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Evaluation of traumatic brain injury patients with signs of alcohol intoxication.

Avaliação de pacientes vítimas de trauma cranioencefálico com sinais de intoxicação alcoólica.

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ABSTRACT

Objetive: to evaluate the influence of alcohol intoxication in the time to perform head computed tomography and tomographic findings in traumatic brain injury patients. **Methods:** a retrospective study of 183 traumatic brain injury patients, divided into two groups: 90 alcoholics and 93 non-alcoholics. Time interval from patient's arrival at emergency room to tomography was calculated for comparison between the groups, and tomographic findings were analyzed. **Results:** in the alcoholic group, the percentage of male patients was higher, the predominant age was between 31 and 40 years, aggression was the most frequent trauma mechanism, and these patients showed lower values on the Glasgow coma scale. It was observed that there was no statistical difference between the two groups regarding the time interval for tomography execution, as well as regarding the tomographic findings. In addition, in the alcoholic patients, when the Glasgow coma scale values were correlated with the time interval, there was no difference from scores 13 to 15 (mild traumatic brain injury) and those equal to or inferior than 12 (moderate and severe traumatic brain injury). **Conclusion:** signs of alcoholic intoxication did not influence the time interval for tomography execution. Patients under alcohol influence showed lower scores on the Glasgow coma scale due to the direct effect of alcohol and not due to a higher prevalence of tomographic findings.

Keywords: Brain Injuries, Traumatic. Brain Concussion. Brain Injuries. Tomography. Glasgow Coma Scale. Alcoholic Intoxication.

INTRODUCTION

Studies show an average alcohol per-capita consumption of 7.8 liters per year in the population over 15 years of age. Considering only alcohol consumers, this amount becomes 19.3 liters per person[1]. This alcohol consumption has been related to the decrease of innumerable cognitive abilities, which in turn may increase the risk of injuries. Globally, it is estimated that almost 1 million deaths and 52.4 million alcohol-related injuries occurred in 2016. Traffic accidents, self-harm, interpersonal violence, and falls caused the most common lesions[1-3].

In this context, it is observed that cranial trauma occurs in a large number of cases and is considered a public health problem, as it generally affects the most active and productive population. In addition, traumatic brain injury (TBI) is associated with high mortality rates and may lead to severe sequelae that impact on quality of life. A review study on TBI performed in Brazil has shown the great importance of an initial neurological assessment in order to avoid deaths and sequelae in the case of severe traumas[4].

When we relate alcoholism with TBI, it is observed that around 30% of patients with this type of trauma have been drunk at the time of the accident[3], with some studies showing values close to 50%[5]. Alcohol reduces the level of consciousness of TBI patients[2] and the Glasgow coma scale (GCS), widely adopted in clinical practice to assess this level of consciousness[6], aids clinical decision-making and guides the diagnosis and management of TBI patients in emergency departments and trauma centers[7].

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GCS assigns points to patient's performance based on three factors: eye opening (4 points), verbal responses (5 points), and motor responses (6 points). The scale reaches values ranging from 3 to 15 points, 3 corresponding to a coma and 15 to the normal state of a patient without trauma or neurological deficits[8]. The severity of TBI can be classified according to GCS values: from 13 to 15 being considered mild; from 9 to 12, moderate; and from 3 to 8, severe[9].

However, the use of this scale may be limited for alcoholic patients[6]. If a low score on this scale is attributed solely to alcohol, the result may be an underestimation of a possible brain injury severity and it may lead to an unnecessary delay in diagnostic and therapeutic interventions. On the other hand, injury severity may be overestimated, generating unnecessary interventions[2].

There are divergences in clinical studies whether alcoholic patients show lower GCS values compared to non-alcoholic. Some studies claim that this difference really exists[2,3,10], while other studies show that the values have no significant difference when measured in the emergency sector[7,11].

Cranial computed tomography (CCT) plays a crucial role in the reliable and rapid diagnosis of these lesions[12]. To increase the effectiveness of this imaging examination use in the detection of intracranial lesions in patients with GCS values from 13 to 15, some criteria are utilized, such as the New Orleans Criteria and the Canadian Head Rule, which are the most well-known and used. These criteria are very important, since not using them can delay the diagnoses of possible harmful injuries to the patient. On the other hand, their use when not carefully recommended may lead to unnecessary radiation exposure[13].

The present study was developed to test the hypothesis that alcoholic patients with TBI may have a diagnostic delay of possible acute brain injuries due to the difficulty in their clinical evaluation and uncertainty regarding the measurement of neurological examination data, such as GCS. A lower score on this scale attributed solely to alcohol could lead to a diagnosis delay.

