







Association between sedation level and mortality of intensive care patients on mechanical ventilation*

Associação entre nível de sedação e mortalidade de pacientes em ventilação mecânica em terapia intensiva

Asociación entre nivel de sedación y mortalidad de pacientes con ventilación mecánica en cuidados intensivos

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ABSTRACT

Objective: To associate the sedation level, criteria for daily interruption of sedation and mortality of patients on mechanical ventilation in an Intensive Care Unit. **Method:** Prospective, longitudinal and quantitative study conducted with patients by using the Richmond Agitation-Sedation Scale (RASS) and the Sepsis-related Organ Failure Assessment (SOFA) score, through a care protocol managed by a nurse at the unit for the daily interruption of sedation once a day. The Chi Square test was used to check the association between variables and the T test for independent analyzes. **Results:** Participation of 204 patients. Most were male, surgical, aged between 40 and 60 years, in sedoanalgesia with fentanyl, midazolam and propofol, with sedation time of one to five days and average stay of 10.7 days. They were in moderate sedation and at high risk for mortality. There was a statistical correlation between death in patients in deep sedation, and sensitivity in relation to discharge from the Intensive Care Unit of those who underwent daily interruption of sedation and were reassessed daily. **Conclusion:** Daily interruption of sedation guided by the Richmond Agitation-Sedation Scale assists in the control of sedation, which favors the treatment and recovery of patients and guides nurses' decision making. However, in this study, it was not configured as an independent factor for predicting mortality in intensive care.

DESCRIPTORS

Conscious Sedation; Mortality; Respiration, Artificial; Intensive Care Units; Critical Care Nursing.

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INTRODUCTION

The sedation of patients on Invasive Mechanical Ventilation (IMV), previously maintained with high-dose medications to keep deep levels of sedation for many days, has been modified to lower doses. This change allows treatment with more physiological dosages and decreases the length of stay in the Intensive Care Unit (ICU), the rate of Ventilator-Associated Pneumonia (VAP) and mortality⁽¹⁾.

Medications used for patient sedation are optimized in their concentrations and duration. The daily interruption of sedation occurs temporarily and includes assessment of how patients awaken, their ability to respond to verbal commands or demonstration of agitation. After checking patients' sedation levels, the dosage of these medications is reduced by half. This process must be performed once a day by nurses of the unit until the ICU multiprofessional team is sure that the patient is fit for extubation and decides that sedation will not be turned on again⁽²⁾.

Although sedatives and analgesics have side effects, they are routinely administered in most patients on IMV, because they reduce stress and provide better tolerance to ventilatory support⁽³⁾. The most widely used medications are benzodiazepines, especially midazolam, which improves acute agitation in a short period of time (between 48 to 72 hours), and propofol for neurosurgical patients or in situations requiring a faster awakening^(1,4).

According to studies conducted in the United States of America (USA) on sedation and analgesia in adults, the Society of Intensive Care Medicine established the daily reassessment of each patient with systematic use of validated scales⁽⁵⁾. One of the most used scores nowadays is the Richmond Agitation-Sedation Scale (RASS), created in Virginia (USA) in 2002 by a multidisciplinary team⁽⁶⁻⁸⁾. This scale is based on the assessment of the degree of agitation and sedation; scores range from the aggressive, violent and dangerous patient, going through several stages, to the extreme of this situation, which is the inability to arouse, no response to sound and physical stimuli⁽⁹⁻¹⁰⁾.

The use of the RASS scale improves the care provided to patients in the ICU, because it avoids the administration of excessive sedation, reduces the time on IMV and the length of hospital stay⁽¹¹⁻¹²⁾.

In a classic study, a sedation protocol was used for the interruption of sedoanalgesics and keeping the patient awake. The time on mechanical ventilation decreased from 124 to 89 hours and the length of stay in the ICU went from 7.5 to 5.7 days⁽¹³⁻¹⁴⁾. Despite the benefits of care protocols, a Brazilian study showed that just over 50% of ICUs use some instrument to assess the level of sedation in patients, and most still do not perform daily interruption of sedation⁽⁷⁾.

