

## Study of the Relationship Between Vital Signs Monitoring and Riker Sedation-Agitation Scale

<sup>1</sup>Reza Pourmirza Kalhori, <sup>2</sup>Amir Jalali and <sup>3</sup>Maryam Mirzaei

<sup>1</sup>Department of Medical Emergency,

Faculty of Paramedical, Kermanshah University of Medical Sciences, Kermanshah, Iran

<sup>2</sup>Department of Psychiatric Nursing, Faculty of Nursing and Midwifery,

Holistic Health Research Center, Kermanshah University of Medical Sciences, Kermanshah, Iran

<sup>3</sup>Department of Intensive Care Nursing, Faculty of Nursing and Midwifery,

Jahrom University of Medical Sciences, Jahrom, Iran

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**Abstract:** Ensuring the adequacy of sedation process in patients was been considered as critical issues in nursing care. Thus, we need to use of standard tools or appropriate measurements to it. The present study examined the association between physiological criteria and Rikersedation-agitation scale. During a clinical trial, 58 patients after undergoing coronary artery bypass graft surgery was been enrolled. From the admission of the subjects in the intensive care unit, the patients hemodynamic parameters (heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure rate, respiratory rate and central venous pressure) were been measured and recorded in each hour in a researcher-made checklist and simultaneously the patients were scored using the Riker sedation-agitation scale. Finally, the correlation between physiological indices changes and Riker sedation-agitation scale changes was been analyzed using Pearson correlation test and SPSS Software, version 18. The results of Pearson correlation test showed the presence of correlation between the scores of Riker sedation-agitation scale and physiological indices in the 1st and 2nd h and 4th and 5th h of intubation. No significant correlation seen between riker scale and physiological parameters at other hours of intubation. Study results showed, control of vital signs cannot be trusted solely as a reliable measure based on which the patient would receive the sedative drugs and the better approach is to use them in combination with other clinical tools such as Riker sedation-agitation scale.

**Key words:** Vital signs, sedation, agitation, riker scale, indices

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### INTRODUCTION

The sedation process is used at time using mechanical ventilation to prevent the patient fighting with the ventilator, relieving the pain, anxiety, causing amnesia and reducing oxygen consumption, which is done using drugs, muscle relaxants and hypnotic medications (Mirzaei *et al.*, 2013). Often after heart surgeries, a short period of controlled mechanical ventilation is used due to the vulnerability of patients undergoing ardiac surgery to myocardial ischemia and for hemodynamic stability of the patients (Keage and Perry, 2003). Performing care procedures may cause pain and stress in patients and requires the use of anti-pain medications and sedatives (Mottahedian *et al.*, 2010). Proper sedation is an important part of care in special care units and has been described as a challenge in providing comfort without coma (Weisbroadt *et al.*, 2011).

Precise control of sedation process can lead to reduced oxygen consumption, more coordination of the patient with mechanical ventilation, reduced need for neural-muscular blockers medications, maintained normal sleep patterns and reduced pain and anxiety (Soliman *et al.*, 2001). Nurses have a major role in the use of tranquilizers, since they are continuously involved in the patient's bedside and responsible for the patient check-up and administrating the mentioned drugs (Goodarzi *et al.*, 2015). Proper adjustment of sedation medicines doses is one of the essential challenges for nurses. For this reason, the tools for examining and controlling the sedation are necessary for the nurses so that they can be continuously aware of changes in the level of sedation in patients and also using a standard and targeted tool, a clear connection could established between them and the doctors. This type of communication can lead to ensured accurate

understanding of the patient need to sedation as well as proper administered doses of sedatives. The process of sedation done using clinical guideline, rating and scoring systems and choice of analgesics and sedative drugs based on a determined target in the intensive care unit would lead triggered faster spontaneous breathing in patients and their faster separation from mechanical ventilation device and shorter stay in the intensive care unit (Martin *et al.*, 2006). The scoring criteria for sedation classified into two subjective and objective or physiological groups. The subjective criteria make it possible for the examiner to interpret the movements, facial expressions, the patient's condition and vital signs of patients unable to communicate so that s/he can determine an identified level of patient's agitation. The drugs are titrated to achieve a predetermined level of sedation and to relieve the behaviors resulting in agitation and internal stress of the patient based on the examiners analyses. The subjective criteria rely upon the interpretation of the examiner of the patient observable behavior, based on which the levels of patient's pain and agitation are determined. These criteria are designed numerically such as Riker scale so that the care providers can assess the patient response to verbal or tactile stimuli and use the criterion as the number related to that behavior (Bucknall *et al.*, 2008).

However, the physiological parameters such as vital signs rely on external monitoring and measure the patient's vital signs and neurological status for determination of sedation level (Sessler, 2004). For to examining and determining of the level of sedation process were been administration of sedatives in ICU patients in the Imam Ali (AS) in Kermanshah, the common method based on the monitoring of physiological signs is been used which include the changes in vital signs, attention to ventilator alarms, changes in the patient's face, patient awakening with more emphasis on changes in vital signs.