Therefore, the objective of this study was to evaluate whether the presence of signs of alcohol intoxication may have influenced the time of CCT performance in alcoholic patients with TBI compared to non-alcoholic patients, correlating with the presence of tomographic findings.

METHODS

This is a retrospective study of 183 TBI patients treated at the emergency room of Hospital do Trabalhador during 2017. These patients underwent CCT and their clinical data, trauma mechanism, and injury characteristics were collected using hospital electronic record. Patients' GCS score was assessed at admission as part of the neurological examination and CCT was performed at the time it was indicated. The study was developed under the approval of the Research Ethics Committee of Hospital do Trabalhador (CAAE 83037418.0.0000.5225).

We included patients older than 18 years and under 60 years and excluded those with a history of chronic alcoholism, psychiatric syndromes, trauma mechanism for many days, causes of non-traumatic origin, and alcohol withdrawal.

In order to optimize data collection, we searched exams performed on Fridays, weekends, and holidays, in addition to holiday eves and days after holidays, as it was found, through an initial pilot test, that these were the days with the highest prevalence of alcoholic patients at emergency room.

The presence of alcohol intoxication was assessed by consulting medical records and, when recorded, was described as reported by the patient himself (herself) or verified by clinical datum, such as alcohol breath. Patients were divided into two groups according to this piece of information: alcoholics (90 patients) and non-alcoholics (93 patients).

The entry times registered in the medical records were computed in hours and minutes, as well as the time of CCT performance, and thus, the time interval between both was calculated in minutes. Other data were collected, such as gender, age, GCS (ranging from 3 to 15), trauma mechanism, presence of acute imaging findings, and, if present, what these findings were. Only one of the evaluated patients had no GCS record. Concerning age, data were categorized into groups: 18 to 30 years, 31 to 40 years, 41 to 50 years, and 51 to 60 years.

Trauma mechanisms were divided into six categories: aggression, same-level fall, fall from height, car crash, trampling, and crash against bulkhead. Tomography findings were divided into two categories: intracranial lesions and facial and/or skullcap fractures.

Time interval was correlated with three other variables. One of them compares time interval between alcoholic and non-alcoholic patients. Another analysis was performed only among patients with positive tomographic findings, comparing time interval between the two study groups. The third analysis was performed only among patients on alcohol use, separating them by GCS values, being one group for patients with scores ≥13 (mild TBI) and the other group for patients with scores ≤12 (moderate and severe TBI).

The collected data were then analyzed using R statistical software[14]. For descriptive analysis, measures of central tendency and dispersion were expressed as medians and minimum and maximum values (median, minimum - maximum) as they presented non-normal distribution. Normality of the samples was tested using Shapiro-Wilk statistical test. Categorical variables, in turn, were expressed as relative frequencies.

For inferential statistical analysis, Mann-Whitney and Kruskal-Wallis tests were used for continuous dependent variables, and chi-square and Fisher's tests for binary or categorical dependent variables. A significance level of 5% was considered for this study.

RESULTS

Of the 183 patients studied, 90 were alcoholic and 93 non-alcoholic. The percentage of male patients in the group with alcohol intoxication was higher than in the non-alcoholic group (96.6%, $p<0.01$). A significant difference in relation to the age group ($p=0.0124$) was also observed. Among the alcoholics, 30% were between 31 and 40 years old and 26.7% between 41 and 50 years old. Among the non-alcoholics, 44.1% were between 18 and 30 years old (Table 1).

There was also a significant difference regarding trauma mechanism ($p<0.001$). Of the alcoholic patients, 45.5% suffered aggression; 21.1%, had a car crash; while, among the non-alcoholic patients, the most prevalent trauma mechanism was car crash (29%), followed by fall from height (25.8%) (Table 1).

When analyzing the relationship between alcoholism and GCS scores, there was a significant difference at the time of patients' admission ($p<0.001$). Among alcoholic patients, we verified lower GCS values (median of 14) than among non-alcoholics (median of 15) (Table 1).

Regarding the time interval between admission to the emergency service and CCT performance, the median was of 69 minutes (16 to 834), considering the entire sample. When comparing the two groups of patients, there was no significant difference; the median was of 63.5 minutes (16 to 834) for alcoholics and 72 minutes (17 to 612) for non-intoxicated. When only patients with abnormal tomographic findings were analyzed, there was no significant difference between alcoholics and non-alcoholics (p=0.7976) (Table 2).

Of all patients, 52.7% had abnormal CCT findings. There was no significant difference between the two groups analyzed (p=0.329), as well as regarding the types of findings between the two groups (Table 3).

