Cognitive Communicative Assessment Protocol for Persons with Dementia in Malayalam (CCAPD-M)

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Abstract

Dementia is an umbrella term for a group of pathological conditions or syndromes that occur with unsuccessful five areas of mental activity (i) Language (ii) Memory; (iii) Visuospatial skills; (iv) Emotion or personality and (v) Cognition (ex: abstraction, calculation, and judgment). Persons with Dementia (PWD) have trouble producing linguistic information because they have trouble thinking and generating and ordering ideas, in part because information processing capabilities of declarative and working memory systems are disturbed. The aim of the current study was to develop an assessment protocol for PWD in Malayalam that can be useful for Speech-Language Pathologist. The developed assessment protocol called 'Cognitive Communicative Assessment Protocol for Persons with Dementia - in Malayalam (CCAPD-M)' consists of six domains - (i) Memory (ii) Linguistic comprehension (iii) Linguistic expression (iv) Problem solving (v) Organization and (vi) Visuo-spatial construction with a total of twenty four sub domains. CCAPD-M was administered on sixty normal individuals (two groups i.e. between 40-60years and between 60-80years) and ten PWD. Results of the study revealed significant deterioration in the performance of normal individuals as the age advanced. PWD performed poorly on delayed recall, generative naming, picture naming, categorization, problem solving etc. compared to other domains. This indicated that cognitive decline as well as semantic decline was more in PWD, while the syntactic abilities were better. Executive dysfunction and working memory deficits can account for many of the linguistic deficits in dementia.

Key words: dementia, cognition, aging, alzheimer's disease, parkinson's disease

The term [1]dementia refers to the clinical syndrome in which there is an impairment of memory, deterioration of intellect sufficient to interfere with social or occupational functioning, unclouded state of consciousness, the presence of an organic factor related to the disturbance, as well as one of the following impairment of abstract thinking, impairment of judgement, personality change, impairment of other cortical functions as evidenced by the presence of aphasia, apraxia, agnosia, or constructional difficulty (DSM III, American Psychiatric Association, 1980). Dementia is an umbrella term for a group of pathological conditions or syndromes that occur with unsuccessful five areas of mental activity viz. (i) Language (ii) Memory (iii) Visuospatial skills (iv) Emotion or personality and (v) Cognition (e.g., abstraction, calculation, and judgment). The prevalence of dementia in Kerala was found to be 33.6 per 1000. Alzheimer's disease (AD) was the most common type (54%) followed by vascular dementia (39%), and 7% of cases were due to other causes such as infection, tumour and trauma (Shaji & Bose, 2005).

Communication and cognition in Dementia: Persons with dementia have trouble producing linguistic information because they have trouble thinking and generating and ordering ideas, in part because information processing capabilities of declarative and working memory systems are disturbed. These individuals have difficulty in comprehending language because of deficits in perception, recognition, attention, inferencing, memory, and degradation of knowledge.

Memory problems are the defining feature of dementia and is the first sign of cognitive decline.

Sensory memory: Many of the functional deficits that results from sensory problems appear in the late stages of dementia, and evidence exist for preserved sensory processing at early stages of perceptual priming tasks (Salmon & Fennema-Notestine, 1996) and on perceptually based repetition priming tasks (Fleischman, Gabrieli, Reminger, Rinaldi, Morrell, & Wilson, 1995).

Working memory: Working memory processes are particularly vulnerable to the effects of dementia, which may be due to the failure in the executive control system or as with sensory memory, due to types of tasks used to document the process. There is evidence of reduced memory span and short term memory capacity in AD (Morris, 1986) and performance deficits in short term memory tasks with divided attention conditions (Morris, 1996). Access to semantic memory has been identified as the cause of working memory deficits in persons with AD, whereas disrupted inhibitory processes are thought to explain working memory in persons with Parkinson's disease (PD).

Declarative memory and explicit memory: Semantic memory is the most central of all cognitive processes and is fundamental to language production and comprehension, reading, and writing, object and face perception. Persons with AD have significant difficulty in recalling recent and current events but demonstrate good retrieval of childhood memories. Remote memory performance was correlated with a

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measure of semantic fluency. There are differences across dementia etiologies in recognition versus recall tasks. Recall memory is more impaired than recognition memory in dementia.

Nondeclarative or procedural memory: Procedural memory is relatively preserved in AD, but impaired in Parkinson's disease (PD) (Zgaljardic, Borod, Foldi & Mattis, 2003) and Vascular Dementia (VaD) (Libon, Bogdanoff, Cloud, Skalina, Giovannetti & Gitlin, 1998).

