Pielęgniarstwo Neurologiczne i Neurochirurgiczne
THE JOURNAL OF NEUROLOGICAL AND NEUROSURGICAL NURSING

eISSN 2299-0321 ISSN 2084-8021 www.jnnn.pl **Original**

DOI: 10.15225/PNN.2018.7.4.1

Sentence Structure Analysis in Patients with Ischemic Stroke

Analiza budowy zdań u pacjentów z udarem niedokrwiennym mózgu

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Abstract

Introduction. The definition of brain health and the best method of promoting optimal brain health is an American Heart Association/American Stroke Association initiative. Intact cognitive function is important following an ischemic stroke for successful rehabilitation. Therefore having a simple metric of cognitive function would be optimal for all health professionals.
Aim. The aim of this study was to investigate if using Developmental Sentence Scoring (DSS) on sentences written by patients on a Mini-Mental State Examination (MMSE) could provide a simple metric of cognitive function.
Material and Methods. This secondary analysis reports on sentences written by patients after an ischemic stroke using quantitative and conventional content analysis methods.
Results. A mean score of 24.38 (SD±13, range 9–30) was found in the 76 patients who had written something in the course of the Folstein MMSE. The number of words ranged from 1 to 16 with the greatest number (21) averaging 5 words. The DSS ranged from 0–11 with a mean of 4. The mean Folstein MMSE (N=30), was 27.53 (SD±2.74, range 18–30) in patients who consented to a home visit 3 years after their stroke. Twenty seven of the 30 patients had written something and the number of words ranged from 1 to 12 with the greatest number (10) averaging 5 words. The DSS ranged from 0–12 with a mean of 4. Conventional content analysis revealed an overarching pattern articulated in two ways: (1) Awareness of recent space and time and remote memories of people and place (2) Expression of the self as person.
Conclusions. This secondary analysis provides normative data and a rich description of cognitive function in a group of individuals describing the DSS at baseline and again at 3 years after stroke but the sample was too small to be able to provide a simple metric of cognitive function. **(JNNN 2018;7(4):140–144)**
Key Words: motor stroke, brain attack, cognition function, sentence structure analysis

Streszczenie

Wstęp. Definicja zdrowia mózgu i najlepsza metoda jego optymalnego promowania jest inicjatywą American Heart Association/American Stroke Association. Niezaburzona funkcja poznawcza po udarze niedokrwiennym jest istotna dla pomyślnej rehabilitacji. Dlatego dysponowanie prostą metryką funkcji poznawczych byłoby optymalnym rozwiązaniem dla wszystkich pracowników służby zdrowia.
Cel. Celem niniejszej pracy było zbadanie, czy wykorzystanie Rozwojowej Oceny Zdania (ang. *Developmental Sentence Scoring* — DSS), w napisanych frazach przez pacjentów w badaniu Mini-Mental (MMSE), mogłoby dać prosty wskaźnik funkcji poznawczych.
Materiał i metody. Niniejsza analiza wtórna przedstawia zdania napisane przez pacjentów po udarze niedokrwiennym za pomocą ilościowych i konwencjonalnych metod analizy treści.
Wyniki. Średni wynik 24,38 (SD±13, zakres 9–30) stwierdzono u 76 pacjentów, którzy napisali coś w trakcie badania Folstein MMSE. Liczba słów mieściła się w przedziale od 1 do 16, przy czym największa ich liczba (21) zawierała średnio 5 wyrazów. DSS mieścił się w przedziale od 0–11 ze średnią wynoszącą 4. Średni poziom MMSE Folstein (N=30) wyniósł 27,53 (SD±2,74, zakres 18–30) u pacjentów, którzy zgodzili się na wizytę domową 3 lata po przebytym udarze. Dwudziestu siedmiu z trzydziestu pacjentów napisało coś, a ilość wyrazów mieściła się w przedziale od 1 do 12, przy

czym największa ich liczba (10) zawierała średnio 5 wyrazów. DSS wahał się w przedziale od 0 do 12 ze średnią 4. Konwencjonalna analiza treści ujawniła nadrzędny wzorzec wyartykułowany na dwa sposoby: świadomość nieodległej przestrzeni i czasu oraz odległe wspomnienia ludzi i miejsc, jak również wyrażanie siebie jako osoby.
Wnioski. Niniejsza analiza wtórna jest źródłem danych normatywnych oraz bogatego opisu funkcji poznawczych w grupie osób opisujących DSS na początku i ponownie w 3 lata po przebytym udarze, jednakże próbka była zbyt mała, aby móc określić prostą metrykę funkcji poznawczych. **(PNN 2018;7(4):140–144)**
Słowa kluczowe: udar mózgu, funkcja poznawcza, analiza struktury zdania

