BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, August 2014. Vol. **11**(2), 621-626

A Study of Correlation between Ramsay "Sedation Level" Scale and Richmond "Agitation–Sedation" Scale and Physiological Parameters to Determine the Need for Sedation in Patients Undergoing Mechanical Ventilation, 2013

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doi: http://dx.doi.org/10.13005/bbra/1314

(Received: 16 June 2014; accepted: 30 July 2014)

"Ramsay" scale is currently used to determine the level of sedation in patients undergoing mechanical ventilation. This scale has advantages and disadvantages. The present study aims to investigate the correlation between the scores obtained from Ramsay "Sedation Level" Scale and Richmond "Agitation–Sedation" Scale and physiological parameters to determine the need for sedation in patients undergoing mechanical ventilation. This study was conducted on 100 patients undergoing mechanical ventilation using purposive sampling. Data were analyzed using Pearson correlation coefficient, regression analyses and descriptive statistics. There was a significant positive correlation between the scores of Richmond "scale" and physiological parameters (respiration, heart rate and blood pressure). There was a significant negative relationship between the scores of Ramsay "scale" and two physiological parameters, i.e. respiration rate and blood pressure. There was an intense and inverse correlation between Ramsay and Richmond scales ($r=0.907$) ($p<0.001$). Considering the high correlation between Richmond scale and components of physiological parameters compared to Ramsay scale, this instrument is an appropriate scale to measure the level of sedation in patients undergoing mechanical ventilation in the intensive care unit (ICU).

Keywords: Sedation, Ramsay "Sedation Level" Scale, Richmond "Agitation-Sedation" Scale

Intensive Care Unit (ICU) is a place where patients with life-threatening diseases receive medical care under the surveillance of the most skilled personnel along with the best conditions and the newest and the most equipped facilities available[1-2]. Mechanical ventilation in ICU is one of the key components of care for patients in critical condition such as serious situations[3]. Patients hospitalized in ICU face many stressful factors. Some obvious stressors include permanent noises of monitoring systems, 24-hour lighting, lack of environmental stimuli, physical pain and discomfort resulting from disease, ventilator connectivity, sleep disorders, usage of invasive techniques, existence of tracheal tube and inability to speak[4-5].

Anxiety and agitation can lead to the increased heart rate and blood pressure and exacerbate the risk of *cardiac dysrhythmia,* arrhythmia. Other physiological responses to stress include the increased metabolic rate and consequently the increased body temperature, increased cardiac output and contractility followed

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by an increase in blood pressure and heart rate, sodium retention, bronchiectasis and increase in respiration rate. It seems that sedation allows the patient to tolerate the physical environment and painful therapeutic measures of ICU).

Therefore, routine evaluation of patients to determine the level and amount of sedation is one of the main steps in caring for critically ill patients. Precise control of sedation leads to a decrease in oxygen consumption, coordination with mechanical ventilator, reduced need for neuromuscular blocking agents, maintenance of normal sleep pattern and reduced pain and anxiety[7-8]

Therefore, determining the amount of sedation includes an important part of the analysis of the patient in ICU. However, this evaluation will be complicated when communication is not possible due to having tracheal tube and the patient's serious conditions.

In this regard, it should be noted that the investigation and evaluation of sedation adequacy can be problematic without using measures or tools since many of its related concepts such as pain, sedation, anxiety, arousal and irritability are of subjective nature and are difficult to measure[1]).

The existence of sedation assessment tools (SAT) can continuously inform nurses of changes in the level of sedation in the patient. In addition, using a standard and purposive tool, the physician can prescribe the appropriate sedative ensuring the proper understanding of the patient's need for sedation[11].

Ramsay "Sedation Level" Scale is currently used as a common scale to investigate the level of sedation in patients. This scale has advantages and disadvantages including having only two levels to determine sedation. Considering the fact that Richmond "Agitation-Sedation" Scale has resolved some of the criteria not stated in Ramsay "Sedation Level" Scale and has varying levels with special span for sedation, it seems that this scale is an appropriate tool to measure the level of sedation[12].

