Rev Bras Anestesiol. 2017;67(4):347–354

REVISTA BRASILEIRA DE ANESTESIOLOGIA
Publicação Oficial da Sociedade Brasileira de Anestesiologia
www.sba.com.br

SCIENTIFIC ARTICLE

The correlation among the Ramsay sedation scale, Richmond agitation sedation scale and Riker sedation agitation scale during midazolam-remifentanil sedation

Turgut Namigar[a,*], **Karacalar Serap**[a], **Akdaş Tekin Esra**[a], **Odacılar Özgül**[a], **Öztürk Ali Can**[a], **Ak Aysel**[a], **Ali Achmet**[b]

[a] *Okmeydani Training and Research Hospital, Department of Anesthesiology and Intensive Care, Istanbul, Turkey*
[b] *Istanbul University, Istanbul Medical Faculty, Department of Anesthesiology and Intensive Care, Istanbul, Turkey*

Received 11 June 2015; accepted 19 July 2016
Available online 10 August 2016

KEYWORDS
Critically ill;
Sedation scale;
Validity;
Reliability

Abstract
Background and objectives: Sedative and analgesic treatment administered to critically ill patients need to be regularly assessed to ensure that previously stated goals are well achieved as the risk of complications of oversedation is minimized. We revised and prospectively tested the Ramsay Sedation scale (RSS) for interrater reliability and compared it with the Sedation-Agitation Scale (SAS) and the Richmond Agitation Sedation Scale (RASS) to test construct validity during midazolam-remifentanil sedation.
Methods: A convenience sample of ICU patients was simultaneously and independently examined by pairs of trained evaluators by using the revised SAS, RSS, and RASS. Ninety-two ICU patients were examined a total of 276 times by evaluator pairs.
Results: The mean patient age was 61.32 ± 18.68 years, 45,7% were female ($n = 42$), 54.3% male ($n = 50$). Their APACHE values varied between 3 and 39 with an average of 13.27 ± 7.86 and 75% of the cases were under mechanical ventilation. When classified by using RSS (2.70 ± 1.28), 10.9% were anxious or agitated (RSS1), 68.5% were calm (RSS 2–3), and 20.6% were sedated (RSS 4–6). When classified by using RASS (−0.64 ± 1.58), 20.7% were anxious or agitated (RASS+1 to +4), 63.0% were calm (RASS 0 to −2), and 16.3% were sedated (RASS −3 to −5). When classified by using SAS (2.63 ± 1.00), 12% were anxious or agitated (SAS 5–7), 57.6% were calm (SAS 4), and 30.4% were sedated (SAS 1–3). RSS was correlated with the SAS ($r = -0.656$, $p < 0.001$) and RASS was correlated with the SAS ($r = 0.565$, $p < 0.001$). RSS was highly correlated with the RASS ($r = -0.664$, $p < 0.001$).
Conclusions: Ramsay is both reliable and valid (high correlation with the RASS and SAS scales) in assessing agitation and sedation in adult ICU patients.

* Corresponding author.
E-mails: drnamigar@yahoo.com.tr, neturgut@yttmail.com (T. Namigar).

http://dx.doi.org/10.1016/j.bjane.2016.07.002

PALAVRAS-CHAVE
Estado crítico;
Escala de sedação;
Validade;
Confiabilidade

Correlação entre a escala de sedação de Ramsay, escala de sedação-agitação de Richmond e escala de sedação-agitação de Riker durante sedação com midazolam-remifentanil

