ORIGINAL ARTICLE

Pain during tracheal aspiration in patients with traumatic brain injury undergoing mechanical ventilation

Dor durante a aspiração traqueal em vítimas de traumatismo cranioencefálico submetidos à ventilação mecânica

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ABSTRACT

BACKGROUND AND OBJECTIVES: Victims of traumatic brain injury, in intensive care units, frequently experience pain. Tracheal aspiration is a procedure with nociceptive potential routinely carried out in these patients. The objective of this study was to evaluate the effectiveness of tracheal aspiration in patients with traumatic brain injury undergoing mechanical ventilation.
METHODS: Prospective study conducted in two intensive care units of a general public hospital in Aracaju, Sergipe, Brazil. During three days, 300 observations were carried out in 20 victims of traumatic brain injury. The pain was assessed using the Brazilian version of the Behavioral Pain Scale and the physiological parameters of heart rate and blood pressure (systolic and diastolic). The sedation depth was measured by Ramsay scores and the Richmond Agitation Sedation Scale. The Friedman test, ANOVA, and the Bonferroni post hoc test were used to verify the existence any differences in pain scores and physiological parameters at the different moments of the evaluation. A 5% statistical significance was accepted.
RESULTS: The sample was predominantly comprised of men, young, from the interior of the State, with no comorbidities and with severe traumatic brain injury. Fentanyl and midazolam were the most used drugs for sedation and analgesia. There was a high prevalence of pain (70.0-85.5%). The pain scores were significantly higher during the tracheal aspiration, and the physiological parameters did not present any statistically significant increase.

CONCLUSION: Valid and trustworthy behavioral scales, as the Behavioral Pain Scale, should be incorporated into the routine of the intensive care units to guide analgesia and sedation management, especially to prevent suffering during these painful procedures.
Keywords: Nociceptive pain, Pain assessment, Sedation, Suction, Traumatic brain injury.

RESUMO

JUSTIFICATIVA E OBJETIVOS: Vítimas de traumatismo cranioencefálico, internadas em unidades de terapia intensiva, frequentemente experienciam dor. A aspiração traqueal é um procedimento com potencial nociceptivo realizado rotineiramente nesses pacientes. O objetivo deste estudo foi avaliar a dor durante a aspiração traqueal em vítimas de traumatismo cranioencefálico submetidos à ventilação mecânica.
MÉTODOS: Estudo prospectivo realizado em duas unidades de terapia intensiva de um hospital geral público em Aracaju, Sergipe, Brasil. Foram realizadas 300 observações em 20 vítimas de traumatismo cranioencefálico durante três dias. A dor foi avaliada por meio da versão brasileira da *Behavioral Pain Scale* e os parâmetros fisiológicos de frequência cardíaca e pressão arterial (sistólica e diastólica). A profundidade da sedação foi mensurada pelos escores de Ramsay e da *Richmond Agitation Sedation Scale*. O teste de Friedman, ANOVA e pós-teste de Bonferroni foram utilizados para verificar a existência de diferença dos escores de dor e parâmetros fisiológicos nos diferentes momentos da avaliação. Foi admitida significância estatística de 5%.
RESULTADOS: A amostra foi composta predominantemente por homens, jovens, do interior do estado, sem comorbidades e com traumatismo cranioencefálico grave. Fentanil e midazolam foram os fármacos mais utilizados para sedação e analgesia. Houve alta prevalência de dor (70,0-85,5%), os escores de dor foram significativamente mais altos durante a aspiração traqueal e os parâmetros fisiológicos não apresentaram elevação estatisticamente significativa.
CONCLUSÃO: Escalas comportamentais válidas e confiáveis, como a *Behavioral Pain Scale*, devem ser incorporadas à rotina das unidades de terapia intensiva para nortear o manuseio da analgesia e sedação, sobretudo, para prevenção de sofrimento durante procedimentos dolorosos.
Descritores: Dor nociceptiva, Mensuração da dor, Sedação, Sucção, Traumatismo cranioencefálico.

