Ramsay and Richmond scores are equivalent for the assessment of sedation level in critical patients

Escalas de Ramsay e Richmond são equivalentes para a avaliação do nível de sedação em pacientes gravemente enfermos

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ABSTRACT

Objective: The main purpose of this study was to compare performance of the Ramsay and Richmond sedation scores on mechanically ventilated critically ill patients, in a university-affiliated hospital.

Methods: This was a 4-month prospective study, which included a total of 45 patients mechanically ventilated, with at least 48 hours stay in the intensive care unit. Each patient was assessed daily for sedation mode, sedative and analgesic doses and sedation level using the Ramsay and Richmond scores. Statistical analysis was made using Student's t-test, Pearson's and Spearman's correlation, and constructing ROC-curves.

Results: A high general mortality of 60% was observed. The length of sedation and daily dose of medication did not correlate with mortality. Deep sedation (Ramsay > 4 or Richmond < -3) was positively correlated with probability of death with an AUC > 0.78. An adequate level of sedation (Ramsay 2 to 4 or Richmond 0 to -3) was sensitively correlated with probability of survival with an AUC > 0.80. A low level of sedation was observed in 63 days evaluated (8.64%), and no correlation was found between occurrence of agitation and unfavorable outcomes. Correlation between Ramsay and Richmond scores (Pearson's > 0.810 – p<0.0001) was good.

Conclusion: In this study, Ramsay and Richmond sedation scores were similar for the assessment of deep, insufficient and adequate sedation. Both have good correlation with mortality in over sedated patients.

Keywords: Deep sedation/methods**;** Respiration, artificial; Monitoring, physiologic; Intensive care; Intensive care units; Hypnotics and sedatives/ administration & dosage

INTRODUCTION

There are numerous reasons why analgesic-sedative drugs must often be used in critically ill patients. Patients admitted to an intensive care unit (ICU) are constantly submitted to intense psychological suffering caused by fear, anxiety, sleep-wake disturbances, uncomfortable manipulation and immobility in the bed. All this, may unleash psychotic conditions with light agitation or even intense aggressiveness and violence,[1] putting at risk the patient's physical integrity, that of the team and thus impairing recovery. These scenarios and maintenance of mechanical ventilation are among the most common indications for use of analgesia and sedation in these patients.[1-3]

Furthermore, during pain and anxiety the organism reacts as in situations of major acute stress. Human response is characterized by increase of the circulating catabolizing hormones such as catecolamines, glucagon and cortisol. Metabolic effects of hormone response to stress include increase of oxygen consumption, hypoglycemia, increase of protein and lipid catabolism, fluid retention and loss of renal potassium.

The delicate homoeostatic balance of the critically ill patients suffers from this hormone response depending on its intensity and duration. Considering that persistence of the algic stimulus increases risk of an unfavorable outcome during stay, use of careful analgesia-sedation in the intensive care has the double benefit of re-establishing the patient's physical and psychical well-being, while preventing metabolic changes, potentially noxious to homeostasis.[4]

Notwithstanding undeniable benefits of using analgesic sedative drugs in critically ill patients, excessive use may be associated to a longer stay, risk of infection and mortality rate.[5]

Therefore use of analgesia-sedation in intensive care must be carefully followed by a strict assessment of the sedation levels achieved to avoid an unnecessarily deep sedation, reducing mechanical ventilation time and length of stay with consequent decrease of hospital costs.

A method to assess ideal sedation must have satisfactory sensitivity and specificity, simplicity, reproducibility, rapid application, minimal discomfort for the patient without requiring complementary exams for bedside use at any time, by any member of the ICU team.[6]

The score most often used now,[7-9] to assess sedation level was proposed by Ramsay et al.[10] in 1974. It is based upon purely clinical criteria for the classification of the sedation level according to a score of 1 to 6 score to rank anxiety, agitation or both up to irresponsive coma.

Due to its characteristics, the Ramsay score approaches the expected ideal for a sedation scale: definitions are simple and intuitive, assuring easy learning, it can be applied at the bedside in a simple and rapid form and has sufficient sensitivity and sensibility to be considered a reference standard among existing sedation scores.

The Richmond sedation score, recently reviewed and validated for critically ill patients,[11] has some advantages over the Ramsay by ranking level of agitation and anxiety. In the scale, the alert and calm patient represents the zero, there are four levels of agitation positively ranked from one to four and other five levels of sedation from one to five negative. The negative part of this scale, equivalent to the score proposed by Ramsay while positive scores discriminate the agitation levels ranging from restless to aggressive and are not envisaged in the Ramsay scale.

