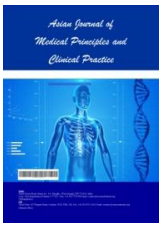

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Standardization of Moscow Coma Scale in Patients Hospitalized in Intensive Care Units in Iran

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Authors' contributions

This work was carried out in collaboration among all authors Author HKA designed and prepared the manuscript. Author MM analysed and author MR interpreted and prepared the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Moscow scale is an appropriate scale for the evaluation of the level of consciousness in patients hospitalized in intensive care units (ICU). This study aimed to standardize the Moscow scale in patients hospitalized in ICU based on Iran's demographics information.

Materials and Methods: This prospective study was performed on 60 patients admitted to ICU. The subjects were selected from Farshchian Medical and Educational Center, in Hamedan Hamadan, 2016. The Moscow questionnaire was translated into Persian by a translator familiar to the subject. Cronbach's alpha was used to determine the reliability of the questionnaire. Moreover, the correlation between the Glasgow Coma Scale (GCS) and Moscow scale was assessed using statistical analysis.

Results: In this quasi-experimental research design, 51.7% of the patients were male and 48.3% were female. The mean age of the subjects was 60.7±20.7 years. According to our findings, 31.7%, 30%, and 21.7% of the patients were in a deep coma, vegetative state, and moderate coma,

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respectively. Based on the Glasgow coma scale, consciousness level was within the range of 3-8 in 93.3% of the patients, while it was higher than 8 in 6.7% of them. Cronbach's alpha coefficient indicates that the Moscow scale is fairly reliable, whereas, in the Moscow scale, the coefficient of agreement between the two observations was obtained at 0.83.

Conclusion: Based on our results, the Moscow evaluation system has favorable reliability to assess the consciousness level in comatose patients. Therefore, this scale can be introduced as an alternative for the GCS scale in Iran.

Keywords: Coma; Glasgow coma scale; ICU; Moscow.

1. INTRODUCTION

Consciousness, as a multifaceted concept, is considered the state of being aware and responsive to one's surroundings; however, it is an ambiguous concept, which still does not have any universal definition covering all its essential aspects [1]. The reciprocal connections in the consciousness process occur between specialized areas of the grey matter within cortical and subcortical networks [1,2].

Two main components of consciousness are awareness (the content of consciousness) and arousal (level of alertness) [3]. The connection between these two components can be indicated by sleep, and awareness about surroundings is reduced during sleep [2]. Consciousness is not observed in patients under pathological and pharmacological coma, such that they cannot react to any stimulus [2]. In addition, decreased awareness and arousal are observed after the use of sedation or during the hypnotic state [4,5].

Coma is defined as a remarkable reduction in the level of consciousness [6]. Since the central nervous system may be damaged in this condition (coma), the assessment of the level of consciousness is very critical [7]. It seems that the standardization of a questionnaire for this state based on the demographic and cultural conditions of each society is very essential. The coma was associated with stroke, seizure, intracerebral hemorrhage (ICH), and toxication in critically ill patients [8].

Consciousness questionnaires are applied to assess the level of consciousness and predict clinical outcomes [8]. There are different tools, such as Glasgow Coma Scale (GCS), Full Outline Of Unresponsiveness (FOUR), Escala de Coma de Jovet (ECJ), as well as Bozza and Moscow, to measure and classify the anatomical and physiological aspects of consciousness such as respiratory rhythm, pupil size, eye movement, motor response, and cranial nerves response in comatose patients [9].

Moscow scale was developed by the Neurosurgery Institute of Union of Soviet Socialist Republics (USSR) in 1991 for the assessment of the level of consciousness [8]. The special characteristic of the Moscow scale is its applicability for patients with myocardial infarction, aphasia, and speech disorders, as well as intubated patients as it does not have any verbal criteria. Regarding the advantages of the Moscow scale, it should be mentioned that this method is based on the expert opinion of the team; moreover, it is quick and easy to complete. In addition, this technique is satisfactory in defining the priorities of projects that are in progress. On the other hand, one of the disadvantages of this model includes the subjectivity of the rules of the Moscow scale. If there is no effective cooperation with business, this prioritization method may be inaccurate. Moreover, this technique needs a team to have a good familiarity with the product features. Additionally, when the participants have different levels of familiarity with the product, it is difficult for them to classify or rank the items [10].