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INTRODUCTION

Traumatic brain injury (TBI) is a serious Brazilian public health problem whose treatment requires intensive support[1]. Thus, in a great part of cases, victims of moderate to severe TBI are hospitalized in critical environments to stabilize the clinical picture.

Intensive care units (ICUs) are characterized by the routine performance of nociceptive procedures for diagnostic and therapeutic purposes or for the maintenance of basic physiological functions[2], such as tracheal aspiration, whose painful potential was observed in a multicenter study performed with patients after discharge from ICU[3].

Pain is a frequent experience in ICUs, but underused, neglected and undervalued[4]. Although most patients are unable to self-report their pain, it does not mean that it does not exist[5]. On the other hand, its adequate handling remains an aspect little explored by the multidisciplinary intensivist team, since the knowledge about valid and reliable instruments to evaluate the pain of these patients is incipient in Brazil.

Behavioral Pain Scale (BPS) is the only observational instrument translated and adapted to the Brazilian culture[6,7]. It is a useful tool for decision making in pain handling in ICU. Its application is fast, has simple language and uses behavioral descriptors that are frequently observed by professionals in their daily practice[8].

Surveys related to pain handling during painful ICU procedures are still scarce in our country. Given the above, this study aimed to evaluate pain during tracheal aspiration (TA) in victims of TBI submitted to mechanical ventilation.

METHODS

Observational, descriptive and prospective study, carried out from September 2015 to June 2016 in the clinical and surgical ICU of a general public hospital of high complexity, located in Aracaju, SE, Brazil.

The sample consisted of the non-probabilistic type for convenience, composed of moderate or severe TBI victims, hemodynamically stable, sedated, and submitted to mechanical ventilation for at least 48 hours. Conditions such as tetraplegia history, neuromuscular blockers use, underlying neurological disease, shock state and/or suspected brain death were considered as exclusion criteria because they interfered with the manifestation of behavioral indicators related to pain.

Sociodemographic and clinical variables present in the data collection form were: age, gender, marital status, educational background, origin, comorbidities, mechanism, and severity of TBI, the intensity of sedation, analgesic drugs, and prescribed sedatives.

Acute Physiology and Chronic Health Disease Classification System II (APACHE II)[9] scores were calculated based on data from the first 24 to 48 hours of ICU admission. Richmond Agitation Sedation Scale (RASS)[10] and Ramsay[11] scores were used to assess the intensity of sedation.

Pain evaluation was performed through the Brazilian version of the Behavioral Pain Scale (BPS-Br)[6] and observation of two physiological parameters whose variations are frequently attributed to the pain presence in clinical practice, heart rate (HR) and systolic blood pressure, and diastolic blood pressure (SBP and DBP).

BPS-Br[6] is an observational instrument for pain assessment for patients who are unable to self-report and has three subscales: facial expression, upper limbs movement, and comfort with mechanical ventilation (Table 1). Each subscale has four behavioral descriptors whose scores vary from one to four, and the total score corresponds to the sum of the partial results, varying from three (absence of pain) to 12 (inadmissible pain)[8]. A score >3 demonstrates the pain presence, and ≥5 indicates significant pain[12].

Table 1. Brazilian version of Behavioral Pain Scale[6]

Item	Description	Score
Facial expression	Relaxed	1
	Partially contracted (e.g., lowering eyelid)	2
	Completely contracted (eyes closed)	3
	Facial contortion	4
Movement of upper limbs	Without movement	1
	Partial movement	2
	Full movement with finger flexion	3
	Permanently contracted	4
Comfort with the mechanical fan	Tolerant	1
	Cough but tolerant to mechanical ventilation most of the time	2
	Fighting with the fan	3
	No ventilation control	4

Initially, a pilot study was carried out to calibrate the team and collection instrument, whose data were excluded from the final analysis. Sociodemographic and clinical data were obtained by analyzing the medical records. The physiological parameters of HR, SBP and DBP were extracted from the multi-parameter monitor. Pain assessment was performed at five different times. Eye cleansing (EC) was considered a non-painful procedure compared to TA, admittedly nociceptive. Patients were evaluated on three different days according to the collection procedure shown in figure 1, resulting in 300 observations (20 patients versus 5 moments versus 3 evaluations).

