# FOUR Score Challenges Glasgow Coma Scale

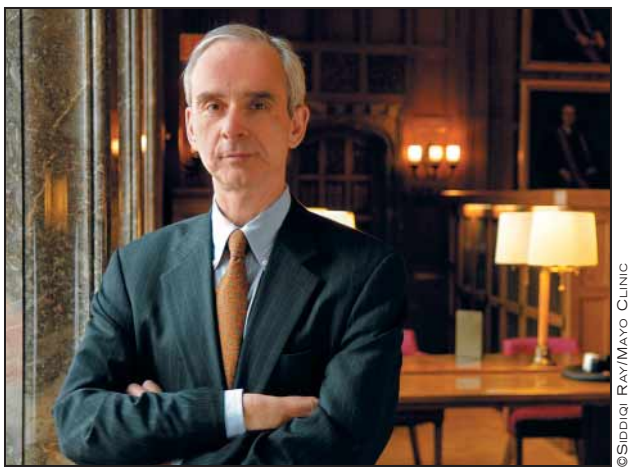
BY MICHELE G. SULLIVAN
*Mid-Atlantic Bureau*

A new coma assessment scale provides greater neurologic detail than the Glasgow system and has the potential to become the most effective means of evaluating unresponsive patients, according to researchers who developed it at the Mayo Clinic.

"The challenge over the years has been to produce a new scale that remains simple but still is comprehensive," said Eelco Wijdicks, M.D., who developed the Full Outline of Unresponsiveness (FOUR) Coma scale.

"Prior attempts to do this have been unsuccessful, largely because they had a more comprehensive scale that lost clarity and simplicity. This scale is very simple to use and greatly appreciated by nursing staff," Dr. Wijdicks said.

Graham M. Teasdale, M.B., inventor of the 30-year-old Glasgow scale, said the new system is more complicated to use and doesn't test as well among neurology nurses.



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**Dr. Eelco Wijdicks notes that FOUR is simple to use, yet comprehensive and helpful to nurses.**

"The Glasgow Coma Scale was developed to fill the need for a practical method to assess impairment of consciousness in all types of patients with acute brain insult, in all places, by all kinds of staff, at all times, often minute by minute," Dr. Teasdale, professor emeritus of neurosurgery at the University of Glasgow, Scotland, said in an interview. The FOUR scale is applicable to a smaller proportion of patients and appears to be more complicated, requiring extra training to effectively implement, he said.

Dr. Wijdicks said that neurologists have long complained that the Glasgow Coma Scale (GCS) was an imperfect tool for assessing consciousness. "The major reason is that the GCS doesn't include brain stem reflexes and respiration patterns, which reflect the severity of coma," Dr. Wijdicks, a neurologist at the Mayo Clinic, Rochester, Minn., said in an interview.

"Also, the eye component doesn't involve voluntary eye movements and so can't recognize visual tracking and a locked-in syndrome." Finally, he said, the GCS verbal assessment is a moot point for intubated patients.

The FOUR scale assesses voluntary and involuntary eye response; voluntary and involuntary motor response; respiration patterns; and brainstem response as measured by pupil and corneal reflexes. When using the FOUR system, evaluators assign a score of 0-4 in each category. A score of 4 represents normal functioning, while a score of 0 indicates nonfunctioning and should alert the physician to consider a brain death evaluation. (See box.)

The eye component detects both locked-in syndrome, characterized by complete paralysis of voluntary muscles except for those that control eye movement, and vegetative state. The motor category assesses for the presence of myoclonus status, a poor prognostic sign after cardiac resuscitation. It combines decorticate and withdrawal responses, a difference Dr. Wijdicks said is often difficult to differentiate.

Breathing patterns are graded, because Cheyne-Stokes respiration and irregular breathing can represent bihemispheric or lower brainstem dysfunction.

A recently published validation study of FOUR included 120 neurointensive care unit patients, the largest validation study ever on coma scales, evaluated by pairs of neurointensivists (neurologists trained in critical care), neurologic nurses, and residents in different combinations. All raters were given the same training on using the system: 20 minutes' instruction using videos, a single page of written instructions, and the opportunity to practice by grading a few patients (Ann. Neurol. 2005; 58: 585-93).

Average patient age was 59 years, and their brain injuries were of mixed etiology, including hemorrhagic or ischemic stroke (24%), traumatic head injury (21%), brain tumor (11%), and other neurologic illness (13%).

Physician rater pairs scored the best, with good to excellent agreement. Nurse pairs had fair to moderate agreement. Nurse agreement was highest on the respiration and motor components and lowest on the eye and brainstem components. The agreement of the nurses with residents and neurointensivists was good to excellent.