Introduction

Ischemic stroke is a leading cause of morbidity and mortality worldwide. In the Unites States (US) there are approximately 795.000 new strokes each year [1]. Stroke is a major source of disability in the rapidly aging population in developed countries. In the US it is the leading cause of serious long-term disability [1].

In the post-stroke period, intact cognition function is needed to form new memories, devise problem solving strategies, and recognize situations which are unsafe. Patients have short hospital stays and are challenged in returning home to devise new strategies, cope with deficits, and attempt to make a good functional recovery. Yet the best method for nursing assessment of cognitive function following stroke is unknown.

The definition of brain health and the best method of promoting optimal brain health is an American Heart Association/American Stroke Association initiative [2]. As part of this initiative it would be optimal to have a simple metric for cognitive function for nurses and all health professionals.

The purpose of this paper is to present the results of sentence structure analysis in patients who had an ischemic stroke. The main aim of this secondary analysis was to investigate if using Developmental Sentence Scoring (DSS) on sentences written by patients on a Folstein Mini-Mental State Examination (MMSE) could provide a simple metric of cognitive function in patients who had an ischemic stroke [3,4].

Material and Methods

Study Design

This secondary analysis used quantitative methods and conventional content analysis to examine sentences that had been written in the course of undergoing a Folstein MMSE [4] during the acute care stay and at the 3 year follow-up of 100 patients. Details of the methods of the parent study as well as the findings during acute care and at 3 years following motor stroke can be found elsewhere [5–9].

Sentence Structure Analysis

DSS is a type of sentence structure analysis used extensively by speech and language clinicians since the 1970s. These methods have been used most commonly to study the progression of language in children [3]. It was used in one study of expressive language profiles in adolescents and young adults with Down Syndrome and Fragile X syndrome [10].

The DSS is obtained by counting the number of words and clauses in a sentence. Then the other grammatical elements of the sentence are used to obtain a developmental sentence score (DSS). The potential range of the DSS is 0 to 20 [3].

Mini-Mental State Examination

In 1975, Folstein, Folstein, and McHugh published the MMSE as a test of cognitive function. The authors did not provide an explicit definition of cognitive function but stated that the tool concentrates on mental functions excluding mood, abnormal mental experiences, and forms of thinking. The intended use was to separate participants with cognitive disturbance from those without such disturbances [4].

The Folstein MMSE consists of 12 items and requires only 5–10 minutes to administer. Questions are grouped into the cognitive domains of orientation to time and place, registration of three words, attention and calculation, recall of three words, language, and visual construction. During the administration of one item in the language section the examiner instructs the patient to write a sentence. The patient response to each item is scored and the total score ranges from 0 to 30 and represents a weighted sum of the correct responses [4].

Procedures

Each sentence was copied from the original MMSE collected either during the acute care stay of the patient or at their 3 year follow-up. The sentences were then analyzed using quantitative and conventional content analysis methods.

Sentences were coded according to the developmental sentence scoring method outlined by Lee and displayed

in Figure. Briefly each sentence was copied, the number of words and clauses counted, then the other grammatical elements of the sentence were used to obtain a DSS for each patient who had written something on the Folstein MMSE. The potential range of the DSS is 0 to 20 [3]. Data were added to an existing database and the Statistical Package for the Social Sciences version 25 was used for quantitative analysis. Descriptive summary statistics were used to provide a description of the sentences written during acute care and at the 3 year follow-up.