Executive function: Executive dysfunction is observed to some extent in all dementias, and accounts, to certain extent for the difficulty in performing instrumental activities of daily living. Across dementia types, executive functioning for complex tasks and problem solving declines with increasing dementia severity. Initiation and planning problems are the earliest signs of executive dysfunction in PD (Zagaliadric et al., 2003). The executive dysfunction deficits seen early in Fronto temporal dementia (FTD) are also more severe than those in AD (Rosen, Hartikainen, Jagust, Kramer, Reed & Cummings, 2002).

Abstraction or problem solving process: An impairment of the abstract thinking and problem solving and a deficient ability to shift or maintain set is often a prominent clinical feature of Dementia of Alzhemier's Type (DAT). These deficits are usually ascribed to the neuropathologic changes that occur in the prefrontal association cortex of patients with DAT. Although these deficits may emerge at different stages in various patients, they are invariably present by the middle stages of the disorder. Freedman and Oscar-Berman (1986) have reported that the impaired performance of the DAT patients on these tasks presumably results from deficiency in cognitive flexibility that is required to alternate responses and shift mental set.

Visuospatial processes: Visuoconstructional tasks (e.g., clock drawing) rely in part on linguistic output and comprehension, as well as praxis, memory and visuo-motor coordination. Adequate performance also depends on reasonably intact attention. Effect of frontal system damage can affect performance. According to Albert, Blacker, Moss, Tanzi and McArdle (2001) some vision related cognitive deficits should be investigated early in dementias. Visual perceptual as well as visual constructional deficits are seen in patients with dementia (Bayles & Kaszniak, 1987).

Language characteristics in dementia: The presence of memory impairment in any form will interfere with language production and comprehension to some extent, and will vary over the course of illness. Semantic and pragmatic language systems have been found to be more impaired in dementia than do syntax and phonology. A number of studies have documented that an increase in the severity of the language deficit parallels an increase in severity of dementia (Albert, 1981; Bayles, 1982; Cummings, Benson, Hill & Read, 1985). The most frequently cited communication problems in the literature include difficulty with verbal memory, word finding (i.e., anomia), disruptive vocalizations, and understanding of spoken language (i.e., auditory comprehension deficits).

Phonologic impairments in dementia: The selection and sequencing of individual phonemes for speech production remain intact throughout most of the duration of AD. Violations of phonotactic constraints of native language and errors in prosody rarely occur (Appel, Kertesz & Fishman, 1982).

Semantic impairments in dementia: The most common early symptoms of dementia are word finding, naming, and verbal description difficulties, due to semantic memory impairment. Difficulty in naming or word retrieval has been observed to be the most obvious early symptom of dementia, regardless of cause, and has been found to occur before other language changes associated with the syndrome are measurable. Studies investigating categorization skills in adults with dementia have revealed that these individuals show significant deterioration in the structure and/or contents of semantic and conceptual knowledge as compared to their peer age matched healthy cohorts. Grossman, Smith, Koenig, Glosser, Rhee and Dennis (2003) found significant difficulty with rule based semantic categorization of familiar object descriptions is found in AD and FTD, although similarity categorization does not differ from control subjects.

Syntactic deficits in dementia: Syntax appears to be less impaired when the context cues or structures the syntactic task. A working memory deficit in AD would contribute to syntactical errors of processing. Kemper, LaBarge, Ferraro, Cheung and Storandt, (1993) found that declines in sentence length, grammatical complexity, verbal fluency, and propositional content were seen in the interview transcript of persons with mild dementia compared to persons without dementia.

Pragmatic deficits: Pragmatics is assessed through discourse production. Some aspects of discourse are clearly impaired in DAT though the mild and moderate DAT patients take conversational turns when appropriate and often produce socially ritually parts of the conversations with appropriate timing affect and linguistic structure. These deficits could be secondary to existing and document problems such as anomia, decreased attention for poor memory, etc.

Oral reading: The ability to read aloud remains relatively intact until the late stages of AD. Single word reading ability was evident on the Functional Linguistic communication inventory (Bayles & Tomoeda, 1994), even in late stage AD.

Written language production: Writing severity has been correlated with dementia severity across a variety of tasks: spelling performance (Aarsland, Hoien, Larsen & Oftedal, 1996), single written sentence performance (Kemper, LaBarge, Ferraro, Cheung & Storandt, 1993).

Auditory comprehension: Bayles and Tomoeda (1994) suggested that individuals with severe dementia occasionally answer multiple-choice and yes-no questions accurately, although overall accuracy is low. They also found that patients at this stage can follow one step commands with 60% accuracy.