Resumo
Justificativa e objetivos: O tratamento de pacientes em estado crítico com sedativos e analgésicos deve ser regularmente avaliado para garantir que as metas pré-definidas estão sendo atingidas, bem como minimizar o risco de complicações resultantes de sedação em excesso. Conduzimos uma revisão e testamos prospectivamente a Escala de Sedação de Ramsay (*Ramsay Sedation Scale* [RSS]) para a confiabilidade interavaliador e a comparamos com a Escala de Sedação e Agitação de Riker (*Riker Sedation-Agitation Scale* [RRSAS]) e a Escala de Sedação e Agitação de Richmond (*Richmond Agitation Sedation Scale* [RASS]) para testar a validade de construto durante a sedação com midazolam-remifentanil.
Métodos: Uma amostra de conveniência de pacientes de UTI foi simultânea e independentemente examinada por pares de avaliadores treinados com o uso das escalas revisadas RRSAS, RSS e RASS. Foram examinados 92 pacientes de UTI por pares de avaliadores em 276 momentos.
Resultados: A média dos pacientes foi de 61,32 ± 18,68 anos; 45,7% eram do sexo feminino ($n = 42$) e 54,3% do masculino ($n = 50$). Seus escores APACHE variaram entre 3-39, com média de 13,27 ± 7,86, e 75% dos casos receberam ventilação mecânica. Quando RSS foi usada para a classificação (2,70 ± 1,28), 10,9% dos pacientes estavam ansiosos ou agitados (RSS1), 68,5% estavam calmos (RSS 2 a 3) e 20,6% estavam sedados (RSS 4 a 6). Quando RASS foi usada para a classificação (-0,64 ± 1,58), 20,7% dos pacientes estavam ansiosos ou agitados (RASS +1 a +4), 63,0% estavam calmos (RASS 0 a -2) e 16,3% estavam sedados (RASS -3 a -5). Quando RSAS foi usada para a classificação (2,63 ± 1,00), 12% dos pacientes estavam ansiosos ou agitados (RSAS 5 a 7), 57,6% estavam calmos (RSAS 4) e 30,4% estavam sedados (RSAS 1 a 3). Houve correlação de RSS com RSAS ($r = -0,656$, $p < 0,001$) e de RASS com RSAS ($r = 0,565$, $p < 0,001$). Houve forte correlação de RSS com RASS ($r = -0,664$, $p < 0,001$).
Conclusões: A RSS é confiável e válida (forte correlação com RASS e RSAS) para avaliar a sedação e agitação em pacientes adultos internados em UTI.

Introduction

Analgesia and sedation are used in the Intensive Care Unit (ICU) for improving the comfort and safety of patients undergoing intensive care therapies. Nevertheless, continuous administration of sedatives prolongs the time on mechanical ventilation and ICU stay. These adverse effects can be reduced by clear definition of the goals of sedation combined with a sedation protocol.[1] Because of the multiplicity of patients admitted to ICU, it is difficult to define a standard procedure for ICU sedation. One may encounter a variety of pathologies of different grades of severity; in addition, the associated morbidity, the circulatory instability and the pharmacodynamic alterations in critically ill patients can make treatment guideline difficult to establish and implement.[2] Precise control of the depth of sedation is often not well managed; patients are frequently over-or-undersedated with an accompanying increase in morbidity, mortality and, economic cost.[3] Sedative and analgesic treatment administered to critically ill patients should be regularly assessed to ensure that predefinite goals are well achieved as the risk of complications of oversedation is minimized.[4]

Interventions that facilitate a total dose reduction in analgesic and sedative medications, e.g. the use of nurse controlled protocol guided sedation, the combination of spontaneous awakening and breathing trials and the use of short acting medications are associated with improved outcomes such as decreased time of mechanical ventilation and ICU length of stay.[5–7]

Recently, eight new bedside scoring systems to monitor sedation have been developed and tested primarily for reliability and validity. The choice of a sedation scale measuring level of consciousness could be made among the Ramsay Sedation Scale, the Richmond Agitation Sedation Scale (RASS) and the Adaptation to the Intensive Care Environment Scale-ATICE.[4] In fact, randomized controlled studies are needed to assess the potential superiority of one scale with respect to others' scales, including evaluation of reliability and compliance to the scale.

We revised and prospectively tested the Ramsay Sedation Scale (RSS) for interrater reliability and compared it with the Riker Sedation-Agitation Scale (SAS) and the Richmond Agitation Sedation Scale (RASS) to test construct validity during midazolam-remifentanil sedation.

All scales were applied to 92 patients by three different critical care team members (nurse, senior critical care physician and critical care resident). We tested each scale for interrater reliability and for validity, by correlations between them.

Methods

This study was a prospective and open-label trial approved by the Research Ethics Committee of Ministry of Health Okmeydanı Research & Teaching Hospital in Istanbul, Turkey. The trial was conducted in the 19 bed capacity ICU of the above-mentioned hospital. Ninety-two patients were included in the study, carried out over a period of time between March 1st and April 30th 2015. 75% of the patients were provided with mechanical ventilation by Pressure Control-Pressure Support ventilation (PC/PSV) mode.

Inclusion criteria

The patients at the age of 18 years or over, requiring mechanical ventilation and sedation.

Exlusion criteria

The patients under the age of 18 years; patients having neuromuscular disease; patients receiving neuromuscular blockers; patients with a known or suspected allergy or intolerance to midazolam, remifentanil; patients died during the study period; patients using toxic substances; alcoholic patients; patients suspected of being pregnant; patients who are moribund (i.e., classified as ASA grade V according to the American Society of Anesthesiologists).

