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Comparision Of GCS And FOUR Scores Used In The Evaluation Of Neurological Status In Intensive Care Units

Yoğun Bakım Ünitelerinde Nörolojik Durumun Değerlendirilmesinde Kullanılan GKS ve FOUR Skorlarının Karşılaştırılması

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ÖZET

Amaç: Yoğun bakım hastalarında nörolojik durumun değerlendirilmesinde en yaygın olarak kullanılan ölçek Glasgow Koma Skalası'dır (GKS). GKS'deki sınırlamalar entübe veya afazik hastalardaki verbal yanıt zorluğunu içermektedir. Full Outline of UnResponsiveness (FOUR) skoru son zamanlarda önerilen sözlü yanıta bağımlı olmayan yeni bir koma skalasıdır. Yeni skalalar, ileri nörolojik ayrıntıyı kolayca sağlayabilen bir skalayı kuvvetle önermektedir. Bizim çalışmamızın amacı FOUR skorun GKS ile yoğun bakımda yatan tüm hastalarda karşılaştırılması ve gözlemciler arası güvenirliğinin saptanmasıdır.

Gereç ve Yöntemler: Çalışmamıza 105 hasta dahil edildi. Hastalar üç farklı uygulayıcı (yoğun bakım hemşiresi, 2.yıl anestezi asistanı, anestezi uzmanı) tarafından FOUR ve GKS skorları açısından değerlendirildi. Sedasyon veya kas gevşetici alan hastalar çalışma dışı bırakıldı. Her hasta, üç uygulayıcı tarafından, birbirinin değerlendirmelerinden habersiz ve en fazla bir saat aralıklı olacak şekilde değerlendirildi.

Bulgular: Çalışmamızda GKS ve FOUR Skorları, uygulayıcılar arasındaki uyumluluk bakımından karşılaştırılmaktadır. FOUR skorunun entübe ve afazik hastalarda üstün olabileceği düşünülse de istatistiksel olarak ne GKS ve FOUR Skorları ne de uygulayıcılar arasında anlamlı fark saptanmadı.

Sonuç: Sonuç olarak, yoğun bakımlarda kullanılan skorlar basit, güvenilir ve öngörülebilir olmalıdır. Bizim çalışmamız göstermiştir ki, FOUR skor en az GKS kadar güvenilirdir. Ayrıca GKS ve FOUR skorlarının hem doktorlar hem de hemşireler için kullanımı kolaydır.

Anahtar Kelimeler: Full Outline of Unresponsiveness Score, Glasgow Koma Skalası, yoğun bakım ünitesi

ABSTRACT

Objective: The Glasgow Coma Scale (GCS) is the most widely used scoring system to evaluation of neurological status for patients in intensive care unit. Limitations of the GCS include severe to assess the verbal score in intubated or aphasic patients. The Full Outline of UnResponsiveness score (FOUR), a new coma scale not reliant on verbal response, was recently proposed. New scales strongly suggest a scale is needed that could provide further nerological detail that is easy to use. We aimed to compare FOUR score and GCS among unselected patients in intensive care units and comparerealibility betweenobservers.

Material-Methods: In our study 105 patients was admitted. Three different types of examiners tested FOUR score and GCS: one intensive care unit nurse, one anaesthesiology resident (2. year), and one anaesthesiology fellow. Patients receiving sedative agents or neuromuscular function blockers were excluded. The raters performed their examination within 1 hour of each other without knowledge of the others scores.

Results: In our study compared the interrater agreement of GCS and FOUR score. Although FOUR score was thought to be superior in aphasic and intubated patients, there was neither a statistical significant difference between the GCS and the FOUR score nor a difference among ICU staff.

Conclusion: As a result, the scores that used in ICUs, should be simple, reliable and predictive. Our study revealed that the FOUR score is at least equivalent to the GCS. And for us, GCS and FOUR scores are easy to use both doctors and nurses.