This study followed the recommendations of the Declaration of Helsinki and Resolution 466/2012 of National Health Council and was approved by Research Ethics Committee of the Federal University of Sergipe under Opinion 903.798 (CAAE: 38567714.1.0000.5546). Due to the patient's impossibility of making decisions, the Free Informed Consent Form (FICF) was signed by one of his/her legal representatives.

Statistical analysis

Data were descriptively analyzed, and the distribution normality was assessed by the Shapiro-Wilk test. Numerical variables were expressed as a mean ± standard error of the mean (SEM) and categorical variables in absolute and relative frequencies. Friedman's non-parametric test and ANOVA were used to compare pain scores and fluctuation of physiological parameters, res-
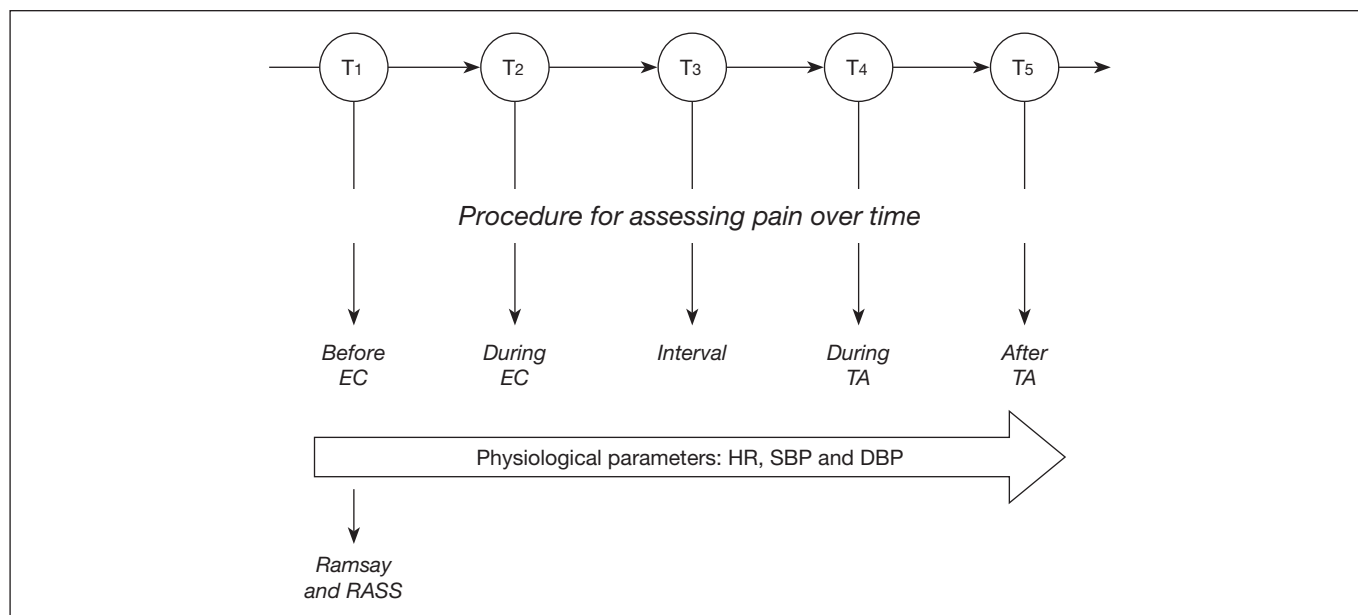
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Figure 1. Timeline of data collection procedure.

TA = tracheal aspiration; HR = heart rate; EC = eye cleaning; DBP = diastolic blood pressure; SBP = systolic blood pressure; RASS = Richmond Agitation Sedation Scale.

pectively, throughout the five moments of evaluation. When the difference was identified, the Bonferroni's post-test was performed. Statistical significance was set at 5% and all tests performed were two-tailed.