Although benefits are described with the reduction of excessive sedation and mortality, the adoption in clinical practice remains limited by the nursing team. A patient in

mild sedation, who undergoes interruption of sedoanalgesic medications requires more attention from the team because there is a higher risk for accidental extubation or loss of invasive devices, such as catheters and tubes, as well as risk for falls. These factors generate greater concern and stress in the team, since adverse events may occur⁽¹²⁾.

Other indexes related to the prognosis or severity of patients in the ICU are associated with the sedation protocol, such as the Sepsis-related Organ Failure Assessment (SOFA). In this protocol, the score is used according to the degree of dysfunction of each organ, based on a numerical scale for the descriptive assessment of morbidity by individualizing organ failure on a daily basis and considering the interventions/treatment and the impact on survival⁽¹⁵⁾.

Considering the use of the RASS scale and the SOFA score as support for the daily interruption of sedation, the objective of this study was to associate the level of sedation, criteria for daily interruption of sedoanalgesia and mortality of patients on mechanical ventilation in an intensive care unit.

METHOD

TYPE OF STUDY

Quantitative, prospective and longitudinal study that correlated the variables through repeated observations of items over a period of time, based on the subjects' exposure⁽¹⁶⁾.

SCENARIO

The study was conducted in a general teaching hospital of special size located in the northwest of São Paulo with approximately 800 beds.

Data were collected in two ICUs, General and Neurological, subdivided into surgical and clinical. In the surgical, intensive care patients from large postoperative periods or with complications are admitted; in the clinical, patients with diagnoses related to the various medical specialties are admitted.

SAMPLE DEFINITION

The sample consisted of 240 sedated patients on IMV, and the number of patients/bed during the data collection period in the two ICUs was considered. Inclusion criteria were patients orotracheally intubated, who were kept sedated with specific medications, hospitalized for more than 24 hours and over 18 years of age. Exclusion criteria were patients who died or were discharged less than 24 hours after admission to the ICU or who were not sedated; 36 patients were excluded. The data collection period was between January 2015 and January 2016.

DATA COLLECTION

The instrument used to assess sedation was implemented in the unit in March 2013 and validated by nurses

for a three month-period in order to adjust its use. Some sedative medications that could be interrupted by nurses at the beginning of the morning shift (at 6 am) were also considered and will be described below. The criteria for non-interruption were based on the following items: intracranial hypertension, Acute Respiratory Distress Syndrome (ARDS) or pulmonary recruitment, use of neuromuscular blocker, status epilepticus, hemodynamic instability, palliative care. After this period, the item medical order was included, when interruption of sedation was not authorized by the medical team.

Data collection was performed using the RASS Scale, which assesses the degree of sedation of patients in the ICU. Examples of scores are:

- +4 aggressive, violent, dangerous;
- +3 very agitated, aggressive conduct, removal of tubes or catheters;
- +2 agitated, frequent uncoordinated movements;
- +1 restless, anxious, but without vigorous or aggressive movements;
- 0 alert, calm;
- 1 sleepy, not fully alert, but sustains arousal to the sound of the voice (>10 sec);
- 2 light sedation, wakes up quickly and makes eye contact with the sound of the voice (<10 sec);
- 3 moderate sedation, movement or opening of the eyes at the sound of the voice, but without eye contact;
- 4 deep sedation, does not respond to the sound of the voice, but moves or opens the eyes with physical stimulation;
- 5 unable to be aroused, does not respond to the sound of the voice or stimulus⁽⁹⁾.

The SOFA was also used, with scores from one to four for the organic dysfunction of each organ. The higher the score, the greater the degree of dysfunction and the worse the prognosis. The following items were assessed: pressure and inspiratory oxygen fraction; platelets; bilirubin level; hypotension; Glasgow coma scale; creatinine level; urinary output⁽¹⁵⁾.