The primary objective of this study was to compare performance of the Ramsay and Richmond sedation scales in critically ill patients under mechanical ventilation and to determine if there is a relation between sedation level and mortality.

METHODS

During four months in an ICU at a high-complexity university affiliated-hospital, patients under mechanical ventilation with at least 48 hours of admission and who used some mode of analgesia-sedation were assessed.

To characterize the population studied, general data such as gender, age, reason for admission, daily scores as Acute Physiological and Chronic Health Evaluation II (APACHE II), Simplified Acute Physiology Score 3 (SAPS 3) and Sequential Organ Failure Assessment (SOFA) were collected. Assessed data specifically related to analgesia-sedation were: reason for sedation and analgesia, sedation mode (intermittent or continued), agents used and daily dose (dose/kg/day) and daily assessment of sedation level using the Richmond and Ramsay scales. As parameters for analysis of the intercurrence rate by agitation (undesired extubation, asynchrony with the ventilator, intense agitation with risk for patient or team). Length of stay (LOS) in the ICU, duration of mechanical ventilation and outcome (discharge or death during ICU stay).

For comparison among means the Student's t test was used, relations among variables were analyzed with Pearson's and Spearman correlation indices. Performance of the Ramsay and Richmond scales was assessed by constructing Receiver Operating Characteristic (ROC) curves**.**

RESULTS

In this study 45 patients were included, adding to 729 days of stay, 574 days of mechanical ventilation, 376 days of use of sedatives and 319 days of analgesic use. Of the 45 patients included in the study, 57.78% were male, the mean age was of 54.73 years (CI95% = 52.8-56.8 years) and most frequent reasons for admis-

sion to the ICU were: systemic inflammatory response syndrome (SIRS), sepsis, severe sepsis or septic shock (31.11%); pulmonary affection (28.89%); or neurological disorder (15.56%). Mean LOS in the ICU was of 16.20 days (CI 95% = 15.01-17.39 days) while mean duration of mechanical ventilation was 12.76 days (CIC95% = 11.66-13.86 days).

Mortality was of 60% and mean values of SAPS 3, APACHE II and SOFA were significantly higher in the group of patients who died, as seen in Table 1. In this study, gender, age and LOS in the ICU and duration of mechanical ventilation did not disclose a relationship with mortality.

Table 1 – Relationship between prognostic scores and mortality

Scores	General	Groups Discharge group	Death group	P value
SAPS 3	62.89	51.19	70.85	< 0.001
APACHE II	19.82	13.81	23.37	0.002
SOFA médio	8.04	4.44	10.26	< 0.001

SAPS - Simplified Acute Physiology Score; APACHE - Acute Physiological and Chronic Health Evaluation; SOFA - Sequential Organ Failure Assessment. Results expressed in mean

As the selected population was exclusively comprised of patients under mechanical ventilation, the main reason observed for beginning analgesia-sedation was instatement and maintenance of artificial ventilation (93.33%), other reasons were control of fear and anxiety (4.44%) and sedation as part of therapy (4.44%).

The most frequent administration mode was by continuous infusion (82.22%), and only in 8 cases intermittent analgesia-sedation was chosen.

The main drug for sedation was midazolam (100% of cases). In three patients diazepam in bolus was used after extubation and in one patient intermittent diazepam was used for seizure therapy. The only analgesic used in this group of patients was fentanyl (95.56% of cases). Mean dose of midazolam was 1.70 mg/kg/day (from 0.12 to 10.89 mg/kg/day), while the mean dose of fentanyl was 15.73 mcg/kg/day (from 4 .00 to 68.84 mcg/kg/day).

Mean Ramsay observed was 4.13 and Richmond mean was -2.81. In 729 assessments inadequately low levels of sedation were observed during 63 days (8.64%) by the Ramsay scale (Ramsay =1) and 68 days (9.33%) by the Richmond scale (Richmond>0). However, only 11 patients had intercurrences associated to agitation: four cases of non-planned extubation (8.89% of patients), three cases of asynchrony with ventilation (6.67%) and four cases of severe agitation (8.89%). Episodes of agitation did not correlate with outcome for Ramsay=1 the area under the curve (AUC) was of 0.501 and for Richmond >0 AUC was 0.481.