The number of items in the Moscow scale is equal to that of GCS, but it has higher clinical applicability. The application of GCS is limited since it cannot evaluate brain reflexes and assess patients with endotracheal intubation [9]. The use of this scale is not common in Iran due to the lack of a standardized questionnaire.

Assessment of consciousness level is very important since damage to the sensitive regions of the brain may lead to reduced consciousness, stroke, seizure, ICH, and toxication [7]. Since no study has attempted to standardize the Moscow scale in patients admitted to the intensive care units (ICUs) in the Iranian population so far, the current study will enhance the determination of the endangered patients with sensitive injuries of CNS. This study aimed to standardize the coma assessment tool of Moscow in patients admitted to ICUs based on Iran's demographics information.

2. MATERIALS AND METHODS

2.1 Research Design

This quasi-experimental study was carried out on 60 patients with different diseases. The samples were selected randomly from the patients admitted to six ICUs with about 35 beds at Farshchian Medical and Education Center, Hamadan, Iran, from April to December 2016. The patients were selected using a purposive sampling model under the supervision of the study statistician.

The inclusion criteria were: 1) the patients who admitted to the ICU, 2) GCS scores equal to or less than 12. On the other hand, hemodynamically unstable patients, those with a fluctuant condition, and the cases whose families or companions were unwilling to continue the research procedure were excluded from the study.

2.2 Data Collection Instrument

The Moscow coma scale, a 15-item quantitative scale. This scale was developed by the Neurosurgery Institute of Union of Soviet Socialist Republics (USSR) in 1991 to assess the level of consciousness [8]. In this study, neurological examination and consciousness status were assessed by this scale.

The total score of the Moscow scale is 75 and the highest score [10] belongs to the item investigating eye-opening stimulated by noise or oculocephalic reflex. The second highest score [8] pertains to obeying the commands. Moreover, a score lower than 15 is considered brain death (Fig. 1) [11]. The special characteristic of the Moscow scale is its applicability in patients with stroke, aphasia, and speech disorders, as well as intubated patients. This scale without speech criteria can be used to determine the level of consciousness in non-traumatic patients. Moreover, cough reflex, which plays a key role in the diagnosis of intubated patients, bilateral mydriasis (pupil dilation in both eyes), and oculocephalic reflex are considered in Moscow scale [11].

2.3 Data Collection Procedure

Demographic information of the patients was gathered by reviewing their medical records, which contained demographics, cause of admission, cause of unconsciousness, history of drug consumption, and the history of heart diseases. The patients were classified into full consciousness and irreversible coma based on neurological responses to the questionnaire items.

First, the Moscow coma scale was translated into Persian by an expert translator. Subsequently, the questionnaire was reviewed and confirmed by two anesthesiologists who were proficient in English. Following that, it was sent back to the first translator to apply their suggestions.

In the next step, the provided questionnaire was completed for 60 patients with a GCS score of less than 12, who were admitted to six ICUs. The patients were separately evaluated by a researcher and a trained nurse. Thereafter, the reliability, internal consistency, and correlation among the items of the questionnaire were evaluated by two assessors, and those who met the standard level were entered to the next stage; otherwise, the items were revised and re-corrected to achieve favorable reliability. The reliability of the Moscow coma scale was satisfactorily high, and its construct validity was supported by the results of the correlation analysis [12].

Fig. 1. Moscow prioritization template

Then, the validity of the questionnaire was established by content validity. To determine content validity, the questionnaire was reviewed by five anesthesiologists and neurologists and then correlation test was applied to consider the correlation of their replies.

2.4 Statistical Analysis

Results were presented as mean±SD for quantitative variables and summarized by frequency (percentage) for categorical variables. Continuous variables were compared using t-test or Mann-Whitney U test whenever the data did not appear to have normal distribution or when the assumption of equal variances was violated across the study groups. On the other hand, categorical variables were compared using the chi-square test. Moreover, ANOVA was employed to measure the trend of the changes in quantitative variables. In addition, the correlation between GCS and Moscow scale was evaluated in SPSS software (version 16) through Spearman's correlation coefficient. The reliability of the questionnaire was also determined using Cronbach's alpha. A p-value less than 0.05 was considered statistically significant.