The data collection instrument was applied by trained nurses through a care protocol implemented in the ICU, always in the first hour of work, from Monday to Friday, in the morning, afternoon and night shifts, observing, checking and writing down the scores at the bedside, according to the RASS Scale and inclusion and exclusion criteria. Interruption of sedation was performed by nurses once a day, early in the morning, and patients' sedation levels were checked throughout the day. Discontinued medications and inclusion and exclusion criteria were described in the ICU care protocol in order to avoid questions of professionals.

The medications used for sedation and analgesia were midazolam, fentanyl, propofol, clonidine, thiopental,

dexmedetomidine and ketamine. The interruption of sedation occurred daily at 6 am, according to criteria for interruption or not of these medications. When interrupting the medications, the behavior of the patients was observed at bedside and actions were taken, according to RASS:

- +2 to +5: medical team communicated about the best course of action;
- 2 to +1: the interruption of sedation procedure was maintained for possible planned extubation;
- 3 to -5: the interruption of sedation was maintained; reassessment of the patient's level of agitation after 2h; if necessary, return of sedation at 50% of the initial dose.

When choosing the conduct, the ICU nurse filled out the instrument again with justification of the decision. In this process, inefficient notes made on the instrument were identified, showing a deficit of information.

ANALYSIS AND TREATMENT OF DATA

Descriptive analyzes of the sample characterization variables were made, with application of the T test for independent samples and the Chi Square test to check the association of these variables

ETHICAL ASPECTS

The study project was approved by the Research Ethics Committee of the Faculty of Medicine at São José do Rio Preto under Opinion number 984.505/2015, according to Resolution number 466/12 of the National Health Council.

RESULTS

Most patients were male 125 (61.3%), and 79 (38.7%) were female. The age was 56.1±20.6 years. The average length of stay in the ICU was 10.7 days, with a standard deviation of 9.0 and a median of 7.5. The mean RASS was -2.4 with a standard deviation of 2.0 and a median of -3.0. One hundred seventy-one (83.8%) patients were sedated for one to five days, while 33 (16.2%) patients remained sedated above five days. There was no interruption of sedation in 107 (52.4%) patients. There was daily interruption of sedation in 97 (47.6%) patients.

The main criteria reported by nurses for no interruption of sedation were: 31 (28.9%) hemodynamic instability of the patient; 24 (22.5%) medical order; 17 (15.9%) ARDS; 16 (14.9%) palliative care; ten (9.4%) high intracranial pressure (ICP); and nine (8.4%) epileptic disease.

Table 1 shows the medical specialties, criteria for no daily interruption of sedation and patients' SOFA score.

Table 1 – Chi square test for association of the SOFA score* and medical specialties, according to the criteria for no daily interruption of sedation of ICU patients – São José do Rio Preto, SP, Brazil, 2018.

	N	%	SOFA*	P†
Surgical specialties	140	68.6	10.9	0.01
Clinical specialties	64	38.7	4.7	
Criteria for no interruption of sedation:				
Hemodynamic instability	31	28.9	10.8	
Medical order	24	22.5	6.7	
ARDS‡	17	15.9	9.4	0.52
Palliative care	16	14.9	8.8	
High ICP§	10	9.4	7.4	
Epileptic disease	09	8.4	4.9	

*SOFA - Sepsis-related Organ Failure Assessment. † P - significance level < 0.05. ‡ARDS - Acute Respiratory Distress Syndrome. §ICP - Intracranial Pressure.

Among patients who remained sedated between one and five days, in 104 (50.9%) the most used drug was fentanyl; in 97 (47.5%), midazolam; in 37 (18.2%), propofol; and in 25 (12.2%) other medications, such as clonidine, dexmedetomidine, ketalar and thiopental, and these patients used more than one sedoanalgesic drug.

Table 2 shows results obtained among the number of patients under sedation, classified according to the RASS Scale as deep and light, in which: -3 to -5 is deep sedation and -2 to +1 is light sedation. The SOFA score was also checked in these samples of sedation and clinical evolution of patients.