Remifentanil and midazolam were used for analgesia and sedation of mechanically ventilated patients who were admitted to the ICU following major noncardiac surgery or who had to be ventilated due to respiratory failure. The remifentanil infusion was started with 0.15 $\mu g.kg^{-1}.min^{-1}$ and adapted in steps of 0.05 $\mu g.kg^{-1}.min^{-1}$ according to clinical needs. In case of sufficient pain relief but inadequate sedation, patients could receive bolus doses of midazolam (1–3 mg) or an infusion of midazolam (0.1 $mg.kg^{-1}.h^{-1}$).

After admission to the ICU, the depth of sedation was adjusted to a Ramsay score level of 4 (sleeping patient, immediately arousable) and then targeted at a level of 2–3 (patient awake, co-operative and tranquil or responding to command only). After the protocol was initiated, daily interruption of analgesia and sedation was performed. Once this daily interruption procedure was completed, the dosages of opioid analgesics and sedative were adjusted in accordance with the patients' needs, as described above.

Measurements and records

We tested each scale (SAS, RSS, and RASS) for interrater reliability and for validity, by correlations between them. All scales were applied to 92 patients by three different critical care team members (nurse, senior critical care physician and critical care resident).

A total of 276 scores were available from each scale.

The patients' demographic data and medical history, and also details of their physical examination, were recorded before starting sedation and analgesia therapy. APACHE II score were recorded in order to assess the severity of the patients' condition. Unless specified, the scores of RSS, RASS and SAS (in order to assess the sedation quality) were recorded.

Statistical analysis

A total 92 patients were required. Sample size calculation was based on the study of Thuong et al.[4] The study was estimated at 95% confidence interval and $p = 0.05$.

All the variables are expressed as mean ± SD. Correlation coefficients were calculated using Spearman rank correlation analysis. A value of $p < 0.05$ was considered as statistically significant.

Results

The study was conducted between March 1st and April 30th 2015 with total 92 cases including 50 men (54.3% of the participats) and 42 women (45.7% of the particitants) at Ministry of Health Okmeydanı Research & Teaching Hospital in Istanbul, Turkey. The ages of participants ranged from 18 to 89 with an average age of 61.32 ± 18.68 years. Their APACHE values varied between 3 and 39 with an average of 13.27 ± 7.86.75% of the cases were applied mechanical ventilation (Table 1).

When assessing Ramsay Sedation Score, Richmond Sedation Agitation Scale and Sedation-Agitation Scale results of the study participants, their distribution percent is seen (Tables 2 and 3; Figs. 1–3). A negative directional (decreased RSS value by increasing RASS value) 66.4% relationship between Richmond Sedation Agitation Scale and Ramsay Sedation Score of the cases joined to the study was found statistically significant ($r = -0.664$; $p = 0.001$; $p < 0.01$) (Table 4, Fig. 4). A positive directional (increased SAS value by increasing RASS value) 56.5% relationship between Richmond Sedation Agitation Scale and Sedation-Agitation Scale results of the cases joined to the study was also statistically significant ($r = 0.565$; $p = 0.001$; $p < 0.01$). Lastly, A

Table 1 Baseline characteristics of patients.

Age (years)[a]	61.32 ± 18.68 (18–89)
Sex	
Male, *n* (%)	50 (54.3)
Female, *n* (%)	42 (45.7)
APACHE[a]	13.27 ± 7.86 (3–39)
Mechanical ventilation, n (%)	75

APACHE, Acute physiology and chronic health evaluation.
[a] Data are shown as medians and interquartile ranges.

Table 2 The average distribution of RSS, RASS and SAS Scores.

	RSS	RASS	SAS
Mean	2.70	−0.64	2.63
SD	1.28	1.58	1.00
Median	2	0	3
Minimum	1	−4	0
Maximum	6	2	5

Table 3 The distribution of RSS, RASS and SAS scores.