Write out sentence		
Number of words		.....
Number of clauses		.....
DSS	a) Noun Modifiers	.....
	b) Prounouns	.....
	c) Main Verbs	.....
	d) Secondary Verbs	.....
	e) Negatives	.....
	f) Conjunctions	.....
	g) Questions	.....
	h) Determiners	.....
Total DSS (a+b+c+d+e+f+g+h=DSS)		.....

Figure. Developmental Sentence Scoring Method

Conventional Content Analysis

The sentences were also entered into an excel spreadsheet and sent to a second researcher for content analysis. Three levels of analysis were performed to explicate the patterns of the narratives of the participants. The first level coding synthesizes significant statements into manageable units, the second level coding clusters these synthesized units into groups which form a common point or idea and the third level coding makes sense of the clustered units into a meaningful and provide a general context of the participants narratives.

From the written response of participants, 100 phrases where decoded and analyzed using conventional content analysis for their patterns [11,12]. An overall analysis of the phrases was done first and further analysis based on gender was then performed.

Results

Quantitative Results

A mean MMSE score of 24.38 (SD±13, range 9–30) was found in the first 3 days following acute motor stroke. Seventy six of the 100 patients had written something. The number of words ranged from 1 to 16 with the greatest number (21) averaging 5 words. The DSS ranged from 0–11 with a mean of 4.

Sixty of the original 100 patients were accounted for the 3 year follow-up, 11 had died, 30 consented to a home visit, 19 were interviewed via phone. A mean MMSE (N=30) of 27.53, (SD+2.74, range 18–30) was found during the home visits. Twenty seven of the 30 patients had written something, the number of words ranged from 1 to 12 with the greatest number (10) averaging 5 words. The DSS ranged from 0–12 with a mean of 4. Seven of the 27 patients had written something only at the time of the 3 year follow-up. The mean number of words ranged from 2 to 8 with a mean of 5 while the DSS ranged from 0 to 8 with a mean of 4.

Twenty one of the patients had written something both at the time of their acute care stay and at the time of the 3 year follow-up. Three remained level with a mean number of words 5 and a mean DSS of 4. Nine showed a decrease with the mean number of words going from 6 during acute care to 4 at the time of the 3 year follow-up. The DSS decreased from a mean of 5 to 3. Another 9 showed an increase with the mean number of words going from 4 during acute care to 6 at the 3 year follow-up. The DSS increased from a mean of 3 to 5. Of note, 2 of these patients were able to write only their name during acute care but then at the 3 year follow-up were able to write a complete sentence.

Conventional Content Analysis

The overarching pattern found during the analysis revolves around the meaning-making between the interaction of the respondents' environment and sense of self. This pattern is articulated in two ways: (1) Awareness of recent space and time and remote memories of people and place (2) Expression of the self as person.

Awareness of Recent Space and Time and Remote Memories of People and Place

This pattern encompasses both the participants' articulation of recent memories which includes instructions and their appreciation of time. It also includes their expression of remote memories including people, place, and their connection with them.

A number of phrases analyzed were verbatim repetition, either of the last words heard by the participants or the instructions given to them. Phrase such as "close your eyes" and "can you write a sentence" is a reflection of this pattern and is present in both genders. Further, the participants were able to provide the day ("Today is Wednesday") or date of the month ("Today is 7th of December") and present an appreciation of the present time ("Today is a nice day"). Although present in both genders, females seem to be able to provide more the subjective appreciation of the present time than their male counterparts. Phrases like "It is a beautiful day" and "the weather is hot today" is only found in the female narratives while the male participants' responses focused on objective facts, like "Today is November 17". Moreover, only narratives from the female participants focus on being in the hospital ("I am in the hospital again") and how they feel being there ("I don't like being here"; "It is so hot").

There is also a recurring pattern in the narratives where people were mentioned and their specific name, such as "Eula", "Anthony Coco", where provided by the participants. It is interesting to note that besides themselves, the people mostly referred to in the narratives were the male's wife and the female's daughters which were subjectively described. Phrases reflective of these patterns include "Love my wife Sharmine" as well as "My daughter Kate has been wonderful".

Moreover, "Home" was the most mentioned place the participants described, with "go home" as the most referred association stated with it. Male participants provided more narratives implying a want to go home as compared to female participants although only one female participant provide a description of her home ("my house is very nice"). Phrases such as "I want to go home", "time to go home" are reflective of this want to go home expressed in their narratives.