Reading comprehension: Reading deficits may be attributed to memory encoding deficits, difficulty keeping multiple ideas in mind and making inferences, or long term and semantic memory deficits. Working memory deficits are thought to account for the deficits in reading comprehension of sentences (Kempler, Van Lancker & Read, 1988).

Assessment: Assessment of cognitive communicative function serves many purposes (Tomoeda, 2001). These include detection of dementia, identification of cognitive communicative deficits, identification of retained abilities, establishment of a baseline of cognitive communicative functioning for planning intervention and measuring response to treatment, counselling caregivers and predicting skills vulnerable to future decline.

A complete evaluation for dementia should include (1) a careful and through case history; (2) neurologic and medical diagnostic studies and examination; (3) behavioral assessment; and (4) communication assessment. There are a variety of tools available for assessment, including formal and informal measures, and observational and interview protocols.

However, the role of Speech-Language Pathologist (SLP) in the assessment of individuals with dementia remains ill-defined. American Speech, Language and Hearing Association (2005) issued a position statement which highlights the SLPs' role in identification/assessment of dementia. SLPs have a primary role in screening, assessment and treatment, as well as a role in caregiver training and counselling. Appropriate and specific assessment and therapy material for people with dementia are limited.

Most of the neuropsychological tests developed for persons with dementia focus on cognitive skills. The rest of them focus on memory and executive functioning. There are only very few test materials available for assessing the communicative deficits in persons with dementia. There are few assessment tools available in western countries such as Functional Linguistic Communication Inventory (FLCI), ABCD (Arizonna Battery for Communication Disorders), COMFI (Communication Outcome Measure of Functional Independence) etc. No suitable tests are available for dementia in Indian context. Cultural and educational background can influence the performance of persons with dementia in various cognitive and linguistic tasks. So, we need to have appropriate tests to identify the persons with dementia in Indian context. Thus the aim of the study was to develop an assessment protocol for cognitive communicative deficits of persons with dementia and to test the efficacy of the protocol using normal and dementia population.

Method

The aim of the study was to develop a cognitive communicative assessment protocol for persons with dementia in Malayalam (CCAPD-M).

Participants: Broadly the participants for the study included two groups: Group1- control group: normal individuals; Group 2- clinical group: individuals with dementia (IWD).

Group 1 (Control group): The participants in the control group were divided into two groups, older adults (in the age range of 40-60 years) and geriatrics (in the age range of 60 years and above). Thirty normal participants were included in each of the two groups. These participants were selected based on the following inclusion criteria: native Malayalam speakers, with no history of neurological or psychiatric illness or of alcoholism or drug abuse, with at least 10 years of education in Malayalam were included for the study. All the participants were initially assessed using Mini Mental Status Examination (MMSE) (Folstein, Folstein & McHugh, 1975). It was found that all the individuals in this group passed with a score of above 23 which indicated that they do not have any cognitive impairment.

Group 2: (Clinical group: Individuals with dementia): The clinical group consisted of ten individuals with dementia (IWD) with varying severity. Individuals with dementia were identified through local hospitals, dementia associations and other dementia clinics. These participants were native Malayalam speakers with adequate hearing and vision (corrected) and who had a history of gradual deterioration in cognitive abilities. All the

participants in the clinical group were also evaluated for their mental status on Mini Mental Status Examination (Folstein, Folstein & McHugh, 1975) and all failed with a score of below 23 which indicated presence of cognitive impairment.

Test material and Procedure for testing: The study was conducted in two phases:
Phase 1: Development of the assessment tool
Phase 2: Test administration

Phase 1: Development of the assessment tool

This cognitive communicative assessment protocol in Malayalam (CCAPD-M) comprised of 6 main domains which were memory, linguistic comprehension, linguistic expression, problem solving, organization and visuo-spatial construction.

These 6 domains consisted of 24 subtests. The subtests were selected from different language tests. The test was developed by adopting various other tools such as the Dementia Assessment Battery in Kannada (Sunil & Shyamala, 2009), Arizona Battery of Communication Disorders for Dementia (Bayles & Tomoeda, 1993), and Cognitive-Linguistic Assessment Protocol (CLAP; Kamath, 2002).

Developed assessment material was given for rating. Rating was done by 20 postgraduate SLPs on the basis of 8 parameters on a 3 point scale (0-poor, 1- average, 2- good). Items that had 90% agreement across the raters were considered for the test protocol. All the parameters were rated above 90%.