		n (%)
RSS		
Score 1	Anxious, agitated, restless	10 (10.9)
Score 2	Cooperative, oriented, tranquil	44 (47.8)
Score 3	Responsive to commands only	19 (20.7)
Score 4	Brisk response to light glabellar tap or loud auditory stimulus	4 (4.3)
Score 5	Sluggish response to light glabellar tap or loud auditory stimulus	13 (14.1)
Score 6	No response to light glabellar tap or loud auditory stimulus	2 (2.2)
RASS		
Score −4	No response to voice, but movement or eye opening to physical stimulation	10 (10.9)
Score −3	Movement or eye opening to voice (no eye contact)	5 (5.4)
Score −2	Briefly awakens to voice (eyes open & contact < 10 s)	5 (5.4)
Score −1	Not fully alert, but has sustained awakening to voice (eye opening & contact >10 s)	15 (16.3)
Score 0	Spontaneously pays attention to caregiver	38 (41.3)
Score 1	Anxious, apprehensive, movements not aggressive	17 (18.5)
Score 2	Frequent non-purposeful movement, fights ventilator	2 (2.2)
SAS		
Score 1	Minimal or no response to noxious stimuli, does not communicate or follow commands	4 (4.3)
Score 2	Arouses to physical stimuli but does not communicate or follow commands, may move spontaneously	10 (10.9)
Score 3	Difficult to arouse but awakens to verbal stimuli or gentle shaking, follows simple commands but drifts off again	14 (15.2)
Score 4	Calm, easily arousable, follows commands	53 (57.6)
Score 5	Anxious or physically agitated, calms to verbal instructions	10 (10.9)
Score 6	Requiring restraint and frequent verbal reminding of limits, biting ETT	1 (1.1)

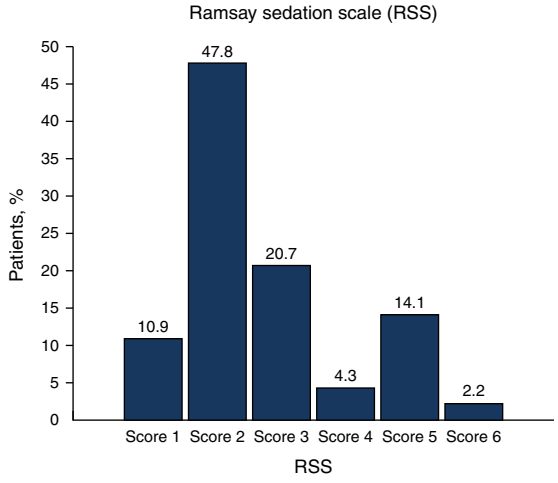

Figure 1 The distribution of Ramsay Sedation Scale.

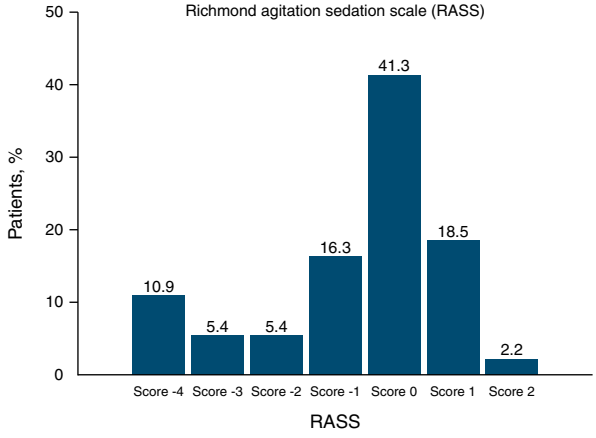

Figure 2 The distribution of Richmond Agitation Sedation Scale.

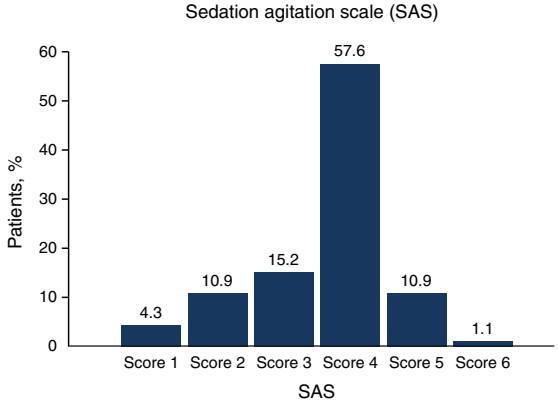

Figure 3 The distribution of Sedation Agitation Scale.

negative directional (decreased SAS value by increasing RASS value) 65.6% relationship between Ramsay Sedation Score and Sedation Agitation Scale results of the cases joined to the study was found statistically significant ($r = -0.656$; $p = 0.001$; $p < 0.01$) (Table 4, Fig. 5). The distribution of Richmond Sedation Agitation Scale Scores and Ramsay Sedation Scale Scores are shown in Table 5. The distribution of Richmond Sedation Agitation Scale Scores and Sedation-Agitation Scale Scores are shown in Table 6. The distribution of Ramsay Sedation Scale Scores and Sedation-Agitation Scale Scores are shown in Table 7.