3. RESULTS

According to the results, the majority of the patients were male (n=31, 51.7%). The mean ages of the male and female patients were 60.25±20.55 and 61.1±21.26 years, respectively, with. No significant difference. The frequencies of different causes of admission are shown in Table 1. Based on this table, the common causes of admission were stroke and seizure, respectively.

The frequencies of different consciousness levels based on Moscow scale are presented in Fig. 2, which indicates that 31.7% (n=19), 30% (n=18), and 21.7% (n=13) of the patients were in a deep coma, vegetative state, and moderate coma, respectively. Additionally, about 8.3% (n=5) and 6.7% (n=4) of them were diagnosed with moderately reversible and irreversible coma, respectively. About 1.7% (n=1) of the patients were fully conscious.

In general, the mean GCS score was 5.7±1.98 (range: 3-11). Based on GCS, the consciousness level was between 3 and 8 in 93.3% of the patients (n=56), and it was higher than 8 in 6.7% of the cases (Table 2).

The mean scores of the Moscow scale obtained by the first and second assessors were 35.5±17.47 and 35.8±17.80, respectively, with no significant difference between them (P=0.352).

The inter-item reliability of the Moscow scale was 0.24. The coefficient of the inter-observer agreement was 0.83; therefore, the Moscow scale has favorable reliability. The inter-rater reliability coefficient was 90%, indicating that this tool has favorable reliability. In addition, the Spearman's correlation coefficient for the two assessments was 99% (P=0.001). The score of the Moscow scale was matched with the score of GCS, the results of which are shown in Table 2. The reliability of the questionnaires was measured by Cronbach's alfa and it 81.3% that means the questionnaire has an acceptable internal consistency.

Table 1. The frequency of the causes resulting in the patients' admissions to the ICU

Variable		Frequency	Percent	Mean age
Gender	Male	31	51.7	60.25±20.55
	Female	29	48.3	61.1±21.26
Cause of admission	Stroke	41	68.3	
	Seizure	7	11.7	
	ICH	4	6.7	
	Toxication	4	6.7	
	Others	4	6.7	

Table 2. Comparison of the scores of Moscow and Glasgow coma scales in the comatose patients admitted to ICU

Glasgow coma scale	Moscow
3	≤10
3-5	11-25
5-8	26-50
8-10	51-60
10 ≤	60≤

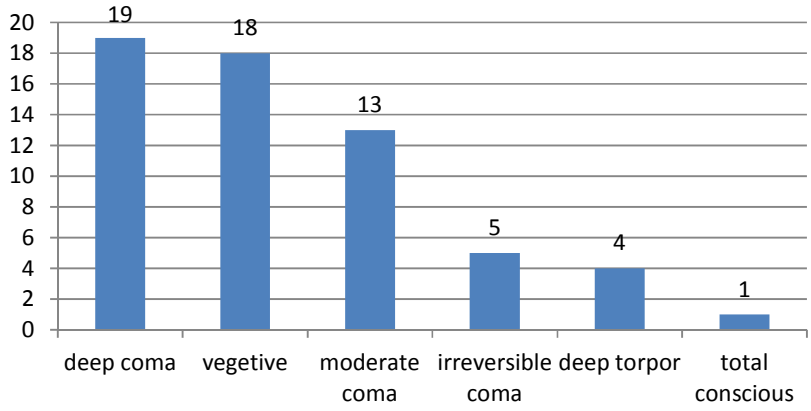

Fig. 2. The frequency of consciousness level of the patients admitted to this study based on Moscow scale

4. DISCUSSION

This is the first attempt to standardize the Moscow scale for patients admitted to ICUs in Iran. According to our findings, favorable inter-rater reliability was obtained for the Moscow coma scale. High validity and reliability of this were shown in many former studies; however, the applicability of this scale is different in various societies [6].

