EDITORIAL

Ultra-early surgery for aneurysmal subarachnoid hemorrhage

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IN this issue, Park and colleagues analyzed patient outcome before and after implementation of a protocol of “emergency treatment” for patients with aneurysmal subarachnoid hemorrhage (SAH) admitted to their high-volume tertiary care hospital.³ Prior to implementing this protocol, the authors admitted patients with SAH on hospital Day 0, performed diagnostic catheter angiography on hospital Day 1, and treated the offending aneurysm on hospital Day 2. After implementing this protocol, the authors admitted patients with SAH, performed diagnostic catheter angiography within 1–2 hours of admission, and treated the offending aneurysm immediately thereafter. Results from this change in treatment approach were substantial: the median time from admission to the start of surgical treatment was reduced from 39.7 to 3.1 hours, and the median time from admission to the start of endovascular treatment was reduced from 49.4 to 2.9 hours. Impressively, these very short-term intervals to treatment were maintained in patients admitted during the day (7 a.m. to 7 p.m.) as well as those admitted at night (7 p.m. to 7 a.m.). This markedly shorter time interval to treatment was associated with a significant reduction in in-hospital rebleeding, i.e., a 6.4% incidence prior to implementing the protocol, compared to a 1.8% incidence after implementing the protocol. This reduction in in-hospital rebleeding had a significant impact on patient outcome, as a propensity score analysis controlling for differences in age, sex, World Federation of Neurosurgical Societies clinical grade, aneurysm location, and treatment modality between the 2 study periods identified a significant improvement in patient outcome (79.7% favorable outcome before the protocol vs 87.9% favorable outcome after the protocol). These data strongly support the notion that definitively treating patients with ruptured brain aneurysms within hours rather than days of admission is beneficial for decreasing rebleed rates and improving patient outcome. The authors are to be applauded for their tremendous ded-

ication towards the care of their patients with SAH and commended for this valuable addition to the literature.

Prior to publication of the International Cooperative Study on the Timing of Aneurysm Surgery,² the standard time for aneurysm treatment was more than 1 week after SAH to allow for subsidence of cerebral edema related to the initial hemorrhage and to avoid the peak window of cerebral vasospasm. Results from this seminal study, however, fundamentally changed this paradigm, as surgical risks were found to be no different in patients treated early after SAH (0–3 days) versus those treated late (more than 7 days), and many patients were noted to have died or had poor outcomes from rebleeding and/or vasospasm while waiting for aneurysm surgery. This led to the modern management schema in which SAH patients are treated “early” after SAH, which is typically defined as within 3 days of ictus. Recent data from the Intra-operative Hypothermia for Aneurysm Surgery Trial not only support this schema, but also suggest that the optimal therapeutic window may actually be 0–2 days rather than 0–3 days, as post hoc analysis showed patients treated 3–6 days after SAH fared worse than those treated 0–2 days after SAH.⁵ Whether further reductions in the time interval between SAH and aneurysm treatment produce even better patient outcomes, however, remains unproven. The main rationale for further decreasing this time interval is to minimize the risk of rebleeding, while the main concern of “emergency” or “ultra-early” aneurysm treatment is the potential that this will lead to increased periprocedural risks in cases performed at night without the benefit of an optimal surgical or endovascular team and with the potential for surgeon/staff fatigue. Results from the present study strongly suggest that very early aneurysm treatment (median times from SAH to aneurysm clip placement/coil embolization were 7.5/7.9 hours after implementation of the protocol) leads to a reduction in rebleeding and improved patient outcome as compared to a treatment paradigm in which aneurysm treatment oc-

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curred 2 days after SAH (median time from SAH to aneurysm clip placement/coil embolization was 39.7/49.4 hours before implementation of the protocol). These results, however, do not address the question of whether “emergency” aneurysm treatment in the middle of the night, in which suboptimal conditions might increase the risk of procedural complications, is beneficial. For this question, an analysis of perioperative complications, rebleed rates, and long-term outcome in patients treated at night versus those treated the next day would be required. One wonders whether the benefit so clearly documented in this study would have been realized if the comparison group of patients had been managed with a protocol of “next day” aneurysm treatment rather than a protocol of treating the aneurysm 2 days after SAH. One also wonders whether the observed benefit would have been realized in centers (such as my own) where a short course of antifibrinolytic drugs is administered to patients with SAH to help prevent early aneurysm rebleeding.^{1,4} Overall, this is a well-conducted study that provides important data that strongly support the notion that patients with SAH should be treated in a very timely fashion (likely within 24 hours of ictus). Whether such patients are best served with “emergency” aneurysm treatment in the middle of the night, however, remains an unanswered question.

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Response

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We are very grateful to Dr. Zipfel for his thoughtful editorial on our article. Our goal was to investigate the effect of a 24-hour-a-day formal emergency treatment protocol in patients with a ruptured aneurysm on the incidence of recurrent hemorrhage and clinical outcomes. As

indicated by Dr. Zipfel, an emergency treatment strategy can increase the periprocedural risks for cases performed at night with the potential of surgeon fatigue, even though it minimizes the risk of in-hospital rebleeding.

This emergency treatment strategy was initiated with the intention to save even 1 out of 100 patients from recurrent hemorrhage. Thus, the strategy was considered meaningful if we could save 1 patient a year. In this study, the positive effects of the emergency treatment on the incidence of recurrent hemorrhage and clinical outcomes were statistically significant when comparing the emergency treatment with a broadly defined early treatment (< 3 days). However, if the emergency treatment strategy is compared with a strict, early (< 1 day) treatment strategy, the positive effects may or may not reach statistical significance. However, the patients who can be saved from recurrent hemorrhage are still present, as there is no definitive method to prevent recurrent hemorrhage except for surgical and endovascular treatments.

The implementation of a formal protocol for emergency treatment of ruptured aneurysms over the past 10 years has also affected the management system in our hospital. The sequence of patient triage in the emergency room, catheter angiography, the in situ joint decision on the treatment by the surgeon and interventionist, and immediate surgical or endovascular treatment are performed systematically and as rapidly as possible. In addition, our surgeons and interventionists are available to treat patients day and night. Essentially, this system has been built and maintained based on the belief and devotion of the team members (residents, fellows, nurses, and staff in the Departments of Neurosurgery, Radiology, and Anesthesia). During this time, cases of acute ischemic stroke have also been increasing and have become another significant emergency burden for our neurovascular team. In recent years, our annual emergencies included 110 cases of a ruptured aneurysm (endovascular coiling or surgical clip placement) and 70 cases of acute ischemic stroke (endovascular or surgical recanalization). Fortunately, the procedural times for cerebrovascular diseases are relatively short: 2 hours for surgical clip placement, 1 hour for endovascular coiling, less than 1 hour for an intraarterial thrombectomy, and 1 hour for a minimally invasive surgical embolectomy.^{1,2}

This study was performed to investigate the effects of our emergency treatment strategy and decide on a future treatment strategy for our hospital. As a result, we will now devise appropriate measures to continue and improve the efficiency of our emergency treatment strategy. However, the implementation of an emergency treatment strategy should be based on the actual situation of individual hospitals.

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