JOURNAL OF
CONTEMPORARY MEDICINE

DOI: 10.16899/jcm.652716
J Contemp Med 2020;10(2):176-180

Orjinal Araştırma / Original Article

Comparison of Two Different Scales of Consciousness Assessment in the Intensive Care Unit

Yoğun Bakım Ünitesinde İki Farklı Bilinç Durumu Değerlendirme Ölçeğinin Karşılaştırılması

Özlem Doğu Kökcü[1], Banu Terzi[2], Özcan Kutlu[3]

[1]Sakarya University, Faculty of Health Sciencies, Sakarya, Turkey
[2]Akdeniz University, Faculty of Nursing, Fundamentals of Nursing, Antalya, TURKEY
[3]Özel Kırıkhan Can Hastanesi, Kırıkhan/Hatay, Turkey

Abstract

Aim: To compare two different consciousness assessment scales used in intensive care units.

Material and Method: The prospective observational study was conducted with a total of 29 patients who were followed up in intensive care units. GCS (Glasgow Coma Scale) and FOUR (Full Outline of UnResponsiveness) Scores and modified Rankin Scale (mRS) scores of the patients who were monitored by the same observer for 10 days in the intensive care units were measured and recorded. Mean±standard deviation was used for the values regarding total scale score means. Pearson's correlation analysis was used for comparing total score means.

Results: GCS and FOUR scores and the mean total mRS scored of the patients on the first day were 6.95±2.25 (range, 3-11), 8.65±2.45 (range, 4-13), and 4.93±0.25 (range, 4-5) respectively. The mean total scale scores on the 10th day were 6.62±3.27 (range, 3-12), 8.13±3.44 (range, 4-13), and 4.89±0.30 (range, 4-5). A statistically significant high-degree relationship was found between the mean total scores of the patients' GCS and FOUR scores ($p<0.001$).

Conclusion: FOUR can be confidently used instead of GCS for the assessment of consciousness. Comparisons of GCS and FOUR score may be conducted with different patient groups and larger samples. Differences between observers should also be evaluated when comparing the scoring systems.

Keywords: Consciousness assessment, full outline of unresponsiveness score, glasgow coma scale, follow-up, nursing

Öz

Amaç: Yoğun bakım ünitesinde kullanılan iki farklı bilinç değerlendirme aracını karşılaştırmaktır.

Gereç ve Yöntem: Prospektif gözlemsel tipteki çalışma yoğun bakım ünitesinde izlenen 29 hasta ile yürütüldü. Yoğun bakım ünitesinde 10 gün süre ile aynı gözlemci tarafından izlenen hastaların GKS (Glasgow Koma Skalası) ve FOUR (Full Outline of Unresponsiveness) Skoru ile Modifiye Rankin Skalası (mRS) ölçülerek kayıt edildi. Ölçek toplam puan ortalamalarına ilişkin değerlerde Ortalama±Standart Sapma; toplam puan ortalamalarının karşılaştırılmasında Pearson Corelasyon Analizi kullanıldı.

Bulgular: Hastaların izlenen 1. günde GKS, FOUR Skoru ve mRS toplam puan ortalamaları sırasıyla 6,95±2,25 (3-11), 8,65±2,45 (4-13) ve 4,93±0,25 (4-5); 10.günde ölçek toplam puan ortalamaları sırasıyla 6,62±3,27 (3-12), 8,13±3,44 (4-13) ve 4,89±0,30 (4-5) olarak ölçüldü. Bilinç değerlendirmesinde, hastaların GCS ile FOUR Skoru toplam puan ortalamaları arasında istatistiksel olarak ileri derecede anlamlı bir ilişki olduğu saptandı ($p<0,001$).

Sonuç: Hastaların bilinç değerlendirilmesinde FOUR Skoru, GKS yerine güvenle kullanılabilir. GKS ve FOUR Skorunun karşılaştırılması farklı hasta grupları ile daha büyük örneklem ile yürütülebilir. Skorlama sistemlerinin karşılaştırılmasında gözlemciler arasındaki farklılıklar da ölçülebilir.