Among alcoholics, those with GCS rates of 13 or greater, the median time interval was 60 minutes (16 to 834) for CCT, compared to 69 minutes (17 to 243) for those with GCS ≤12, resulting in no statistical difference (p=0.7441) (Table 4).

Table 1. *Patients' characteristics, trauma mechanisms, and values on the Glasgow coma scale at admission.*

	Non-alcoholics (N=93)	Alcoholics (N=90)	p
Male	77.4%	96.6%	<0.001
Age group			0.0124
18 to 30 years	44.1%	25.6%	
31 to 40 years	17.2%	30%	
41 to 50 years	16.1%	26.7%	
51 to 60 years	22.6%	17.8%	
Trauma mechanism			<0.001
Aggression	19.3%	45.5%	
Same-level fall	10.7%	15.5%	
Fall from height	25.8%	12.2%	
Car crash	29%	21.1%	
Trampling	9.7%	5.5%	
Crash against bulkhead	5.4%	0%	
GCS*	Median 15 (12-15)	Median 14 (6-15)	<0.001

** Glasgow coma scale.*

Table 2. *Time interval between admission to the emergency service and CCT performance of all patients and of those with CCT findings.*

	Non-alcoholics (N=93)	Alcoholics (N=90)	p
Time interval (minutes)	Median 72 (17-612)	Median 63.5 (16-834)	0.6723
Time interval (minutes) of patients with abnormal findings on CCT*	Median 61 (17-353)	Median 60 (16-834)	0.7976

** Cranial computed tomography.*

Table 3. *Presence of abnormal CCT findings and types of findings.*

	Non-alcoholics (N=93)	Alcoholics (N=90)	p
Presence of abnormal CCT* finding	49.4%	56.7%	0.329
Type of finding			0.8152
Intracranial finding	12.9%	15.6%	
Facial/Skullcap fracture	21.5%	21.1%	
Intracranial finding and facial/Skullcap fracture	15%	20%	

** Cranial computed tomography.*

Table 4. *Time interval between admission to the emergency service and CCT performance in alcoholic patients.*

	Alcoholic with GCS*≤12 (N=11)	Alcoholic with GCS*≥13 (N=69)	p
Time interval	Median 69 (17-243)	Median 60 (16-834)	0.7441

** Glasgow coma scale.*

DISCUSSION

This study had its origin in the hypothesis that alcoholic patients may show a delay in the diagnosis of acute brain injuries. This hypothesis was based on the difficulty in the clinical evaluation of these patients in the emergency service. They may present a state of agitation and a lowering of consciousness level due to the effect of alcohol. However, when suffering a TBI, it becomes difficult to assess whether these changes in consciousness level are due to alcohol or possible acute brain injuries.

Based on the profile of patients treated at emergency services, a higher percentage of male patients[3,4] was already expected, regardless of intoxication state. Among alcoholics, this difference between genders became even more significant, with 96.6% of patients being male. However, the same did not occur when we analyzed data regarding the age of patients. This study found that most (56%) of the alcoholic patients was between 31 and 50 years old, while in previous studies the alcoholic patients were younger[3].

Regarding trauma mechanism, the results showed significant differences between the two groups of patients, and were divergent from literature, with aggressions being more frequent among the alcoholic patients. This may reflect a more pronounced violence rate in Brazil[15].

Regarding GCS values measured in the emergency service, there is some divergence in the literature[2,3,7,10,11]. The present study observed that alcoholic patients showed lower values when compared with the control group. This may be a factor that leads to confusion in the clinical assessment of patients, as it may cast doubt on whether this drop in GCS values is due to alcohol or a possible brain injury, as it had been hypothesized.

When we evaluated the time interval for CCT performance, there was no statistical difference between the two groups of patients, even with alcoholic patients presenting a lower GCS median than non-alcoholic patients. We attribute this result to a small sample number. This time analysis was also performed in the group of alcoholic individuals according to the values on the GCS, considering that patients with scores ≥13, that is, classified as mild TBI, could wait more time for CCT to be performed when compared to patients with scores ≤12 (moderate and severe TBI). In the latter group, the need for tomography is clearer and only this cut-off point on GCS is already sufficient to indicate CCT[15]. It is worth remembering that there is no protocol for the indication of exclusive CCT for alcoholic patients with TBI[16].