The level of sedation was significant in relation to deep and light sedation, but patients with RASS from -3 to -5

had similar clinical outcome: 82 (48.8%) were discharged from hospital and 86 (51.1%) died. These data show that the RASS value alone cannot be considered independently for patients' classification, as the pathophysiology of diseases interferes with their clinical outcome.

When SOFA was applied in this same follow-up, there was a significant difference in relation to the type of sedation and the patient's clinical evolution; those who died had higher SOFA compared to patients discharged from hospital. However, when comparing SOFA in relation to the level of sedation, there was no significant difference.

Table 2 – Sample distribution of the SOFA score* in relation to light and deep sedation and clinical evolution of ICU patients – São José do Rio Preto, SP, Brazil, 2018.

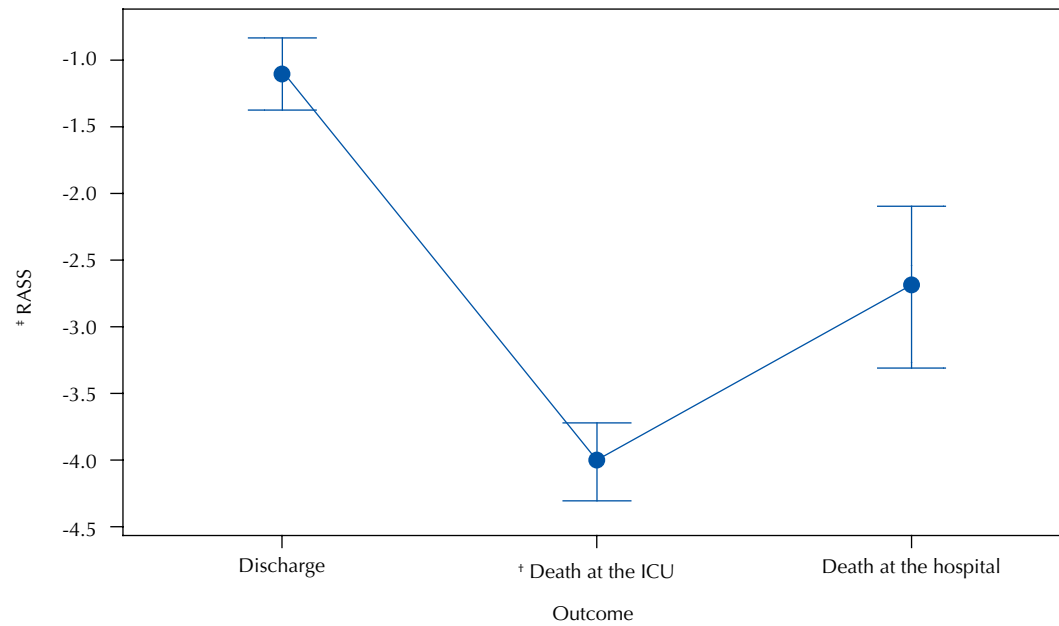
	N	%	SOFA*			
Deep sedation -3 to -5 RASS†	168	82.3	5.31			
Light sedation -2 to +1 RASS†	36	17.6	4.79			
	Discharge		SOFA*	Death		SOFA*
	N	%		N	%	
Deep sedation -3 to -5 RASS†	82	48.9	3.2	86	51.1	8.9
Light sedation -2 to +1 RASS†	30	83.3	2.95	6	16.6	9.1

*SOFA - Sepsis-related Organ Failure Assessment. †RASS - Richmond Agitation-Sedation Scale

Figure 1 illustrates the clinical outcome of patients according to the RASS Scale and shows the relationship between lower scores and hospital discharge.

Among patients with daily interruption of sedation, 39 (40.3%) were discharged from the ICU and had an average SOFA of 3.1; 58 patients (59.7%) died, with a

mean SOFA of 8.1, showing no statistical significance ($p=0.035$). Of patients with no daily interruption of sedation, 47 (43.9%) were discharged from the ICU, with a mean SOFA of 2.8. Sixty (56.1%) patients died, with a mean SOFA of 9.6, showing a statistically significant relationship ($p<0.001$).