Anahtar Kelimeler: Bilinç değerlendirmesi, full outline of unresponsiveness skoru, glasgow koma skalası, izlem, hemşirelik

Corresponding *(İletişim)*: Banu TERZİ, Akdeniz University, Faculty of Nursing, Fundamentals of Nursing, Konyaaltı, Antalya, TURKEY
E-mail *(E-posta)*: banuterzi@akdeniz.edu.tr
Received *(Geliş Tarihi)*: 29.11.2019 **Accepted *(Kabul Tarihi)*:** 02.05.2020

INTRODUCTION

Assessment of consciousness is the best and most practical way of distinguishing brain dysfunction. For this purpose, the Glasgow Coma Scale (GCS) was developed by Teasdale and Jennett in 1974.[1,2] The GCS is a commonly used international scale for the assessment of comatose patients and allows rapid identification of changes in patients' consciousness.[2-4]

The GCS, which includes "eye aperture", "motor response," and "verbal response" parameters, is commonly used for assessing consciousness for diseases such as head trauma, central nervous system diseases, and concussion.[5] However, the GCS remains incapable of identifying certain neurologic examinations. It is not designed for detecting different details of neurologic examinations such as brain stem reflexes and eye movements. In this sense, it is not adequate for predicting the patients' condition, especially concerning the verbal component.[1,6,7]

In this direction, Wijdicks et al. developed the Full Outline of UnResponsiveness Score (FOUR Score), which includes detailed examinations of abnormal respiratory rhythm, brain stem reflexes, eye opening and blink reflexes, and motor responses.[1,8,9] Studies state that FOUR is more effective than the GCS, it provides knowledge about important details such as brain stem reflexes, eye movement, and respiratory rhythm, and more studies on this matter are needed.[10-15] Furthermore, FOUR is applicable for patients who are intubated or aphasic and can be used to identify the severity of coma (abnormal brain stem reflexes, fluctuant respiratory rate and mechanic ventilation rate).[16,17] FOUR is composed of "eye response," "motor response," "brain stem reflexes," and "respiration" parameters. It is thought that it is easier to remember FOUR than the GCS because each parameter is calculated on a 4-point scale.[10] The studies conducted to date also emphasize that FOUR is easily applicable by nurses.[10,15,18]

In this direction, the aim of the study was to compare the GCS and FOUR by using these scales for assessing the consciousness of patients in the intensive care unit (ICU).

MATERIAL AND METHOD

Design; A prospective observational study.

Place and sample of the study

In the research, the sample width determination method was chosen for the relationship between the scale scores. For the sample size, a value of 0.70 and higher was assumed to be high and a one-way hypothesis test was performed. Other parameters required for the calculation of the sample size are Type I error and Type II error amount. In order to make a reliable decision of 95% for type error and 80% for type II error, the software is entered as α error 0.5 and β error 0.20. G*Power 3.1.9.4 software[19] was used in the calculation. According to the results of the analysis, the expected sample size was calculated as 11 people. Accordingly, a sample of 29 patients seems to be sufficient. The study was conducted with a total of 29 patients hospitalized in a 6-bed adult ICU of a training and research hospital in Sakarya, between February and May, 2019. Patients aged over 18 years who were intubated, sedated, and monitored in the ICU for at least 10 days and examined neurologically using the GCS were included in the research. Patients with spinal cord injury, head trauma, and those who were discharged before 10 days or who were exitus (total of 12 patients) were excluded.

Data collection scales

Data of the research were collected using a Patient Information Form, the GCS, FOUR, and the modified Rankin Scale.

Patient Information Form: This form questioned diagnostic and operational parameters such as length of ICU stay, duration of intubation, and duration of mechanic ventilation, as well as socio-demographic characteristics such as age and sex (10 items).