Among the different scales of consciousness evaluation, GCS is known as a proper scale, [13-15]; however, this scale suffers from some limitations such as inability to assess consciousness level in intubated and unable to speak patients [14]. This scale cannot assess the respiratory condition and brain reflexes in comatose patients [14,16]. For these reasons, evaluation of other scales assessing the consciousness level is necessary. For example, FOUR is a good known scale, which is suggested as a viable alternative to GCS. Based on Chen et al., the area under the curve (ROC) was higher in FOUR than GCS [17]. The applicability of the FOUR scale was confirmed by other similar studies [18-21]. The predictive value of the FOUR scale was assessed in Iran by Gorji et al., who showed that this scale has a higher predictive value than GCS [22]. Moreover, the inter-observer variability of the FOUR score in acute stroke patients was assessed in some studies, which showed a good correlation with GCS and thus can be used as a reliable tool for the assessment of the consciousness level in these patients [23,24].

Some scales for the assessment of consciousness levels such as the Moscow coma scale and Innsbruck coma scale have been used in a limited number of countries [13]. Moscow scale is commonly used in Russia and the countries of Former Soviet Union and is a proper system to assess the consciousness level in stroke patients with aphasia, as well as speech and linguistic disorders, and intubated patients. Another advantage of the Moscow scale over the GCS scale is ranking the exact level of consciousness, which can provide a more accurate assessment of the consciousness status of patients [11].

Although the Moscow scale can be used for the correct classification of consciousness level of patients, this scale is less known in the medical community and the validity and reliability of this scale have not been assessed in other countries [11].

In the Moscow system, without verbal criteria, it is possible to determine the level of consciousness in non-traumatic and non-comatose neurological patients. On the other hand, the cough reflex, which plays a diagnostic and key role in the extubation of the intubated patients, is also included in this system. Moreover, bilateral midiases (whether exist or not) and DOLL's EYE reflexes (an item for determination of brain death) are included in this scale. Corneal and plantar reflexes can help localize the lesion in the CNS. The number of items in this system is equivalent to GCS; however, the application of Moscow's scoring system seems to be more practical in the clinical setting.

Another benefit of the Moscow scale is the number of consciousness levels that are more than those on the Glasgow scale, which can reflect a more accurate assessment of the patient's alertness. Furthermore, it consists of five levels of consciousness from complete

consciousness to irreversible cramps that can give the evaluator a better understanding of patients' consciousness.

Based on our results, the patients were not significantly different in terms of age and gender; therefore, our findings were not affected by these variables. In addition, our findings showed that stroke is the most common cause of ICU admission.

In a study performed by Shakhnovich et al., all the patients who had Moscow scale score of less than 15 died. It can be indicated that Moscow score can be considered a good predictive value for patient outcome [8]. Since there are few studies assessing the Moscow scale, the comparison of our results with similar findings is not possible.

Considering the limitations of GCS in assessing the consciousness level in patients with aphasia or speech disorders, the use of other systems such as Moscow can lead to better prognosis prediction than GCS; however, the Moscow scale is rarely used, such that in one review study only one article about this scale was found [11]. Given that Moscow system is easy to use and has high reliability, it can be used as a good alternative to GCS.

5. STUDY LIMITATIONS

Since this study was conducted in the ICU of a single hospital, it reduces the generalizability of the study findings. In addition, few studies have considered the Moscow coma scale, which leads to a limited amount of evidence in the literature. Furthermore, the sample size was small, and the distribution of the patients was not matched based on the levels of unconsciousness, which can limit the generalizability of our findings in this study. Finally, for the assessment of the questionnaire, we conducted construct validity instead of factor analysis that can be considered as a risk for assessment by less valid tools.

6. CONCLUSION

Based on the results of the study, the Moscow scale demonstrated favorable reliability, compared to GCS for assessing consciousness level in comatose patients. This system can be useful for assessing consciousness level in patients with reduced consciousness level. Moreover, the findings reveal that the Moscow scale is a good predictive test; however, few studies evaluated the reliability of this scale. We suggest conducting further studies in this regard with larger sample sizes and a greater number of assessors. In addition, in our study, the ROC curve was not drawn for the prognosis of patients; therefore, further studies are required in this regard.

CONSENT

It is not applicable.

ETHICAL CONSIDERATION

The study protocol was approved by the Ethics Committee of Hamadan University of Medical Sciences, Hamadan, Iran. Before the initiation of the study, informed consent was obtained from all the patients or their companions, and they were allowed to withdraw from the study at any time. The data were gathered anonymously, and the patients were assured of the confidentiality of the data.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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