*RASS- Richmond Agitation-Sedation Scale. †ICU- Intensive Care Unit

Figure 1 – Sample distribution of patients and clinical outcome according to the RASS Scale in the ICU – São José do Rio Preto, SP, Brazil, 2018.

Of the 36 (17.7%) patients in light sedation (-1 to +2 RASS), for 14 (38.9%), the procedures to continue without sedation were described, that is, sedation should be interrupted with subsequent observation and analysis of the patient's behavior. Of 168 (82.3%) patients under deep sedation (-5 to -3 RASS), in only six (3.5%) patients the instrument was filled out correctly, containing the case description and conduct to reduce sedation by 50% of the dose.

Of 204 sedated patients, in only 20 (9.8%) there was an adequate description of the conducts after daily interruption of sedation, which was in the protocol of the unit as a routine of ICU nurses. Even though the actions were performed by nurses, they were just not described, which should happen.

DISCUSSION

Strategies to improve the sedation process must be adopted to make it lighter, more superficial and safer for ventilatory weaning⁽¹⁾. As deep sedation is a serious problem in patients on IMV, the use of sedation control protocols has resulted in shorter ventilation times, and reduction of ICU stay and overall mortality⁽¹⁷⁾.

In this study, mortality occurred in patients aged between 40 and 60 years, different from a study that identified an association between age and high mortality rate in the ICU. Hospital care for the elderly population accounted for 31.6% of public spending on hospitalizations⁽¹⁸⁾, but this aspect should not be considered in isolation, and associated with other factors such as disease severity and the previous functional state, as they influence the increase of mortality rate in elderly patients⁽¹⁹⁾.

The SOFA severity score daily assesses the physiological, laboratory, chronic diseases and age variables during patients' hospitalization. The higher the SOFA value the greater the risk for death. In this study, the average score was 15.8 (considered high), which is in line with another study, where the SOFA score was greater than 11, showing higher mortality and prolonged ICU stay⁽²⁰⁾. In this study, there was no relationship between the SOFA score and patients' levels of sedation.

According to medical specialties, the SOFA score was higher in surgical patients (mean 10.9), corroborating a study conducted in an ICU in northeastern Brazil, in which the average score in this same patient profile was greater than 8⁽²¹⁾.

According to the National Medical Association for Respiratory Care, patients who needed IMV had an average of seven days in ventilatory support and sedation, and 13 days of length of stay in the ICU⁽¹⁸⁾. In this study, the average time on IMV and sedation ranged from one to five days in 171 (83.8%) patients, and it was more than five days in 33 (16.2%) patients. The average length of stay in the ICU was 10.7 days with a standard deviation of 9.0 and a median of 7.5.

Despite the indisputable need for sedation in critically ill patients, the deleterious effects of excessive sedation have been extensively studied by taking into consideration its determining factor in the evaluation of the quality of treatment and length of stay in the ICU. In a study where the algorithm was evaluated in 102 critical patients, the influence of adequate administration of sedoanalgesic drugs on the time of IMV and hospital stay was evident⁽²²⁾.

In this study, 128 patients experienced daily interruption of sedation and spent less time on IMV with no complications related to the decrease in these drugs. Daily interruption of sedation is an important procedure to avoid side effects such as higher levels of agitation, rates of ICU admission, risk for infections and adverse events⁽²³⁻²⁴⁾.

The RASS Scale was an independent factor in the mortality rate in this study, as 86 (51.1%) patients in deep sedation died and 82 (48.8%) were discharged from hospital. In another study with the same reference, the level of sedation and mortality were not statistically significant for assessing the patient's evolution in the ICU, which requires other parameters such as age, comorbidities and underlying pathologies⁽²⁴⁾.

In a study conducted in João Pessoa, Paraíba state, light levels of sedation (-2 to +1 RASS) were positively correlated with discharge from the ICU, with sensitivity of 100% and specificity of 67%⁽²⁵⁾. Deep sedation (-3 to -5) was positively correlated with mortality, with specificity of 97% and sensitivity of 75%⁽⁹⁾. Adherence to the practice of daily interruption of sedation varies in some countries but is low in most of them, namely 14% in Malaysia, 31% in Denmark and 34% in Germany. Waiting for the patient's spontaneous awakening is a more common procedure⁽¹⁾.