Considering the complications of the patient's sedation medication under ventilator and the necessity to determine the actual need for prescribing these drugs, a precise and reliable tool should be introduced to nurses to take care of these patients in ICU. Therefore, this study aimed to investigate the correlation between the scores obtained from Ramsay "Sedation Level" Scale and Richmond "Agitation–Sedation" Scale and physiological parameters to determine the need for sedation in patients undergoing mechanical ventilation in hospitals affiliated with Shahid Beheshti University of Medical Sciences to use the results obtained in selecting the appropriate method to evaluate the patients' need for sedation in care and treatment planning.

MATERIALS AND METHODS

This was a descriptive correlational study conducted on 100 patients undergoing mechanical ventilation hospitalized in ICU in Labafinejad, Imam Hossein and Modarres hospitals were selected using convenience and purposive sampling. The Glasgow Coma Scale (GCS) score was at least 9 for these patients. Inclusion criteria included lack of hearing loss, lack of visual problem, lack of neuromuscular block, lack of the paralysis of all four limbs (quadriplegia) and not receiving sedative. In addition, if the patient had already received a sedative, he was included in the study after medication washout period and ensuring that he was no longer affected by the sedative. It should be noted that the medication washout period is unique for each patient and is characterized by the re-emergence of agitation and lack of cooperation.

Four data collection tools included a demographic information questionnaire, Richmond "Agitation-Sedation" Scale, Ramsay "Sedation Level" Scale and vital signs checklist. Ramsay "Sedation Level" Scale has two awareness levels (score 1 to 2) and four sleep levels (score 3 to 6). Scores[1] and (6) show agitation and lack of response, respectively. In addition, Richmond "Agitation-Sedation" Scale has 10 levels and five sedation levels. Score (+4) being the highest score, scores (0) and (-5) represent aggression, sedation and lack of response, respectively. Validity and reliability of both Ramsay and Richmond tools were analyzed by Katrina Leydon and Sandra Hahnemann (2011), Wesley Eli (2003) *et al*. and Curtis *et al*. (2002) as well as Tadrisi *et al*. (2010) in Adult ICU, Adult ICU and Baghiyatollah University, respectively and were introduced as appropriate tools to measure the sedation status in Persian ICU patients. In this

study, the reliability of tools was investigated using intra-rater and inter-rater agreement methods on 10 patients undergoing mechanical ventilation. In order to determine the reliability of tools for intra-rater agreement, 10 patients were analyzed by the researcher twice using both tools at a 15-minute interval and in all cases, the Spearman correlation coefficient was estimated equal to 0.96 and 0.94 for Ramsay and Richmond tools, respectively. In order to determine the inter-rater reliability, the agitation level of 10 patients was measured by two raters (researcher and a trained ICU nurse) using both Ramsay and Richmond tools and the Spearman correlation coefficient was estimated equal to 0.96 and 0.98 for Richmond and Ramsay tools, respectively. Inter rater reliability was used to determine the reliability of physiological parameters. The tool was given to two observers; then being implemented on 10 patients, the inter rater reliability was measured. According to the Pearson correlation test, the correlation coefficient was above 0.9.

Selecting samples from the desired population, the patient's base physiological parameters were firs recorded in the sheet. Then two observers simultaneously determined the level of need for sedation for each sample based on the Richmond and Ramsay scales, and physiological parameters including systolic blood pressure, diastolic blood pressure, heart rate, respiration rate, temperature) were simultaneously measured and recorded.

It should be noted that in this study, the level of sedation in patients was analyzed by two nurses not knowing the other one's score using two above-mentioned scales.

Finally, the obtained information was analyzed using the statistical package of SPSS (version 16) through correlational parameters such as Pearson correlation coefficient, regression analyses and descriptive statistics.

RESULTS

The total sample size in this study was 100, the majority of whom were male (65%). In addition, most samples were married (77%) and over 50 years old (66.14%). The average age was 51.47 (SD=19.453). None of these 100 patients received sedatives but 46 persons were prescribed sedatives. Scores obtained from Richmond "Agitation-Sedation" Scale, Ramsay "Sedation Level" Scale, physiological parameters, age and Glasgow Coma Scale are presented in Table 1. The Spearman's correlation coefficient showed a significant inverse correlation between Richmond "Agitation-Sedation" Scale and Ramsay "Sedation Level" Scale. The correlation was equal to -0.907 ($p<0.001$). This correlation is negative since the lowest (1) and the highest (+4) scores are considered for agitation in Ramsay scale table and Richmond scale table, respectively.