Table 4 The correlation assessment of RASS, RSS and SAS scores.

	RASS		RSS		SAS	
	r	*p*	*r*	*p*	*r*	*p*
RASS	–	–	−0.664	0.001[a]	0.565	0.001[a]
RSS	−0.664	0.001[a]	–	–	−0.656	0.001[a]
SAS	0.565	0.001[a]	−0.656	0.001[a]	–	–

r, Spearman's correlation coefficient.
Correlation as measured by Spearman rank correlation coefficient.
[a] $p < 0.01$.

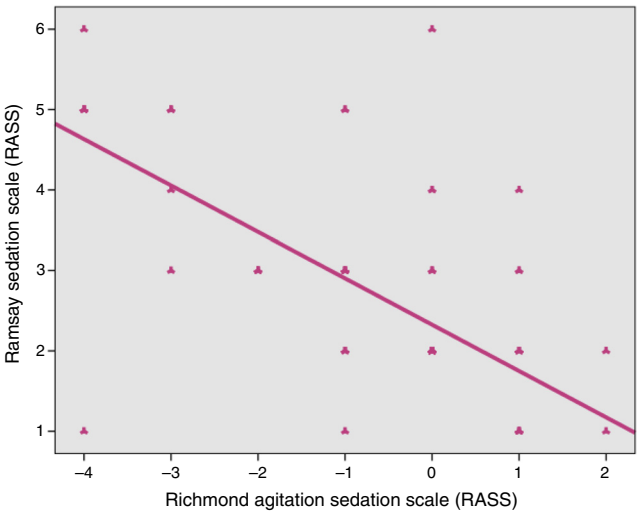

Figure 4 Correlations between RSS and RASS.

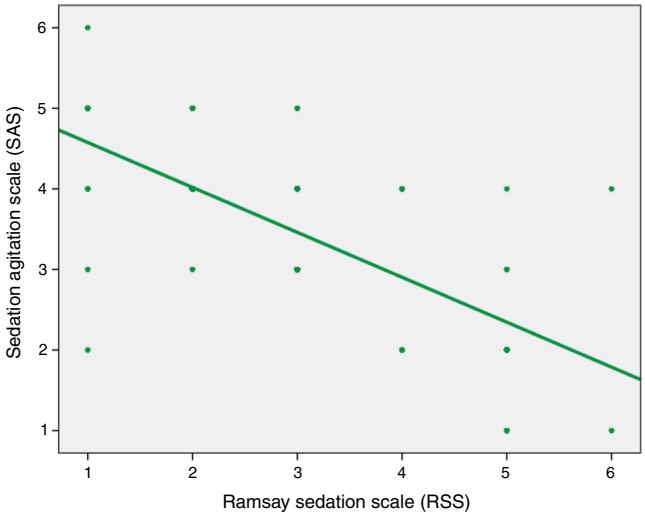

Figure 5 Correlations between RSS and SAS.

Discussion

In assessing agitation and sedation in adult ICU patients, Ramsay is both reliable (high interrater agreement) and valid (high correlation with the RASS and SAS scales).

In order to provide optimal comfort and sedative drug therapy for patients in Intensive Care Unit (ICU), establishing a goal of therapy often defined by a desired level of consciousness, with titration of medications to achieve this target is important. An assessment of the consciousness level is best performed using a simple tool, such as a sedation scale that relies on observation of the patient to assign a level of conscious that ranges from alert to unarousable.[8]

With its easy titratability and organ-independent metabolism, remifentanil is an ideal agent for analgosedation. In comparison with sedative-hypnotic regimens, remifentanil-based regimens were associated with shorter duration of mechanical ventilation, more rapid weaning from the ventilator and, shorter ICU length of stay.[9]

For optimal sedoanalgesia, sedation and analgesia scales plays an important role with reference to mechanical ventilation and ICU discharge time. Botha et al. demostrated that

Table 5 Cross-tabulation of RASS and RSS scores in overall patient population.

