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ABSTRACT

Objective: To translate the Galveston Orientation and Amnesia Test into Portuguese and to validate this Portuguese version among Brazilians who had traumatic head injury. **Methods:** The Galveston Orientation and Amnesia Test was translated into Portuguese and back-translated to English by independent translators, and equivalence between the two versions of the test was examined. A sample of 73 Brazilians adults with closed head injury was used to establish the psychometric properties of the Portuguese version of the test. **Results:** The estimate of reliability of the Portuguese version of the test was á = 0.76. The convergent and discriminative validity of the test was determined through comparison between an individual's scores on the Portuguese version of the test and the Glasgow Coma Scale. **Conclusion:** The study's findings suggest that the Portuguese version of the *Galveston Orientation and Amnesia Test* might be used to measure Post Traumatic Amnesia among Brazilians with closed head injury.
Keywords: Craniocerebral trauma; Amnesia; Neuropsychological tests; Validation studies [Publication type]

RESUMO

Objetivo: Traduzir e validar o Galveston Orientation and Amnesia Test para uso em nosso meio. **Métodos:** Esse teste foi traduzido para o português e retro-traduzido para o inglês por diferentes especialistas na língua e por fim, feita a avaliação da equivalência entre o instrumento original e a versão retro-traduzida. Sua aplicação em 73 vítimas de trauma crânio-encefálico contuso e a indicação da gravidade dessa lesão, estabelecida pela Escala de Coma de Glasgow, permitiram verificar as propriedades de medida do instrumento. **Resultados:** A confiabilidade verificada pelo Alfa de Cronbach resultou em 0,76. Houve indicação de validade convergente e discriminante do instrumento quando os resultados de aplicação do Galveston Orientation and Amnésia Test foram analisados perante a gravidade do trauma crânio-encefálico. **Conclusão:** Os resultados observados dão suporte para a aplicação do *Galveston Orientation and Amnesia Test* em nosso meio como indicador do término da amnésia pós-traumática.
Descritores: Trauma crâniocerebral; Amnésia; Testes neuropsicológicos; Estudos de validação [Tipo de publicação]

RESUMEN

Objetivo: Traducir y validar el Galveston Orientation and Amnesia Test para su uso en nuestro medio. **Métodos:** El test fue traducido al portugués retrotraducido al inglés por diferentes especialistas en la lengua y por fin, realizada la evaluación de la equivalencia entre el instrumento original y la versión retrotraducida. Su aplicación en 73 víctimas de traumatismo encéfalo craneano con constusión y la indicación de la gravedad de esa lesión, establecida por la Escala de Coma de Glasgow, permitieron verificar las propiedades de medida del instrumento. **Resultados:** La confiabilidad verificada por el Alfa de Cronbach fue de 0,76. Hubo indicación de validez convergente y discriminante del instrumento cuando los resultados de aplicación del Galveston Orientation and Amnésia Test fueron analizados frente a la gravedad del traumatismo encéfalo craneano. **Conclusión:** Los resultados observados dan soporte para la aplicación del *Galveston Orientation and Amnesia Test* en nuestro medio como indicador del término de la amnesia post-traumática.
Descritores: Trauma cráneo cerebral; Amnesia; Pruebas neuropsicológicas; Estudios de validación [Tipo de publicación]

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INTRODUCTION

Non-penetrating traumatic brain injury (TBI) is normally followed by a transitory state of confusion and disorientation, known as posttraumatic amnesia (PTA). This transitory state is characterized by amnesia related to past events and behavioral disturbances such as insomnia, agitation, fatigue, confabulation and, occasionally, affective and psychotic symptoms[1,2].

PTA has been a relevant indicator for TBI[3], and it is used in developed countries to determine whether or not rehabilitation would be worth among patients presenting with this kind of injury[4]. Among all behavioral measures available, PTA is considered the best predictor of cognitive, neurological, and functional impairment[3]. PTA has been extensively studied for over 70 years, after Ritchie Russel, in 1932, presented it as an index of head injury severity[3]. Until the 80's, PTA duration and resolution were determined retrospectively, questioning the patient after his memory was reestablished[5].

