

Reliable assessment of sedation level in routine clinical practice by adding an instruction to the Ramsay Scale

Anne-Margreet van Dishoeck^{a,*}, Truus van der Hooft^b, Maarten L. Simoons^a,
Martin van der Ent^a, Wilma JM Scholte op Reimer^a

^a Department of Cardiology, Erasmus MC, Rotterdam, The Netherlands

^b Department of Nursing Health Science, University Utrecht, The Netherlands

Received 2 October 2007; received in revised form 19 October 2008; accepted 24 October 2008

Available online 3 December 2008

Abstract

Objective: The level of sedation in mechanically ventilated patients is most often assessed with the Ramsay Scale. Its reliability, however, has never been evaluated in a large group of professionals using the Ramsay Scale in daily clinical practice, while differences in interpretations among professionals have been indicated. We developed a written stepwise instruction to optimize the inter-observer reliability of the Ramsay Scale within a large group of Intensive Care (IC) nurses.

Design: Reliability study.

Setting: The Intensive Care Cardiology (ICC) and the Intensive Care Thoracic surgery (ICT) units of a university hospital.

Patients and participants: The study population comprises randomly selected mechanically ventilated patients and IC nurses with a bachelor's degree in Nursing and an IC certification. In total 2x105 Ramsay measures were performed in 45 patients by 24 nurses.

Measurement and results: Analysis of 105 paired Ramsay scores showed an almost perfect agreement between observers (weighted $K (K_w) = 0.90$). In both ICC patients and ICT patients, agreement between Ramsay scores was high ($K_w = 0.95$ and $K_w = 0.86$, respectively).

Conclusion: 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.

© 2008 European Society of Cardiology. Published by Elsevier B.V. All rights reserved.

Keywords: Ramsay scale; Reliability; Sedation; Intensive care

1. Introduction

Sedation is often a necessary component in the care of critically ill patients requiring mechanical ventilation [1]. In most cases a sedation strategy aims at a level of consciousness that prevents agitation, anxiety and discomfort but also prevents oversedation to avoid a longer ventilation period than needed and related complications [1,2]. Adequate monitoring of the level of sedation in ventilated

patients is therefore essential in Intensive Care (IC) management [3].

Several measurement tools are available to quantify the level of sedation. The Ramsay Scale, a 1-item scale with six response options describing the observed sedation level (Table 1), [4] is most often used in both research and clinical practice [5]. The Ramsay Scale is simple and feasible, with a high face-validity [6]. Among subjective measures, the Ramsay Scale has shown the highest criterion validity by comparison with more objective measures like the auditory evoked potentials (AEP) [7]. Also, for two response options of the Ramsay scale a satisfying comparison has been shown with an electroencephalogram (EEG), [4] and the total Ramsay Scale proved to be comparable with the Bispectral

* Corresponding author. Erasmus MC, Z-626, PO Box 2040, 3000 CA Rotterdam, The Netherlands. Tel.: +31 10 703 4591; fax: +31 10 408 94 84.

E-mail address: a.m.vandishoeck@erasmusmc.nl (A.M. van Dishoeck).

Table 1
Ramsay scale with stepwise instruction.

| Added instruction | | Original scale | |
|---------------------|---|---|--------------|
| Stepwise assessment | | Observation | Ramsay score |
| Step 1 | Observe the patient. | Anxious, agitated or restless | 1 |
| Step 2 | Walk to the patient. Eye contact and response to commands? | Cooperative, oriented and tranquil | 2 |
| Step 3 | Talk to the patient. Eye contact and response to commands? | Sedated but response to commands | 3 |
| Step 4 | Physically stimulate by shaking the shoulder while speaking loudly to the patient. Response within 10 s? | Asleep; brisk response to physical stimulation or loud auditory stimulus | 4 |
| Step 5 | Physically stimulate the patient by shaking the shoulder while speaking loudly to the patient. Response after 10 s? | Asleep; sluggish response to physical stimulation or loud auditory stimulus | 5 |
| Step 6 | Use painful stimuli. No response? | Asleep; no response to painful stimuli | 6 |

Index (BIS) [8] and with heart rate variability [9]. Convergent validity of the Ramsay Scale, by comparison with other subjective measures, proved to be high when compared with the more detailed Richmond Agitation-Sedation Scale (RASS) [10]. Reliability has shown to be good, but was assessed pair wise only in thoroughly trained assessors [10,11].

The Ramsay scale was introduced at the Intensive Care at the start of our sedation project using a nurse-led sedation protocol aiming to improve the quality of sedation to effect the duration of mechanical ventilation. The need for a user's instruction became apparent when the Ramsay Scale was used routinely by 2 teams of IC nurses and was also found in the literature [5,12–14]. There was a difference in opinion, for example, about how to classify a patient who is asleep but anxious or agitated when woken up after application of stimuli. This patient can be classified in Ramsay 4 because he is asleep at first but also Ramsay 1 because he is agitated when woken up. We therefore developed a written instruction, with a stepwise assessment approach (Table 1), to optimize the inter-observer reliability of the Ramsay Scale when used in daily clinical practice by a large team of IC nurses.