Key words: Full Outline of Unresponsiveness Score, Glasgow Coma Scale, Intensive Care Units

INTRODUCTION

The Glasgow Coma Scale (GCS) is the most widely used scoring system to evaluation of neurological status for patients in intensive care. Limitations of the GCS include the impossibility to assess the verbal score in intubated or aphasic patients. First, many comatose patients are intubated, the verbal component cannot be tested. Some clinicians use the lowest possible score; others extrapolate the verbal response based on other neurological findings. Second, abnormal brainstem reflexes, changing breathing patterns, and the need for mechanical ventilation could reflect severity of coma, but the GCS does not include those clinical indicators. Third, the GCS may not detect subtle changes in neurological examination. More recently, a study in traumatic head injury found lack of correlation between outcome and GCS Score[1,2]. These concerns and prior attempts to design new scales strongly suggest a new scale is needed that could provide further neurological detail in coma that is easy to use and that could predict outcome.[3] We aimed to compare FOUR (Full Outline of UnResponsiveness) score and GCS and compare reliability between observers.

MATERIALS AND METHODS

Description of the New Coma Scale

The new coma scale was named the FOUR score. The FOUR score has four testable components, in contrast with the GCS (Table 1). The number of components and the maximal grade in each of the categories is four (E4, M4, B4, R4). (It is easier to remember than the GCS with its varying number of scores [E4, M6, V5] and is reinforced by the acronym).[3,4] The FOUR score detects a locked-in syndrome, as well as the presence of a vegetative state where the eyes can spontaneously open but do not track the examiner's finger. The motor response is obtained preferably at the upper extremities. The motor category includes the presence of myoclonus status epileptics (persistent, multisegmental, arrhythmic, jerk like movements), a poor prognostic sign in comatose survivors after cardiac resuscitation.

Table 1. Comparison of the FOUR Score with the Glasgow Coma Scale

FOUR Score	Glasgow Coma Scale
Eye response	**Eye response**
4 eyelids open or opened, tracking, or blinking to command	4 eyes open spontaneously
3 eyelids open but not tracking	3 eye opening to verbal command
2 eyelids closed but open to loud voice	2 eye opening to pain
1 eyelids closed but open to pain	1 no eye opening
0 eyelids remain closed with pain	
Motor response	**Motor response**
4 thumbs-up, fist, or peace sign	6 obeys commands
3 localizing to pain	5 localizing pain
2 flexion response to pain	4 withdrawal from pain
1 extension response to pain	3 flexion response to pain
0 no response to pain or generalized myoclonus status	2 extension response to pain
	1 no motor response
Brain-stem reflexes	**Verbal response**
4 pupil and corneal reflexes present	5 oriented
3 one pupil wide and fixed	4 confused
2 pupil or corneal reflexes	3 inappropriate words
1 pupil and corneal reflexes absent	2 incomprehensible sounds
0 absent pupil, corneal, and cough reflex	1 no verbal response
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 apnea	

The motor component combines decorticate and withdrawal responses. The hand position tests (thumbs-up, fist, and peace sign) have been validated previously and are reliable to assess alertness. Three brainstem reflexes testing

mesencephalon, pons, and medulla oblongata function are used in different combinations. The clinical sign of acute third nerve dysfunction (unilateral dilated pupil) is included. The cough reflex mostly becomes absent when both cornea and pupillary reflexes are absent. Breathing patterns are graded. Cheyne-Stokes respiration and irregular breathing can represent bihemispheric or lower brainstem dysfunction of respiratory control. In intubated patients, over breathing the mechanical ventilator represents functioning respiratory centers. With all categories graded 0, the examiner is alerted to consider brain death evaluation. The FOUR score can be graded in a few minutes. A former study suggest that the FOUR score could be used instead of GCS; 124 patients enrolled and found that FOUR score has major advantages and provide important details of the neurologic examination such as brain reflexes and eye movements.[5]

Methods

Our study was performed 2011 October-2012 January, at our hospital, in 3 intensive care units (anaesthesiology& reanimation,medical and surgical ICUs). 105 patients admitted to this study (62 male, 43 female). Three different types of examiners tested the FOUR score and the GCS: one intensive care unit nurse, one anaesthesiology resident (second year), and one anaesthesiology fellow.

