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A Descriptive Study of Cognitive Status Three Years Following Motor Stroke

Badania opisowe funkcjonowania kognitywnego pacjentów po trzech latach od wystąpienia udaru mózgu z objawami ruchowymi

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Abstract

Background. Stroke, or brain attack, is a leading cause of morbidity and mortality worldwide. In the post-stroke period, intact cognition is needed to recognize dangerous situations, for problem solving, and forming new memories. Cognitive status 3 years after one particular type of ischemic stroke, motor stroke, has received minimal attention.

Material and methods. This was a descriptive study of cognitive status of 60 patients 3 years following a motor stroke.

Results. Of the patients available, 11 had died, 30 consented to a home visit and 19 were interviewed by telephone. The mean age of patients at the time of follow-up was 64 years and cognitive status was measured using three instruments. The median Mini-Mental State Examination (MMSE) score at baseline was 26.00 (interquartile range, 22.25 to 28.00) and 28.50 (interquartile range, 25.75 to 30.00) at three years. Median scores on Cognistat (The Neurobehavioral Cognitive Status Examination) at baseline was 65.00 (interquartile range, 58.00 to 73.75) and 74.00 (interquartile range, 67.50 to 79.50) at three years. The mean cognitive subscore on the Functional Independence Measure (FIM™) at baseline was 33.43 (± 3.28) and 26.5 (± 13.25) at three years. There were statistically significant differences between baseline and three years on each of the three cognitive measures.

Conclusions. This study provides a rich description of the cognitive status of a group of individuals 3 years after motor stroke. Although limited by a small sample size neuroscience nurses need to be aware that cognitive status may not decline in this subtype of stroke. **(PNN 2012;1(3):97-102)**

Key words: Motor stroke, Brain attack, Cognition, Cognitive status

Streszczenie

Wprowadzenie. Udar mózgu jest wiodącą przyczyną zgonów i inwalidztwa na całym świecie. W okresie następującym po udarze konieczne są nienaruszone funkcje kognitywne, potrzebne do rozpoznawania niebezpieczeństwa, rozwiązywania problemów oraz kształtowania nowych wspomnień. Do tej pory niewiele uwagi poświęcono funkcjonowaniu kognitywnemu pacjentów, którzy trzy lata wcześniej doznali niedokrwiennego udaru mózgu z ruchowymi objawami.

Materiał i metody. Badania opisowe funkcjonowania kognitywnego 60 pacjentów trzy lata po udarze z ruchowymi objawami.

Wyniki. Spośród wszystkich badanych pacjentów – 11 zmarło, 30 zgodziło się na wizytę domową, a 19 na kontakt telefoniczny. Średni wiek pacjentów w okresie trzech lat po udarze wynosił 64 lata; funkcje kognitywne mierzono przy użyciu trzech instrumentów. Średni wynik na Krótkiej skali oceny stanu psychicznego (Mini-Mental State Examination – MMSE) wyniósł 26,00 w linii bazowej (zakres międzykwartylowy od 22,25 do 28,00) i 28,50 (zakres międzykwartylowy od 25,75 do 30,00) trzy lata później. Średni wynik na skali Cognistat (The Neurobehavioral Cognitive Status Examination) w linii bazowej wyniósł 65,00 (zakres międzykwartylowy od 58,00 do 73,75) i 74,00 (zakres międzykwartylowy od 67,50 do 79,50) po trzech latach. Średni wynik na podskali Skali niezależności funkcjonalnej (Functional Independence Measure – FIM™) w linii bazowej wyniósł 33,43 (± 3,28) i 26,5 (± 13,25) po trzech latach. Zaobserwowano statystycznie istotne różnice między linią bazową a okresem po trzech latach na każdej z zastosowanych skal.

Wnioski. Badania przedstawiają szczegółowy opis funkcjonowania kognitywnego grupy pacjentów trzy lata po udarze mózgu z objawami ruchowymi. Mimo małej próby pacjentów objętych badaniem, pielęgniarki neurologiczne powinny mieć świadomość, że funkcje kognitywne w tego rodzaju udarze mogą nie ulegać obniżeniu.
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Słowa kluczowe: udar mózgu z objawami ruchowymi, udar mózgu, funkcje poznawcze, funkcjonowanie kognitywne

Introduction

Stroke, or brain attack, is a leading cause of morbidity and mortality worldwide and a major source of disability in the rapidly aging population in developed countries. In the United States there are currently an estimated 3 million stroke survivors which is double the number of survivors 25 years ago [1].

One sub-type of stroke is pure motor stroke that is characterized by a hemi paresis or hemiplegia which affects the face, arm, and leg equally; although the exact pattern may differ according to the anatomic location of the infarction within the brain [2]. Pure motor strokes account for approximately 12% [3] to 14 % of the total stroke population [4] and 25% of ischemic strokes [5]. Research with patients following ischemic stroke needs to make comparisons within, rather than among, various etiologic groups such as those with motor stroke.

