EDITORIAL

Subarachnoid hemorrhage grading scales

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THE first popular scale grading neurological condition after subarachnoid hemorrhage (SAH) was published by Botterell and Cannell.¹ Hunt and Hess later modified this scale, emphasizing the importance of level of consciousness.⁵ They believed, correctly, that the level of consciousness reflected the status of the brain, in terms of swelling, hyperemia, and friability on surgical exposure. Neurosurgeons at that time (during the 1970s) began to realize that patients classified in Hunt and Hess Grades I and II did not generally have a “swollen, red, angry brain,” and therefore an operation could be performed early with relative safety. Later, the World Federation of Neurosurgical Societies (WFNS) introduced a new grading scale mostly based on the Glasgow Coma Scale (GCS) score, but also incorporating the presence of focal neurological deficits.¹³ Sano et al. proposed a modification of the WFNS scale that was strictly defined by the GCS, disregarding the presence of focal neurological deficits.¹² This modification was demonstrated to have better discriminating value between grades in terms of outcome.

In this issue of the *Journal of Neurosurgery*, Fung et al. introduce an interesting modification to the WFNS scale.⁴ Essentially, they classify as Grade IV not only the patients previously classified as Grade IV on the WFNS scale, but also those patients who would be classified as Grade V because of a GCS score of 3–6, but who do not exhibit any “positive” signs of brainstem dysfunction (posturing and/or pupillary abnormalities). Their rationale for this modification is that the “negative” signs (absence of verbal or motor response) can be due to factors such as sedation and postictal state, which are not incompatible with good recovery. On the other hand, they rightly assume that the presence of positive signs of brainstem dysfunction is much more likely to be correlated with an eventual poor outcome. They tested their hypothesis by comparing the WFNS scale with their own modification and found that their scale, which they abbreviate as hWFNS (for WFNS herniation scale), shows a better correlation with outcome in terms of discriminating between Grades IV and V.

It should be pointed out that there are serious limitations to this study. Most importantly, the study is retrospective and, of the poor-grade patients, only 57% were treated, which may have introduced a very significant bias by treating only those patients who were thought to have a better chance of making a good recovery. Additionally, the difference in the discriminating value between the two scales was quite modest, which may or may not have been a reflection of the relatively small number of patients studied. It should also be noted that the authors are certainly not the first to have suggested that the presence of positive signs of brainstem dysfunction is useful in identifying patients in poor grade initially who are not likely to have a good outcome. Nakagawa et al., for example, suggested that patients with WFNS Grade V who did not have oculomotor palsy recover significantly better than those who had that finding.⁹

There have been several attempts to improve the discriminating potential of grading scales by increasing the granularity with which a patient's condition is assessed. Clearly, factors such as age, intraventricular hemorrhage, cardiac dysfunction, and other medical comorbidities weigh heavily on outcome.^{6,14} Ogilvy and Carter proposed a comprehensive grading system for patients with SAH that includes age, aneurysm size, Fisher grade, and Hunt and Hess score.¹¹ They indeed found that their scale was useful in stratifying outcomes with significant accuracy. The SAH prognosis score was another scale proposed to better stratify these patients by taking into account several important contributors to outcome, such as age and aneurysm size.⁸ The SAH score, which includes GCS score, age, and medical comorbidities, was also found to have better predictive power than the WFNS or the Hunt and Hess grading scales.¹⁰ However, none of these more complicated grading systems have gained significant popularity.

Fung and colleagues allude in their article to the importance of the timing of the grading. In fact, they grade their patients multiple times: at presentation, when they were first seen by a physician; at admission to the neuro-

surgical unit; and after diversion of CSF (when necessary). For the purposes of their study, they used the grading after diversion of CSF, presumably by ventriculostomy. This issue is extremely important. Nowadays, we see reports of high percentages of patients with Grade IV and V SAH who make good recoveries. One has to wonder at what point those patients were graded. It is a relatively common practice now to see a patient with SAH in the emergency room who may be in very bad neurological condition at that time, and therefore classified in a poor grade, and then to take that patient directly to the angiography suite where he or she is rapidly sedated, intubated, and ventriculostomy is performed, followed by diagnostic angiography and endovascular treatment when an aneurysm is found. Clearly many of these patients would have improved after ventriculostomy, and if they had been observed for some time off sedation, they would then have been reclassified as a lower grade, and therefore one should not be surprised that they had a good outcome.