Patients receiving sedative agents or neuromuscular function blockers were excluded. Each patient was rated on both scales by three different raters. The raters performed their examination within 1 hour of each other without knowledge of the other's scores. This study allowed us to evaluate reliability between types of examiners.

Statistical analysis:

Statistical analyses were performed using SPSS version 17.0 (SPSS Inc, Chicago, IL, USA) for Windows. A value of p less than 0.05 was considered to be statistically significant. Results are expressed as mean plus or minus standard deviation. Comparison of parameters between the groups was performed with ANOVA test.

RESULTS

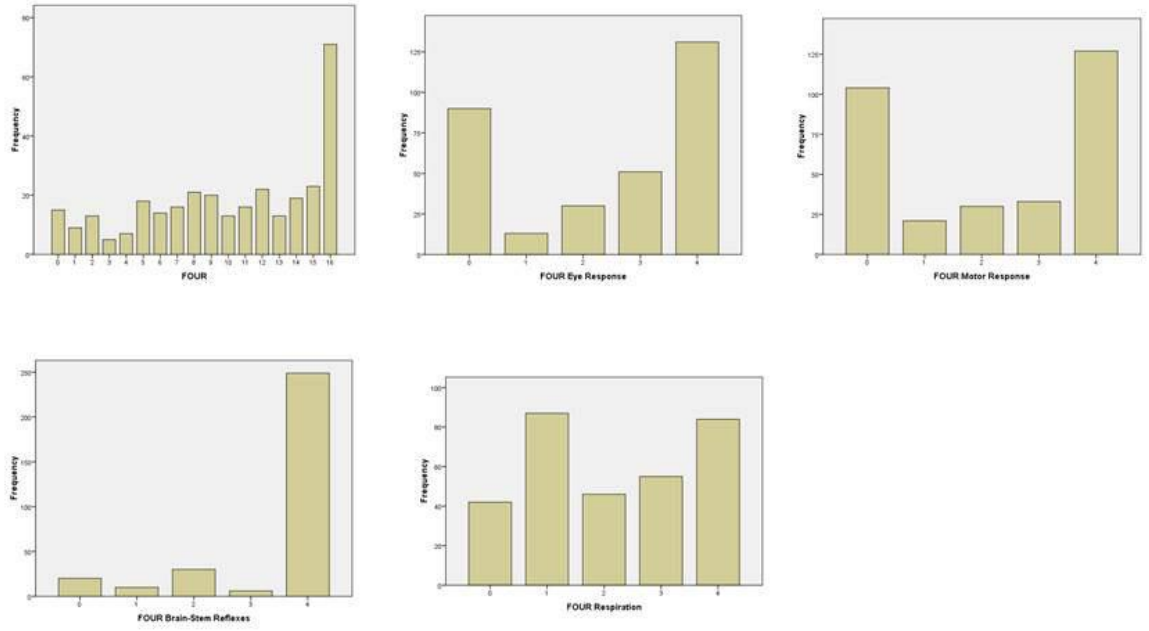
From 2011 October-2012 January, 105 patients were enrolled (62 male, 43 female). The average age of patients was 60.63 (60.63±19.73). The diagnose of the patients; ischemic or hemorrhagic stroke (40 patients, 38%), pulmonary and cardiac arrest (23 patients, 22%), sepsis-septic shock (12 patients, 11.3%), intoxication (8 patients, 7.5%), others (15 patients, 12.2%) (Table 2).

Table 2. Diagnose and number of patients

Diagnose of Patients	Number of Patients
Ischemic or hemorragic stroke	40 (38%)
Pulmonary and cardiac arrest	23 (22%)
Sepsis-septic shock	12 (11.3%)
Intoxication	8 (7.5%)
Others	15 (12.2%)
Total	105 (100%)

The mortality rate was 37.14% (39 patients). In both groups, patients who had low scores had more mortality rate. In-hospital mortality was higher for the lowest total FOUR and GCS scores. In our study 45 patients (38%) were intubated and mechanically ventilated. There was no significant statistical difference between interrater scores (Figures 1, 2, Table 3). The interrater reliability was perfect for both the FOUR score and the GCS score.

