Critical Review:
Exploring the Use of Discourse Analysis in the Early Identification of Alzheimer's disease

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This study provides a critical review of the literature examining the use of discourse analysis in the early identification of Alzheimer's disease (AD). This critical review involves an evaluation of six articles, each using various outcome measures to analyze discourse of individuals with AD and compare it to discourse of healthy elderly individuals. Overall, the results of this review suggest that discourse analysis is sensitive enough to capture disruptions in language that are present even in the early stages of AD.

Introduction

Alzheimer's disease (AD) is an age-associated degenerative disorder characterized by progressive deterioration in memory, executive functions, and language (Duong et al., 2005). AD is the most common form of dementia, accounting for approximately 60% of dementia cases in Canada, with the majority of cases seen in people over the age of 65 (Ontario Neurodegenerative Disease Research Initiative, 2016). With our aging population, AD is becoming a growing problem that burdens caregivers, and has the potential to overwhelm our healthcare system (Ontario Neurodegenerative Disease Research Initiative, 2016). Because of this, we need efficient and accurate assessment procedures in order to diagnose AD in the early stages and begin appropriate intervention.

Discourse is a complex activity that involves different levels of the linguistic system (i.e. phonology, morphosyntax and pragmatics) in conjunction with memory and executive functions (Drummond et al., 2015). There is growing evidence to suggest that discourse analysis captures language breakdowns and executive functioning deficits even in the early stages of AD (Ahmed et al., 2013; De Lira et al., 2011; Drummond et al., 2015; Forbes-McKay & Venneri, 2005). It is important to explore the evidence in order to determine whether or not discourse analysis may be a useful tool in achieving earlier diagnosis of AD, and implementing specific intervention strategies for individuals and their caregivers that improve their communication and overall quality of life.

Objectives

The objective of this paper is to review and critically evaluate the existing literature on using discourse analysis to identify language disruptions in AD, and to determine which outcome measures, if any, were the most successful in identifying AD in its early stages.

Methods

Search Strategy

Online databases (PSYCHINFO, MEDLINE, ProQuest Nursing & Allied Health, and PubMed) were searched using the following terms: (discourse analysis OR narrative discourse) AND (Alzheimer's disease OR dementia).

Selection Criteria

Studies included in this paper were peer-reviewed articles that examined lexical, semantic and/or pragmatics measures in order to distinguish discourse samples of individuals with AD from healthy elderly controls. Studies were excluded from this review if they were non-English, did not include a control group and/or did not use a picture description task to elicit discourse. All studies had control groups, however, some studies had significant differences in age, sex or education level between the control and AD groups. This should be taken into consideration when evaluating the validity and reliability of the authors' conclusions since age, sex and education level differences may have impacted the results of cognitive assessment and the discourse samples themselves.

Data Collection

The literature search generated six articles related to discourse analysis and AD that fit the above criteria. All of the studies were cohort studies with a control group (level III research evidence).

Results

Ahmed, de Jager, Haigh & Garrard (2013)

This is a study that explored differences in the semantics of narrative discourse samples produced by 18 individuals with AD compared to samples produced by 18 healthy elderly controls. Participants completed the Mini Mental State Examination (MMSE) and the Cambridge Cognitive Examination (CAMCOG) to assess cognition and classify individuals as AD or control. The cookie theft picture description task from the Boston Diagnostic Aphasia Examination (BDAE) was used to collect narrative discourse samples. Recorded samples were transcribed and analyzed by two transcribers with acceptable intra- and inter-rater reliability.

Discourse analysis included global measures such as total semantic units, idea density (total semantic units divided by total number of words in speech sample) and efficiency (total semantic units divided by duration of speech sample in seconds) as well as component measures such as subjects (e.g. mother, boy, girl), locations (e.g. kitchen), objects (e.g. cookie, jar, stool) and actions (e.g. boy/stool falling, woman drying/washing dishes).

Appropriate use of independent samples t-tests and logistic regression revealed that the AD group had significantly lower total semantic units and efficiency in their discourse compared to the controls. As well, the AD group showed significantly less references to subjects and action verbs in their discourse compared to controls. The best predictors of early stage AD were total semantic units and efficiency.

The article included sufficient detail about participant selection and procedures used for collecting discourse samples to allow for replication. Authors outlined the limitations of their study including the fact that the small sample size restricted them to univariate regression analysis, a more limited comparison than multivariate regression analysis, in order to determine the predictive strengths of the different measures in the identification of early AD.

The study presents suggestive evidence that semantic disruptions present in narrative discourse can be used to identify individuals with AD in early stages of the disease.