Glasgow Coma Scale (GCS): The GCS was developed as a practical scale in 1974 by Teasdale and Jennett to evaluate the level of consciousness of patients following acute or traumatic brain damage.[20] Although its validity is frequently questioned, it is still the most commonly used scoring system. It is a simple and practical scale, especially for admission to the ICU and monitoring clinical course. A GCS score of 8 or less indicates severe damage, 9-12 points indicate moderate damage, and 13-15 points indicate minor trauma. The scale is composed of three different parameters: eye opening, verbal response, and motor response. The GCS is calculated by adding up the patient's scores from each parameter. This score ranges between 3-15 points. A GCS total score of 13-15 means that the patient is conscious, a score of 8-12 indicates pre-coma, and scores less than 8 indicate coma. In this study, the break point of the GCS was a score less than or equal to five (GCS≤5). The Cronbach alpha coefficient was 0.96 in the study.

Full Outline of UnResponsiveness (FOUR) Score: The scale, which was developed by Wijdicks et al.[8] as an alternative to the GCS, was adapted to Turkish by Örken et al.[16] The score is composed of four parameters: eye response, motor response, brain stem reflexes, and respiration. Scores of 0-4 can be obtained from each parameter. "0 points" indicate deep coma, "4 points" indicate full wakefulness and awareness. The maximum score that can be obtained is 16. This score outclasses the GCS because it is applicable for patients who are intubated or aphasic. Moreover, it is easier to remember and use compared with the GCS because each parameter is evaluated out of four. Nurses can easily use this score following training on its use.[10,15,18] The Cronbach alpha coefficient was 0.95 in the study.

Modified Rankin Scale (mRS): This scale was first introduced by Dr. John Rankin[21] modified by Warlow et al.[22] and used for the first time by van Swieten et al.[23] The scale is used to measure the degree of disability and dependency of patients with stroke or other neurologic problems. It is evaluated between 0-6 points; 0 points mean no symptoms, 1 point indicates no significant disability despite symptoms (able to carry out all

usual activities), 2 points indicate slight disability (unable to perform some previous activities but able to carry out own activities without assistance), 3 points indicate moderate disability (requiring some help but able to walk without assistance), 4 points indicate moderate-severe disability (not able to walk and attend to bodily needs without assistance), 5 points indicate severe disability (bedridden, incontinent and require constant care), and 6 points mean that the patient is dead.[24,25] In the mRS, 0-2 points means good prognosis and 3-6 points mean poor prognosis.[26] In this study, this scale was used to monitor the prognosis of patients. The Cronbach alpha coefficient of the study was 0.97.

Data Collection Process

Socio-demographic characteristics were questioned during the first encounter with the patients who were admitted to the ICU. The GCS, FOUR, and mRS scores of the patients were recorded. Patients were monitored in the ICU for 10 days. Data were collected by a researcher with ICU experience of more than one year and who is knowledgeable about GCS and FOUR scoring. Data were collected by the same researcher at the same time intervals in order to achieve an objective evaluation. GCS and FOUR scoring was tested on some patients prior to the study and these patients were not included in the study. Scales were calculated by using the original formulae.

Study ethics: The Declaration of Helsinki was abided by throughout the research. Ethics committee approval was obtained in writing from Sakarya Unıversity Medical Faculty (Permission No. 12.12.2018/06). Written consent was obtained from the patients/patients' relatives.

Data analysis: Data were analyzed using the Statistical Package for the Social Science for Windows Version 21.0 (SPSS, IBM). Ordinal variables were evaluated as the arithmetic mean and standard deviation, minimum, maximum. The results of total scale score means are given as Mean±Standard Deviation (SD). Pearson' correlation analysis was used to compare total scale score means. Reliability analyses of the GCS and FOUR are given using Cronbach's alpha. The significance level was accepted as $p<0.05$.

