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Journal of the Neurological Sciences 229–230 (2005) 95–101

Journal of the Neurological Sciences

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Optimized neuropsychological procedures at different stages of dementia diagnostics☆

Marinella Damian[a,*], Markus Kreis[a], Bertram Krumm[b], Frank Hentschel[a]

[a]*Department of Neuroradiology, Central Institute of Mental Health (CIMH), Faculty of Clinical Medicine Mannheim, University of Heidelberg, 68159 Mannheim, Germany*

[b]*Department of Biostatistics, Central Institute of Mental Health (CIMH), Faculty of Clinical Medicine Mannheim, University of Heidelberg, 68159 Mannheim, Germany*

Available online 29 December 2004

Abstract

Objective: To establish a staged procedure in dementia diagnostics and to propose specific, abbreviated test batteries suitable for the three diagnostic stages: Primary medical care, neuro-psychiatry, and memory clinic.

Methods: A total of 159 participants underwent comprehensive clinical, neurological, neuropsychological, and MRI examinations. The neuropsychological examination took approximately 90 min per individual and was based on tests of verbal and visual memory, language, abstract thinking, attention, visuo-constructive and spatial functions. Stepwise discriminant analyses were performed to identify which subset of the 18 variables of the comprehensive test battery was the most appropriate to differentiate between specific diagnostic groups, and which variables could be discarded to abbreviate the test battery without substantial loss in diagnostic accuracy.

Results: The abbreviated versions of the test battery retained adequate diagnostic accuracy. The accuracy decreased by maximally 4%, whereas the test administration time dropped substantially from previously 90 min to a maximum of 50 min.

Conclusion: Depending on the diagnostic question, a specifically abbreviated version of the comprehensive test battery can be used without unacceptably reducing diagnostic accuracy.

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Keywords: Dementia; Cognitive impairment; Diagnostics; Neuropsychology; Primary care; Neuro-psychiatrist; Memory clinic

1. Introduction

In the memory clinic of the CIMH (Central Institute of Mental Health) in Mannheim, Germany, a comprehensive neuropsychological examination takes approximately 90 min per individual. For physicians in primary medical care and for neuro-psychiatric specialists, such time-consuming and expensive evaluations are not realistic in daily practice. Many patients, therefore, do not undergo cognitive screening [1,2], and if they are screened, no further diagnostics is done [3]. Screening for dementia does not provide an accurate measure of cognitive impairment [4,5]. A high percentage of individuals with dementia are currently not recognized by primary care physicians as having cognitive impairment [6,7]. Callahan et al. [8] found that 97% of patients with cognitive decline were not recognized as being at an early stage of dementia and, according to Eefsting et al. [9], general practitioners in primary medical care often underestimate the prevalence of dementia. On the other hand, in a surprisingly large number of individuals, the extent of the cognitive impairment is overestimated [10].

As the neuropsychological assessment of individuals with cognitive impairment is often limited by financial constraints, by restricted time resources, and by the

☆ Extended version of a poster presented at the Third International Congress on Vascular Dementia (awarded 2nd place by the Poster Award Committee in Prague, 2003).

* Corresponding author. Tel.: +49 621 1703 1846; fax: +49 0721 4024626.

E-mail address: damian@zi-mannheim.de (M. Damian).

0022-510X/$ - see front matter © 2004 Elsevier B.V. All rights reserved.
doi:10.1016/j.jns.2004.11.043

individuals' level of impairment and/or cooperation, it is suggestive to create abbreviated test batteries retaining adequate diagnostic accuracy [11]. The aim of the present study was to set up abbreviated test batteries suitable for the specific diagnostic questions of either primary care physicians, neuro-psychiatric specialists, or memory clinics. We, therefore, defined three stages of dementia diagnostics. In stage one, the primary care physician has a key role in the determination of dementia or cognitive impairment. In stage two, a neuro-psychiatrist bases his/her diagnosis on the primary care evaluation and completes it by further tests. If necessary, the neuro-psychiatrist calls in a memory clinic, which regularly disposes of special neuropsychological, neuroimaging, laboratory, and other methods of extended clinical diagnostics, thus defining stage three.