Considering the intensity of correlation, there was a significant inverse relationship between Ramsay "scale" and two components of physiological parameters, i.e. respiration rate and

Table 1. Scores obtained from Richmond "Agitation-Sedation" Scale, Ramsay "Sedation Level" Scale and physiological parameters

Variable	Number	Maximum	Minimum	Mean	Standard Deviation
Ramsay	100	6	1	1.96	1.377
Richmond	100	3	-4	0.67	1.564
Temperature 0	100	42	35	37.071	1.1138
Temperature 1	100	40	36	37.313	0.8220
Heart rate 0	100	145	2	88.60	22.689
Heart rate 1	100	141	55	98.42	21.299
Respiration rate 0	100	37	0	12.15	8.461
Respiration rate 1	100	38	0	15.53	8.540
Systolic blood pressure 0	100	200	60	121.15	31.076
Systolic blood pressure 1	100	200	81	129.73	28.121
Diastolic blood pressure 0	100	121	39	73.74	17.421
Diastolic blood pressure 1	100	109	43	78.65	15.401

Table 2. Pearson correlation coefficient between Ramsay "Sedation Level" Scale and physiological parameters

Ramsay scale	Temperature	Respiration rate	Diastolic blood pressure	Systolic blood pressure	Heart rate
	-0.165 0.102	-0.464 (p<0.001)	-0.533 (p<0.001)	-0.561 (p<0.001)	-0.285 0.004

Table 3. Pearson correlation coefficient between Richmond "Agitation-Sedation" Scale and physiological parameters

Ramsay scale	Temperature	Respiration rate	Diastolic blood pressure	Systolic blood pressure	Heart rate
	0.136 0.177	0.477 (0.001>p)	0.555 (0.001>p)	0.587 (0.001>p)	0.422 (0.001>p)

blood pressure. The highest to the lowest intensity of correlation included respiration rate, diastolic blood pressure and systolic blood pressure. However, there was no significant relationship between temperature and heart rate (Table 2).

There was a significant positive correlation between the scores of Richmond "scale" and all components of physiological parameters (respiration, heart rate and blood pressure) except temperature. The highest to the lowest intensity of correlation included systolic blood pressure, diastolic blood pressure, respiration rate and heart rate. There was no significant relationship between Richmond "scale" and temperature (Table 3).

DISCUSSION

Average scores obtained from Richmond "Agitation-Sedation" Scale and Ramsay "Sedation Level" Scale showed that the use of sedation tools in patients undergoing mechanical ventilation leads to the reduced use of sedatives in these patients and the improvement of the quality of sedation in ICU patients. Investigating the effect of using sedation and pain guidelines by nurses on the level of sedation, pain and the use of tranquilizers and sedatives in addicted patients hospitalized in ICU, Rafiee *et al*. showed that the use of sedation and pain management guidelines not only leads to a better sedation and analgesia in patients, but also reduces the use of tranquilizers (Midazolam) and narcotic analgesics (Morphine) in these patients[13]. Results of a study conducted by Eduardo *et al*. on forty patients undergoing mechanical ventilation show similar findings: Using sedation and pain management guidelines compared to the conventional method improves the quality of sedation in ICU patients[14]. Considering the use of pain management and sedation guidelines in ICU patients, Ali Akbar Keykha *et al*. showed that the use of pain management and sedation guidelines can leads to a better analgesia and sedation in these patients[15].

Unlike the results of this study and most similar researches, a study conducted by Buknall *et al*. on 312 patients in Australia (2008) shows that the use of sedation guidelines by nurses to sedate patients has contributed not much to sedating ICU patients. In addition, they reported that the use of sedation and pain management guidelines in ICU patients cannot reduce the duration of need for mechanical ventilation, duration of hospitalization in ICU, duration of hospitalization in the hospital and mortality rate. Buknall *et al*. stated that the difference between their findings and most studies conducted in this field is due to the difference in the tasks of Australian nurses. Buknall *et al*. believe that Australian nurses pay much attention to the investigation of pain and the level of sedation in their patients even when they are not using sedation guidelines. This has led to the controlled pain and favorable sedation in their patients[16].

