VALIDITY AND RELIABILITY OF THE PORTUGUESE VERSION OF THE CONFUSION ASSESSMENT METHOD (CAM) FOR THE DETECTION OF DELIRIUM IN THE ELDERLY

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ABSTRACT - This study has tested the validity and reliability of the Portuguese version of the Confusion Assessment Method (CAM), a diagnostic assessment instrument for delirium developed by Inouye et al. (1990). The sample was formed by 100 patients with 60 and more years of age, admitted at the emergency service of Santa Casa de São Paulo, in the time periods between July and August, 1996, November and December, 1996 and February and March, 1997. The sensibility was 94.1% and specificity 96.4%. The assessors reliability in a sample of the 24 patients resulted in a kappa = 0.70. We have concluded that CAM is an adequate instrument to assess the presence of delirium, reliable to assess elderly patients at the emergency services.

KEY WORDS: delirium, elderly, emergency service, validity, CAM.

Presently, delirium is defined as an organic brain syndrome without specific etiology, characterized by the simultaneous presence of disturbances related to consciousness and attention, perception, thinking, memory, psychomotor behavior, emotions and sleep-wake cycle¹. Prevalence studies indicate that delirium is present in 10-24% of adults admitted to hospital and that another 32% will develop the disorder as inpatients²,³. Typical symptoms of delirium include reduced ability to focus and maintain attention, memory deficits, disorientation, language difficulties, illusions, hallucinations, and many other behavioral abnormalities. Infection, cardiovascular diseases, metabolic disturbances, and drug use or withdrawal are the most frequent causes of delirium⁴-⁵. Only 33-64% of the patients with delirium are correctly identified by practicing physician⁶-¹⁰. This is a major source of concern, as delirium is associated with increased morbidity and mortality¹¹-¹⁶.

A number of scales and semi-structured interviews have been designed to assist the clinician with the assessment and diagnosis of delirium¹⁷. One such instrument, the “Confusion Assessment Method” (CAM), has gained wide acceptance among medical practitioners. The scale shows good sensitivity (94-100%) and specificity (90-95%) when compared to the diagnosis of delirium according to the Diagnostic and Statistical Manual Disorders (DSM) III-R criteria¹⁸ and inter-observer reliability rates are high (kappa=0.81 to 1.00)¹⁹.

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We designed the present study to investigate the reliability of the Brazilian version of the CAM as well as validity according to DSM-IV criteria for the diagnosis of delirium

**METHOD**

One hundred subjects were selected among the older adults (age 60 years or over) assessed during the Winter and Spring of 1996, and Summer of 1997 at the Emergency Room of a large teaching hospital in the city of São Paulo, Brazil, the “Hospital Santa Casa de São Paulo”. Patients in mutism or those who scored 11 or more in the “Glasgow scale” 20 were excluded from the study.

All subjects were assessed with the Brazilian version of the CAM 19. The scale was translated from the original version into Portuguese and then back into English by an independent translator with the aim of ensuring the maintenance of the meaning of all items. Briefly, the CAM consists of 9 sections assessing rate of onset, attention, thinking, level of consciousness, orientation, memory, sensory perception, psychomotor activity, and sleep-wake cycle (Table 1). The diagnosis of delirium by the CAM requires the presence of acute onset/fluctuating course and inattention, and disorganized thinking or altered level of consciousness.

All subjects were assessed by a geriatrician with the CAM within 24 hours after admission to the Emergency Room. An independent psychiatrist interviewed patients using the DSM-IV criteria for the diagnosis of mental disorders (including delirium). The interval between these two assessments was never longer than 2 hours. A subset of 24 subjects independently rated with the CAM by geriatrician and a clinician during the same interview. These rates were used to investigate the inter-observer reliability of the CAM.

Data analysis. The data were analyzed using the Statistical Package for the Social Sciences (SPSS 6.0 for Windows). Likelihood ratio analysis of contingency tables was used in the investigation of categorical data, the statistical result being distributed as chi-squared. The relative risk of certain events was estimated by the odds ratio statistic. Agreement between raters and between CAM/DSM-IV diagnosis of delirium was calculated with the kappa statistic. Student’s t-test (t) was used to compare the means of continuous (in practical terms) non-skewed data such as age (the degrees of freedom for the t-tests equal the total number of subjects minus 2). Ninety-five percent confidence intervals (CI) were calculated for the means, difference between means (Cid), and odds ratio (Ciodds). In the case of non-parametric data the Cid refers to difference between means, and is presented only as an estimate of the difference between groups.