Figure 1: Results of FOUR scores



CONCLUSION

The FOUR score is simple to use as far as GCS score. Our interrater study is a study of a coma scale with 3 ratings involving one intensive care unit nurse, one anaesthesiology resident (second year), and one anaesthesiology fellow. In this study, the two scores of each patient occurred as closely in time as possible to minimize the possibility that the patient's condition had changed. Recent studies have involved nurses, research psychologists, paramedics, and occupational therapy graduate students supervised by a medical director of the neurointensive care unit.[3] Our examiners were chosen because in practice they would examine these patients.

Table 3. Interraters' Scores

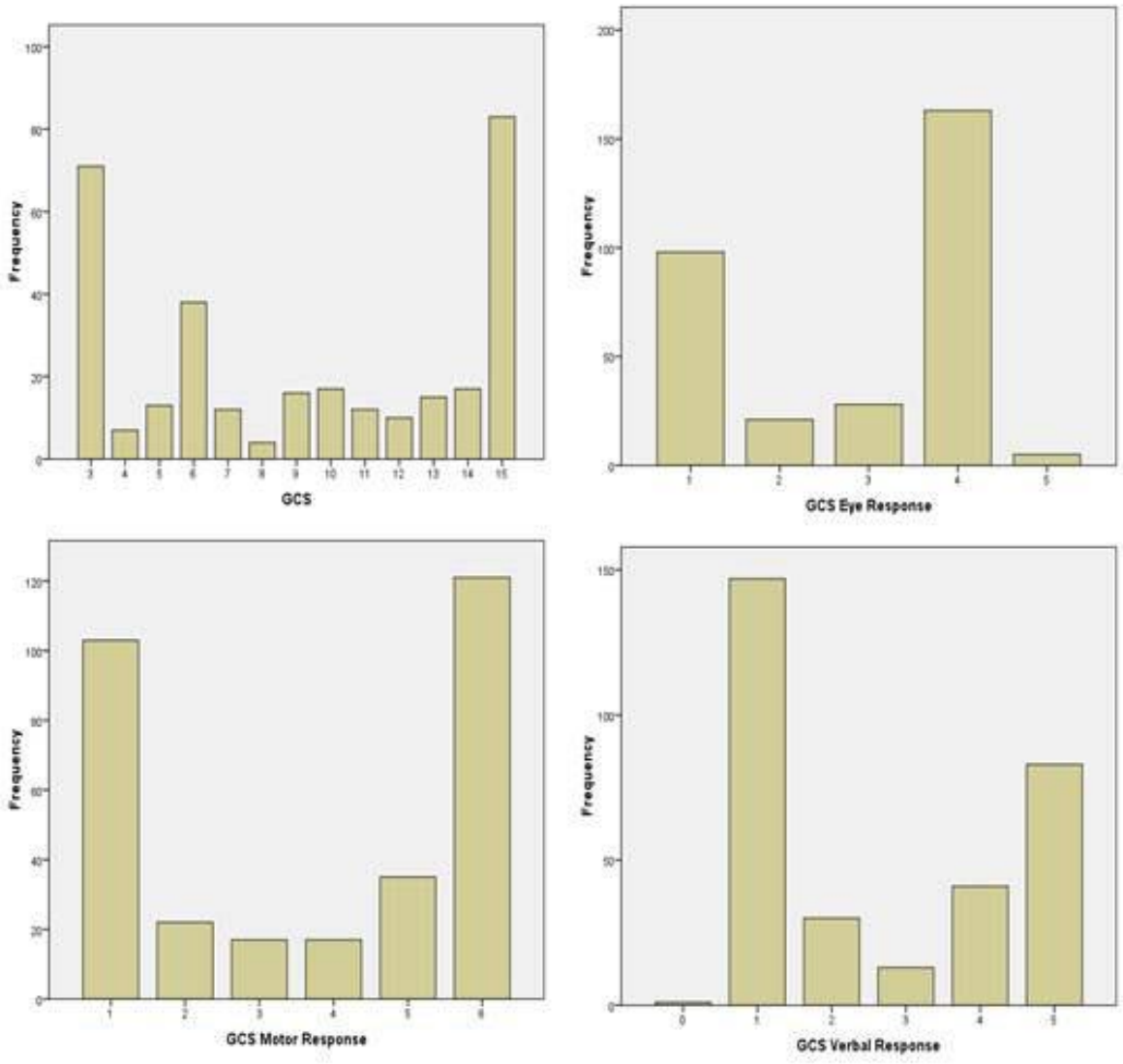
Examiners	GCS	FOUR
Anaesthesiology and ICU fellow	9.13±4.64	10.00±4.95
Anaesthesiology resident	9.07±4.73	10.04±5.08
ICU nurse	9.36±4.95	10.42±5.25
P	0.89	0.80