Excessively high sedation levels were observed in 296 assessments 40.60%) with Ramsay (Ramsay 5 0r 6) and in 294 assessments (40.33) with Richmond (Richmond -4 or -5). Deep sedation had a positive correlation with mortality (Figure 1), Ramsay 5 or 6 and Richmond -4 or -5 presenting an AUC of 0.787 and 0.803 respectively. At the same time, adequate levels for sedation correlated positively with survival (Figure 2) AUS of 0.807 and 0.819 for Ramsay between 2 and 4 and Richmond from 0 and -3 respectively.

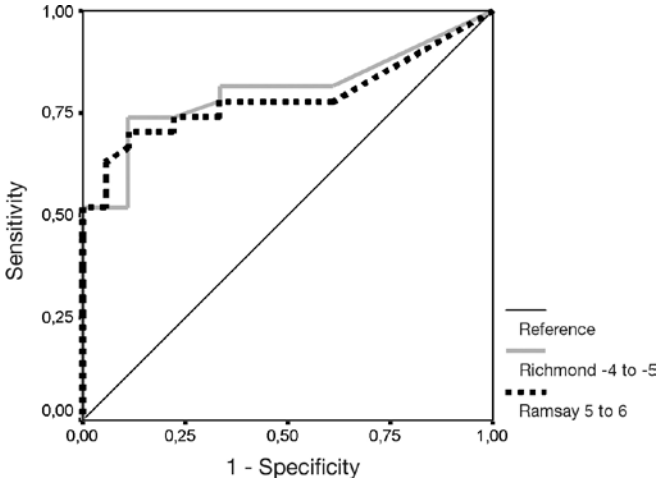

Figure 1 – ROC curve for the Ramsay and Richmond scales in relation to mortality.

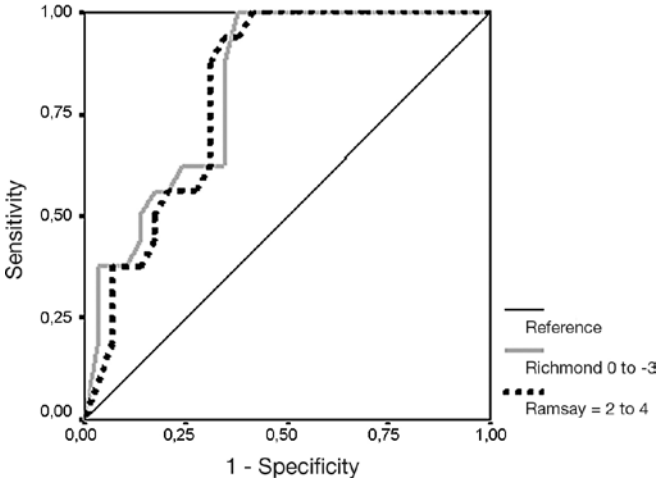

Figure 2 – ROC curve for the Ramsay and Richmond scales in relation to discharge.

However the group of patients with excessively heavy sedation also presented significantly higher values of SAPS 3 and APACHE II (Table 2), which certainly contributed to a higher mortality among these patients. Due to the sample size, multivariate analysis did not disclose sedation level as an independent factor for prognosis of mortality.

Table 2 – Subgroup analysis per sedation level

	Adequate sedation[a]	Inadequate sedation[b]	P value
SAPS 3	57.71	65.79	0.02
APACHE II	17.14	20.96	0.05
Fentanyl dose (µg/kg/day)	12.44	17.61	0.06
Midazolam dose (mg/kg/day)	1.05	1.59	0.05

SAPS - Simplified Acute Physiology Score, APACHE - Acute Physiological and Chronic Health Evaluation II. Results expressed in mean. a - Ramsay mean between 2 and 4 or Richmond mean between 0 and -3; b - Ramsay mean between 5 and 6 or Richmond between -4 and -5

Upon dividing the sample according to the sedation level it was observed that the group with Ramsay means between 2 and 4 and Richmond between 0 and -3 received a mean midazolam dose 67% smaller than those with Ramsay between 5 and 6 and Richmond between -4 and -5 (p=0.05) as well as a 30% smaller dose of fentanyl (p=0.06).

There was good correlation between the mean Ramsay and Richmond scores, Pearson's = 0.810 (p<0.0001). Likewise Ramsay and Richmond were equivalent for diagnosis of an inadequately low level of sedation (Pearson's correlation index o = 0.995 with p<>0.0001), excessively high level of sedation (Pearson's correlation index = 0.991 with p<0.0001) or adequate sedation (Pearson's correlation index – 0.980 with p<0.0001).