RESULTS

In the research, the mean age of the patients was 76.82+15.55 years, 37.9% were male and 62.1% were female. The patients' mean length of stay in the ICU was 25 days and the mean duration of intubation was 24 days. When the medical diagnoses of the patients were examined, it was seen that majority of the patients was monitored in the ICU due to cerebrovascular accident (31.0%) and pneumonia (24.1%) (**Table 1**).

When invasive procedures that were performed on the patients were examined, it was detected that all patients had urethral catheters inserted (n=29), the majority had nasogastric catheters (n=22, 75.9%), and none was under analgesia treatment (**Table 2**).

Table 1. Medical diagnosis groups of the patients

Diagnosis	n	(%)
Acute renal failure	2	(6.9)
Cancer	1	(3.4)
Gastrointestinal hemorrhage	3	(10.3)
Chronic heart failure	5	(17.2)
Pneumonia	7	(24.1)
Sepsis	2	(6.9)
Cerebrovascular accident	9	(31.0)

Table 2. Distribution of treatment attempts for patients

Treatments		n	%
Arterial catheter	Yes	0	0.0
	No	29	100.0
Central catheter	Yes	4	13.8
	No	25	86.2
Urethral catheter	Yes	29	100.0
	No	0	0.0
Nasogastric catheter	Yes	22	75.9
	No	7	24.1
Analgesic treatment	Yes	0	0.0
	No	29	100.0

The total score means for the routinely used GCS and concurrently applied FOUR and mRS on the patients in the ICU are shown in **Table 3.** The mean GCS total scores were under 8 for the 10 days of monitoring, and the patients were evaluated as being in a coma. The total mean FOUR scores was 8-9 points, also indicating coma. The mean mRS total score of all patients was >2 in the prognosis evaluation. For the consciousness assessment of patients included in the research, a statistically significant high-degree relationship was detected between the GCS and FOUR ($p<0.001$) (**Table 3**).

Table 3. Relationship between the results of FOUR, the GCS, and the modified Rankin Scale

Follow-up Days	[a]GCS 3-15 x±sd (min-max)	[a]FOUR 0-16 x±sd (min-max)	[b]r, p	mRS 0-5 x±sd (min-max)
Day 1	6.95±2.25 (3-11)	8.65±2.45 (4-13)	0.887, 0.001	4.93±0.25 (4-5)
Day 2	7.03±2.22 (3-11)	8.82±2.26 (4-13)	0.920, 0.001	4.93±0.25 (4-5)
Day 3	6.96±2.32 (3-11)	8.75±2.53 (4-13)	0.953, 0.001	4.89±0.30 (4-5)
Day 4	7.48±2.54 (3-11)	9.37±2.71 (4-13)	0.969, 0.001	4.89±0.30 (4-5)
Day 5	7.10±2.60 (3-11)	8.89±2.85 (4-13)	0.969, 0.001	4.89±0.30 (4-5)
Day 6	7.06±2.53 (3-11)	8.75±2.82 (4-13)	0.965, 0.001	4.93±0.25 (4-5)
Day 7	7.06±2.84 (3-12)	8.89±3.01 (4-13)	0.964, 0.001	4.89±0.30 (4-5)
Day 8	6.82±2.91 (3-12)	8.48±2.97 (4-13)	0.966, 0.001	4.86±0.35 (4-5)
Day 9	6.65±3.01 (3-12)	8.27±3.09 (4-13)	0.964, 0.001	4.89±0.30 (4-5)
Day 10	6.62±3.27 (3-12)	8.13±3.44 (4-13)	0.974, 0.001	4.89±0.30 (4-5)

[a]Values regarding scale total scores are given as Mean±SD.
[b]Pearson correlation analysis was used for comparing scale total scores.