Critiques made to the accuracy of the retrospective measure highlighted the subjectiveness of the method and considered that PTA duration and end point could be only estimated after the patient has recovered from mental confusion[5-7]. In 1979, Levin, O'Donnell e Grossman published the Galveston Orientation and Amnesia Test (GOAT)[5]. This was the first of a number of measures aiming to establish prospectively the duration of amnesia following TBI.

The GOAT has been widely used since its publication. The test was used in several studies and its importance in detecting PTA and in determining its duration has been empirically reported[2,8]. Therefore, having no instruments in Portuguese to measure one's orientation and amnesia, the purpose of this study was to translate and validate the GOAT in Portuguese and make it available to researchers and clinicians in Brazil.

METHODS

GOAT's translation

Authorization was obtained from authors[5] to translate and validate the GOAT in Portuguese. This was accomplished in three phases: translation into Portuguese, back-translation into English (instrument was translated from Portuguese back to its original language), and evaluation of cross-cultural equivalence between the original GOAT and the back-translated version.

Using Guillemin and cols's[9] methodology, translation of original instrument from English into Portuguese was performed by two nurses, specialists in intensive care and proficient in both languages (Portuguese and English). Two other nurses, who were also experts in English and Portuguese, performed back-translation of the scale into English. Then, a Canadian neuroscience nursing specialist who was proficient in English and Portuguese, evaluated the cross-cultural equivalence between the original instrument and the back-translated version. During the translation and back-translation process, the translators worked independently. After consistency of the translations and back-translations, a final Portuguese version of the scale was produced.

Reliability and convergent and discriminant validity

Internal consistency analysis was performed to verify the reliability of the instrument. Cronbach's Alpha set at .70 or above was the minimum acceptable estimate of reliability[10]. Convergent and discriminant validity were determined by examining the relationship among subject's initial impaired consciousness, PTA duration, and TBI severity.

The Glasgow Coma Scale (GCS) and the GOAT were the measures used to detect such alterations. Frequently, GCS is used as an early index to assess severity of TBI, after stabilization of respiration and homodynamic. GCS scores ranging from 3 to 8 indicate severe TBI; scores from 9 to 12 indicate moderate, and scores of 13 or above indicate mild injury[11].

In this study, the first GCS score registered in the medical records by the neurosurgery team was used to characterize TBI severity. The GCS scoring is routinely performed by the neurosurgery team after the patient's respiratory and homodynamic stabilization.

To determine convergent validity it is hypothesized that the GCS score established by the neurosurgery team in the first assessment and the GOAT initial score were positively correlated. This hypothesis was based on the assumption that scores on the instrument would be in the same direction. Also, it was hypothesized that PTA duration in days would correlate negatively with the first GCS score as well. Here, the negative correlation hypothesis is based on the assumption that a longer PTA duration predicts a more severe TBI, while a higher GCS scores represent less severe injuries. The analysis consisted of computing Spearman-Brown's correlation coefficients.

Discriminant validity was determined through comparison of the mean values of the GOAT scores and the CGS. Patients were divided into a case or a control group. The control group was formed by patients whose injuries were classified as mild or moderate TBI by the GCS scores (9 to 15), while the case group was formed by patients whose injuries were classified as severe TBI by the GCS scores (3 to 8). Also, comparison between the GOAT score and the PTA scores was made. Orientation and amnesia was measured daily with the GOAT to determine PTA duration in days. Analysis consisted of Kolmogorov-Smirnov test and Student t-

Test for independent samples.

Statistical significance for this study was set at p-values less than 0.05.

Application of GOAT and GCS

To evaluate the reliability and validity of GOAT, the field testing of the Portuguese version of the GOAT used inpatients from a governmental trauma center hospital, located in Western São Paulo. TBI patients were admitted to this hospital through the emergency room (ER). The study sample were non-penetrating TBI subjects, aged between 12 and 60 years-old, without previous diagnosis of either TBI or memory impairments, who where admitted in the study after injury and underwent in-hospital treatment from January, 3rd to May, 5th, 2001.