Domain-1: Memory: This domain consisted of four subtests within it. Total score of this domain was 50.

Episodic memory: This subtest consisted of 10 items. The questions may be given orally or in writing. Each correct answer was assigned with a score of 1 and for incorrect answer a score of 0 was given. The maximum possible score of this subtest is 10.

Working memory: This subtest consisted of 10 items, 5 in each of digit forward task and digit backward task. In the digit forward task, the list of 3-4-, 5-, 6-, 7- digits were presented to the participants and they were instructed to hear and repeat those numbers in the same order. In the digit backward task, the list of digits was presented to the participants and participants were instructed to hear and repeat those numbers in the reverse order. Every correctly repeated sequence was assigned a score of 1. The maximum possible score of this subtest was 10.

Semantic memory: This subtest consisted of two tasks: co-ordinate naming and super ordinate naming. In co-ordinate naming, participants were instructed to name two items for the given activity. Each correct response was assigned a score of 1and the total score was 5. In super-ordinate naming, the participants were given a list of items belonging to a particular class and they were instructed to identify the class/ category to which the given items may be classified. A score of 1 was assigned for each correctly named class. The maximum possible score of this subtest was 10.

Delayed story recall: The participants were presented a story and were asked to answer five questions after 45 minutes of the presentation of story. Each correct response were assigned score of 2. The maximum possible score of this subtest was 10.

Domain-2: Linguistic expression: Six subtests are included in this domain. The total maximum score of this domain was 50.

Picture naming: In this subtest, participants were presented with 10 pictures and were asked to name the pictures. Each correct response was assigned score of 1 and mild paraphasias were accepted. The maximum possible score of this subtest was 10.

Generative naming: In this subtest, participants were asked to name as many animals as possible in one minute time. Each response was assigned 0.5 score. The maximum score of this subtest was 10.

Sentence completion: This subtest consisted of 5 items and the participant was instructed to fill in the blanks with suitable answer. Each correct response was assigned with a score of 1. The maximum score for this subtest was 5.

Responsive speech: In this subtest, participants were instructed to answer 5 questions with suitable answers. Each correct response was assigned a score of 1. The maximum score of this subtest was 5.

Spontaneous speech: In this test, participants were asked to tell about him/her and his/her family. Both information content and fluency in patient's response were checked. The responses were rated on a 5 point scale (with 1 being least and 5 being maximum score) for both information content and also on fluency aspects. The maximum possible score was 20.

Repetition: In this subtest, the participants were asked to repeat the given words and sentences. Clinician repeated items once if the patient asked or did not seem to hear. Minor errors in articulation were scored as correct. Take 1 point off for errors in order of word sequence or for each literal paraphasia.

Domain-3: Linguistic comprehension: The third domain of CCAPD-M was linguistic comprehension and this domain consisted of four subtests within it. The maximum score of this domain was 50.

Comparative questions: This subtest consisted of 5 items which were presented to the participants and they were instructed to answer either yes or no. Each correct answer was assigned a score of 2 and the maximum possible score is 10.

Following commands: This subtest consisted of 5 items which were arranged in increasing complexity. Participants were instructed to listen and follow the commands given. Score for each command is given

in the test material. The maximum possible score was 20.

Reading comprehension of sentences: This subtest consisted of 5 items, which were presented to the participants in orthographic mode and the participants were asked to choose the correct answer from four answers. Each correct response was assigned a score of 2 and the maximum possible score was 10.

Reading commands: This subtest consisted of 5 commands and were presented to the participants in orthographic mode and the participants were instructed to read and follow the commands. Score for each command is given in the test material and the maximum possible score was 10.

Domain-4: Problem solving: This domain consisted of five subtests that assess reasoning abilities to aid in problem solving. The maximum possible score was 60.

Sentence formulation: This is a word order unscrambling task to form a grammatically correct sentence. Each correct response was assigned a score of 2. The maximum score of this subtest was 10.

Predicting the outcome: In this subtest a situation was given and the outcome of that situation had to be predicted by the participants. For each correct response a score of 2 was assigned. The maximum possible score of this subtest was10.

Comparing and contrasting two objects: The participants had to give one similarity and one difference between a pair of objects named. For each correct response a score of 2 was assigned. The maximum possible score of this subtest was 10.

Predicting cause of a described situation: A situation was given and the participants had to predict the cause of that situation. For each correct response a score of 2 was assigned. The maximum possible score of this subtest was 10.

Answering why questions: Each correct response was assigned a score of 2. The maximum possible score of this subtest was 10.