The most used medications in patients sedated for one to five days were fentanyl in 104 patients (50.9%), midazolam in 97 (47.5%) and propofol in 37 (18.2%). The findings partially corroborate with a study that also evaluated the drugs used for sedoanalgesia in the ICU, and found a prevalence of midazolam (63%) and propofol (35%), the second and third most used drugs in the study⁽¹⁾.

As for nurses' decision-making and conduct after the daily interruption of sedation, only 20 (9.8%) protocols were properly completed and most were incomplete. The nursing team was involved in the sedation protocol, but many protocols were not completed. Incomplete or inadequate completion makes it difficult to know the conduct taken, the justifications for the RASS score and the level of sedation of the critical patient in the ICU⁽⁵⁾.

The limitations of the study were the incomplete forms filled out by nurses from the units studied and the performance of data collection in three ICUs at the same institution.

Another limiting factor was the lack of recent studies in the Brazilian reality representing estimates of rates of use of scales for sedation assessment in the ICU.

CONCLUSION

Most patients were male, surgical, aged between 40 and 60 years, under sedation with fentanyl, midazolam and propofol, sedation time of one to five days, who did not have the daily interruption of sedation due to hemodynamic instability and medical order, and without statistical association with the level of sedation.

The use of the Richmond Scale correlated with death in patients under excessive sedation (RASS<-4) and demonstrated sensitivity in relation to discharge in adequately sedated patients (0 to -3 RASS), that is, under light sedation.

The daily interruption of sedation performed by nurses and guided by the RASS scale helps to control the level of sedation, which favors the treatment and patient's recovery, although it was not configured as an independent predictor of mortality.

RESUMO

Objetivo: Associar nível de sedação, critérios de desligamento diário das drogas sedoanalgésicas e mortalidade de pacientes em ventilação mecânica em Unidade de Terapia Intensiva. **Método:** Estudo prospectivo, longitudinal e quantitativo, realizado com pacientes, por meio da Escala de Agitação e Sedação de Richmond (do inglês, RASS) e o *Sepsis-related Organ Failure Assessment*, através de protocolo assistencial gerenciado por enfermeiro da unidade para a interrupção diária da sedação, uma vez ao dia. O teste estatístico de Qui Quadrado foi utilizado para verificar associação entre variáveis e o teste T para análises independentes. **Resultados:** Participaram 204 pacientes. A maioria era do sexo masculino, idade entre 40 e 60 anos, cirúrgicos, em sedoanalgesia com fentanil, midazolam e propofol, com tempo de sedação de um a cinco dias e média de permanência de 10,7 dias. Estavam com sedação moderada e apresentavam risco alto para mortalidade. Houve correlação estatística entre óbito em pacientes com sedação profunda, e sensibilidade em relação à alta da Unidade de Terapia Intensiva daqueles que sofreram a interrupção da sedação e foram reavaliados diariamente. **Conclusão:** A interrupção diária da sedação guiada pela Escala Richmond auxilia no controle da sedação, o que favorece o tratamento e recuperação do paciente e direciona a tomada de decisão do enfermeiro. Porém, neste estudo, não se configurou como fator independente para previsão de mortalidade em terapia intensiva.

DESCRITORES

Sedação Consciente; Mortalidade; Respiração Artificial; Unidades de Terapia Intensiva; Enfermagem de Cuidados Críticos.