RESULTS

Thirty-seven patients were included for the first study evaluation. During the follow-up, 17 were excluded because they were extubated in a programmed way, received discharge to the ward or died, so that the final sample consisted of 20 patients (Figure 2). Participants were predominantly males, 19 (95.0%), young adults (40.5±3.0 years), non-white skin color, 14 (70.0%), low schooling (4.1±0.8 years) from state's interior, 14 (70.0%), without comorbidities, with an average APACHE II score of 15.4±0.9. Severe TBI prevailed, 18 (90.0%), the main mecha-

nism of trauma being collisions, 13 (65.5%), especially those involving motorcycles, 11/13 (84.6%).

During all evaluations, participants were intensely sedated; the infusion of sedative and analgesic solution, composed predominantly of fentanyl and midazolam, was active in more than half of the cases. Despite the simple analgesics prescription's high frequency such as paracetamol and dipyrone, these drugs were used irregularly (if necessary) (Table 2).

Pain prevalence during TA varied from 70.0 to 85.0%. Significant pain (BPS≥5) was more frequent in the second evaluation, 11/16 (68.7%) (Table 2). Pain scores were significantly higher during TA at all assessments. However, the physiological parameters were inconsistent, since HR and DBP did not show a statistically significant increase in all evaluations. Additionally, the increase in SBP was not significant in any of the evaluations (Figure 3).
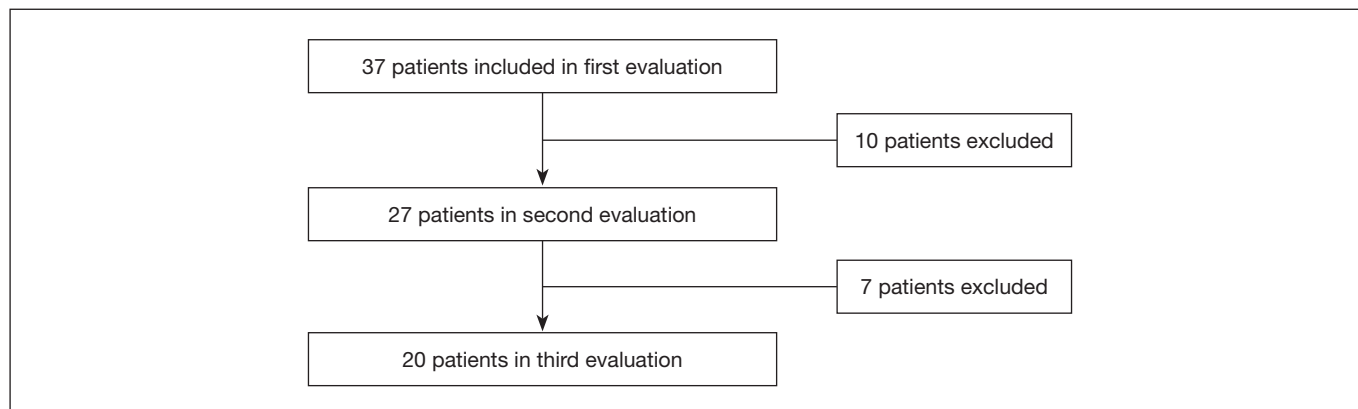

Figure 2. Allocation and follow-up flowchart of participants

Table 2. Pain, analgesia and sedation

Variables	First evaluation Mean±SEM		Second evaluation Mean±SEM		Third evaluation Mean±SEM	
Numerical						
Sedation scores						
Ramsay	5.6±0.2		5.4±0.2		5.5±0.2	
RASS	-3.7±0.5		-4.0±0.3		-3.8±0.3	
Categorical variables	n	%	n	%	n	%
Sedation and active analgesia						
Yes	13	65.0	12	60.0	14	70.0
Prescribed analgesics						
Fentanyl	18	90.0	17	85.0	17	85.0
Other opioids	3	15.0	1	5.0	7	35.0
Simple analgesics	19	95.0	18	90.0	19	95.0
Prescribed sedatives						
Midazolam	18	90.0	15	75.0	15	75.0
Propofol	1	5.0	-	-	2	10.0
Pain during TA						
Yes	14	70.0	16	80.0	17	85.0
Significant pain during TA						
Yes	7	35.0	11	55.0	11	55.0