The FOUR score, unlike the GCS, does not include a verbal response, and thus is more valuable in ICU practices that typically have a large number of intubated patients. In contrast, the GCS, which uses a verbal score as one of the three components, was less useful in patients because they were intubated. In one study, the verbal agreement is artificially high because the patient have an endotracheal tube inserted, which obviates the need to further examine the verbal response.[3] This would be expected because the verbal component has been recognized as the least reliable component of the GCS. The reliability of testing brainstem reflexes has rarely been studied in a large population of patients but was similar among our raters. In one recent study, pupillary responses and oculocephalic responses were tested in 28 patients, and fair interrater agreement was found for only the oculocephalic responses.[5] There are significant advantages over the GCS score. The FOUR score remains testable in ill patients who are intubated. The FOUR score tests essential brainstem reflexes and provides information about stages of brainstem injury that is unavailable with the GCS. But in our study there is no significant differences between two groups

who intubated or not. This study was done only in ICU workers. It would be of interest to test the FOUR score in emergency physicians, trauma surgeons, medical or surgical intensivists, and allied nursing staff.

Eken et al.[6] found that FOUR score is not superior to the GCS in the emergency service with patients who presented with an altered level of consciousness.

Figure 2: Results of GCS scores



In our study compared the interrater agreement of GCS and FOUR score. There was neither a significant difference between the GCS and the FOUR score nor a difference among ICU staff. And there was no significant difference between FOUR score and the GCS.

Wijdicks and colleagues[3], Wolf and colleagues[7], and Iyer and colleagues[8] from the Mayo Clinic devised and validated the FOUR score. Compared with the GCS, this new coma scale does not depend on a verbal response and provides greater neurological detail by inclusion of brainstem reflexes and breathing patterns. In agreement with the first reports we observed that the interrater reliability for the FOUR score is at least as good as that of the GCS.[3,7,8]Our results demonstrate that the FOUR score is not superior to the GCS with regard to exact interrater agreement. In our study, mortality is higher with the lowest scores, both FOUR and GCS. In a recent study, their results demonstrate that mortality in medical ICU patients with the

lowest FOUR score is higher than in patients with the lowest GCS.[9] The repetitive assessment of the level of consciousness is a routine procedure in ICU and so far the GCS is the most widely used tool. The present study confirms previous reports on a less than perfect interobserver agreement of the GCS.[10-12]For the new FOUR score, the interrater agreement was never worse and partly better than that of the GCS. But in our study there were no significantly difference between interrater agreements. Despite its limitations, the GCS has remained the standard coma scale over the past decades. In modern ICUs, multiple scores are repetitively used. Ideally, these scores should be simple, reliable, and predictive for relevant outcomes and/or relevant clinical decisions. With regard to these criteria, the present study revealed that the FOUR score is at least equivalent to the GCS.

Wijdicks EF[3]found advantages of FOUR score between GCS: one is; it contains brain-stem reflex, so gives information about progress and urgent approach with intubated patients. The other one; It predicts mortality better. Mortality is higher among low score patients than with low score of GCS. And the last is; the observers' compliance is higher. On the other hand, disadvantage of the FOUR scale; The FOUR scale does not test for all of the behavioral criteria required to diagnose minimally conscious state (MCS). 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).[14] 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.[15]

In conclusion, the GCS remained the standard coma scale over the past decades. In present, multiple scores are used. These scores should be simple, reliable and predictive. For these criteria, this study revealed that the FOUR score is at least equivalent to the GCS score.

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