According to the results obtained from their studies, Ramsay *et al*. (2002) and Walsh *et al*. (2004) state that one of the limitations of widely using Ramsay "Sedation Level" Scale is

the lack of an adequate measurement of agitation in patients. Therefore, documentations obtained from the agitated behavior cannot well contribute to assessing the remediable causes of agitation and unrest simultaneously with assessing the response to treatment by nurses[17-18].

Results of the study conducted by Siro *et al*. (2008) titled The Similarity of Ramsay "Sedation Level" Scale and Richmond "Agitation-Sedation" Scale to assess the level of sedation in ICU patients showed that Richmond "Agitation-Sedation" Scale is a good scale to assess the level of sedation in ICU patients and can measure the level agitation more precisely than Ramsay "Sedation Level" Scale[19].

Considering the physiological changes, the results obtained show that agitation increases heart rate, respiration rate and systolic and diastolic blood pressure proportional to the admittance time. However, agitation is followed by slight changes in body temperature.

In his study, Imani states that agitation increases the heart rate and the risk of arrhythmia. Some physiological responses to agitation frequently observed include the increased metabolic rate and consequently the increased body temperature, increased cardiac output and contractility followed by an increase in blood pressure, heart rate and respiration rate[6]. In their study, Han *et al*. state that agitation and tension increase heart rate, respiration rate and blood pressure[20]. The result of the above-mentioned study is consistent with that of the study conducted by Han *et al*. (2010) and inconsistent with that of the study conducted by Imani (2009) and shows that there is no significant relationship between the incidence of agitation and the increased temperature.

According to the results of this study, there is a significant positive correlation between the scores of Richmond "scale" and all components of physiological parameters (respiration rate, heart rate and blood pressure) except temperature. Agitation increases all components of physiological parameters except temperature. This result confirms the suitable use of Richmond "scale" to determine the level of agitation in patients undergoing mechanical ventilation.

According to the results of this study, there is a significant negative relationship between the scores of Ramsay "scale" and two components of physiological parameters, i.e. respiration rate and blood pressure and no significant relationship between the scores of Ramsay "scale" and two other components, i.e. temperature and heart rate. This is due to the limitation of Ramsay "scale" to precisely assess the level of agitation in patients since various studies and books have proved that agitation leads to the increased need for oxygen and consequently the increased metabolic rate, increased cardiac output and contractility and increased heart rate. The above-mentioned results show that the use of Richmond "scale" is much better than Ramsay "scale" in patients undergoing mechanical ventilation due to its special extension to measure the levels of agitation.

CONCLUSION

Generally, findings of this study indicate that both Richmond "Agitation-Sedation" and Ramsay "Sedation Level" Scales are appropriate tools to measure the sedation status in patients undergoing mechanical ventilation in ICU. Therefore, considering the great role of nurses in identifying the agitation in patients undergoing mechanical ventilation, effective clinical measures can be taken using the above-mentioned scales, early recognition of patients' need for sedation and evaluation of treatment strategies. Considering the high correlation between Richmond "Agitation-Sedation" Scale and components of physiological parameters compared to Ramsay "Sedation Level" Scale, it can be said that this scale is an appropriate scale to measure the level of sedation in patients undergoing mechanical ventilation due to its special extension to measure the level of sedation distinguishing it from other scales stated in one or two levels of sedation since Ramsay "Sedation Level" Scale has 4 sleep levels and 2 awareness levels and as previously stated, one of the limitations of this scale is the lack of an adequate measurement of agitation, since the amount of agitation as well as the need for sedation varies among patients and all patients cannot be classified in the same level of agitation, while Richmond "Agitation-Sedation" Scale has a logical sequence for agitation and documentations obtained from the agitated behavior can contribute to assessing the remediable causes of agitation and

unrest simultaneously with assessing the response to treatment by nurses.

ACKNOWLEDGEMENTS

We thank all ICU personnel of Imam Hossein, Modarres and Labafinejad hospitals for their cooperation with the researcher to sample and reduce noises in ICU.

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