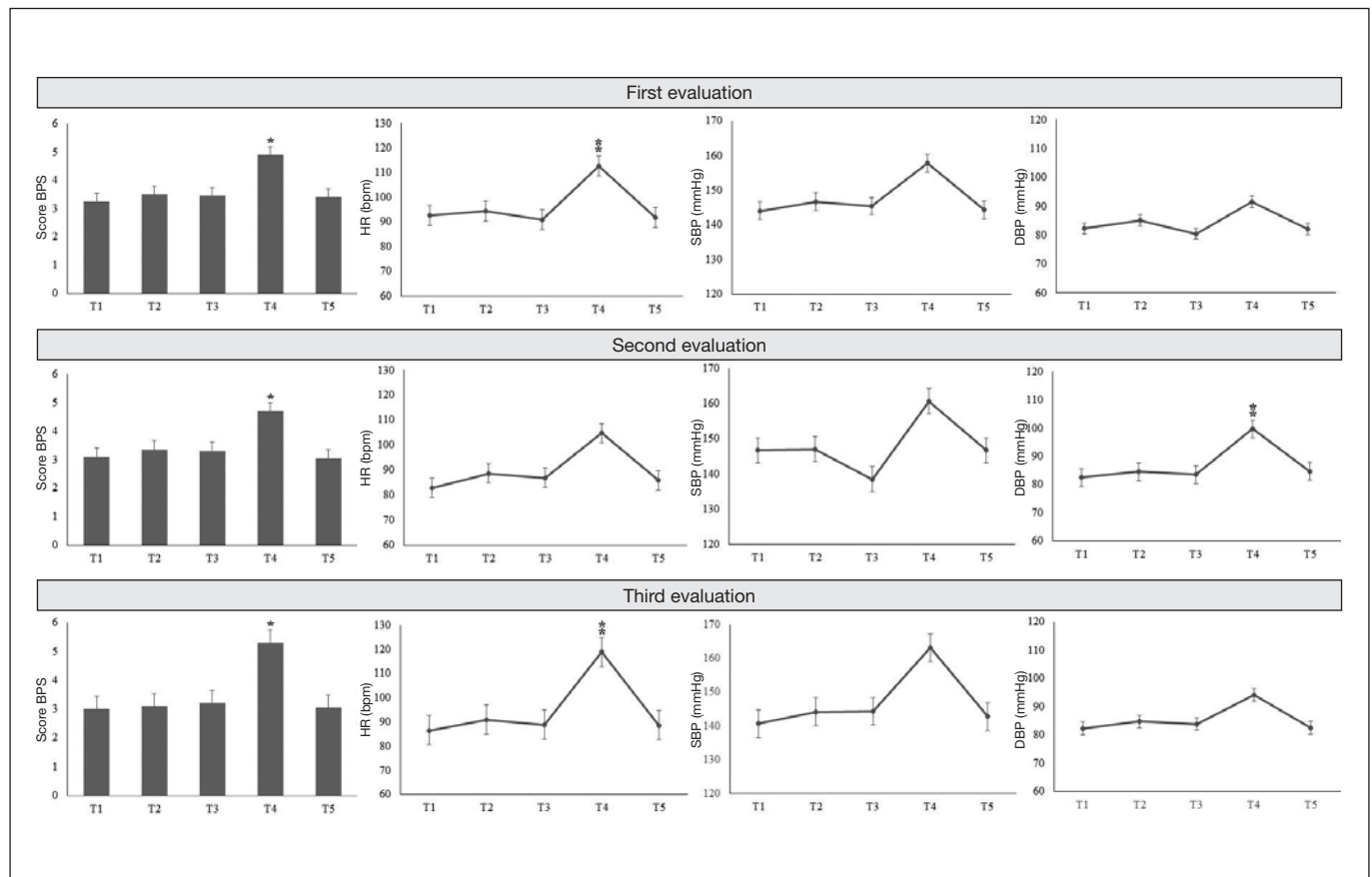RASS = Richmond Agitation Sedation Scale; TA = tracheal aspiration.