During the data collection period, admissions were screened for TBI victims who were treated in the emergency room and admitted in hospital within 24 hours. In order to identify and locate study subjects, medical records of patients admitted through the emergency room were screened daily, and further information was gathered from ER nurses. Once eligible subjects were located, GOAT was applied daily and preferably at the same time of the day, until the PTA end point was determined (minimum of 75 points during two successive days). However, some circumstances described in the subject's records determined ending of follow-up before PTA resolution. Surgeries, out-of-unit diagnostic tests or any other situation that might trouble the test's application were succinctly described in the data collection instrument but did not determine the end of the subject's follow-up.

GOAT's total score was obtained according to its authors, therefore subtracting error scores from 100 (Total score = 100 – error scores). GOAT presents 10 questions which are orally exposed to the subject. Error scores are previously assigned for incorrect response to items; such scores are described in the test, in brackets after each item, as presented in Figure 1. GOAT scores less than 75 indicate that amnesia has not been resolved. Previous research support that the PTA end point is the first day of two consecutive days, when the subject's GOAT score was 75 or greater [4,5].

Because the inclusion of a coma period in determining the PTA duration is not unanimous among authors, two distinct criteria were used to establish the value of this variable[2,5,7,12-16].In the first value, the difference between the date of injury and the first of two consecutive GOAT scores of 75 or greater determined amnesia's duration. The second value was determined trough the difference, in days, between the first of two days when the patient punctuated 6 for best motor response in GCS and the first of two consecutive GOAT scores of 75 or greater[4].

By the end of the data collection period, data were inserted in Excel for Microsoft Windows. After information was inserted in the data bank, data was analyzed to determine the population profile and to address proposed study objectives. The study was authorized by the Committee of Research Ethics from the study hospital and the subjects were included in the study sample after the provision and signature of an informed consent by the person with an injury or a legal responsible party.

RESULTS

After submission to different translation steps, GOAT Portuguese version emerged and is presented in Figure 1.

During the data collection period, 73 subjects of traumatic brain injury met the study inclusion criteria, (72.6%) males and (79.5%) and they were between the ages of 12 to 36 years. The most frequent cause of traumatic brain injury was traffic crashes (75.3%), followed by falls (21.9%). For the severity of TBI as assessed by GCS, most victims were divided between extremes, being 35.6% classified as severe and 48.0% as mild. Mean time of victim follow-up was 8.7 days. PTA mean duration was 7.1 and 5.1 days, respectively considering and not considering coma periods.

From 73 potential participants enrolled in the study, only 40 (54.8%) had PTA duration determined. Several situations impeded daily assessment of subjects until amnesia was resolved: 14 (19.2%) were discharged from the hospital; 9 (12.3%) died; 5 (6.8%) were transferred from the study hospital; 2 (2.8%) escaped from the hospital and 3 (4.1%) presented impairments which impeded memory evaluation (aphasia and behavioral disturbances).

The GOAT Cronbach's alpha was 0.76, value above the minimum acceptable estimate of reliability[10].

Results concerning convergent validity are presented in Table 1.

Table 1 - Correlation between variables of interest to proceed with convergent validation of GOAT, HCFMUSP, 2001.

Variables	Spearman's coefficient of correlation
GOAT (1st assessment) x GCS (severity of TBI)	r = 0.56; p<0,005
Amnesia duration (date of trauma) x GCS (severity of TBI)	r = -0.53; p<0,005
Amnésia duration (after coma) x GCS (severity of TBI)	r= -0.53; p<0,005

Table 1 shows positive correlation between initial GCS score and first GOAT score (r = .56; p < .05). Also, there was a negative correlation between GCS and PTA duration (r = -.53; p < .05).

Table 2 shows the discriminant validity between the GOAT and the PTA duration. The Student t-test for independent samples supported statistical evidence (p< 0,005) that the control group mean score is greater than the case group values. The Student t-Test for independent samples also revealed statistical significance to assert that mean PTA days of the case group overcomes duration of PTA days of the control group, when both means to establish PTA duration are used.