2. Materials and methods

The study population comprises 24 IC nurses, with a bachelor's degree in Nursing and an IC certification, who observed 45 randomly selected mechanically ventilated adult IC patients. Patients in whom the level of sedation could not be regulated with medication were excluded, such as patients who are in coma for neurological reason, and patients in whom neuromuscular blockade was administered. For measuring the level of sedation the Ramsay Scale was used (Table 1). The Ramsay scale is a one item scale with six response options describing the observed sedation level. The medical ethics committee approved the study and it was performed using the standards of good clinical practice.

2.1. Data collection

Couples of IC nurses randomly selected patients for assessment of their level of sedation, independently of each other. We aimed at an equal distribution of the measurements

across patients and nurses. A strict protocol was applied for obtaining unbiased double scores. For example, to prevent a situation in which the first nurse finds a patient asleep (Ramsay 4) and wakes him or her up, while the second nurse finds the patient still awake (Ramsay 2) a few minutes later. The protocol dictated that both nurses approached the bed together, and the patient was first classified as awake (Ramsay 1–3) or asleep (Ramsay 4–6) by both nurses. Then, one of the two nurses gave stimuli according to the written instruction, and both nurses gave a Ramsay Score, independently of each other, at the same time.

2.2. Statistical analyses

Dichotomous data are described as numbers and percentages, and continuous data are presented as means with standard deviation (SD). We used the weighted Kappa (K_w) statistic to estimate inter-observer agreement on the Ramsay Scale. K_w reflects the amount of agreement beyond chance between the scores. K_w values are interpreted as poor ($K_w < 0$), slight ($K_w = 0–0.20$), fair ($K_w = 0.21–0.40$), moderate ($K_w = 0.41–0.60$), substantial ($K_w = 0.61–0.80$) or almost perfect ($K_w = 0.81–1.00$) [15].

3. Results

Mean age of the 45 included patients was 63 years (SD=15 years), and the majority were male (62%). In most patients (56%) one Ramsay score was obtained, in 16 (36%) 2–5 scores, and in 4 patients (8%) more than five scores were performed. Of 105 paired measurements, 2×50 scores were obtained in Acute Cardiac Care patients and 2×55 scores in Thorax surgery patients.

In total, 24 of 28 ICC nurses (86%) participated. The reasons for nonparticipation were holiday, sickness, or a part-time job with only evening or night shifts during the study period. Of the 24 participating nurses, 19 were female (79%) and mean age was 43 years (SD=7). The majority (79%) had worked on the ICC for more than 5 years. Our aim of equal participation of all IC nurses was achieved with the large majority (79%) bringing out 5–10 Ramsay scores.

In both ICC and ICT patients, Ramsay 1 (agitated) was rarely scored (1% and 2%, respectively), while Ramsay

Table 2
Agreement of the 105 paired Ramsay scores.

| | Ramsay-score observer 2 | | | | | | Total |
|-------------------------|-------------------------|----|----|----|----|----|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | |
| Ramsay-score observer 1 | 1 | 0 | 1 | 0 | 1 | 0 | 2 |
| | 2 | 1 | 35 | 4 | 0 | 0 | 41 |
| | 3 | 0 | 0 | 5 | 2 | 0 | 7 |
| | 4 | 0 | 2 | 2 | 10 | 1 | 15 |
| | 5 | 0 | 0 | 0 | 1 | 10 | 11 |
| | 6 | 0 | 0 | 1 | 0 | 4 | 24 |
| Total | 1 | 38 | 12 | 14 | 15 | 25 | 105 |

score 2 (cooperative) was most often observed (35% in ICC patients, and 44% in ICT patients). Oversedation (Ramsay score 6) also occurred frequently in both ICC and ICT patients (24% and 30% of the scores, respectively).

Analysis of 105 paired Ramsay scores showed an almost perfect agreement between observers ($K_w=0.90$). In both ICC patients ($K_w=0.95$) and ICT patients ($K_w=0.86$), agreement between Ramsay scores was high. Agreement between observers was highest for Ramsay score 2 (70/79 scores=89%) and lowest for Ramsay score 1 (0/3=0%) (Table 2). Disagreement most often occurred between Ramsay scores 3 and 4 (8/48=16%). Disagreement between observers exceeding one sedation level occurred in 5 out of 105 paired observations (5%).

4. Discussion

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.