Figure 3. Pain evaluation by the Behavioral Pain Scale and physiological parameters
* T4 x T1, T2, T3 and T5: Friedman's test (p<0.001) and Bonferroni's post-test (p<0.05); ‡ T4 x T1, T2, T3 and T5: ANOVA (p<0.05) and Bonferroni's post-test (p <0.05).

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DISCUSSION

Pain relief is a fundamental right of the human being and a fundamental step for the assistance humanization[13]. Despite being considered the fifth vital sign, pain is not systematically assessed in several institutions[14]. This fact is even more worrying in the intensive care picture, given that institutional protocols of analgesia and sedation are scarce and there is a mistaken belief that sedated patients do not feel pain[15].

Pain is an inherent experience of trauma, especially in victims of TBI[16]. The results of this study show that victims of severe TBI, young adults, deeply sedated and submitted to mechanical ventilation experience pain during TA, corroborating the study done with 755 intensive care's patients[17]. This result demonstrates that the analgesia of these patients should be optimized. In addition, it is important for practitioners to look for the correct implementation of the TA technique, as a recent study emphasizes that following the American Association for Respiratory Care (AARC 2010), recommendations can reduce pain during the procedure[18].

As for analgesia, the most recent guidelines on ICU agitation, sedation and delirium have prioritized the approach of analgesia and sedation, with pain relief and comfort in detriment of deeper sedation, reducing the need for the use of hypnotics[19,20]. However, deep sedation and irregular prescription of analgesics prevailed in our results, evidencing that oligoanalgesia and the regimen of analgesia and sedation are still predominant in the institution where the study was performed.

Exacerbated use of benzodiazepines adversely influences patient outcomes, as it may be associated with respiratory depression, hemodynamic instability, changes in bowel function, micro aspirations, increased risk of pressure injury, immunosuppression, muscular weakness, increased costs, the persistence of cognitive deficits, longer ICU stay, delirium and greater dependence on the mechanical ventilator[15,21].

Although elevated, pain prevalence during TA found in this study may have been underestimated, since deep sedation may reduce the manifestation of pain-related behaviors[15]. In addition, patients with traumatic brain injury may present unconventional behaviors when the painful condition lasts, which may have underestimated the results of this study[22].

Pain assessment is indispensable for proper pain handling and to avoiding deep sedation. In this way, valid, reliable, easy-to-use instruments with clear and objective descriptions are essential in this process[23], including for systematic recording, which does not occur in the study's institution. Although the psychometric properties of the scale used in this study have been tested in different countries[24], including Brazil[6,7], BPS is not an instrument widely used in Brazilian ICUs.

In this sense, the physiological parameters, such as those investigated (HR, SBP, and DBP), are still used to evaluate the pain phenomenon. The present results corroborate with other studies[25,26], which indicate that these parameters cannot be used in isolation since they are not pain-specific and are influenced by other factors. None of the investigated parameters presented a consistent increase during the three evaluations, i.e., they did not present discriminant validity. The persistence of these parameters' isolated use in clinical practice may be related to the lack of knowledge about pain in patients sedated or unable to self-report.

Studies[15,27,28] have demonstrated the precarious knowledge in pain of students and health professionals. This fact is worrying since pain training must be transversal and continuous. Therefore, practitioners should be able to use valid and reliable instruments for measurement and assessment of pain specific to each situation, as well as being aware that adequate pain handling can prevent clinical complications, agitation, delirium, post-traumatic stress syndrome[15] and even chronic pain after discharge from ICU[29].

CONCLUSION

There was a high prevalence of pain among mechanically ventilated young adults with severe TBI during TA, demonstrated by a significant increase in BPS-Br scores. Deep sedation with the use of benzodiazepines at the expense of analgesia and sedation was predominant in this study. Although they presented elevation during TA, the physiological parameters were not valid indicators for pain detection. Therefore, they should not be used in isolation.

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