	RASS							Total
	Score −4	Score −3	Score −2	Score −1	Score 0	Score 1	Score 2	
RSS								
Score 1	1	0	0	1	0	7	1	10
Score 2	0	0	0	4	32	7	1	44
Score 3	0	1	5	8	3	2	0	19
Score 4	0	1	0	0	2	1	0	4
Score 5	8	3	0	2	0	0	0	13
Score 6	1	0	0	0	1	0	0	2
Total	10	5	5	15	38	17	2	92

Table 6 Cross-tabulation of RASS and SAS scores in overall patient population.

	RASS							Total
	Score −4	Score −3	Score −2	Score −1	Score 0	Score 1	Score 2	
SAS								
Score 1	4	0	0	0	0	0	0	4
Score 2	5	2	0	1	0	2	0	10
Score 3	0	1	2	9	0	1	1	14
Score 4	0	1	3	5	37	7	0	53
Score 5	0	1	0	0	1	7	1	10
Score 6	1	0	0	0	0	0	0	1
Total	10	5	5	15	38	17	2	92

Table 7 Cross-tabulation of RSS and SAS scores in overall patient population.

	RSS						Total
	Score 1	Score 2	Score 3	Score 4	Score 5	Score 6	
SAS							
Score 1	0	0	0	0	3	1	4
Score 2	1	0	0	2	7	0	10
Score 3	1	1	10	0	2	0	14
Score 4	2	40	7	2	1	1	53
Score 5	5	3	2	0	0	0	10
Score 6	1	0	0	0	0	0	1
Total	10	44	19	4	13	2	92

the introduction of a sedation scale led to a reduction in the duration of mechanical ventilation.[6,10] Breen et al. demonstrated a decrease in the duration of mechanical ventilation when using remifentanil-based analgesia and sedation.[11]

Implementation of sedation scales has been related to improved outcomes, and frequent assessment of the level of consciousness using sedation scale is strongly recommended in clinical practice guidelines.[8]

Recent studies have shown that, analgesics and sedatives medications can produce adverse patient outcomes. Interventions that facilitate a total dose reduction in analgesic and sedative medications, e.g., the use of nurse controlled protocol guided sedation, the combination of spontaneous awakening and breathing trials, and the use of short acting medications are related to improved outcomes such as decreased time of mechanical ventilation and ICU length of stay.[5]

A main objective of every medical system is to provide a high-quality care in the Intensive Care Units (ICUs). In achieving this goal, nurses play a crucial role. One of the most important responsibilities of nurses is sedation and pain control of patients.[12]

Using a validated observational sedation-scoring tool is a method to optimize patient sedation. Nevertheless, what the optimal instrument available is for use in this clinical context is not clear. Varndell et al. identified total 27 observational sedation-scoring instruments in their systematic literature review. The Richmond Agitation and Assessment Scale was identified as the most suitable to be trialled prospectively within an Australian Emergency Department.[13]

Since nurses are constantly in contact with the ICU patients, their practice of a sedation protocol can result in better sedation and pain control in the patients, thus reducing the administered doses of sedatives and analgesics.[12] Riker et al. suggested that, SAS, one of the subjective scales used for assessment of agitation and sedation in ICU patients is correlated with Harris and Ramsay scales.[14] Khan et al. found that a high level of agreement between the RASS and SAS in identifying patients eligible for delirium assessment in the ICU.[15] In our study, RASS score of 3 or 4 was not seen in any patients in our therapy performed in accordance with our sedoanalgesia protocol.

In order to measure the level of consciousness, a sedation scale could be chosen among the Ramsay sedation scale, the Richmond Agitation Sedation scale (RASS) and the Adaptation to The Intensive Care Environment scale-ATICE.[4] In our study, midazolam-induced sedation was assessed by validated RSS, RASS and, SAS. Riker et al. demonstrated good validity and reliability with SAS and a good correlation between the SAS and the RSS. Also in our study, a strong, negative correlation between RSS and RASS was observed ($r = -0.664$; $p = 0.001$; $p < 0.01$), besides, we found positive correlation between RASS and SAS ($r = 0.565$; $p = 0.001$; $p < 0.01$) and negative correlation between RSS and SAS ($r = -0.656$; $p = 0.001$; $p < 0.01$).

Mirski et al.[16] stated that 7 level scale (+3, ''dangerously agitated'' to -3, ''deeply sedated'', Nursing Instrument for the Communication of Sedation [NICS]) could be easily used by nurses and suggested that the Richmond Agitation-Sedation Scale demonstrated excellent

correlation ($rs = 0.98$, $p < 0.001$). NICS is a valid and reliable sedation scale for use in a mixed population of intensive care unit patients. NICS ranked highest in nursing preference and ease of communication, thus allowing more effective and interactive management of sedation.

