

## A new score to validate coma in emergency department – FOUR score

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**Abstract:** The Glasgow Coma Scale (GCS) is the most widely used method for evaluation of coma, but it has a number of shortcomings, including limited utility in intubated patients and an inability to assess brainstem reflexes. A new coma score, the Full Outline of Un Responsiveness (FOUR) has been developed. to overcome these shortcomings and to provide further neurological details that might predict outcome in coma. Four different components are included in the FOUR score (eye, motor, brainstem and respiration), each of which has a maximal score of 4. In contrast to the GCS, verbal response is not a component of the FOUR score, making it fully applicable in intubated patients.

**Keywords:** coma, GCS, FOUR score, head injury.

### INTRODUCTION

The Glasgow Coma Scale (GCS) is the most widely used tool for the evaluation of the level of consciousness<sup>1</sup>. The Full Outline of Unresponsiveness (FOUR) Score is a new coma Scale that was developed considering the limitations of the GCS, and has been found to be useful in an intensive care setting<sup>2,3</sup>.

The Glasgow Coma Scale has missing key essential elements of a comprehensive neurological examination for comatose patients. Other scales are so complicated and they are not user-friendly. FOUR score maintains simplicity and, at the same time, provides far better information, particularly for intubated patients. Health care practitioners initially use a coma scoring system to assess comatose patients to determine the severity of the brain injury, monitor progress, and determine the best treatment. Scores also help to determine whether a patient is likely to live and, if so, how disabled the patient might be upon recovery<sup>4</sup>.

When using the FOUR Score, evaluators assign a score of 0 to 4 in each of four functional categories: eye response, motor response, brainstem reflexes, and respiration. A score of 4 represents normal function in each category, while a score of 0 indicates nonfunctioning<sup>5,6</sup>.

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This scale provides a much more accurate snapshot of the patient from a neurological standpoint. It provides a better reading of the patient's needs, which enables us to act more quickly and have a better exchange of information with other clinicians<sup>7</sup> (Table 1).

**Table 1:** FOUR Score

#### EYE RESPONSE

- 4 = Eyelids open or opened, tracking or blinking to command
- 3 = Eyelids open but not to tracking
- 2 = Eyelids closed but opens to loud voice
- 1 = Eyelids closed but opens to pain
- 0 = Eyelids remain closed with pain stimuli

#### 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 generalized Myoclonus status

#### BRAINSTEM 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 = Absent pupil, corneal, or cough reflex

#### RESPIRATION

- 4 = Regular breathing pattern
- 3 = Cheyne-Stokes breathing pattern
- 2 = Irregular breathing
- 1 = Triggers ventilator or breathes above ventilator rate
- 0 = Apnea or breathes at ventilator rate.

## DISCUSSION

The advantages of the FOUR score have been outlined by Wijndicks et al<sup>8</sup>. This new coma scale includes important clinical neurological findings in patients with impaired consciousness that can be assessed by emergency physicians, residents, and nurses in the emergency department with excellent agreement<sup>9</sup>.

FOUR score is a robust predictor of in-hospital mortality, functional outcome at hospital discharge, and overall survival in patients seen for neurologic complaints<sup>8</sup>. The GCS has remained the “gold standard” for assessment of impaired consciousness in all patient populations. Studies in the ED have not only involved validation of the scale, but also attempts at modifications (e.g., simplified motor scale) eliminating the eye and verbal response<sup>3</sup>.

Further simplification of the GCS diminishes neurologic assessment despite better interobserver reliability. The FOUR score was developed to fill in a need for an easy to use rapid assessment of all essential neurologic signs in patients with impaired consciousness. It ignores disorientation or confusion used in the verbal scale, but provides a good assessment of eye movements, brainstem reflexes, and respiratory drive in ventilated patients<sup>8</sup>.

The FOUR score has the potential to recognize a locked-in syndrome, uncal herniation, brain death, and less severe neurologic injury<sup>9</sup>. A more comprehensive assessment of a patient with an impaired consciousness could assist in initial decision making, assess the need for additional neuro consultation and more effectively triage patient to the most appropriate Intensive Care Unit, neuroradiology suite, or operating theater. The probability of in-hospital mortality was higher for the lowest total FOUR score when compared with the lowest total GCS score<sup>5</sup>.

This scale provides doctors with a much more accurate tool to communicate to a patient’s family<sup>6</sup>. The Glasgow Coma Scale does not enable us to accurately explain a patient’s condition to his or her family. The FOUR Score system allows us to provide far more detailed information on what the patient’s status is and what the outcome will be. The scoring is simple, uncomplicated and understandable that anyone on the medical team can use it – a nurse, an attending physician, or a physician in training. 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. 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<sup>10</sup>.

As for the diagnosis of the vegetative state, the scale explicitly tests for visual pursuit, and hence can disentangle the vegetative state from the minimally conscious state (MCS)<sup>11</sup>.

As for the vegetative state, MCS can be encountered in the acute or subacute setting as a transitional state on the way to further recovery, or it can be a more chronic or even permanent condition. The MCS refers to patients showing inconsistent, albeit clearly discernible, minimal behavioral evidence of consciousness (eg, localization of noxious stimuli, eye fixation or tracking, reproducible movement to command, or nonfunctional verbalization). The FOUR scale does not test for all of the behavioral criteria required to diagnose MCS<sup>4</sup>. It is known from the literature<sup>12</sup> that about a third of patients diagnosed with vegetative state are actually in MCS, and this misdiagnosis can lead to major clinical, therapeutic, and ethical consequences<sup>13</sup>.

In conclusion, this new scale and its effort to more accurately and expeditiously diagnose the locked-in syndrome by specifically assessing voluntary eye movements is a welcome.

The FOUR scale also adds assessment of eye tracking, which allows it to differentiate vegetative from MCS patients, but it should be noted that both acute and chronic patients may solely show visual fixation, an item not evaluated by the FOUR scale.

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