

Original article

Intersecting pentagon copying and clock drawing test in mild and moderate Alzheimer's disease



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ABSTRACT

Background: In Alzheimer's disease (AD) drawing and constructional abilities are impaired and worsen as the disease progresses.

Purpose: To examine the feasibility of and develop a method for screening, diagnosis, and staging of dementia that can be quickly administered and interpreted in the clinical setting.

Methods: The study aims to describe a scoring mechanism of the intersecting pentagon copying (IPC) task based on the degree of drawing failure and pitted against the Mini-Mental State Examination (MMSE) and the clock drawing test (CDT), which is probably its most likely competitor for a small measure. This is a prospective cohort study of 91 probable dementia patients of the Alzheimer type referred to the geriatrician over a period of 3 years where the suitability of prescribing acetyl cholinesterase inhibitor is investigated. The patients were categorized as follows: 18 (20%) normal, 31 (34%) mild dementia, and 42 (46%) moderate dementia. The copying of the pentagon was part of the MMSE and these drawings were further scrutinized and a 10-point scoring method developed. Each IPC and CDT was blindly and independently rated by two geriatricians.

Results: The MMSE and Clinical Dementia Rating were found to have very similar staging results. The IPC had some commonality with these measures for patients defined as normal in that most score 10/10 for the IPC. However, both mild and moderate dementia patients according to other measures have an overlapping range of scores on the IPC scoring method developed. The highest association for the IPC with the CDT was 0.68. IPC had a stronger correlation with the total MMSE than with the two shorter versions.

Conclusion: The IPC seems to operate more as a screening tool rather than a dementia staging instrument and assists in identifying normal patients.

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1. Introduction

In Alzheimer's disease (AD) drawing and constructional abilities worsen as the disease progresses. Förstl et al¹ found a correlation between widespread brain changes and several neuropsychological deficits in severe AD, one of them being drawing disability. Compared to the controls, spontaneous drawings of patients with AD exhibited fewer angles, impaired perspective and spatial relations, simplification, and overall impairment. These are related

these to perceptual and executive dysfunction in the visuospatial domain.²

Patients with AD in particular have difficulty in visuospatial function tests. Visuospatial function is impaired in dementia more so later in the disease.³ Both the intersecting pentagon copying (IPC) test and the clock drawing test (CDT) embrace visuospatial constructional skills and executive function. In patients with AD, IPC is influenced by multiple cognitive functions as measured by Folstein's Mini-Mental State Examination (MMSE).⁴ According to Ala et al⁵ patients with mild and moderate dementia with MMSE scores > 13, IPC is more impaired in dementia with Lewy bodies than in AD.

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MMSE is of limited value in some patients with sensory deprivation or low education. Design emphasizing copying an intersecting double pentagon figures is one item in the MMSE test and given a maximum of “one” point. Assessment of visuospatial and executive functions is limited in MMSE and these functions may alter in some dementias in the early stages of the disease and become more pronounced than language and memory.⁶

The result of the CDT findings is abnormal in Alzheimer’s disease even in the early phase but can be impaired by perceptual to praxis difficulties.⁷ Brodaty and Moore⁸ have shown that the CDT can be better than the MMSE in the memory clinic. Singly these instruments have their difficulties. However, it will be useful to devise a set of short and precise tests that can be used in screening of dementia in the primary care setting and in the community.

2. Methods

This is a physician’s office-based retrospective study of 91 patients referred over a period of 3 years for the purpose of determining their suitability for an acetyl cholinesterase inhibitor.

2.1. Diagnosis

The diagnosis of dementia was established on clinical grounds using a modified form of the Cambridge Examination for Mental Disorders of the Elderly (CAMDEX).⁹ For the cognitive part of the examination Folstein’s MMSE⁴ was administered and supplemented by such items as the ability to abstract and calculate, and for perceptual abilities. Interviews with relatives or caregivers included such information as orientation, memory, behavior, and the ability to manage every day activities.