DISCUSSION

The quality of a measurement instrument relates to the extent to whether it is valid and reliable. Reliability is concerned with accurate and random error-free measures, while validity refers to whether a measurement instrument accurately measures what it is supposed to measure. To be valid, an instrument has to be congruent with the construct it is supposed to measure. That is, validity is concerned with demonstrating an instrument's adequacy to measure what it is meant to measure. Evidence demonstrated in the results of this study support GOAT's convergent validity, since results obtained from the use of GOAT correlated with another measure the same construct, the GCS. Also, the results indicated the instrument's discriminant validity because it distinguished two groups of respondents who would theoretically differ.

The validity of GOAT was also documented by its authors[5], who considered the results of GCS and computerized tomography as criteria for evaluating TBI gravity. In this study, 52 victims of TBI with different

Figure 1 - Portuguese version of Galveston Amnesia and Orientation Test

	PONTOS DE ERRO
1. Qual o seu nome?(2*)................................ Qual a data do seu nascimento? (4*) .... Onde você vive? (4*)..	------
2. Onde você está agora? (5*) cidade...................................... (5 *) hospital............................ (não é necessário dar o nome do hospital)	------
3. Qual a data que você foi admitido neste hospital? (5*) .... Como você chegou aqui? (5*)	------
4. Qual foi a primeira coisa que você lembra depois do acidente?(5*)........................ Você pode descrever com detalhes (por ex: data, hora, pessoas) a primeira coisa que você lembra depois do acidente? (5*)	------
5. Você pode descrever a última coisa que você lembra antes do acidente? (5*)............ Você pode descrever com detalhes (por ex: data, hora, companhia) a ultima coisa que lembra antes do acidente? (5*)...	------
6. Que horas são agora?........(1 para cada ½ hora de erro da hora correta, num máximo de 5)*	------
7. Qual é o dia da semana hoje? .... (1 para cada dia que se desvia do dia correto)*	------
8. Que dia do mês é hoje? .. (1 para cada dia que se desvia da data correta, num máximo de 5)*	------
9. Em que mês estamos? .... (5 para cada mês que se desvia do correto, num máximo de 15)*	------
10. Em que ano estamos? ...... (10 para cada ano que se desvia do correto, num máximo de 30)*	------
TOTAL DE PONTOS DE ERRO	------
ESCORE TOTAL (100 – TOTAL DE PONTOS DE ERRO)	------
* pontos de erro a serem atribuídos	

Table 2 - Comparison of control group and case group mean, HCFMUSP, 2001.

Groups Variables	Case(GCS 9 a 15)		Control (GCS 3 a 8)		P-value
	Mean	**Standart Deviation**	**Mean**	**Standart Deviation**	
GOAT (1st Assessment)	32.88	29.72	71.09	28.88	= .005*
Amnesia duration (date of trauma)	14.45	10.86	4.38	5.61	< .02*
Amnesia duration (after coma)	10.09	8.65	3.36	3.88	< 0.04*

(*) Comparison using t Student Test for independent samples

severity levels were tested with GOAT and the results of the test was compared with the three indicators of GCS (eye opening, best verbal and best motor response) as determined by the neurosurgeon upon admission. Results showed that GOAT scores lower than 75 were strongly related to lower scores in all three GCS indicators. Also, when GOAT's results were confronted with brain tomography findings, diffused bilateral brain injury was related to amnesia periods longer than 14 days, when compared to injury restrained to only one side of the brain. Still aiming to validate GOAT, its authors analyzed the relation between PTA duration, GOAT determination, and TBI late outcome. A significant relationship was observed.

Other study analyzed 164 individuals admitted to a TBI rehabilitation unit. The study results indicated significant correlation ($r^2 = 0,233$) between the higher GCS score in early posttraumatic period and PTA duration [17]. The relation between both variables was weaker than the evidenced in the present study. However, important differences could be noticed in the sample under investigation and in two other aspects. In this study, subjects whose GOAT score was 75 in admission had a PTA duration estimated through medical records and family interviewing. Also, to analyze correlation, PTA was considered as weeks rather than days, different from the present study.

CONCLUSION

The results of GOAT's reliability, convergent, and discriminant validity observed in this study sum up to the analysis performed by its authors and support the use of GOAT as an indicator of cerebral alterations after non-traumatic TBI in our reality.

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