DISCUSSION

Although goal-directed sedation is considered the state of the art in intensive care,[7-8] the utilization rate of sedation scores remains uneven. Recent studies show a considerable difference between countries: in the USA,[9] 78% of services use some sedation scale, in the United Kingdom[12] use of scales reaches 72%, in Canada[11] it is of 39% and in Western Europe, one of the countries that least uses sedation scales is Austria,[9] with only 18%. In Latin America there are no recent representative studies on the utilization rate of sedation scales.

The most commonly used clinical method to assess sedation level is the Ramsay scale, however there is a growing interest for use of complementary devices, such as the bispectral index system (BIS), which theoretically supply more objective numerical data and are more sensitive for diagnosis of the brain activity level during coma. However, use of these devices is not routine in most services. This is partly due to the high and unjustified costs, because this method has been proven beneficial in relation to the Ramsay scale.

On the other hand, the Richmond scale is a good alternative for assessment of sedation in critically ill patients.[13,14] It has all the advantages of applicability and reproducibility of the Ramsay scale, in addition of a more precise assessment of agitation states.

The main finding of this study was good equivalence between the Ramsay and Richmond scales for critically ill patients under mechanical ventilation. Notwithstanding the size of the sample, correlation indices between the two variables were always statistically significant, which supports the hypothesis that both scales may be clinically similar.

This equivalence between Ramsay and Richmond scores may be relevant for the selection of the sedation level assessment method when preparing the goal directed sedation protocol. Use o the Richmond scale may allow for more specific therapeutic conducts for different levels of agitation and anxiety.

Adequate sedation levels Ramsay from 2 to 4 and Richmond from e 0 to -3, have a positive correlation with discharge from ICU, with 100% sensitivity and 67% specificity. Ramsay and Richmond scores also present good correlation with unfavorable outcome. Deep sedation Ramsay ≥ 5 or Richmond ≤ -4 have a positive correlation with mortality, with 97% specificity and 75% sensitivity. Even though the sedation level did not prove to be an independent factor to predict mortality in this study.

In this series no relation between occurrence of agitation and mortality was noted, suggesting that more superficial sedation levels, even short periods of agitation, might be tolerable in view of the risks of heavy sedation.

CONCLUSION

The Ramsay and Richmond scores presented an excellent correlation with equivalent sensitivity and specificity to establish the sedation level. Both have shown a good correlation with death of excessively sedated patients (Ramsay > 4 or Richmond > -3), while showing good sensitivity with regard to discharge of adequately sedated

patients (Ramsay 2 to 4 or Richmond 0 to -3), although, in this study the sedation level was not an independent factor to predict mortality. Occurrence of agitation is not correlated with prognosis.

RESUMO

Objetivo: O objetivo principal deste estudo foi comparar o desempenho das escalas de sedação de Ramsay e Richmond em pacientes críticos sob ventilação mecânica em um hospital universitário.

Métodos: Estudo prospectivo onde foram incluídos todos os pacientes sob ventilação mecânica com pelo menos 48 horas de internação, durante quatro meses, totalizando 45 pacientes. Foram avaliados diariamente a modalidade de sedação, dose dos sedativos e analgésicos e o nível de sedação através das escalas de Ramsay e Richmond. O teste T de Student, os índices de correlação de Pearson e Spearman, e a elaboração de curvas Receiver Operating Characteristic (ROC) foram utilizados para a análise estatística.

Resultados: A mortalidade geral observada foi de 60%. Nesta série, o tempo de sedação e a dose de sedativos utilizada não se correlacionaram com a mortalidade. Sedação profunda (Ramsay > 4 ou Richmond < -3) correlacionou-se positivamente com uma maior probabilidade de morte, com uma área sob a curva (ASC) > 0,78. Níveis adequados de sedação (Ramsay 2 a 4 ou Richmond 0 a -3) correlacionaram-se sensivelmente à probabilidade de sobrevivência, com uma ASC > 0,80. Em 63 evoluções (8,64%) foram observados níveis baixos de sedação, porém não se evidenciou nenhuma correlação entre a ocorrência de agitação e prognósticos desfavoráveis. Houve uma boa correlação entre as escalas Ramsay e Richmond (Pearson > 0,810 – p<0,0001).

Conclusão: Neste estudo, as escalas de Ramsay e Richmond mostraram-se equivalentes para a avaliação de sedações profunda, insuficiente e adequada e ambos demonstraram boa correlação com mortalidade em pacientes excessivamente sedados.

Descritores: Sedação profunda/métodos; Respiração artificial; Monitorização fisiológica; Cuidados intensivos; Unidades de terapia intensiva; Hipnóticos e sedativos/administração & dosagem

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