RESUMEN

Objetivo: Asociar el nivel de sedación, los criterios para la interrupción diaria de la sedación y la mortalidad de los pacientes con ventilación mecánica en una Unidad de Cuidados Intensivos. **Método:** Estudio prospectivo, longitudinal y cuantitativo realizado con pacientes utilizando la Escala de Agitación-Sedación de Richmond (RASS) y el *Sepsis-related Organ Failure Assessment* (SOFA) score, a través de un protocolo de atención administrado por enfermeros en la unidad para la interrupción diaria de la sedación, una vez al día. La prueba Chi Square se utilizó para verificar la asociación entre variables y la prueba T para análisis independientes. **Resultados:** Participación de 204 pacientes. La mayoría eran hombres, quirúrgicos, edad entre 40 y 60 años, en sedoanalgesia con fentanilo, midazolam y propofol, con un tiempo de sedación de uno a cinco días y una estancia promedio de 10,7 días. Estaban en sedación moderada y tenían un alto riesgo de mortalidad. Hubo una correlación estadística entre la muerte en pacientes en sedación profunda y la sensibilidad en relación con el alta de la Unidad de Cuidados Intensivos de aquellos que se sometieron a la interrupción diaria de la sedación y fueron reevaluados diariamente. **Conclusión:** La interrupción diaria de la sedación guiada por la Escala de

Agitação-Sedação de Richmond ajuda a controlar a sedação, lo que favorece el tratamiento y la recuperación de pacientes y guía la toma de decisiones de los enfermeros. Sin embargo, en este estudio, no fue un factor independiente para predecir la mortalidad en cuidados intensivos.

DESCRIPTORES

Sedación Consciente; Mortalidad; Respiración Artificial; Unidades de Cuidados Intensivos; Enfermería de Cuidados Críticos.