De Lira, Ortiz, Campanha, Bertolucci & Minett (2011)

These authors conducted a study to explore whether micro-linguistic aspects of discourse such as lexical errors and syntactic complexity are altered in AD. Participants included 60 individuals with AD and 61 controls, grouped based on their MMSE and Alzheimer's Disease Assessment Scale (ADAS-Cog) scores. Discourse samples were obtained using a picture sequence task. Discourse samples were recorded and transcribed for analysis. Reported inter- and intra-rater reliability was acceptable.

Discourse samples were analyzed for lexical errors (i.e. word-finding difficulties, repetitions, revisions, substitutions and paraphasias) and syntactic index (i.e. the ratio of complex sentences to total sentences in sample).

Appropriate use of t-tests and logistic regression revealed that the AD group had significantly more lexical errors (i.e. word-finding difficulties, repetitions and revisions) and less syntactic complexity (i.e. coordinated sentences and reduced sentences) than the control group.

Authors reported that a limitation of their study was that the average age of the AD group was significantly older than the control group. This age difference resulted from the difficulty of finding subjects over 80 years of age with the minimum education level for the control group. Also, the number of males versus females in each group was not specified.

This study provides compelling evidence that picture description tasks are a tool that is sensitive enough to capture microlinguistic disruptions of discourse in early AD, which can help with earlier diagnosis and better monitoring of disease progression.

Drummond, Coutinho, Fonseca, Assunção, Teldeschi, Oliveira-Souza, Moll, Tovar-Moll & Mattos (2015)

This study looked at whether quantitative narrative discourse analysis could be used to distinguish between 41 healthy elderly controls, 22 individuals with Mild Cognitive Impairment (MCI) and 14 individuals with AD. Discourse samples were collected by asking participants to tell the story depicted in seven sequenced pictures (i.e. the car accident) with the examiner blind to participant's group. Samples were recorded and transcribed.

Discourse samples were analyzed for narrative time, total words, discourse type (i.e. narrative versus descriptive), overall coherence, referential cohesion, index of discourse effectiveness, and narrative structure.

Appropriate use of ANOVA revealed significant differences in AD compared to controls with the MCI

group's scores as an intermediate for the following measures: closed class words, repeated words, total macropropositions, total micropropositions, irrelevant micropropositions, and index of discourse effectiveness. The measure that best distinguished the three groups was the discourse effectiveness index.

Authors clearly outlined limitations of their study. One was that they used a picture description task in order to avoid making episodic memory demands, however, they recognize that cognitive domains are interrelated, so tasks designed to evaluate one specific aspect must consider other potential contributors to performance. Also, since the sample size was small the MCI group was comprised of individuals with single and multiple domain subtypes, making the group heterogeneous. This may have resulted in high levels of variability within the group, resulting in less reliable results.

This study present compelling evidence that narrative discourse is an ecological assessment that allows for the characterization of complex language skills that are affected in the early stages of AD and MCI.

Duong, Giroux, Tardif & Ska (2005)

The authors of this study explored whether a cognitive framework with measures at the lexical-semantic, conceptual-semantic and organizational-semantic levels would be able to distinguish between discourse samples from 46 individuals with AD and 53 controls. Discourse samples were obtained by having participants complete a single picture and a picture sequence description task.

Samples were analyzed at the lexical-semantic level for information units, complex clauses and referential pronouns, at the conceptual-semantic level for micropropositions, macropropositions, and right shifts, and at the organizational-semantic level for narrative elements, completeness and transitional markers.

Results indicated that the picture sequence task elicited five different discourse patterns while the single picture task led to four different discourse patterns. However, these observed discourse patterns could not readily distinguish between the control group and the AD group, as appropriate cluster analysis revealed a number of mixed clusters containing both AD and control participants.

The authors discussed potential limitations which may have affected the validity of their study. The criteria for MCI, a gray zone between normal aging and AD, had not been specified at the time the study's databank was created. As a result, controls were not screened for MCI. There is some evidence that individuals with MCI produce discourse patterns intermediate to normal and AD (Drummond et al., 2015). Therefore, it could be argued that in the mixed clusters, some the controls behaved more like individuals with AD if they had MCI.

This study provides weak evidence to support the author's claims that discourse may not be useful in differential diagnosis of AD.

Forbes-McKay & Venneri (2005)

This study had two objectives. The first was to collect normative data from healthy elderly controls for a picture description task designed to assess spontaneous language abilities. The second was to test whether the cut-off scores obtained from the normative data were able to detect subtle deficits that occur in the early stages of AD. The large normative sample included 240 healthy individuals aged 18-90 years, and the AD group included 30 individuals classified as mild, moderate or severe AD based on MMSE scores. Participants completed pictures description tasks for two simple stimuli and two complex stimuli. The simple and complex pictures differed in the number of pictorial themes (i.e. 7 in the simple and 11 in the complex stimuli).