Sequential task analysis: The steps involved in carrying out a named task, was required to be listed by the participants. The participants were required to analyze the task into at least four steps for a full score to be given. The maximum possible score was 10.

Domain- 5: Organization

Categorization abilities: Participants have to select the item which is in the same category of the already told item. Each correct response in this domain carries a score of 2. The maximum possible score of each subtest was 10.

Analogies: This task consisted of items to test ability to recognize word concept to meet task demands. This task also involves logical reasoning processes. Each correct response in this domain carries a score of 2. The maximum possible score of each subtest was 10.

Domain – 6: Visuospatial construction

Generative drawing: This subtest consisted of 2 items, where the participants were asked to draw pictures of eight items free handedly and the total score of this subtest was 30.

Figure copying: This subtest consisted of 2 figures and was presented to the participants and the participants were instructed to copy the figures. Each correct response was assigned a score of 5 and the maximum possible score was 10.

Phase 2: Test administration

A Pilot study was carried out in which the developed protocol was administered on 5 participants in the age group of 40-60years, 5 participants in the age group of 60-80years, and 5 participants with dementia. Further revision of the test items was done due to lengthy test duration and ease of performance. By following the above procedure the final version of Cognitive Communicative Assessment Protocol for Persons with Dementia in Malayalam was prepared.

All the participants were first screened using MMSE-Malayalam. After the above preliminary assessment procedures, the developed assessment protocol CCAPD-M was administered. All the participants were tested in a quiet room wherein they were seated comfortably. The administration took around one and a half to two hours for normal individuals in a span of two sessions and their responses were quantitatively recorded. IWD were tested with breaks in between. They took around 2-4 sessions for the test administration, each session was around 40 minutes. Initially IWD were very uncooperative to the test administration. For mild group of individuals the test administration was easier. IWD with moderate severity was used to topic shift frequently during the administration of test material. All of them were very reluctant to answer the questions, even though they know the correct answer. It took lot of effort on the part of examiner to come out with answer. All the responses were recorded for proper analysis.

All the participants scores were coded and was analyzed using SPSS-16version software. Raw scores and percenatge scores were calculated for each individual and for each subtest. Mean and standard deviation for each age group, for each subtest, each domain and for the clinical group was also calculated. For the group wise comparison MANOVA (Multi Variate Analysis of Varience) was done i.e. between two age groups and control and clinical group. Within age groups comparison was done across domains using Friedman test to find any significant difference in performance across domains

Table 1. *Mean (in %) and Standard Deviation (SD) scores for all sub domains across age groups for both the groups*

Domain	Subtest	Control group				Clinical group	
		Younger group1 (N=30)		Older group 2 (N=30)		Group 3 (N=5)	
		Mean	SD	Mean	SD	Mean	SD
Memory	MEPI	98.67	3.46	91.33	7.30	54.00	18.17
	MWR	72.67	7.85	50.17	13.03	26.00	11.40
	MSEM	98.83	2.15	84.67	15.92	36.00	15.17
	MDEL	98.67	3.46	73.00	22.15	24.00	16.73
	MEM	93.53	2.96	77.20	13.38	35.20	14.87
Linguistic expression	LEPIC	99.00	30.05	77.33	19.99	18.00	14.83
	LEGN	98.33	3.79	66.00	18.68	16.00	11.40
	LESC	98.67	5.07	78.00	14.24	68.00	26.83
	LERS	98.00	6.10	79.33	17.80	72.00	22.80
	LESS	99.33	2.54	71.00	15.61	52.00	26.83
	LERT	98.00	80.05	65.33	13.83	38.00	13.04
	LETO	97.33	7.15	71.67	15.48	34.80	15.21
Linguistic comprehension	LCCQ	98.00	6.10	75.33	17.95	36.00	16.73
	LCFC	98.50	4.38	69.50	15.78	34.00	15.17
	LCRCS	97.33	6.91	77.33	22.73	52.00	17.89
	LCRCC	96.33	9.99	77.33	22.73	56.00	21.91
	LCTO	97.73	6.10	74.60	16.16	42.40	16.76
Problem solving	PSSF	98.67	5.07	81.33	16.55	48.00	17.89
	PSPO	99.33	3.65	80.67	17.80	40.00	24.49
	PSCC	98.67	5.07	77.33	18.18	48.00	26.83
	PSPC	98.00	6.10	78.00	18.46	48.00	17.89
	PSY	100.00	0.00	79.33	17.80	52.00	17.89
	PSSA	97.33	6.91	77.33	19.64	40.00	24.49
	PSTO	98.56	3.78	78.77	17.67	45.60	20.56
Organization	OC	96.67	9.22	73.00	22.15	44.00	16.73
	OA	96.67	9.22	70.33	24.14	40.00	24.49
	OTO	96.67	9.22	71.67	22.91	42.00	19.24
Visuospatial skills	VSGN	97.33	6.91	69.33	23.18	32.00	17.89
	VSFC	98.67	5.07	71.33	23.00	44.00	16.73
	VISS	98.67	5.07	70.33	22.97	60.00	24.49
Total	TS	97.05	4.55	70	20.00	39.80	16.56