DISCUSSION

In the study, in which we aimed to compare the GCS and FOUR in the assessment of consciousness of patients in the ICU, the correlation between the GCS and FOUR was found significant at a high degree. FOUR was found to be as effective as the GCS in assessing the degree of consciousness. In other a study, the significant relationships were existed between GCS and FOUR scores with mortality and poor outcomes.[27] There are other studies indicating good correlations between GCS and FOUR scores.[28,29] On the other hand, it is reported that FOUR Score have better sensitivity, specificity, and predictive ability compared to GCS in patients with endotracheal tube intubation.[30] Despite all disadvantages, GCS is affirmed as the gold standard for evaluating the consciousness and comatose level of patients.[31] The GCS is limited, especially for assessing verbal response of patients who are intubated and aphasic.[31,32] In this sense, FOUR eliminates these limitations and allows the assessment of respiratory parameters and brain stem reflexes of patients. FOUR is as good as the GCS for predicting mortality.[33] FOUR can easily be used by nurses who receive training on the subject.[13]

Similar studies have compared the GCS and FOUR in different patient groups. A study by Jalali and Rezaei found that FOUR was a better and more comprehensive scale for neurologic assessment as compared with the GCS.[13] FOUR has been reported as being more effective in predicting the mortality and discharge of patients in pediatric ICUs.[34] On the other hand, a study by Şahin et al.[15] found no significant difference between the GCS and FOUR or implementers. No statistically significant difference was detected between the GCS and FOUR in predicting mortality of patients in the ICU with traumatic brain damage.[35] Similarly, in another study, it was found that FOUR had no distinct advantage over the GCS in predicting morbidity and mortality of pediatric patients with head trauma.[32]

In our study, the GCS and FOUR were compared in terms of mean total scores; sub-parameters of the scoring systems were not examined individually. However, when the mean total scores of both scores were examined, it was observed that patients were at the level of coma. This shows that the scores are consistent. Different studies that individually compare the sub-parameters of the scores with different patient groups (e.g. intubated and non-intubated) should be conducted. Furthermore, this study was conducted in a single ICU with a single observer. Similar research should be conducted in different clinics such as emergency units, neurosurgery wards, and stroke units, and comparisons should be performed between different observers.

FOUR, which was developed as an alternative to the GCS, is an easily applicable and valid scale. However, it is not a sufficient scale to perform full neurologic examinations for patients with coma.[36] This scale also assesses neurological status of patients with greater accuracy. High sensitivity of FOUR scale in clinical assessment has eased treatment and monitoring of patients for the medical team. Using brain stem reflexes and respiratory pattern, this scale provides an accurate and correct assessment of patients in coma, and has the ability to assess minor changes in neurological status of patient. Therefore, FOUR is recommended as a tool for assessment of neurological patients with changes in consciousness levels.[37]

Limitations of the study: The main limitations of the research are that the research was conducted in a single ICU with only 29 patients, and the patients were evaluated by a single observer.

CONCLUSION

The study showed that the GCS and FOUR are in a significant relationship in assessing the state of consciousness of patients. FOUR is a scale for consciousness assessment that can be substituted for the GCS. However, it is suggested that studies comparing FOUR and the GCS with larger samples and different samples should be conducted. In addition, scales for assessing consciousness for patients in the ICU that can be used easily by nurses should be developed.

ETHICAL DECLARATIONS

Ethics Comittee Approval: The study was carried out with the permission of Sakarya Unıversity Medical Faculty Ethics Committee (Permission No. 12.12.2018/06).
Informed Consent: Written informed consent was obtained from all participants who participated in this study.
Status of Peer-review: Externally peer-reviewed.
Conflict of Interest Statement: The authors have no conflicts of interest to declare.
Financial Disclosure: The authors declared that this study has received no financial support.
Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