The inclusion criteria for the study were the satisfaction of the DSM-IV-R specifications for the diagnosis of dementia. This broadly included impairment of memory, deterioration of personality or intellectual ability and impaired functional capacity. The diagnosis of probable dementia of the Alzheimer type was based on the history, clinical presentation, and evidence of progressive intellectual deterioration and exclusion of other causes of dementia.

2.2. Data collection

In the MMSE, a number of cut off points have been put forward for dementia, however the international cut off point is considered to be 24. We have staged the MMSE scores as follows: 30–25 as normal; 24–21 as mild; 20–10 as moderate; and 9 or less as severe dementia. Subscores within the MMSE involving items relating to attention, registration, and memory recall ($n = 11$) and those relating to language ($n = 8$) were cumulated respectively. Dementia was graded on the Clinical Dementia Rating (CDR) scale of Hughes et al¹⁰ into three stages: 1, mild; 2, moderate; 3, severe; 0, no dementia; and 0.5, questionable (0 and 0.5 were taken as normal).

For the CDT, each patient was given a sheet on which a 10 cm circle was drawn and was told that the circle represents the face of the clock and instructed to write the numbers on it to make it look like a clock, and thereafter to indicate the time 10 minutes past 11 o’clock. There are numerous validated scoring systems with CDT but several studies have shown that recording methods by Sunderland et al¹¹ and Shulman¹² are more valid and reliable. Three scoring methods^{11–13} were used to analyze the CDT performance in this study.

IPC was part of the MMSE. A retrospective analysis of the drawings by the 91 patients was conducted and 10 portrayals identified. It was possible to assign a score of 1–10 for each portrayal. Score 10: normal – all sides were equal, all the angles of the figures were present, and the two figures intersected. A score of

“1” was given when there was no reasonable attempt at drawing or the drawing was just a squiggle or scrawl. The interval scores were judged on the level of performance. Score 9: one or two sides are of different length; Score 8 same as Score 9 but no intersection; Score 7: loss of one or more angles; Score 6: one pentagon incomplete; Score 5: reduced number of sides; Score 4: loss of sides and angles; Score 3: grossly incomplete sides; Score 2: not interpretable; the score for each portrayal is shown in Fig. 1. Rotation of the figures or tremor was overlooked according to the original criteria.⁹

2.3. Statistical analysis

Descriptive preliminary analyses were scores for all instruments. Chi-square tests were used to investigate whether the sex distribution by dementia staging was significantly different than what could be expected by chance. Chi-square test was also part of the Kruskal–Wallis test, which assessed the difference between mean rankings on each variable for the dependent level factors, which in this study was stages of dementia. The Mann–Whitney *U* test was used to assess each relevant pair comparison for when the Kruskal–Wallis test was significant. Pearson’s moment correlation coefficient was used to assess the linear association between the dementia diagnostic measures for the whole sample and Spearman’s Rho when examining the correlation between two ordinal variables. It was appropriate to use a parametric based test for the correlations as they were conducted on the entire sample of 91. However, when analyzing the results by dementia staging, the smaller number of cases required a nonparametric approach. IBM SPSS Statistics for Windows, Version 19.0 (IBM Corp., Armonk, NY, USA) was used for all analyses.

3. Results

A scoring method based on the degree of drawing failure has been described. Table 1 presents the results of dementia staging classification using both the CDR and MMSE scores. No patients in this study had severe dementia according to either scale. As shown

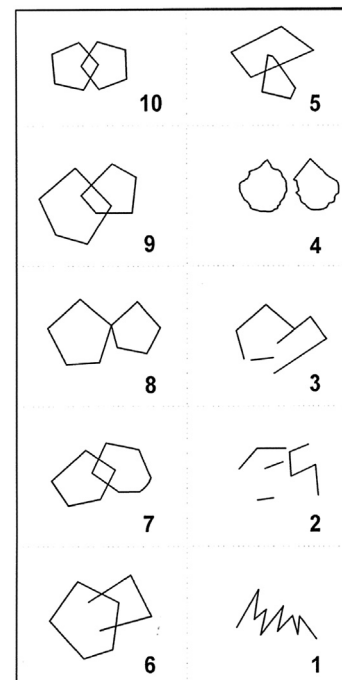


Fig. 1. Intersecting pentagon scoring system.

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