical stage.

Conclusions

Our findings demonstrate a valuable contribution of endovascular therapy to the management of poor-grade SAH. An early endovascular treatment followed by aggressive medical management is indispensable to prevent repeated rupture and vasospasm during the acute phase. This becomes particularly important in patients with Hunt and Hess Grade IV SAH. These patients may achieve a substantial clinical recovery if the dangers of aneurysm rebleeding and symptomatic vasospasm are aggressively treated. Multidisciplinary long-term clinical and angiographic follow up are also imperative for the potential higher functional recoveries and possible additional endovascular treatment.

References

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