All scales demonstrated good interrater reliability and were comparable. RASS and SAS showed the best correlations and the best agreement results in all professional categories. All these characteristics make RASS and SAS good scales from the point of validity, reliability and applicability for bedside evaluation of sedation-agitation in critically ill patients.[17]

Despite not being a common practice, sedation is recommended to be assessed routinely among critically ill patients since lack of routine assessment has potentially harmful consequences.

Although more than two-third of the responding ICUs reported the use of sedation-and-pain-scales, assessment frequency was low, and objective assessment of pain in the non-communicating patients was extremely rare. Similarly, the use of written procedure was low. The use of sedation-analgesia written procedure in an ICU seems strongly influenced by a more global involvement of the ICU in the protocolisation of complex care.[18]

The positive effect of systematic evaluation of pain and agitation in ICUs has recently been demonstrated. Therefore, it is very important to routinely assess sedation in critically ill patients, and sedation-agitation scales are instruments that allow to achieve appropriate sedation.

It is important to emphasize that these scales are used to evaluate not only sedation levels but also agitation levels. Therefore, they are commonly applied to patients without intubation in almost all validation studies, and they serve as screening tools for evaluating delirium.[3] In our study, 75% of the patients were intubated. Both SAS and RASS led to similar rates of delirium assessment by using the CAM-ICU.[15]

Among sedation scales, the Ramsay scale is the most used one in ICU practice. Being the oldest scale, it is also one the most used in clinical studies. It is a scale that is able to identify somnolence and agitation visually.[19] Some authors have suggested that Ramsay's sedation levels are not conclusive, however. In our study, the RSS and RASS scales had the best agreement among the observers. These data indicate that RASS and SAS are easy to apply at the bedside. These newer scales are also able to define agitation levels.

By using a written stepwise instruction with the Ramsay Scale, the inter-observer reliability of the level of sedation measurements, performed in daily clinical practice within a large team of IC nurses, proved to be almost perfect.[19] Also in our study, Ramsay Scale, SAS and RASS were found to be clinically applicable by the nurses in ICU.

Robinson et al.[20] described and analyzed the development and psychometric properties of subjective sedation scales developed for critically ill adult patients. 36 articles were reviewed and 11 sedation scales were researched for the study. The scale development process, psychometric properties, feasibility, and implementation of sedation scales were analyzed using a 0–20 scoring system. In the study, Richmond Agitation-Sedation Scale (19.5) and the Sedation-Agitation Scale (19) demonstrated scores indicating ''very good'' psychometric properties. Scores with ''moderate'' properties were the Vancouver Interaction and Calmness Scale (14.3), Adaptation to the Intensive Care Environment (13.7), Ramsay Sedation Scale (13.2), Minnesota Sedation Assessment Tool (13), and the Nursing Instrument for the Communication of Sedation (12.8). Scales with ''low'' properties included the Motor Activity Assessment Scale (11.5) and the Sedation Intensive Care Score (10.5). The New Sheffield Sedation Scale (8.5) and the Observer's Assessment of Alertness/Sedation Scale (3.7) demonstrated ''very low'' published properties. On the contrary, in spite of three months training programme and using a standard protocol in their study, Haddad et al. found differences in SAS scores which were aimed and then obtained after. Then they emphasized that more delicate approaches were required for titration of sedation.[21]

Analgesics and sedatives are commonly prescribed in the ICU environment for patient comfort. Nevertheless, recent studies have shown that these medications can themselves lead to adverse patient outcomes. Interventions such as using nurse controlled protocol guided sedation and a specialized ICU team including physicians, nurses and pharmacists facilitate a total dose reduction in analgesic and sedative medications. Therefore, the clinical effect of medicines maximizes and the risk of treatment-induced adverse events minimizes.

In our study three different critical care team members (nurse, senior critical care physician and critical care resident) assessed three different sedation scales simultaneously and independently from each other. We tested each scale for interrater reliability and for validity, by correlations between them.[4]

Conclusion

A strong correlation between RSS and RASS was found in this study which confirms the value of these measurement criteria. These tools should therefore be utilized by the ICU team to ensure the patient is comfortable without being oversedated.

For daily interruption of sedonanalgesia then adjusting it for patient's clinical need in ICU, avoiding oversedation and minimizing the risk of treatment-induced adverse events, sedation scales should be easy to use for ICU nurses and critical care physician and provide accuracy and safety.