Discourse samples were analyzed for melodic line, phrase length, articulation, grammatical form, phonological paraphasias, semantic paraphasias, visual paraphasias, word-finding delays, response to word-finding delays, information content, error monitoring and pictorial themes. Each measure was scored using a 7-point Likert-type scale ranging from 1 (severely impaired functioning) to 7 (no abnormality).

Normative mean and cutoff scores were determined for each of the above measures as they relate to simple picture stimuli and complex picture stimuli. Appropriate multiple regression analyses revealed that the AD group scored below the normative cut-off scores on measures related to semantic processing, namely: information content, pictorial themes, word-finding delays and response to word-finding delays.

Authors did not provide a discussion of limitations. Using Likert-type scales could be considered somewhat subjective measures, however, authors reported test-retest, inter-rater, and parallel form correlation coefficients of 0.78-1.00, suggesting good reliability and limited subjectivity. Also, the AD

sample size of 30 individuals was small. While the normative sample of 240 individuals included groups across the adult lifespan with norms adjusted for sex and education level, some of the groups, especially in the older ages, included less than ten individuals, which are small samples and may not account for normal variability.

This study provides suggestive evidence that measures associated with semantic processing are able to reliably discriminate between performance of healthy aged individuals and that of individuals with AD, including those in the early stages of the disease, on discourse tasks.

Tomoeda, Bayles, Trosset, Azuma & McGeagh (1996)

The aim of this study was to investigate the relationship between dementia severity and the quantity and quality of spoken discourse in individuals with AD. Participants included 52 controls, 5 individuals with MCI and 63 individuals with AD. Staging of dementia used the MMSE and the Global Deterioration Scale (GDS), both commonly used tests for assessing cognitive status. Discourse samples were obtained using a picture description task.

Samples were analyzed for quality and quantity using the following measures: total words, information units, conciseness, circumlocutions, frustrations, aborted phrases, revisions and ideational repetitions.

Appropriate regression analyses indicated that AD samples contained significantly more aborted phrases and ideational repetitions, and significantly less information units and conciseness than controls. Information units and conciseness steadily decreased as dementia severity increased, and were found to be the best measures for quantifying changes in language that occur as AD progresses.

While the authors did not specifically report any limitations, the number of males and females in each group was not specified and may be important to control for since gender effects can occur in narrative discourse.

This study provides compelling evidence to support the use of oral discourse as a method for documenting language and communication changes in individuals with AD as the disease progresses.

Discussion

Overall, the findings from the reviewed studies indicate that discourse analysis is a sensitive enough tool to capture language deficits, especially those related to semantic processing, information content and overall efficiency, that are present in early AD. Two important considerations arose from the critical review. First is the importance of screening participants for MCI, since it has been shown that individuals with MCI perform on cognitive and language tasks at a level intermediate to normal and AD, which can impact results if they are mistakenly considered control or AD participants (Duong et al., 2005).

Second, all of the studies included a control group, however, some studies had significant differences in age, sex and/or level of education between the control and AD groups. Previous studies have shown that younger individuals with higher levels of education perform better on cognitive and discourse tasks (Duong & Ska, 2001; Crum et al., 1993; Elias et al., 1997). In addition, studies have shown that males and females differ in terms of their cognitive abilities, with males being better at visuospatial tasks and women being better at verbal fluency tasks (Elias et al., 1997; McCarrey et al., 2016). These findings highlight the importance of controlling for age, sex, and education levels across control and AD participants in order to limit the confounding effect of these variables on cognitive assessment and discourse production.

Clinical Implications and Recommendations

Alzheimer's disease (AD), the most common form of dementia, is characterized by progressive deterioration in memory, executive functions and language, which together limit an individual's ability to communicate with others. There are interventions, such as communication strategies, that can be taught to caregivers of individuals with AD in order to reduce communication breakdowns and problem behaviors, and improve overall quality of life (Wilson et al., 2012). Currently, there are a variety of different stimuli and outcomes measures used in discourse analysis. In order for intervention to be initiated, clinicians require valid and reliable assessment tools that capture AD in its earliest stages. Discourse analysis has the potential to become a clinical tool that clinicians use to facilitate early diagnosis and intervention of AD, however, more rigorous studies that control for age, sex and level of education are required in order to establish standardized assessment procedures and outcome measures with valid normative data.

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