Adding a written stepwise instruction to the Ramsay scale solved various interpretation problems between IC nurses as observed earlier in clinical practice [5,12–14]. For example, a difference in rating of patients who were asleep but woke up agitated after stimuli, was rarely observed after implementation of a stepwise written instruction. In this example, using the instruction leads to Ramsay score 4, that is the patient is asleep. The fact that the patient is restless or agitated when waken up is additional information that should be further explored. A delirium screening scale, for example, could be used to assess the presence of a delirium, or if the patient is in pain attention should be focused on that aspect. The level of sedation, however, remains level 4.

Earlier research by Ely et al demonstrated a high inter-observer reliability of the Ramsay scale, but two research workers performed all 290 measures [10]. Also research by Riker et al revealed a high inter-observer reliability of the Ramsay scale [11]. In this study, however, nine specifically trained IC nurses carried out the measurements. Both studies do not reflect clinical practice, but an artificial situation. Several authors have therefore expressed a need for clarification when the Ramsay scale is used in daily clinical practice [5,12–14]. Our study shows that adjustment of the

Ramsay scale is not necessary. Using a written stepwise instruction showed to provide sufficient clarification.

Metric qualities of the Ramsay scale have mainly been evaluated in IC patients in general, without exploring differences in performance among subgroups. Our study showed a high inter-observer reliability of the Ramsay scale in both ICC and ICT patients. Research to confirm our positive findings on inter-observer reliability in other IC patient groups is recommended.

Despite the high frequency of sedation assessment in critically ill patients and the large amount of published sedation scales, all available scales have limitations. One-item scales are feasible for frequent assessment but fail to fully describe the level of sedation of a patient and also fail to evaluate whether the various possible aims of sedation, i.e. amnesia or relieve of pain or anxiety, are achieved. Additional assessment is often needed for evaluation of these aims. These limitations must be taken in account while using the Ramsay scale, and depending on the aim the sedation strategy the use of other scales should be considered.

Adequate sedation of mechanically ventilated patients requires a systematic monitoring of the level of sedation. By using a written stepwise instruction, the one-item Ramsay scale proved to be a reliable instrument for routine assessment of the level of sedation in daily clinical practice by a large group of IC nurses.

Acknowledgement

We thank Marja Veldhuijzen and Eugenie Eenkhoorn for coordinating the data collection.

References

- [1] Jacobi J, Fraser GL, Douglas B, Coursin DB, Riker RR, Fontaine D, et al. Clinical practice guidelines for the sustained use of sedatives and analgesics in the critically ill adult. *Crit Care Med* 2002;30:119–41.
- [2] Brook AD, Ahrens TS, Schaiff R, Prentice D, et al, Sherman G, Shannon W. Effect of a nursing-implemented sedation protocol on the duration of mechanical ventilation. *Crit Care Med* 1999;27:2609–15.
- [3] Carrasco G. Instruments for monitoring intensive care unit sedation. *Crit Care* 2000;4:217–25.
- [4] Ramsay MAE, Savege TM, Simpson BRJ, Goodwin R. Controlled sedation with alphaxalone–alphadolone. *Br Med J* 1974;2:656–9.
- [5] De Jonghe B, Cook D, Appere-De-Vecchi C, Guyatt G, Mede M, Outin H. Using and understanding sedation scoring systems: a systematic review. *Intensive Care Med* 2000;26:275–85.
- [6] Lieberman J, Tremper K. Sedation: if you know where you are going, any road will get you there (editorial). *Crit Care Med* 1999;27(7): 1395–6.
- [7] Schulte-Tamburen A, Scheier J, Briegel J, Schwender D, Peter K. Comparison of five sedation scoring systems by means of auditory evoked potentials. *Intensive Care Med* 1999;25:377–82.
- [8] Mondello E, Siliotti R, Noto G, Cuzzocrea E, Scollo G, Trimarchi G, et al. Bispectral index in ICU: correlation with Ramsay score on assessment of sedation level. *J Clin Monit Comput* 2002;17:271–7.
- [9] Haberthur C, Lehmann F, Ritz R. Assessment of depth of midazolam sedation using objective parameters. *Intensive Care Med* 1996;22: 1385–90.

- [10] Ely EW, Truman B, Shintani A, Thomason JWW, Wheeler AP, Gordon S, et al. Monitoring status over time in ICU patients. Reliability and validity of the Richmond Agitation-Sedation Scale (RASS). *JAMA* 2003;289:2983–91.
- [11] 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.
- [12] Wittbrodt ET. The ideal sedation assessment tool: an elusive instrument (editorial). *Crit Care Med* 1999;27:1384–5.
- [13] Hansen-Flaschen J, Cowen J, Polomano RC. Beyond the Ramsay scale: need for a validated measure of sedating drug efficacy in the intensive care unit. *Crit Care Med* 1994;22:732–3.
- [14] Chulay M. Sedation assessment: easier said than done! *Crit Care Nurs Clin North Am* 2004;16:359–64.
- [15] Landis R, Koch GG. The measurement of observer agreement for categorical data. *Biometrics* 1977;33:159–74.