Another Score to Predict Ischemic Stroke Mortality?

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An 84-year-old man with a history of atrial fibrillation, congestive heart failure, and chronic renal insufficiency has a moderate to severe right middle cerebral artery infarct. He was not a candidate for intravenous or intra-arterial thrombolytics because of symptom onset on awakening and a completed infarct with no appreciable penumbra on computed tomography angiography or computed tomography perfusion. Following acute stabilization of patients like this man, the primary goals of care are to prevent complications and to begin rehabilitation. In addition, discussions with family regarding code status, end-of-life care preferences, and prognosis occur soon after admission. Clinicians generally rely on their anecdotal experience when these discussions occur, and these predictions have been shown to be relatively good. In one study of ischemic stroke patients, 90% of patients predicted to do poorly were dead or dependent at 6 months. However, clinicians tend to overestimate the likelihood of good outcome in stroke patients. In the same study, only 65% of ischemic and hemorrhagic stroke patients predicted by clinicians to survive 1 year and be independent were actually independent (defined as modified Rankin Score  $\leq 2$). Having a quantitative estimate of mortality or outcome in a patient such as this gentleman can help guide family discussions, since reliance solely on clinical prediction is insufficient.

Multiple prognostic models for mortality and functional status in stroke patients have been developed and validated. Simple models that include only age and National Institutes of Health Stroke Scale within the first 6 hours of symptom onset were shown to predict mortality up to 150 days poststroke. In this stroke population, mortality was predicted better by the models than by the treating physicians’ predictions. This model was subsequently validated in a clinical trial cohort (Virtual International Stroke Trials Archive, or VISTA) and was shown to have 75% accuracy for prediction of survival. Other models have included a variety of demographic, neurological, and disability predictors of survival. Despite the number of published models, very few have been widely accepted for clinical use.

The newest score, developed by Saposnik et al and published in this issue of *Circulation*, represents a significant step forward in the development of a clinical estimate of 30-day and 12-month mortality in ischemic stroke patients. This score, based on variables available during the acute stroke evaluation, was rigorously derived and internally validated in over 12,000 patients within the Registry of the Canadian Stroke Network and then externally validated with data from 3270 stroke patients in the Ontario Stroke Audit. In addition to age, gender, premorbid disability, admission glucose, and stroke type and severity, the list of variables include previously understudied comorbidities, such as renal failure on dialysis and cancer. Other risk factors are also important predictors, although heart-related conditions such as atrial fibrillation, congestive heart failure, and prior MI dominate the list. A novel aspect of this scale is the inclusion of age as a continuous variable in calculating risk, rather than using age strata or a cutoff, making it much easier to use clinically. This scale shows an excellent predictive value for 30-day and 1-year mortality across the spectrum of the scores, stratifying patients into very low to very high risk for death. For example, patients with scores of $<105$ have 1% to 3% 30-day mortality, whereas patients with scores of $>175$ have an estimated 40% mortality.

There are several notable benefits of this new scale. First and foremost is its inclusion of a variety of clinically relevant comorbidities that impact survival, all of which are available within the medical record early after the stroke admission. Of note, a comorbidity score such as the Charlson Index was not included, because as the model was developed, specific comorbidities, namely renal dialysis and cancer, and not just the quantity of comorbidities, predicted mortality.

An added strength of the score is that brain imaging results are intentionally excluded from the calculation. However, imaging data in addition to identifiable clinical syndromes would be used to determine the stroke type (lacunar versus nonlacunar), which is included within the score. This makes sense, because patients with lacunar stroke type have a much lower mortality rate and a lower stroke severity rate. If the stroke type is lacunar by imaging but causes severe impairment, or if there have been multiple prior lacunar strokes affecting prestroke disability, then these features are captured with the calculation of the iScore. This score should, therefore, be easy for nonneurologists to use, because the majority of stroke patients are cared for by these providers, often in small community hospitals where magnetic resonance imaging scanners may not be readily available. The lack of imaging data to calculate the iScore is very appealing for these settings.

Another benefit of the score is that it was developed and validated in a real-world sample of stroke patients, making it easily generalizable. This is in contrast to some scores that
were developed using clinical trial cohorts, where there were multiple biases associated with the patients who were eligible and who consented to participate. The authors also showed that there was a nearly linear relationship, with scores between 110 and 285, so there is no ceiling effect and only a floor effect with scores under 110. In addition, by testing assumptions that age and stroke severity provide the bulk of the predictive value, the authors showed that using only these 2 variables actually underestimated mortality at 30 days and 1 year.

No score is perfect, and there are some with notable weaknesses. First, race-ethnicity was not available in a portion of the derivation cohort and therefore could not be included in the model. It is a primarily white cohort based on the geographic regions where the data were collected. This lack of information may limit the generalizability to race-ethnic groups such as blacks and Hispanics. This is important because blacks have been shown to have higher stroke mortality than whites.9,10 Therefore, it would be useful to validate this score in a more diverse cohort prospectively to determine any race-ethnic differences. In addition, socioeconomic status or social support was not included, which may not influence mortality directly. However, indirectly, socioeconomic status and social support can impact access to medications or services, such as rehabilitation or adherence to appointments or medications.

There are multiple settings in which this score could be applied. For example, the iScore could be used to develop measures of quality of care for stroke patients postdischarge and for health system decisions. In this new era of accountability, when the observed mortality exceeds those predicted by the iScore, attention could be paid to acute and postacute care processes to determine the reasons for the excess mortality. In addition, 30-day readmission rates may also be closely tied to the iScore, another important measure of quality currently being instituted by Center for Medicare and Medicaid Services.

Back to the 84-year-old man with a moderate to severe right middle cerebral artery stroke and comorbidities, his iScore is 219, indicating a 38.5% 30-day and 84.8% 1-year mortalities. Should the patient and his wife be told these numbers do not replace clinical judgment and tacitful discussions with patients and families. In addition, the score does not include the presence of advanced directives, but it should certainly motivate discussing end-of-life care if those issues have not already been addressed. The iScore is likely to be most useful for patients whose scores are at the extreme high or low ends of the spectrum.

Many scores have been developed and, for various reasons, have never become part of clinical practice, so it remains to be seen if clinicians will embrace this score. The appeal of the iScore is the inclusion of clinical variables, the ease of use of the web-based tool, and the ability to have an early, quantitative estimate of mortality rather than relying on purely anecdotal (ie, gut feeling) predictions. Although this score could benefit from further testing in a variety of international, geographic, and race-ethnic groups, the iScore is likely to be useful as a guide for clinical decision-making, patient and family discussions, and health policy-making.

Disclosures

None.

References


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