As a result, randomized controlled studies are needed to assess the potential superiority of one scale with regard to other scales, including evaluation of the reliability and the compliance to the scale.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Tallgren M, Pettilä V, Hynninen M. Quality assessment of sedation in intensive care. Acta Anaesthesiol Scand. 2006;50:942–6.
2. Costa MG, Chiarandini P, Rocca GD. Sedation in the critically Ill patient. Transpl Proc. 2006;38:803–4.
3. Cevik F, Celik M, Clark PM, Macit C. Sedation and analgesia in intensive care: a comparison of fentanyl and remifentanil. Pain Res Treat. 2011:650320.

4. Thuong M. Sedation and analgesia assessment tools in ICU patients. Ann Fr Anesth Reanim. 2008;27:581–95.
5. McGrane S, Pandharipande PP. Sedation in the intensive care unit. Minerva Anestesiol. 2012;78:369–80.
6. Kollef MH, Levy NT, Ahrens TS, Schaiff R, Prentice D, Sherman G. The use of continuous i.v. sedation is associated with prolongation of mechanical ventilation. Chest. 1998;114:541–8.
7. Brook AD, Ahrens TS, Schaiff R, et al. Effect of a nursing-implemented sedation protocol on the duration of mechanical ventilation. Crit Care Med. 1999;27:2609–15.
8. Sessler CN, Riker RR, Ramsay MA. Evaluating and monitoring sedation, arousal, and agitation in the ICU. Semin Respir Crit Care Med. 2013;34:169–78.
9. Devabhakthuni S, Armahizer MJ, Dasta JF, Kane-Gill SL. Analgosedation: a paradigm shift in intensive care unit sedation practice. Ann Pharmacother. 2012;46:530–40.
10. Botha JA, Mudholkar P. The effect of a sedation scale on ventilation hours, sedative, analgesic and inotropic use in an intensive care unit. Crit Care Resus. 2004;6:253–7.
11. Breen D, Karabinis A, Malnrain M, et al. Decreased duration of mechanical ventilation when comparing analgesia-based sedation using remifentanil with standart hypnotic-based sedation for up to 10 days in intensive care unit patients: a randomised, controlled trial. Crit Care. 2005;9:200–10.
12. Abdar ME, Rafiei H, Abbaszade A, et al. Effects of nurses' practice of a sedation protocol on sedation and consciousness levels of patients on mechanical ventilation. Iran J Nurs Midwifery Res. 2013;18:391–5.
13. Varndell W, Elliott D, Fry M. The validity, reliability, responsiveness and applicability of observation sedation-scoring instruments for use with adult patients in the emergency department: a systematic literature review. Aust Emerg Nurs J. 2015;18:1–23.
14. Riker RR, Picard JT, Fraser GL. Prospective evaluation of the Sedation-Agitation Scale for adult critically ill patients. Crit Care Med. 1999;27:1325–9.
15. Khan BA, Guzman O, Campbell NL, et al. Comparison and agreement between the Richmond agitation-sedation scale and the Riker sedation-agitation scale in evaluating patients' eligibility for delirium assessment in the ICU. Chest. 2012;142:48–54.
16. Mirski MA, LeDroux SN, Lewin JJ 3rd, Thompson CB, Mirski KT, Griswold M. Validity and reliability of an intuitive onscious sedation scoring tool: the nursing instrument for the communication of sedation. Crit Care Med. 2010;38:1674–84.
17. Nassar Junior AP, Pires Neto RC, de Figueiredo WB, Park M. Validity, reliability and applicability of Portuguese versions of sedation-agitation scales among critically ill patients. Sao Paulo Med J. 2008;126:215–9.
18. Constantin JM, Chanques G, De Jonghe B, et al. Current use of sedation and analgesia: 218 resuscitations in France services practices survey. Ann Fr Anesth Reanim. 2010;29:339–46.
19. van Dishoeck AM, van der Hooft T, Simoons ML, van der Ent M, Scholte op Reimer WJ. Reliable assessment of sedation level in routine clinical practice by adding an instruction to the Ramsay Scale. Eur J Cardiovasc Nurs. 2009;8:125–8.
20. Robinson BR, Berube M, Barr J, Riker R, Gélinas C. Psychometric analysis of subjective sedation scales in critically ill adults. Crit Care Med. 2013;41:S16–29.
21. Haddad S, Arabi Y, Al-Dawood A, et al. Sedation in ICU: are we achieving goals? Middle East J Anaesthesiol. 2009;20:389–96.