Note: MEPI-memory -episodic memory, MWR- memory- working memory, MSEM- memory-semantic memory, MDEL- memory-delayed recalling, MEM- memory, LEPIC –linguistic expression-picture naming, LEGN- linguistic expression-generative naming, LESC- linguistic expression-sentence completion, LERS- linguistic expression-responsive speech, LESS- linguistic expression- spontaneous speech, LERT- linguistic expression-repetition, LETO- linguistic expression –total, LCCQ- linguistic comprehension-comparative questions, LCFC- linguistic comprehension-following commands, LCRCS- linguistic comprehension- reading comprehension of sentences, LCRCC- linguistic comprehension- reading comprehension of commands, LCTO- linguistic comprehension- total, PSSF-problem solving-sentence formation, PSPO- problem solving-predicting outcome, PSCC- problem solving- compare and contrast, PSPC- problem solving-predicting cause, PSY- problem solving- why questions, PSSA- problem solving- sequential analysis, PSTO- problem solving-total, OC- organization-categorization, OA- organization- analogies, OTO-organization- total, VSGN- visuospatial- generative naming, VSFC- visuospatial-figure copying, VISS- visuospatial-total, TS- total scores.

if any. If significant differences were noticed Wilcoxen test was administered to find the pairwise difference across domains.

Results and Discussion

The results have been presented and discussed under separate sections given below.

Domain 1: Memory: The data was statistically analyzed for total memory score and each of the sub domains separately. Analysis of results on total scores for memory domain revealed that mean score was better for group 1 compared to group 2. The results also revealed that there was a significant difference between the performance of two groups [$F(1, 58) = 43.147$, $p<0.001$]. Analysis of results showed that the performance of older group was poorer than the younger group and this indicated that there was a decline in the memory skills with increase in age. The results revealed that there was a decline in the subdomains of memory including

episodic memory, semantic memory and working memory. Salthous and Meinz (1995) said that changes in working memory during the course of ageing are pivotal determinant of more general age related decline in cognitive performance. Current study findings are consistent with the above findings that age related decline is seen in all domains of memory.

Domain 2: Linguistic expression

Analysis of results on total scores for linguistic expression domain revealed that mean score was better for group 1 compared to group 2. The results also revealed that there was a significant difference in performance between the two groups [F(1, 58)=67.95,p<.001]. This indicated that as age increased there was a decline in linguistic expression. Results revealed that across age groups performance decreases i.e. as age advances mean scores for linguistic expression were found to be decreasing. Naming skills was scored less compared to other sub domains. Picture naming was better compared to generative naming as age advances. Generative naming required more cognitive load as compared to picture naming. Responsive speech and sentence completion scored better than other domains.

Researchers say that decline in linguistic expression may be due changes in neuronal structures (Raz, 2000). Decline in linguistic expression can also be explained on the basis of transmission deficit hypothesis (Burke & Shafto, 2004), which explains that ageing may cause reduction in activation between phonological, semantic, and orthographic system, as a result of which word finding difficulties can emerge. So in the current study also decline in linguistic expression may be due to reduction in activation between phonology, semantics, orthography, which causes word finding problems.

Domain 3: Linguistic comprehension

Analysis of results on total scores for linguistic comprehension domain revealed that mean scores was better for younger group 1 compared to older group 2. The results also revealed that there was a significant difference in performance between the two groups [F(1, 58) =53.79,p<.001]. This indicated that as age increases there is a decline in linguistic comprehension.

Overall the result showed that there was a significant difference in performance across age groups. Decrease in mean scores was noticed as age advanced. Main differences were noticed in comparative questions and following commands. For the second group poor performance may be because of their short term memory deficit. Reading comprehension was relatively preserved compared to other sub domains.