The question is whether relying on changes in vital signs would be an appropriate guide to determine the levels of patient sedation and agitation or not. It should be noted that this method has its own risks and it is possible that greater doses of sedatives would be used for a patient not experiencing great distress which can cause progressive accumulation of the drug in the patient's body, leading to delayed recovery, increased length of hospital stay and other complications (Connor *et al.*, 2010). Given the above, the researchers decided to measure the relationship between vital signs and the Riker sedation-agitation tool as a valid and reliable tool in assessment of agitation levels in every hour after exiting the operating room until the patient fully wake-up to answer the above question. Hence, the present study

was provided with the aim of examining the association between psychological symptoms and the Riker scale as a physiological criterion.

## MATERIALS AND METHODS

This present study is a part of the first researchers's dissertation results that its first part has been published. This was a clinical trial which was begun with the permission of the Ethics Committee of Deputy of Research and Technology, Kermanshah University of Medical Sciences with No. 33970 registered in the Iranian Clinical Trials Database as 4N201209244736IRCT. The research environment was intensive care unit after heart surgery in Imam Ali (AS) educational-treatment hospital in Kermanshah. From patients undergoing coronary surgery, 58 subjects were included in the study by available sampling method. Before the study, written informed consent was been obtained from all the samples.

The sedation level of samples was been checked every hour from the beginning of entry into the intensive care unit to the time of endotracheal extubation by Riker sedation scale (Table 1). The scale is a valid instrument in assessment of sedation level in patients hospitalized in intensive care unit which has been assessed and approved in terms of reliability and validity in several studies in general intensive care units, surgical and internal units and intensive care unit after cardiac surgery (Riker *et al.*, 2001; Arbour *et al.*, 2009). The Riker scale with internal agreement  $>0.92$  and  $0.85$  is a valid measure (Lewis and Reliability, 2004; Riker *et al.*, 1999; Janz and Clifford, 2005). Simultaneously, the patient's vital signs including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure rate, respiratory rate and central venous pressure were measured during the patient's sedation hours until the time of extubation and all the information were recorded in a researcher-made checklist with confirmed face and content validities. At different hours of intubation, the sedation protocol for the samples was administration of 2-3 mL of Sufentanil (equivalent 10-15  $\mu\text{g}$ ) if necessary. To neutralize muscle relaxant received in the operating room, the Neostigmine injection as  $0.04 \text{ mg kg}^{-1}$  of body weight and atropine injection as  $0.02 \text{ mg kg}^{-1}$  of body weight were been used.

**The study inclusion criteria:** Patients undergoing coronary artery bypass graft surgery, age between 30-70 years old, ejection fraction  $>30\%$ , the number of grafts between 1-4 numbers without endarterectomy, lack of vision and hearing problems and full understanding of Persian language. The study exclusion criteria were the patient need to artificial ventilation for  $>24 \text{ h}$ ,

Table 1: Riker sedation-agitation scale

Response	Sedation-agitation level	Score
Minimal response or lack of response to painful stimuli; does not communicate or follow commands	Non-waking	1
He is awakened by physical stimulation but does not communicate or follow commands	Very quiet	2
He is hard to wake up; he gets up with sound stimuli or gentle shaking but falls a sleep again, follows the simple instructions	Quiet	3
He is quiet, follows the commands and easily awakens	Quiet and harmonious	4
He is anxious and confused, but trying to get up; becomes calm with verbal commands	Agitated	5
Despite repeated verbal warnings, he does not become calm is not calm, he needs a restraint, bites the endotracheal tube	Very agitated	6
Removes the endotracheal tube; climbs up the bedside rails, tries to remove the catheter, attacks the care provider and struggles	Dangerous agitation	7

cardiopulmonary arrest during or after surgery, abnormal bleeding so that the patient will require reoperation and in case if patient's needed to receive a continuous infusion of sedative and muscle relaxant drugs. Finally, the relationship between different levels of Riker scale with changes in physiological parameters (heart rate, systolic blood pressure, diastolic blood pressure, mean study pressure rate, central venous pressure and respiratory rate) were examined at different times of intubation using Pearson correlation test.

## RESULTS AND DISCUSSION

A number of 58 patients were been enrolled in the study. The average age of the subjects was equal to 59.1±7.7 and the highest frequency was seen in the age range of 60-70 years. Among the completely studied samples, 68% were male and 32% female. The highest recorded risk factors were hypertension (43.1%) and smoking (39.7%). The mean duration of intubation and the average consumption of drugs until the full consciousness of the patients were as 7.1±2.37 h and 5.5±8 mg, respectively (Table 2).

