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Attention, vigilance and visuospatial function in hospitalized elderly medical patients: Relationship to neurocognitive diagnosis

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ABSTRACT

Objective: Efficient detection of neurocognitive disorders is a key diagnostic challenge. We explored how simple bedside tests of attention, vigilance and visuospatial function might assist in identifying delirium in hospitalized patients.
Methods: Performance on a battery of bedside cognitive tests was compared in elderly medical inpatients with DSM-IV delirium, dementia, comorbid delirium-dementia, and no neurocognitive disorder.
Results: 193 patients [mean age 79.9 ± 7.3; 97 male] were assessed with delirium ($n = 45$), dementia ($n = 33$), comorbid delirium-dementia ($n = 65$) and no neurocognitive disorder (NNCD) ($n = 50$). The ability to meaningfully engage with the tests varied from 84% (Spatial Span Forwards) to 57% (Vigilance B test), and was especially problematic among the comorbid delirium-dementia group. The NNCD was distinguished from the delirium groups for most tests, and from the dementia group for the Vigilance B test and the Clock Drawing Test. The dementia group differed from delirium groups in respect of the Months Backward Test, Vigilance A and B tests, Global assessment of visuospatial ability and the Interlocking Pentagons Test. Overall, patients with delirium were best identified by three tests – the Months Backward Test, Vigilance A test and the Global Assessment of visuospatial function with failure to correctly complete any two of these predicting delirium status in 80% of cases.
Conclusion: Simple bedside tests of attention, vigilance and visuospatial ability can help to distinguish neurocognitive disorders, including delirium, from other presentations. There is a need to develop more accurate methods specifically designed to assess patients with neurocognitive disorder who are unable to engage with conventional tests.

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1. Introduction

Major neurocognitive disorders are commonly misdiagnosed in hospitalized elderly [1,2]. Accurate and timely recognition of these disorders is important because they are linked to a variety of adverse outcomes [3] with improved management of these under-recognized neuropsychiatric presentations considered a key healthcare target [4]. However, accurate identification is complicated by considerable phenomenological overlap and high comorbidity between neurocognitive disorders, with the prevalence of delirium superimposed upon dementia in hospital settings estimated between 22–89% [5]. In addition, there is a lack of clarity regarding optimal approaches to bedside cognitive assessment [6].

Recent studies have helped to clarify the comparative phenomenological profile of major neurocognitive disorders [7–12]. These studies have mostly focused upon characterizing the neuropsychiatric features of comorbid illness rather than identifying distinguishing features of delirium versus dementia. Moreover, they include limited account of the comparative neuropsychological profile of various neurocognitive disorders. Direct comparisons of the usefulness of different bedside tests of cognition are few [13–15] but suggest that tests of attention, vigilance and visuospatial abilities have particular utility in distinguishing neurocognitive disorders because these domains are disproportionately affected in delirium [16–19]. In particular, the Months Backward Test

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(MBT) and vigilance A and B test can distinguish delirium and comorbid delirium-dementia from subjects with dementia without delirium [12,14,15]. Such studies can inform efforts to identify a 'cognitive vital sign' for routine and systematic assessment of cognition in everyday practice.

We studied performance on a battery of simple bedside tests of attention, vigilance and visuospatial function in elderly medical inpatients to: (i) explore whether performance on tests of attention, vigilance and visuospatial function differs according to delirium and dementia status, (ii) compare the coverage of common bedside cognitive tests in terms of percentage of patients able to meaningfully engage with each individual test, and (iii) identify which combination of tests is the most discriminating of delirium.

2. Methods

2.1. Subjects and design

We conducted a prospective cross-sectional study of neuropsychiatric symptoms and cognitive performance in referrals to a consultation-liaison psychiatry service of patients with delirium, dementia, comorbid delirium-dementia, as well as comparison subjects with no neurocognitive diagnosis (NNCD). Consecutive cases with altered mental state were identified on daily rounds by the medical team and referred for assessment and diagnosis by the research team.

Assessments were conducted by raters (ML, FA, HO'C, OW, DM) specifically trained in the use of the tests included herein (see below) and to further enhance inter-rater reliability, ratings associated with any uncertainty were discussed and agreed by consensus between raters.

Delirium was diagnosed according to a cutoff score of ≥15 on the severity scale of the DRS-R98 [20] and/or presence of DSM IV criteria based upon a full clinical assessment. Dementia was defined as a clear history of documented DSM-IV dementia (based on all available information at the time of assessment including clinical case notes and collateral history from family and/or carers) *or* a short Informant Questionnaire on Cognitive Decline in the elderly (IQCODE) score of ≥3.5 [23]. Comorbid delirium-dementia was defined as the presence of both disorders.