Domain 4: Problem solving

Analysis of results on total scores for problem solving domain revealed that mean scores was better for younger group 1 compared to older group 2. The results also revealed that there was a significant difference between the two groups at [F (1, 58) = 35.93, p<.001]. This indicated that as age increased there was a decline in problem solving. Mean values for the entire sub domains were less for older group 2 compared the younger group 1. Sentence formulation was less impaired as compared to other subtest, indicating the intactness of syntactic skills. Performance of compare and contrast and sequential analysis was less compared to other domains. This may be because compare and contrast depends on semantic knowledge, and sequential analysis on procedural memory, which declines as age advances. Davis and Klebe (2001) and Kamath (2002) reported that there is decline in problem solving skills in elderly adults as compared to young adults but the result was not significant. They suggest that decline in problem solving may be due to decrease in working memory or executive function with ageing.

Domain 5: Organization

Analysis of results on total scores for organization domain revealed that mean scores was better for younger group 1 (Mean = 96.67) compared to older group 2 (Mean = 71.67). The results also revealed that there was a significant difference between the two groups [F (1, 58) =32.93, p<.001]. This indicated that as age increased there was a decline in organization skills. Categorization (OC) was found to be declining as age increased. This difference was found to be significant [F(1,58)=29.18,p<0.001]. Within organization, analogies were performed poorer by older group 2 compared to younger group 1. Difference was found to be statistically significant. Age related decrease in performance was found for organization i.e. as age increased organization skills are decreasing. Performance of analogies was poor compared to categorization because the task involved in analogies required the participant's lexical retrieval skills. Lexical retrieval was difficult because of interference happening due to poor inhibition.

Domain 6: Visuospatial skills

Analysis of results on task for visuospatial tasks revealed that mean scores were better for younger group 1 (Mean = 98.67) compared to older group 2 (Mean = 70.33). Difference between the two age groups were statistically significant at [F (1, 58) =43.53, p<.001]. This indicated that as age increased there was a decline in visuospatial skills. Results indicated that visuospatial skills showed a decrease in performance across age groups. Visuospatial test performance declined with age, whereas verbal test performance remained fairly constant. This pattern has been attributed to an age-related decline in either

right-hemisphere functioning or executive functions (EFs), which may be associated with prefrontal cortical decline. Poor performance of participants in the current study may be due to more change in the right hemisphere rather than left hemisphere.

Comparison of normal and clinical group across domain: Data was analyzed for each age groups and group 3 across all domains. Mean and standard deviation (SD) values were calculated for each domain for three groups. Each domain will be discussed in detail in following sections.

Memory

The analysis of results for the memory domain revealed that the mean scores were found to be less for group 3 compared to the two other groups. Scores for episodic memory, working memory, semantic memory and delayed recall was poor compared to other sub domains in group 3. Within working memory, digit forward task was performed better than digit backward task. Semantic and delayed recall was less compared to other two domains. Within semantic memory both super ordinate naming and coordinate naming was performed equally. Since most of the participants in this study were individuals with moderate dementia all memory domains were impaired.

Research evidences shows that individuals with AD have a distribution of disease that includes modality- neutral association cortex in the temporal and frontal lobes, implicating a categorization deficit in AD patient's semantic memory difficulties (Grossman et.al, 2003), IWD have damage to the frontal lobes, and the structures that input to the frontal lobes. As a consequence of this may be the functioning of working memory is compromised in them.

Linguistic expression

Results revealed that performance of group 3 was poor in all sub domains of linguistic comprehension compared to two normal groups. Significantly poor scores were found for picture naming and generative naming for IWD compared to older group 2. So this task can be used to differentiate between IWD and elderly individuals. Paraphasias, perseverations were noticed in spontaneous speech of IWD. Repetition was better compared to generative naming and picture naming. Responsive speech and spontaneous speech was better compared to other domains. So this cannot be used for differentiating between dementia and normal ageing. Discourse analysis is needed for the assessment for IWD, as it assesses language functions at a higher level. In this current study discourse analysis was included.

According to Bayles (1982) to name an object requires the perception and recognition of the item and retrieval of its referent from the mental lexicon. Language tasks such as naming, linguistic disambiguation, correction of phonologic, syntactic, and semantically anomalous, sentences, verbal expression, and story re-telling, which interface with cognitive process of abstraction, memory, attention, perception, and reasoning may have clinical potential for use with dementia patients. In the current study for picture naming tasks equal number of living and non living items were included. Performance of persons with dementia was better for nonliving items compared to living things. This result indicated that there was a selective deficit in the knowledge of living items.

Linguistic comprehension

The results also revealed that there was a significant difference between the first and third group at $|Z| = 4.602$ at 0.05 level of significance. At the same level of significance difference between second and third group was found to be statistically significant ($|Z| = 3.328$).