In addition to the importance of the timing of the grading, it is also important to understand why the patient is in poor neurological condition. The patient could be classified in a poor grade initially not only from hydrocephalus, which can be corrected by ventriculostomy, but also, for example, from a temporal lobe hematoma. It is well known that when operations are performed expeditiously, many of these patients, even some who already had signs of herniation, make excellent recoveries. The situation is very different, of course, if the hematoma is centrally located; these patients are not likely to do well, even if the hematoma is evacuated. Another condition that can lead to an initial classification as poor grade is the not infrequent situation of the patient presenting in a postictal state due to an early-onset seizure, which has been estimated to occur in up to 26% of patients after SAH.⁷ As the group in Vienna have previously pointed out, many of these patients can be expected to have a significantly better outcome than the presenting grade would suggest.³ Nonconvulsive status epilepticus is also seen occasionally early after SAH; however, this condition is usually associated with an extremely poor outcome.²

Given the multiplicity of factors that determine outcome in patients with SAH, one has to consider the true utility of any grading scale, however complex. Clearly, these scales are useful in terms of communicating among treating physicians, and communicating in the literature. It would be difficult to contrast different therapeutic interventions if we did not have a common language with which to stratify these patients according to neurological presentation. However, when prognosticating for an individual patient, there is no substitute for the knowledge and experience of the clinician who can integrate all the factors pertinent to that particular patient, to come up with an intelligent prediction of outcome, which may influence the treatment plan. Certainly, a decision to not treat the patient (or what we sometimes euphemistically refer to as treating the patient “conservatively”) should never be made on the basis of the grade alone, since it is clear that some of these patients, when treated appropriately, make a good recovery. For example, 14% of patients with hWFNS Grade V (coma and positive signs of herniation) in the study by Fung et al. made a satisfactory recovery. There must have

been something in the initial evaluation of these patients that led these clinicians to treat these patients, because there were other patients with the same hWFNS grade that they chose not to treat. That “something” cannot be given to us by any scale—the clinician is still necessary!

The article by Fung et al. clearly confirms the fact that having positive findings of brainstem dysfunction is important in terms of predicting which patients are less likely to recover well, and considering this in our grading of patients with SAH, as proposed by the authors, seems reasonable.⁴ But how important is it to include other focal neurological deficits, such as hemiparesis and aphasia? It would be hard to argue that patients with these findings are likely to recover as well as other patients with the same level of consciousness who do not have those findings. However, as shown by Sano and others, downgrading a patient on the basis of a focal neurological deficit does not discriminate outcome significantly better than can be predicted from level of consciousness alone. It may be that including minor focal neurological deficits has diluted the significance of a serious hemiparesis or aphasia. Here again, in terms of the individual patient, there is no substitute for the clinician in terms of evaluating the significance of these deficits.

We heartily congratulate Fung et al. on their contribution with this study, and we look forward to the results of their prospective trial.

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Disclosure

The authors report no conflict of interest.

Response

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We thank Drs. Wang and Heros for their very thoughtful comments. Many groups have introduced or refined grading scales for SAH with the ultimate goal of improving prediction of patient outcome. We acknowledge that

many of the scales mentioned by Drs. Wang and Heros are more predictive than the original WFNS grading or any proposed simple modification. The drawback of some of these grading scales, however, is their complexity and the fact that grading was designed by statistical methods rather than by clinical pictures. Therefore, these statistically more predictive grading systems are often not intuitive and have not gained wide clinical popularity.

In general, grading should not be made more complicated simply to achieve a more accurate prediction of outcome when the management of the patient is unlikely to be changed. On the other hand, it may be worthwhile to modify a grading scale when a distinct clinical picture can be captured that may influence a management decision. Brainstem herniation is a distinct neurological syndrome that can be clinically diagnosed and is often associated with a worse prognosis and clinical course. We tried to limit the WFNS Grade V grading by the following methods: 1) excluding patients who do not show signs of brainstem herniation, and who according to clinical knowledge should have a better prognosis; and 2) using the grading scale after stabilization and CSF diversion instead of taking the scores of the patient at the initial presentation or at admission. We think poststabilization is when most decisions about the further management are made, except for patients in very poor condition in whom treatments such as CSF diversion have already been stopped.

We agree with Drs. Wang and Heros about the limitations of our study and that proof of our hypothesis in a prospective multicenter trial is required.