Expression of the Self as Person

This pattern encompasses the recurring concept of the self as reflective person perceptually aware of their surroundings, emotions, needs and plans. It is echoed in the participants' constant use of "I", the explicit expression of their needs and the presence of self-reflection in their narratives.

Out of the 100 phrases analyzed, 37 contain the word "I" representing the subject of the phrase. The most common topic among those phrases containing "I" is the expression of the participants' wish to go home ("I can't wait to go home") and be better ("I hope it all got better"). Another theme among the phrases containing "I" is the participants' perceptual awareness of the surrounding and their memory. Phrases such as "I am in the hospital again"; "I was about to leave as you come" and "I am sure glad we have air conditioning" points out to their perceptual awareness of the present context they are in while phrases such as "I dressed my granddaughter today", "I am right handed", "I came to the hospital on Tuesday" reflects their ability to remember things.

Besides perceptual awareness and memory, the participants' narrative also shows element of self-reflection such as expressing future plans ("I am going to town"; "I will look for my cat") emotions ("I feel good"; "I am happy"; "I am glad today") and sense-making ("I can't make it today"; "I hope you are telling the truth"; "Why did I travel here"). It is interesting to note that both genders exhibited all the above mentioned patterns in their narratives.

Discussion

Cognitive function after stroke has been studied by multiple researchers from multiple angles [2]. The major contribution of this study is that it provides normative data on the DSS and a rich description of cognitive function at baseline and 3 years after a motor stroke, a sub-type of ischemic stroke.

These finding are consistent with other researchers who have reported improvement in Folstein MMSE scores following stroke. One group reported that recovery of cognitive impairment three years after stroke in patients with right hemisphere strokes [13]. Another group reported a median increase of one point on the Folstein MMSE scores in patients with lacunar strokes one year following the event compared to 6 months [14]. It has also been reported that the Folstein MMSE is insensitive to mild cognitive impairment and executive function in a population based study of nearly 500 patients 5 years after a stroke [15]. The current study, with mean Folstein MMSEs of 24 and 28 are within the mild impairment range and the DSS does help provide a richer description of this impairment [9].

Despite the frequent use of the Folstein MMSE and the recommendation for its use with stroke patients, by the admission of the originators, it is designed as a screening tool [4]. This study, with the first report of DSS provides a more in-depth snapshot of one aspect of the Folstein MMSE in a group of patients following motor stroke.

The conventional Content Analysis found an overarching pattern that revolved around meaning-making between the interaction of the respondents' environment and sense of self. This pattern was articulated in two ways: (1) Awareness of recent space and time and remote memories of people and place (2) Expression of the self as person. This is the first report of any patterns of this type.

In summary, cognitive decline after stroke has been well documented, yet the results of this study show no decline in cognitive function on either the total Folstein MMSE or the DSS, in fact improvement was found in this group of patients [15–17]. The patterns identified during content analysis are unique and very informative. Further study with a larger sample is needed to confirm these findings.

Conclusions

This secondary analysis provides normative data and a rich description of cognitive function in a group of individuals at baseline and again at 3 years after motor stroke. While these data provide a snapshot of cognitive function the sample was too small to be able to accomplish the main aim of the study, to provide a simple metric of cognitive function in patients who had an ischemic stroke.

Implications for Nursing Practice

This study has several important implications for nursing practice. All health care professionals need to be aware that cognitive function differs for individual patients after stroke. At present no one metric has been identified as a measure of brain health. Further larger scale, well designed studies are clearly warranted to continue to understand the possible role of the DSS as a measure of cognitive function in brain health with patients who have had a stroke.

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Conflict of Interest: None
Funding: None
Author Contributions: Janice L. Hinkle[A–H], Rudolf Cymorr Kirby P. Martinez[E–H]
(A — Concept and design of research, B — Collection and/or compilation of data, C — Analysis and interpretation of data, D — Statistical analysis, E — Writing an article, F — Search of the literature, G — Critical article analysis, H — Approval of the final version of the article)
Received: 29.09.2018
Accepted: 21.11.2018