**RESULTS**

A total of 1044 patients or above were assessed at the Emergency Room during the study period. Three hundred and ninety-six (37.9%) were aged 60 years or older, although only 100 of them were included in the study. Reasons for exclusion include: (A) the clinical state of the patient prevented assessment (n= 61), (B) the time length between assessment with the CAM and the mental state evaluation according to the DSM-IV was longer than 2 hours (n= 41), (C) the patient was discharged from the Emergency Room in less 24 hours (n= 194).

The mean age of the 100 subjects included in the study was 73.80 (CI= 72.12 to 75.48). Fifty-two were male, 46 were married, and 84% were of European descent. Third-two subjects were unable to read or write fluently, and only 15 of the elderly had more than 8 years of formal education.

A convenience sub-sample of 24 patients was selected for the inter-observer reliability study of the CAM. There was no age (mean age=74.50/73.37, t=0.57, p=0.570) nor gender (percentage of males=58.3/50.0%), (20.51, p=0.0476) difference between subjects selected/not selected for the study. The two raters agreed on 22/24 ratings, with 3 of the patients receiving the diagnosis of delirium (kappa=0.70).

Seventeen and 19 subjects fulfilled criteria for delirium according to DSM-IV and the CAM respectively. Sixteen were classified as cases of delirium by both the DSM-IV and the CAM (kappa=0.86). The CAM showed good specificity (96.4%), sensitivity (94.1%), positive predictive value (84.2%), and negative predictive value (98.7%) for the diagnosis of delirium according to DSM-IV criteria. Table displays specificity, sensitivity, and positive and negative values for the diagnosis of delirium all CAM items.

**DISCUSSION**

Delirium is the result of an organic insult to the brain that hinders its appropriate functioning. In spite of its organic basis, the diagnosis of delirium is totally based on the clinical presentation of the patient, which can be subtle and difficult to identify. The use of International Statistical Classification of Diseases and Related Health Problems – 10th rev (ICD-10)22 or DSM-IV criteria has contributed to improve the awareness of clinicians for the diagnosis of delirium in clinical settings, although a large proportion of cases remain undiagnosed6,8. The systematic use of delirium scales increase the detection rate of cases.

A number of scales have been devised for that purpose. In 1973 Lowy and colleagues introduced the “Delirium Scale” (D-Scale), which included 53...
Table 1. Portuguese version of the confusion assessment method - CAM (Inouye et al., 1990).

|   |   |
|---|---|
| 1) | Início agudo |
|   | Há evidência de uma mudança aguda do estado mental de base do paciente? ( ) |
| 2) | Distúrbio da atenção* |
|   | 2.A) O paciente teve dificuldade em focalizar sua atenção, por exemplo, distraiu-se facilmente ou teve dificuldade em acompanhá-lo o que estava sendo dito? ( ) |
|   | - Ausente em todo o momento da entrevista ( ) |
|   | - Presente em algum momento da entrevista, porém de forma leve ( ) |
|   | - Presente em algum momento da entrevista, de forma marcante ( ) |
|   | - Incerto ( ) |
|   | 2.B) Se presente ou anormal, este comportamento variou durante a entrevista, isto é, tendeu a surgir e desaparecer ou aumentar e diminuir de gravidade? ( ) |
|   | - Sim ( ) |
|   | - Não ( ) |
|   | - Incerto ( ) |
|   | - Não aplicável ( ) |
|   | 2.C) Se presente ou anormal, descreva o comportamento: ( ) |
| 3) | Pensamento desorganizado |
|   | O pensamento do paciente era desorganizado ou incoerente, com a conversação dispersiva ou irrelevante, fluxo de ideias pouco claro ou ilógico, ou mudança imprevisível de assunto? ( ) |
| 4) | Alteração do nível de consciência |
|   | Em geral, como você classificaria o nível de consciência do paciente? |
|   | - Alerta (normal) ( ) |
|   | - Vigilante (hiperalerta, hipersesível a estímulos ambientais, assustando-se facilmente) ( ) |
|   | - Letárgico (sonolento, facilmente acordável) ( ) |
|   | - Estupor (dificuldade para despertar) ( ) |
|   | - Coma ( ) |
|   | - Incerto ( ) |
| 5) | Desorientação |
|   | O paciente ficou desorientado durante a entrevista, por exemplo, pensando que estava em outro lugar que não o hospital, que estava no leito errado, ou tendo noção errada da hora do dia? ( ) |
| 6) | Distúrbio (prejuízo) da memória |
|   | O paciente apresentou problemas de memória durante a entrevista, tais como incapacidade de se lembrar de eventos do hospital, ou dificuldade para se lembrar de instruções? ( ) |
| 7) | Distúrbios de percepção |
|   | O paciente apresentou sinais de distúrbios de percepção, como por exemplo alucinações, ilusões ou interpretações errôneas (pensando que algum objeto fixo se movimentava)? ( ) |
| 8) | Agitação psicomotora |
|   | Parte 1 - Durante a entrevista, o paciente apresentou aumento anormal da atividade motora, tais como agitação, beliscar de cobertas, tamborilar com os dedos ou mudança súbita e frequente de posição? ( ) |
|   | Retardo psicomotor |
|   | Parte 2 - Durante a entrevista, o paciente apresentou diminuição anormal da atividade motora, como letargia, olhar fixo no vazio, permanência na mesma posição por longo tempo, ou lentidão exagerada de movimentos? ( ) |
| 9) | Alteração do ciclo sono-vigília |
|   | O paciente apresentou sinais de alteração do ciclo sono-vigília, como sonolência diurna excessiva e insônia noturna? ( ) |