The lower nurse agreement could be one of the biggest drawbacks to the FOUR system, said Donald W. Marion, M.D., a fellow at the Brain Trauma Foundation in New York City. "The fact is, when Dr. Teasdale devised the Glasgow score, the original intention was to develop a score easily used by nurses," Dr. Marion said. "They were concerned that nurses be able to accurately report to the next shift and to physicians the status of the patient."

Reliability among less highly trained personnel is a key indicator of a tool's simplicity and ease of use, Dr. Marion pointed out. "If no one other than a specialist can use it, that's a problem."

Dr. Teasdale agrees. "The study uses too restricted a range of staff—all were in a specialized tertiary critical care unit," he said. "What about the 'average' emergency room or hospital?"

The FOUR scale does succeed in getting around some of the biggest problems with GCS, including the issue of intubation, which negates the verbal assessment. But FOUR probably won't be any more useful than GCS for traumatic brain injury patients, many of whom are sedated by the time they are assessed at a trauma center, Dr. Marion said.

Nevertheless, "there are some real pluses with it—most importantly, looking for pupil changes and corneal responses. That's a real important improvement over the Glasgow score." The FOUR scale may be a good supplement to the GCS in some specific areas, but probably won't supplant it, Dr. Teasdale said. "It must and will remain as a basic universal language. However, one of its benefits is its flexibility so it can be adapted, which is the essence of what Dr. Wijdicks has done, as have others in the past." ■

## Scoring the Full Outline Of Unresponsiveness

**EYE RESPONSE**
4 = Eyelids open, tracking or blinking to command.
3 = Eyelids open but not tracking.
2 = Eyelids closed but open to loud voice.
1 = Eyelids closed but open to pain.
0 = Eyelids remain closed to pain.

**MOTOR RESPONSE**
4 = Thumbs up, fist, or peace sign.
3 = Localizing to pain.
2 = Flexion response to pain.
1 = Extension response.
0 = No response to pain, or general myoclonus status.

**BRAIN STEM REFLEXES**
4 = Pupil and corneal reflexes present.
3 = One pupil wide and fixed.
2 = Pupil or corneal reflexes absent.
1 = Pupil and corneal reflexes absent.
0 = Pupil, corneal, and cough reflexes absent.

**RESPIRATION**
4 = Not intubated, regular breathing pattern.
3 = Not intubated, Cheyne-Stokes breathing pattern.
2 = Not intubated, irregular breathing.
1 = Breathes above ventilator rate.
0 = Breathes at ventilator rate or with apnea.

Source: Dr. Wijdicks

*To receive a copy of the FOUR pocket instructional card, e-mail Dr. Wijdicks at wijde@mayo.edu.*

# Novel Drug Shows Promise for Sleep Initiation, Maintenance

BY BRUCE JANCIN
*Denver Bureau*

DENVER — Gaboxadol significantly improved sleep initiation and maintenance while also increasing time spent in restorative slow-wave sleep in an acute phase II placebo-controlled trial, Stephen Deacon, Ph.D., reported at the annual meeting of the Associated Professional Sleep Societies.

Based upon these and other encouraging findings, gaboxadol—first in a novel class of sleep medications known as selective extrasynaptic γ-aminobutyric acid-A agonists, or SEGAs—is now in larger definitive phase III clinical trials, added Dr. Deacon, head of clinical development for sleep disorders at H. Lundbeck, Ltd., Milton Keynes, England.

The benzodiazepine receptor agonists, a class of drugs widely prescribed for insomnia, also target γ-aminobutyric acid (GABA) receptors; however, their action is confined to synaptic GABA receptors. The extrasynaptic GABA-A receptors modulated by gaboxadol are richly present in parts of the brain thought to be important in sleep regulation, he explained.

Dr. Deacon reported on 26 adults with primary insomnia who participated in a double-blind triple-crossover polysomnographic study. They received either 5 or 15 mg of gaboxadol or placebo half an hour before bedtime on two consecutive nights during three sessions separated by 1-2 weeks.

The low- and higher-dose gaboxadol reduced total nightly time awake by 15% and 16%, respectively, compared with the mean 68.5 minutes with placebo. Each of the two dosages of gaboxadol improved total sleep time by 3% over the mean 409 minutes with placebo.

In addition, gaboxadol at 15 mg increased the amount of time patients spent in slow-wave sleep by 21% over the mean 94 minutes with placebo. The mean 30-minute latency to persistent sleep on placebo decreased by 21% on nights when patients took 15 mg of the investigational SEGA.

Both doses of gaboxadol were well tolerated. There were no next-day residual drug effects.

The study was sponsored by H. Lundbeck, which is partnering with Merck & Co. to develop and market gaboxadol in the United States and Japan. ■

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