The advantage of such a staged procedure in dementia diagnostics is a reduction of time-consuming and expensive evaluations in a memory clinic, since only those individuals are sent for further evaluation, whose diagnosis is not clear after the first two stages.

In summary, the aim of this work was:

(1) To set up abbreviated versions (short forms) of the comprehensive (long form) test battery, which meet the diagnostic requirements of primary care physicians, neuro-psychiatrists, and/or memory clinics.
(2) To abbreviate the comprehensive test battery in order to save administration time without reducing diagnostic accuracy by more than 4%.

2. Materials and methods

2.1. Study population

The study population originally comprised 178 examined individuals. Eight patients were subsequently excluded since they were diagnosed with symptomatic dementia due to a temporal encephalitis, a brain tumor, a lipom of the corpus callosum, and/or nutritive toxic cerebral and somatic findings. Ten more patients were excluded because they could not complete the neuropsychological testing due to severe cognitive decline or lack of motivation; one patient revoked his study consent. The data for this investigation was collected from the remaining 159 participants who were consecutively transferred to the memory clinic of the CIMH for the diagnostics and differential diagnostics of dementia. The Ethics Committee of the Faculty of Clinical Medicine Mannheim, University of Heidelberg approved the study protocol. All participants or their authorized representatives gave informed consent. The 159 participants underwent clinical, neurological, neuropsychological, MRI, and laboratory examinations. The general study methods have been detailed elsewhere [12].

2.2. Neuropsychological assessment

The neuropsychological test battery comprised the CERAD (Consortium to Establish A Registry for Alzheimer's Disease [13,14]) test battery and a modified version of the clock test [15,16]. Alongside these tests, further measures were administered to evaluate their contribution to the differential diagnostics of dementia (see Table 1). The neuropsychological diagnosis was exclusively based on the CERAD and the clock test results and only consisted in the statement "dementia" vs. "no dementia" or "cognitive impairment" vs. "no cognitive impairment". Dementia was diagnosed according to the DSM-IV criteria [19]. To evaluate the verbal intelligence, a vocabulary test was administered in order to be able to exclude individuals with premorbid cognitive deficits [20].

According to the clinical discharge diagnosis which took into consideration the neuropsychological basis evaluation,

Table 1
Comprehensive test battery

Acronym	Tests and subtests	Cognitive function(s)
BNT	Boston Naming Test (CERAD [13,14])	Naming
MMSE	MMSE (CERAD)	Orientation, Memory, Praxis, Abstract reasoning
IR	Wordlist Immediate Recall (CERAD)	Short-term memory
SAV	CERAD-Savings (CERAD)	Long-term memory
CP	Constructional Praxis (CERAD)	Constructional Praxis, Visual-spatial perception
WL Recall	Wordlist Delayed Recall (CERAD)	Long-term memory
RECOG	Wordlist Recognition (CERAD)	Recognition memory
CP Recall	Praxis Delayed Recall (CERAD)	Long-term memory for figures
CLOCK	Clock-Drawing-Test [15,16]	Memory, Abstract reasoning, Constructional Praxis
VF	Verbal Fluency (CERAD)	Verbal Fluency
DST	Digit-Symbol-Test [17]	Attention
TMT-A	Trail-Making-Test A [18]	Processing speed
TMT-B	Trail-Making-Test B [18]	Cognitive flexibility
MT	Maze-Test [17]	Visual-motor Coordination, Planning
CWT-I	Color Word Test Board I [17]	Reading speed
CWT-II	Color Word Test Board II [17]	Color naming speed
CWT-III	Color Word Test Board III [17]	Concentration
CWT-IV	Color Word Test Board IV [17]	Interference, Selective attention

SAV=CERAD-Savings.

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