The results of Pearson correlation test showed the presence of correlation between the scores of Riker sedation-agitation scale and physiological indices in the 1st and 2nd h (level 1 of Riker sedation scale) and 4th and 5th h (the majority with level 4 of Riker sedation scale) of intubation. The Riker score in the first hour of intubation which coincided with the level 1 of Riker sedation scale (i.e., the patient in a non-waking situation) was correlated with systolic blood pressure and diastolic blood pressure ( $r = 0.41, p = 0.001$  and  $\alpha = 0.01$ ) and ( $r = 0.31, p = 0.01$  and  $\alpha = 0.05$ ). In the second hour of intubation there was also a significant correlation between the Riker score and the heart rate ( $r = 0.28, p = 0.03$ ). At the fourth and fifth intubation hours in which the majority of patients (53-63%) had progressed from non-waking up to the full awakening of states (which coincided with the fourth level of Riker sedation scale), statistically significant correlations were observed between the Riker scores with

Table 2: Demographic data and risk factors of the samples

Demographic data	Values
Age (mean±SD)	59.1±7
<b>Gender</b>	
Male (%)	68.4
Female (%)	31.6
Left ventricular ejection fraction (mean±SD)	48.4±9.3
Duration of surgery (mean±SD)	3.1±0.38
BMI (mean±SD)	26.4±4.4
History of hyperlipidemia (%)	36.2
History of hypertension (%)	43.1
History of diabetes (%)	27.6
History of smoking (%)	39.7
History of drug use (%)	22.4

diastolic blood pressure and mean arterial pressure ( $r = 0.27, p = 0.04$ ) and ( $r = 0.35, p = 0.01$ ). No significant correlation was observed between Riker scores and physiological parameters at other intubation hours.

Although, the sedation criteria typically do not include the physiological variables assessment, however, the nurses may normally use these parameters to determine the patient's need to sedation and specifying the normal values of these variables (Grap *et al.*, 2012). According to Weinert and Calvin (2007), 70% of nurses believe that the majority of patients receiving sedation less than their need will develop tachypnea and increased heart rate and blood pressure (Weinert and Calvin, 2007).

Findings of this study show that the observed relationship between physiological indices such as vital signs and levels of sedation in patients could be seen mostly in the early hours, in which the patients are mostly in the state of deep to light sleep (equivalent to Riker levels 1-3). Few studies that done in this regard. In the study by Janz and Clifford (2005), the agitation and sedation in patients were evaluated using Riker criteria levels and systolic and diastolic blood pressure rates, heart rate and respiration rate. The results showed with patient progress toward agitation, a slight increase occurs in physiological parameters which suggests that changes in physiological parameters and their relationship with Riker scale scores are not sufficient to differentiate the agitation and sedation from each other (Janz and Clifford, 2005). In the present study, we only saw correlation between some vital signs with levels of sedation and

agitation only in the early hours of intubation, in which the patient is mostly in a drowsy state and has not experienced the full consciousness.

In a study by Grap *et al* (2012), physiological indicators were been evaluated in three levels of sedation (deep, moderate and awake). The findings suggested no significant relationship between levels of sedation and changes in physiological parameters (heart rate, respiratory rate and arterial oxygen saturation) announced that although vital signs stability could not see at all levels of sedation however, at deeper levels of sedation, the vital signs are more stable. This result was consistent with our study results. In this study, the majority of the correlations were seen between vital signs and initial levels of Riker scale (deep sedation levels).

In a study by Arbour and Gelinas (2010), the validity of vital signs in evaluating pain after open-heart surgery was been examined. He states that the use of vital signs is not reliable for assessment of pain status and they should use with caution. They can be used when the behavioral indicators are not seen in patients undergoing mechanical ventilation or in non-alert patients (Arbour and Gelinas 2010).

In a study by Haberthur *et al.* (1996) using coded measure and respiratory rate changes to examine the level of sedation provided by Midazolam it was proven that there is a significant correlation between the depth of sedation and changes in heart rate in patients under intubation and mechanical ventilation and even the heart rate can be considered as a reliable accurate and non-invasive measure. However, in our study, the most correlations were seen between levels of agitation and sedation with the blood pressure and except for the second hour, no relationship was observed between the sedation and heart rate such as other reports (Haberthür *et al.*, 1996).

All correlations observed in the present study were low and high correlation (Pearson coefficient  $>0.75$ ) was seen between none of the physiological indicators with Riker scale levels at any hour. Thus, it can be concluded that physiological indicators are not reliable criteria to determine the level of sedation or agitation in patients receiving sedatives which reveals the need to use of a valid tool instrument for assessment of the level of sedation and agitation and titration of sedative drugs.

One of the limitations of the study was that the conducted correlation was in patients who were not undergoing continuous infusion of sedative drugs and according to the anesthesiologist decision and based on the patient's clinical condition were ordered to have a short term intubation and mechanical ventilation. In this short period, several factors such as prior drug use or the

difference between the patients threshold level of pain led to no response in appearance and only developing some increase in vital signs values and vice versa. On the other hand, the patients suffering from hypertension could show vital signs such as high blood pressure while considered at sedation level according to the Riker scale. Therefore, factors such as high blood pressure or differences in pain threshold were considered as the confounding factors in the study. Thus, it is recommended that in future studies, more pure results would be targeted with matching the samples.

## CONCLUSION

Given that no correlation was seen between Riker scale scores and changes in vital signs in all the hours (apart from the early hours) regarding the relationship between physiological parameters and sedation levels it can be concluded that vital signs cannot be trusted as a reliable measure based on which the patient will receive sedative drugs and perhaps concomitant use of vital signs with a sedation-agitation tool such as the Riker scale can help to appropriate decision-makings about proper levels of patient sedation-agitation.

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