Group 3 was compared with the normal group (first and second) to find the differences. Overall the result showed that there was significant difference across these groups. Decrease in mean scores was noticed as age advanced. Significant differences were noticed between second and third group. Reading comprehension was better compared to other sub domains in this age group. IWD were able to follow 1-2 step commands. But for long step commands performance was poor because of the short term memory loss.

Poor comprehension of grammatical component of sentences in IWD is associated with little recruitment of the inferior frontal area. So for IWD in this study reduced activation in the dorsal frontal area may be attributed to their poor performance in linguistic comprehension. Cummings, Houlihan and Hill (1986) reported that the reading aloud was intact in all except the most severely impaired cases and was found to be relatively independent of intellectual deterioration. Reading comprehension declined progressively with increasing dementia severity and correlated well with quantitative mental status assessments. Albert (1981) written comprehension is relatively preserved in dementia than auditory comprehension.

Domain 4: Problem solving

The results also revealed that there was a significant difference between the first and third group at $|Z| = 4.604$ at 0.05 level of significance. Mean values for the entire sub domains were less for

third group compared the first and older group 2. Analysis of results revealed that performance of third group i.e. group 3 was significantly lower than the performance of first and older group 2. Sentence formulation was less impaired as compared to other subtest, indicating the intactness of syntactic skills in group 3 as well as older group 2. The deficits in the frontal/executive functions also suggest that a disruption of cortical pathways to the frontal lobes and the pathological changes in this region occur early in the disease. These changes in executive functions may be the cause of problem solving skills impairment for IWD in the current study.

Domain 5: Organization

In this domain performance of third group (IWD) is poor compared to first and older group 2. AD patients suffer a gradual deterioration of the organization and content of semantic memory as the disease progresses. Lots of literature shows that semantic memory is impaired in dementia (Chertkow & Bub, 1990).

Domain 6: Visuospatial tasks

Analysis of data revealed that there was significant difference across groups in this domain. This may because of significant change in the brain structure in dementia. Newcombe (1985) suggested that temporal-parietal regions play an important role in visuo spatial tasks. Visuoconstructional dysfunction in AD patients is significantly correlated with a lower glucose metabolism in the right parietal cortex or in the bilateral occipital and temporoparietal regions (Ober, Jagust, Koss, Delis & Friedland, 1991). In the current study also may be because of poor glucose metabolism visuospatial skills are impaired compared to normal elderly.

Comparison of performance of IWD across domains

Analysis of results revealed that MEM and LETO was not statistically different at $|Z| = 3.68$, $p>0.05$. No significant difference was noticed across LCTO and MEM. Difference between PSTO and MEM was also insignificant. Difference between MEM and VISS was found to significant at $|Z| = 2.02$, $p>0.05$. LETO was found to be significantly different from LCTO and VISS. VISS was significantly different from OTO at $|Z| = 2.041$, $p>0.05$. VISS was different from PSTO at $|Z| = 2.02$, $p<0.05$. Picture naming and generative naming was significantly different from other sub domains within the linguistic comprehension domain. For linguistic comprehension domain performance scores were poor for following commands and sequential analysis. Within the problem solving domain performance was poor for predicting outcome and sequential analysis.

Conclusions

The aim of the current study was to develop an assessment protocol for persons with dementia in Malayalam that can be useful for speech language pathologist. The developed assessment protocol called – Cognitive Communicative Assessment Protocol for Persons with Dementia - in Malayalam (CCAPD-M) consists of six domains - (i) Memory (ii) Linguistic comprehension (iii) Linguistic expression (iv) Problem solving (v) Organization and (vi) Visuo-spatial construction with a total of twenty four sub domains. CCAPD-M was administered on sixty normal individuals (2 groups i.e. between 40-60years and between 60-80 years) and ten IWD. Results of the study revealed significant deterioration in the performance of normal individuals as the age advanced. Across age groups performance of memory, linguistic expression, linguistic comprehension, problem solving, organization, and visuospatial tasks decreased. Episodic memory, semantic memory, picture naming, responsive speech, spontaneous speech, linguistic comprehension etc. were better compared to other sub domains. Generative naming, delayed recall etc. were performed poorly by elderly population. So these skills cannot be used for differentially diagnosing IWD from elderly normal. Performance of IWD was very less compared to elderly participants across all domains. Delayed recall, generative naming, picture naming, categorization, problem solving etc. were performed poorly compared to other domains. This indicated that cognitive decline as well as semantic decline was more in IWD, whereas syntactic abilities were better. Executive dysfunction and working memory deficits can account for many of the linguistic deficits in dementia.

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