REFERENCES

1. Shinotsuka CR, Salluh JF. Perceptions and practices regarding delirium, sedation and analgesia in critically ill patients: a narrative review. *Rev Bras Ter Intensiva*. 2013;25(2):155-61. DOI: <http://dx.doi.org/10.5935/0103-507X.20130027>
2. 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. DOI: 10.1055/s-0033-1342971
3. Riker RR, Fraser GL. Altering intensive care sedation paradigms to improve patient outcomes. *Anesthesiol Clin*. 2011;29(4):663-74. DOI: <https://doi.org/10.1016/j.anclin.2011.09.006>
4. Sanders RD, Hussell T, Maze M. Sedation & immunomodulation. *Anesthesiol Clin*. 2011;29(4):687-706. DOI: 10.1016/j.anclin.2011.09.008
5. Strøm T, Martinussen T, Toft P. A protocol of no sedation for critically ill patients receiving mechanical ventilation: a randomised trial. *Lancet*. 2010;375(9713):475-80. DOI: 10.1016/S0140-6736(09)62072-9
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(2):541-8. DOI: <https://doi.org/10.1378/chest.114.2.541>
7. 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(9 Suppl 1):S16-29. DOI: 10.1097/CCM.0b013e3182a16879
8. 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. *Australas Emerg Nurs J*. 2015;18(1):1-23. DOI: 10.1016/j.aenj.2014.07.001
9. Mendes CL, Vasconcelos LCS, Tavares JS, Fontan SB, Ferreira DC, Diniz LAC, et al. Ramsay and Richmond's scores are equivalent for the assessment of sedation level in critical patients. *Rev Bras Ter Intensiva*. 2008;20(4):344-8. DOI: <http://dx.doi.org/10.1590/S0103-507X2008000400005>
10. Agarwal V, O'Neill PJ, Cotton BA, Pun BT, Haney S, Thompson J, et al. Prevalence and risk factors for development of delirium in burn intensive care unit patients. *J Burn Care Res*. 2010;31(5):706-15. DOI: 10.1097/BCR.0b013e3181eebee9
11. Schweickert WD, Pohlman MC, Pohlman AS, Nigos C, Pawlik AJ, Esbrook CL, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomised controlled trial. *Lancet*. 2009;373(9678):1874-82. DOI: 10.1016/S0140-6736(09)60658-9
12. McGahan M, Kucharski G, Coyer F. Nurse staffing levels and the incidence of mortality and morbidity in the adult intensive care unit: a literature review. *Aust Crit Care*. 2012;25(2):64-77. DOI: 10.1016/j.aucc.2012.03.003
13. Mehta S, Burry L, Fischer S, Martinez-Motta JC, Hallet D, Bowman D, et al. Canadian survey of the use of sedatives, analgesics, and neuromuscular blocking agents in critically ill patients. *Crit Care Med*. 2006;34(2):374-80. DOI: 10.1097/01.ccm.0000196830.61965.f1
14. Guérin C, Reignier J, Richard JC, Beuret P, Gacouin A, Boulain T, et al. Prone positioning in severe acute respiratory distress syndrome. *N Engl J Med*. 2013;368(23):2159-68. DOI: 10.1056/NEJMoa1214103
15. Ferreira AF, Bartelega JA, Urbano HCA, Souza IKF. Acute pancreatitis gravity predictive factors: which and when to use them? *Arq Bras Cir Dig*. 2015;28(3):207-11. DOI: 10.1590/S0102-67202015000300016
16. Massaroli R, Martini JG, Massaroli A, Lazzari DD, Oliveira SN, Canever BP. Nursing work in the intensive care unit and its interface with care systematization. *Esc Anna Nery*. 2015;19(2):252-8. DOI: <http://dx.doi.org/10.5935/1414-8145.20150033>
17. Morton PG, Fontaine DK, Hudak CM, Gallo MB. *Cuidados Críticos de Enfermagem: uma abordagem holística*. 8ª ed. Rio de Janeiro: Guanabara Koogan; 2007.
18. Minhas MA, Velasquez AG, Laul A, Salinas PD, Celi LA. Effect of protocolized sedation on clinical outcomes in mechanically ventilated intensive care unit patients: a systematic review and meta-analysis of randomized controlled trials. *Mayo Clin Proc*. 2015;90(5):613-23. DOI: 10.1016/j.mayocp.2015.02.016
19. Oliveira ABF, Dias OM, Mello MM, Araujo S, Dragosavac D, Nucci A, et al. Factors associated with increased mortality and prolonged length of stay in an adult intensive care unit. *Rev Bras Ter Intensiva*. 2010;22(3):250-6. DOI: <http://dx.doi.org/10.1590/S0103-507X2010000300006>
20. Devabhakthuni S, Armahizer MJ, Dasta JF, Kane-Gill SL. Analgosedation: a paradigm shift in intensive care unit sedation practice. *Ann Pharmacother*. 2012;46(4):530-40. DOI: 10.1345/aph.1Q525
21. McGrane S, Pandharipande PP. Sedation in the intensive care unit. *Minerva Anesthesiol* [Internet]. 2012 [cited 2018 Sep 24];78(3):369-80. Available from: <https://www.minervamedica.it/en/journals/minerva-anestesiologica/article.php?cod=R02Y2012N03A0369>
22. Hissa PNG, Hissa MRN, Araújo PSR. Análise comparativa entre dois escores na previsão de mortalidade em unidade terapia intensiva. *Rev Bras Clin Med* [Internet]. 2013 [cited 2018 Sep 24];11(1):21-6. Available from: <http://files.bvs.br/upload/S/1679-1010/2013/v11n1/a3383.pdf>.
23. Barbosa TP, Beccaria LM, Pereira RAM. Evaluation of postoperative pain experience in intensive care unit patients. *Rev Bras Ter Intensiva*. 2011;23(4):470-7. DOI: <http://dx.doi.org/10.1590/S0103-507X2011000400012>

24. Namigar T, Serap K, Esra AT, Özgül O, Ali Can O, Aysel A, et al. The correlation among the Ramsay sedation scale, Richmond agitation sedation scale and Riker sedation agitation scale during midazolam-remifentanyl sedation. *Rev Bras Anesthesiol.* 2017;67(4):347-54. DOI: <http://dx.doi.org/10.1016/j.bjane.2016.07.002>
25. Siqueira EMP, Ribeiro MD, Souza RCS, Machado FS, Diccini S. Correlation between work load of nursing and severity of critical general, neurological and cardiac patients. *Esc Anna Nery.* 2015;19(2):233-8. DOI: <http://dx.doi.org/10.5935/1414-8145.20150030>



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