REFERENCES

1. Iyer VN, Mandrekar JN, Danielson RD, Zubkov AY, Elmer JL, Wijdicks EFM. Validity of the FOUR score coma scale in the medical intensive care unit. Mayo Clinic Proceedings 2009;84(8):694–701.
2. Teasdale G, Jennett B. Assessment of coma and impaired consciousness. A practical scale. Lancet 1974;2(7872):81–84.
3. Jennett B. Development of Glasgow Coma and outcome scales. Nepal J Neuroscience 2005;2(1):24-28.
4. Sepit D. Level of consciousness: assessment and Glasgow Coma Scale as an assessment scale. HEAD 2005;2(1):12-16.
5. Akdemir G. Trauma scoring and Glasgow Coma Scale. Turkiye Klinikleri J Neurosurg-Special Topics 2008;1(1):6-11.
6. Middleton PM. Practical use of the Glasgow Coma Scale; a comprehensive narrative review of GCS methodology. Australas Emerg Nurs J. 2012;15(3):170-83.
7. Reith FC, Brennan PM, Maas AI, Teasdale GM. Lack of standardization in the use of the Glasgow Coma Scale: results of ınternational surveys. J Neurotrauma 2016;33(1):89-94.

8. Wijdicks EF, Bamlet WR, Maramattom BV, Manno EM, McClelland RL. Validation of a new coma scale: The FOUR Score. Ann Neurol 2005;58:585-93.
9. Wijdicks EF, Rabinstein AA, Bamlet WR, Mandrekar JN. FOUR score and glasgow coma scale in predicting outcome of comatose patients: a pooled analysis. Neurology 2011;77(1):84-5.
10. Arlı ŞK. A new scale for evaluating of the consciousness: Four Scor. ACU Sağlık Bilimleri Dergisi 2018;9(3):220-2.
11. Bruno MA, Ledoux D, Lambermont B, et al. Comparison of the full outline of unresponsiveness and glasgow liege scale/glasgow coma scale in an intensive care unit population. Neurocritical Care 2011;15(3):447-53.
12. Eken C, Kartal M, Bacanli A, Eray O. Comparison of the full outline of unresponsiveness score coma scale and the glasgow coma scale in an emergency setting population. Eurasian Journal of Emergency Medicine 2009;16(1):29-36.
13. Jalali R, Rezaei M. A comparison of the Glasgow Coma Scale score with full outline of unresponsiveness scale to predict patients' traumatic brain injury outcomes in intensive care units. Critical Care Research and Practice 2014;2014(Article ID 289803):1-4.
14. Koçak Y, Öztürk S, Ege F, Ekmekçi AH. A useful new coma scale in acute stroke patients: FOUR score. Anaesth Intensive Care 2012;40(1):131-6.
15. Şahin AS, Şahin M, Öztürk NK, Kızılateş E, Karslı B. Comparision of GCS and FOUR Scores used in the evaluation of neurological status in intensive care units. Journal of Contemporary Medicine 2015;5(3):167-72.
16. Örken DN, Sağduyu AK, Şirin H, et al. Yeni bir koma değerlendirme ölçeği olan FOUR skorun türkçe çevirisinin güvenirlik çalışması. reliability of the Turkish version of a new coma scale: FOUR Score. Trakya Univ Tıp Fak Derg 2010;27(1):28-31.
17. Sacco S, Carolei A. The FOUR Score: A reliable ınstrument to assess the comatose stroke patient. Eur Neurol 2010;63(6):370–1.
18. Wolf CA, Wijdicks EFM, Bamlet WR, McClelland RL. Further validation of the FOUR score coma scale by intensive care nurses. Mayo Clin Proc 2007;82(4):435-8.
19. Faul F, Erdfelder E, Lang AG, Buchner A. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods 2007;39:175-91.
20. Reith FC, Synnot A, van den Brande R, Gruen RL, Maas AI. Factors influencing the reliability of the glasgow coma scale: a systematic review. Neurosurgery 2017;80(6):829-39.
21. Quinn TJ, Dawson J, Walters M. Dr John Rankin; his life, legacy and the 50th anniversary of the Rankin Stroke Scale. Scott Med J 2008;53(1):44–47.