Each subject was assessed using a battery of cognitive tests (see below). For each test performance was rated on a standardised scale with a score of 0 used to denote those who were unable to engage with testing at a level that indicated any meaningful correct response or positively rateable engagement with the test. Standard cut off performances were used to apply a binary (pass/fail) for each test where a fail corresponded with evidence of clinically significant impairment. Assessors were not aware of the patients' formal neurocognitive diagnoses.

2.2. Informed consent

The procedures and rationale for the study were explained to all patients but because many patients had cognitive impairment at entry into the study it was presumed that many might not be capable of giving informed written consent. Because of the non-invasive nature of the study, University Hospital Limerick Regional Ethics Committee approved an approach to establishing consent by virtue of augmenting patient assent with proxy consent from next of kin (where possible) or a responsible caregiver for all participants in accordance with the Helsinki Guidelines for Medical research involving human subjects [22].

2.3. Assessments

Demographic data and medication at the time of the assessment were recorded. All available information from medical records and collateral history was used. Nursing staff were interviewed to assist rating of symptoms over the previous 24 h.

The Delirium Rating Scale-Revised-98 [DRS-R98] [20] is designed for broad phenomenological assessment of delirium. It is a 16-item scale with 13 severity and 3 diagnostic items with high interrater reliability, sensitivity and specificity for detecting delirium in mixed neuropsychiatric and other hospital populations. Each item is rated 0 (absent/normal) to 3 (severe impairment) with descriptions anchoring each severity level. Severity scale scores range from 0 to 39 with higher scores indicating more severe delirium. Delirium typically involves scores above 15 points (Severity scale) or 18 points (Total scale) when dementia is in the differential diagnosis.

The Informant Questionnaire on Cognitive Decline in the Elderly-Short Form (IQCODE-SF) is a validated screening tool for detecting cognitive impairment. The short version of the IQCODE includes 16 items that rate cognitive change over time, each of which are rated by an informant on a 5 point Likert scale. The short-IQCODE takes approximately 10 min to administer. The total score divided by the number of questions provides a mean item score where ratings ≥3.5 are considered indicative of longstanding cognitive difficulties and dementia [21].

The Delirium Etiology Checklist (DEC) [23] was used to document etiological underpinnings of delirium. This standardised checklist captures delirium etiology according to twelve categories. The presence and suspected role of multiple potential causes were documented for each case of delirium, rated on a 5-point scale for degree of attribution to the delirium episode, ranging from 'ruled out/not present/not relevant' (0) to 'definite cause' (4).

2.4. Cognitive testing

2.4.1. WORLD backwards

The WORLD backwards test was applied according to the format of the MMSE [24]. Each participant was asked to spell WORLD backwards. A point was awarded for each letter correctly identified and the total number of points was recorded. Patients who self-corrected their own mistakes without prompting when spelling WORLD backwards were given the point for each letter they were able to correct. Additionally if a patient was unable to recite a particular letter, they were told that letter in order for them to make an accurate attempt at the next letter to follow. Failure to correctly recite all five letters is considered to equate with clinically significant inattention (and thus a failed test).

2.4.2. Months Backward Test (MBT)

In this test, the participant was asked to recite the months of the year in reverse order starting from December. Test duration was a maximum of 90 s at which point the subjects best performance was noted. Scoring was according to that proposed by Meagher et al. [25] with patients rated as; unable to engage (0), able to engage but unable to reach July without more than one error (1), able to reach July with less than two errors (2), able to reach January without error (3). In subjects over age 60, failure to reach July without more than one error of omission equates with clinically significant inattention (and thus a failed test).

2.4.3. Spatial Span Forwards (SSF)

This was conducted according to the description in the Cognitive Test for Delirium (CTD) [26]. The SSF is a visual form of the digit span forwards. The subject is asked to copy the examiner in touching squares on a card (A5 size with 8 × 1 cm red squares). Each square represents a number and the test on each occasion requires that the squares corresponding to the digit span code are tapped at 1 s intervals. Two trials are conducted and the best performance is used. Failure to correctly complete a sequence of 5 or more numbers is considered to equate with clinically significant inattention (and thus a failed test).

2.4.4. Spatial Span Backwards (SSB)

Similarly, the SSB uses squares (blue) that are repeated in reverse order to that indicated by the assessor. Two trials are conducted and the best performance is used. Failure to correctly complete a sequence

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