The Canadian Head Rule for CCT indication, one of the most used in clinical practice, states that CCT is indicated in mild TBI

(defined as loss of consciousness, amnesia, or disorientation in patients with GCS scores from 13 to 15), when there is any high- or moderate-risk criterion, or when there is coagulation disorder[13]. The high-risk criteria are: GCS <15 after two hours from trauma; open fracture or sinking of the skull; skull base fracture; vomiting (at least two episodes) and age ≥65 years. Moderate-risk criteria include pre-impact amnésia >30 minutes and severe trauma mechanism[17].

Following this same rule, if the alcoholic patient has mild TBI and does not meet any criterion for moderate or severe risk, CCT will only be indicated for those with GCS<15 after two hours of injury. The median found in this study for the time interval of alcoholic patients with mild TBI was of 60 minutes. In this study, the objective was not to evaluate whether CCT indication criteria are followed, but this finding was important, since CCT scans may be being performed without the real need, subjecting the patient to unnecessary examinations and causing expenses to the public health system, besides subjecting the patient to significant doses of radiation[18].

Another important point is that there is no specific criterion for CCT indication in intoxicated patients. The New Orleans protocol, designed for patients with a GCS of 15, is the only one that considers signs of alcohol and other drug intoxication as data for CCT indication[13]. However, it does not advocate an observation period of these patients, something which is fundamental when it comes to alcoholic patients and with overestimation of GCS for CCT indication. What is observed is a high sensitivity of New Orleans Criteria in relation to other protocols, since the specificity of this criterion is extremely low and may lead to excessive indication of tomography[19].

The discussion about the importance of the existence of an exclusive protocol for intoxicated patients who had TBI was raised because, since the GCS is one of the main guidelines for the indication of this test and it is altered in alcoholics, maybe these patients do not fit these already existing protocols. Another contributing factor is that it has already been verified that, in intoxicated patients with TBI, GCS values increase as the body metabolizes the drug and this is clinically important because clinical evaluation and conducts to be taken would be different[7], and perhaps excessive CCT indications would decrease if there was an observation period for mild TBI in alcoholic patients.

This study is retrospective and has common limitations to this type of work. Another limiting factor concerns the diagnosis timing of acute brain injuries, which does not occur exactly when CCT is performed. The actual diagnosis time was not in the system used for data search.

Thus, although the signs of alcohol intoxication did not influence the time interval for CCT performance, it was found that intoxicated patients had lower GCS scores, probably due to the direct effect of alcohol and not for a higher prevalence of tomographic findings in this group. The indication time of CCT showed no significant difference between the groups of alcoholics with mild TBI and moderate/severe TBI.

Due to the confusion that alcohol intoxication may cause in the level of consciousness and, consequently, in the clinical evaluation in the emergency service, we consider it important to develop specific criteria for the indication of CCT in this group of patients not to subject them to unnecessary examinations, but without causing a diagnostic delay of acute brain injuries.

R E S U M O

Objetivo: *avaliar, em vítimas de traumatismo cranioencefálico, a influência da intoxicação alcoólica no tempo para submissão destes pacientes à tomografia de crânio, comparando também os achados tomográficos nos pacientes alcoolizados e não alcoolizados.* **Métodos:** *estudo retrospectivo de 183 pacientes com traumatismo cranioencefálico, divididos em dois grupos: 90 alcoolizados e 93 não alcoolizados. Foi calculado o intervalo de tempo desde a chegada do paciente ao pronto socorro até a realização da tomografia para comparação entre os grupos, e analisados os achados tomográficos.* **Resultados:** *no grupo alcoolizado, o percentual de pacientes do sexo masculino foi maior, a idade predominante situava-se entre os 31 e os 40 anos, a agressão foi o mecanismo de trauma mais frequente e estes pacientes apresentaram valores mais baixos na escala de coma de Glasgow. Observou-se que não houve diferença estatística entre os dois grupos quanto ao intervalo de tempo para realização de tomografia, bem como, em relação aos achados tomográficos. Além disso, nos pacientes alcoolizados, quando correlacionados os valores da escala de coma de Glasgow com o intervalo de tempo, não houve diferença entre valores de 13 a 15 (traumatismo cranioencefálico leve) e os iguais ou menores do que 12 (traumatismo cranioencefálico moderado e grave).* **Conclusão:** *os sinais de intoxicação alcoólica não influenciaram no intervalo de tempo para realização da tomografia. Os pacientes alcoolizados apresentaram escores mais baixos na escala de coma de Glasgow por efeito direto do álcool e não por uma maior prevalência de achados tomográficos.*

Descritores: *Lesões Encefálicas Traumáticas. Concussão Encefálica. Lesões Encefálicas. Tomografia. Escala de Coma de Glasgow. Intoxicação Alcoólica.*

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