22. Farrell B, Godwin J, Richards S, Warlow C. The United Kingdom transient ischaemic attack (UK-TIA) aspirin trial: final results. J Neurol Neurosurg Psychiatry 1991;54(12):1044–54.
23. van Swieten JC, Koudstaal PJ, Visser MC, Schouten HJ, van Gijn J. Interobserver agreement for the assessment of handicap in stroke patients. Stroke 1988;19(5):604–7.
24. Aksakallı E, Turan Y, Şendur ÖF. Outcome scales in stroke rehabilitation. Turk J Phys Med Rehab 2009;55(4):168-72.
25. Sümer M, Benbir G, Can U, Kutluk K, Uzuner N. Scales: guidelines of Turkish society of cerebrovascular diseases–2015. Turkish J Cerebrovascular Diseases 2015;21(3):185-8.
26. Domaç FM, Özden T, Adıgüzel T, Mısırlı H. Nontraumatic hemorrhagic stroke in adults younger than 45 years. J Turkish Cerebrovascular Diseases 2010;16(2):45-9.
27. Heidari Gorji MH, Hoseini SH, Gholipur A, Mohammadpur RA. A comparison of the diagnostic power of the full outline of unresponsiveness scale and the glasgow coma scale in the discharge outcome prediction of patients with traumatic brain injury admitted to the intensive care unit. Saudi Journal of Anesthesia 2014;8(2):193-7.
28. Mercy SA, Thakur R, Yaddanapudi S, Bhagat H. Can four score replace gcs for assessing neurological status of critically ill patients - an Indian study. Nursing and Midwifery Research Journal 2013;9(2):63-72.
29. Ramazani J, Hosseini M. Comparison of full outline of unresponsiveness score and glasgow coma scale in medical intensive care unit. Annals of Cardiac Anaesthesia 2019;22:143-8.
30. Oktarina Y, Simajuntak CA. Comparison of glasgow coma scale with full outline of unresponsiveness score in measuring consciousness level of endotracheal tube intubated patient in the intensive care unit. Int J Res Med Sci 2018;6:1882-5.
31. Temiz NÇ, Köse G, Tehli Ö, Açıkel C, Hatipoğlu S. A comparison between the effectiveness of full outline of unresponsiveness and glasgow coma score at neurosurgical intensive care unit patients. Turk Neurosurg 2016;26(1):1-4.
32. Büyükcam F, Kaya U, Karakılıç ME, Çavuş UY, Turan F, Odabaş Ö. Predicting the outcome of children with head trauma: comparison of FOUR score and GCS. Ulus Travma Acil Cerrahi Derg 2012;18(6):469-73.
33. Jamal A, Sankhyan N, Jayashree M, Singhi S, Singhi P. Full outline of unresponsiveness score and the glasgow coma scale in prediction of pediatric coma. World J Emerg Med 2017;8(1):55–60.
34. Khajeh A, Fayyazi A, Miri-Aliabad G, Askari H, Noori N, Khajeh B. Comparison between the ability of glasgow coma scale and full outline of unresponsiveness score to predict the mortality and discharge rate of pediatric intensive care unit patients. Iran J Pediatr 2014;24(5):603-8.
35. Hosseini SH, Ayyasi M, Akbari H, Gorji MAH. Comparison of glasgow coma scale, full outline of unresponsiveness and acute physiology and chronic health evaluation in prediction of mortality rate among patients with traumatic brain injury admitted to intensive care unit. Anesth Pain Med 2017;7(5):e33653.
36. Wijdicks EFM. Why you may need a neurologist to see a comatose patient in the ICU. Critical Care 2016:20;193.
37. Sepahvand E, Jalalı R, Mırzaeı M, Ebrahımzadeh F, Ahmadı M, Amraıı E. Glasgow coma scale versus full outline of unresponsiveness scale for prediction of outcomes in patients with traumatic brain injury in the intensive care unit . Turk Neurosurg 2016;26(5):720-4.