*As perguntas listadas abaixo deste tópico foram repetidas para cada item quando aplicáveis.
items assessing cognitive functioning. The D-Scale has the merit of having been one of the first attempts to make a more systematic evaluation of these patients, although its rather complex design limited its use in clinical practice. The “Mini-Mental State Examination” (MMSE) has also been occasionally used as a screening test for delirium, even though low rates are not necessarily indicative of delirium. Others have been specially designed for the evaluation of patients by non-medics. Examples are the NEECHAM Confusion Scale, Confusion Rating Scale, Clinical Assessment Confusion, Nursing Delirium Rating Scale and the Delirium Symptom Interview.

There also instruments that were designed to assess the severity of the clinical features of patients with delirium: Delirium Rating Scale, Memorial Delirium Assessment Scale, and Confusion State Evaluation.

The CAM was developed with the aim of helping non-psychiatrists identifying cases of delirium. The scale has been used widely, particularly because it is reliable and has a friendly format. The present study aimed to validate the Brazilian version of the CAM according DSM-IV criteria. The Scale showed high levels of sensitivity (94.1%) and specificity (96.4%). It also showed high positive (84.2%) and negative (98.8%) predictive values, which suggests that very few cases of delirium are not identified if the scale is used systematically. Only 4 of 100 subjects evaluated with the CAM were misdiagnosed. Three cases were incorrectly classified as delirium, with 1 of the patients actually suffering from dementia. Others had already suggested that the differential diagnosis of delirium and dementia can be difficult, particularly because they share many common clinical features. In addition, patients with dementia are more vulnerable to the development of delirium, so that both disorders can coexist in the same patient at the same time.

In summary, we showed that the CAM is a valid and reliable instrument for the assessment of delirium among older adults. We anticipate that its systematic use in high risk clinical settings, such as emergency rooms, will improve detection rates and contribute to decrease the morbidity and mortality associated with the clinical diagnosis of delirium.

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Table 2. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of CAM individual items

| Clinical feature                  | Sensitivity | Specificity | PPV   | NPV   |
|----------------------------------|-------------|-------------|-------|-------|
| Acute onset                      | 94.1        | 93.9        | 76.1  | 98.7  |
| Inattention                      | 94.1        | 87.9        | 61.5  | 98.6  |
| Disorganized thinking            | 76.4        | 98.7        | 92.8  | 95.3  |
| Altered level of consciousness   | 88.2        | 87.9        | 60.0  | 97.3  |
| Disorientation                   | 70.5        | 87.9        | 54.5  | 93.5  |
| Memory impairment                | 100         | 54.2        | 30.9  | 100   |
| Perceptual impairment            | 11.7        | 100         | 100   | 84.6  |
| Psychomotor agitation            | 17.6        | 98.7        | 75.0  | 85.4  |
| Psychomotor retardation          | 70.5        | 91.5        | 63.5  | 93.8  |
| Altered sleep-wake cycle         | 64.7        | 92.7        | 64.7  | 92.7  |
| Total CAM schedule               | 94.1        | 96.3        | 84.2  | 98.8  |
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