UEV and the presence of dissecting aneurysms are the strongest predictors of aneurysmal rebleeding. Their presence should be carefully evaluated in the acute management of poor-grade aSAH [1)]

Agitation, stress, unwarranted mobilization, straining, intramuscular injection, pain and fever can increase hemodynamic stress and predispose to rebleeding. Blood pressure (BP) management is crucial to prevent occurrence of stroke, reduce rebleeding, and maintain cerebral perfusion. Risk of rebleeding in the 1st 24 h is as high as 14%. A practical goal is to maintain systolic BP <160 mmHg till obliteration of aneurysm

Recognizing risk factors for aneurysmal rebleeding is particularly relevant and might help to identify the aneurysms that benefit from acute treatment [2)]

Blood Pressure

Nicardipine, labetalol and sedation have been used to control hypertension. Almost 90% patients demonstrate some ECG changes attributable to neuro-cardiac response to sudden increase in ICP or intracranial bleed. These changes may be difficult to differentiate from that of myocardial ischemia. Severe arrhythmias (prolonged QT interval) and ischemic changes (ST changes) can result in increased hemodynamic complications, ischemic deficits, increased neurological intensive care unit (NICU) stay and mortality.

Hypotension can also occur after aSAH and is a manifestation of myocardial dysfunction. It manifests from excessive catecholamine levels and myocardial band necrosis and is seen with poor grade aSAH [3)].

Challenges during anesthetic induction and intubation

General goals include smooth induction and hemodynamic control to prevent rebleeding. Propofol or thiopentone in liberal doses attenuates hemodynamic response and rebleeding risk in good grade patients. In poor grade patients with raised ICP, dose reduction is required as induction hypotension can compromise cerebral perfusion. Intubation should be smooth and swift to minimize hemodynamic stimulation as rupture of the aneurysm during intubation is associated with poor outcome.

Difficult intubation may be encountered when a large internal carotid artery (ICA) aneurysm protrudes into the oral cavity.

The risk from hemodynamic and hypoxic stress associated with repeated attempts at intubation can have an adverse bearing on the outcome [4)].

Time

Recurrent hemorrhage is highest within 24 hours of subarachnoid hemorrhage (SAH) and increases with the severity of the clinical grade, a recurrent hemorrhage can occur anytime after the initial SAH in patients with both good and poor clinical grades.

Park et al. adopted a 24-hour-a-day, formal protocol, emergency treatment strategy for patients with

ruptured aneurysms to secure the aneurysms as early as possible. The incidences of in-hospital rebleeding and clinical outcomes were investigated and compared with those from previous years when broadly defined early treatment was used (< 3 days of SAH).

During an 11-year period, a total of 1224 patients with a ruptured aneurysm were managed using a strategy of broadly defined early treatment between 2001 and 2004 (Period B, n = 423), a mixture of early or emergency treatment between 2005 and 2007, and a formal emergency treatment protocol between 2008 and 2011 (Period A, n = 442). Propensity score matching was used to adjust the differences in age, sex, modified Fisher grade, World Federation of Neurosurgical Societies (WFNS) clinical grade at admission, size and location of a ruptured aneurysm, treatment modality (clip placement vs coil embolization), and time interval from SAH to admission between the two time periods. The matched cases were allotted to Group A (n = 280) in Period A and Group B (n = 296) in Period B and then compared.

During Period A under the formal emergency treatment protocol strategy, the catheter angiogram, endovascular coiling, and surgical clip placement were started at a median time from admission of 2.0 hours, 2.9 hours, and 3.1 hours, respectively. After propensity score matching, Group A showed a significantly reduced incidence of in-hospital rebleeding (2.1% vs 7.4%, p = 0.003) and a higher proportion of patients with a favorable clinical outcome (modified Rankin Scale score 0-3) at 1 month (87.9% vs 79.7%, respectively; p = 0.008). In particular, the patients with good WFNS grades in Group A experienced significantly less in-hospital rebleeding (1.7% vs 5.7%, respectively; p = 0.018) and better clinical outcomes (1-month mRS score of 0-3: 93.8% vs 87.7%, respectively; p = 0.021) than the patients with good WFNS grades in Group B.

Patients with ruptured aneurysms may benefit from a strategy of emergency application of surgical clip placement or endovascular coiling due to the reduced incidence of recurrent bleeding and improved clinical outcomes [5)].

Size

A meta-analysis was performed to evaluate whether an association could be determined between aneurysm diameter and the rebleeding rate before treatment. Potentially confounding factors such age, aneurysm location, and the presence of hypertension were also evaluated.

Boogaarts et al. systematically searched the PubMed, Embase, and Cochrane databases up to April 3, 2013, for studies of patients with aneurysmal subarachnoid hemorrhage that reported the association between aneurysm diameter and pretreatment aneurysmal rebleeding. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria were used to evaluate study quality.

Seven studies, representing 2121 patients, were included in the quantitative analysis. The quality of the studies was low in 2 and very low in 5. Almost all of the studies used 10 mm as the cutoff point for size among other classes, and only one used 7 mm. An analysis was performed with this best unifiable cutoff point. Overall rebleeding occurred in 360 (17.0%) of 2121 patients (incidence range, from study to study, 8.7%-28.4%). The rate of rebleeding in small and large aneurysms was 14.0% and 23.6%, respectively. The meta-analysis of the 7 studies revealed that larger size aneurysms were at a higher risk for rebleeding (OR 2.56 [95% CI 1.62-4.06]; p = 0.00; I 2 = 60%). The sensitivity analysis did not alter the results. Five of the 7 studies reported data regarding age; 4 studies provided age-adjusted results and identified a persistent relationship between lesion size and the risk of

rebleeding. The presence of hypertension was reported in two studies and was more prevalent in patients with rebleeding in one of these. Location (anterior vs posterior circulation) was reported in 5 studies, while in 4 there was no difference in the rebleeding rate. One study identified a lower risk of rebleeding associated with posterior location aneurysms.

This meta-analysis showed that aneurysm size is an important risk factor for aneurysmal rebleeding and should be used in the clinical risk assessment of individual patients. The authors' results confirmed the current guidelines and underscored the importance of acute treatment for large ruptured aneurysms [6].

1)
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