In the post-stroke period, intact cognition is needed to form new memories, devise problem solving strategies, and recognize situations which are unsafe. This is especially true for patients who have had a motor stroke, who often have mild associated deficits and short hospital stays. These patients are challenged in returning home to devise new strategies, cope with deficits, and attempt to make a good functional recovery. While depression and dementia are well-recognized long-term sequelae of stroke, some suggest that impaired cognitive status is the least studied aspect of stroke [6]. Declining cognitive status is significant as it has been identified as a risk for nursing home placement [7].

The aim of this paper is to present the results of a descriptive study of the cognitive status of 60 patients 3 years after a motor stroke. This was part of a larger study describing functional recovery at 3 years following motor, the results of which can be found elsewhere [8]. The specific aim of this portion of the study was to describe cognitive status 3 years after a motor stroke. A secondary aim was to identify if cognitive status improved or declined 3 years post-stroke compared to the acute phase of motor stroke.

Material and methods

Approval was obtained from the institutional review board of Villanova University to conduct this study. Informed consent was obtained from all participants. Those who participated in a home visit were offered an incentive of a $20.00 gift certificate to a local restaurant or grocery store to compensate them for their time.

Study Design and Procedure

A prospective descriptive follow-up study was conducted using an existing database that included participants from a precious study of 100 patients who had a motor stroke. A description of these patients during acute care and 3 months after motor stroke have been published previously [9].

Attempts were made to contact each of the known surviving patients by telephone, provide an explanation of the study, and invite them to participate. If the patient had died this information was recorded. Subjects who had a subsequent major stroke, were having major medical problems, or had been newly diagnosed with Alzheimer's disease since the motor stroke were excluded. If the patient was available and willing to participate a home visit was arranged. During the home visit demographic variables and the three cognitive measures were collected. If the patient did not have time for a home visit and agreed, a phone interview was conducted during which demographic variables and the telephone version of the FIM™ was collected.

Cognitive Measures

This study used three measures of cognitive status. The mini-mental state examination (MMSE) is a widely used tool used to screen for cognitive impairment. Cognistat (The Neurobehavioral Cognitive Status Examination) provides an in-depth measurement of cognitive status. The cognitive subscore of the FIM™ provides another description of cognitive function. These three instruments are recommended in the Agency for Health Care Policy and Research clinical practice guidelines for use in research involving patients who have had a stroke [6].

Mini-Mental State Examination. In 1975, Folstein, Folstein, and McHugh published the MMSE as a test of cognitive function. While the authors did not provide an explicit definition of cognitive function they stated that the tool concentrates on mental functions excluding mood, abnormal mental experiences, and forms of thinking [10]. The intended

use was to separate participants with cognitive disturbance from those without such disturbances [10]. The MMSE consists of 12 items and requires only 5-10 minutes to administer [10]. 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.

The patient response to each question is scored and the total score ranges from 0 to 30 and represents a weighted sum of the correct responses [10]. A total score of less than 24 is considered evidence of impaired cognitive status. A total score can also be used to classify the severity of cognitive impairment into three levels. A patient with a score of 24-30 is considered to have no impairment, 18-23 mild impairment, and 0-17 severe cognitive impairment [11].

The MMSE has been examined for internal consistency as well as test-retest reliability. A high Cronbach's alpha level (.96) was reported with a group of medical patients, while moderate levels (.68 and .77) were reported with community dwelling samples [11]. The Cronbach alpha for the MMSE at baseline was 0.70 and 0.54 at the 3 year follow up in this study.

Cognistat (The Neurobehavioral Cognitive Status Examination). This instrument is a standardized instrument designed to assess cognition at the bedside. It is a second generation mental status instrument recently found to be sensitive to the cognitive effects of stroke [12]. Cognitive status is defined as the intellectual functioning of the individual involving level of consciousness, orientation, attention, language, visual construction, verbal memory, calculations, and verbal reasoning [13]. The instrument assesses each of the eight areas with 11 subtests; the language area includes comprehension of simple oral commands, repetition, and naming; the reasoning area includes similarities and judgment [13]. The test takes 5-30 minutes to administer and can be performed at the bedside [13]. The Cognistat was administered according to the instructions provided by the developers [14]. Scores range from a low of 20 indicating severe impairment to a high of 82, indicating normal cognitive functioning. The Cronbach alpha for Cognistat at 3 months was 0.85 and at three years 0.92 in this study.

FIM™ cognitive subscale. The FIM instrument is widely used and contains 18 scores, 13 pertaining to physical and 5 pertaining to cognitive abilities [15]. The cognitive items include comprehension, expression, social interaction, problem solving, and memory. Each item is rated on a 7 point scale so scores range from 5 indicating a low level of independence in cognitive function to 35 indicating a high level of independence [16].

The FIM™, with seven levels, is sensitive to change compared to other disability scales, is widely used in the stroke population (6), and there is a reliable and valid telephone version [17]. The Cronbach alpha for the FIM™ cognitive subscale scores at 3 months was 0.90 and at three years 0.87 in this study.

Procedure

Quantitative data were coded and entered into the Statistical Package for the Social Sciences Version 20. Descriptive summary statistics were used to provide a description of cognitive status in motor stroke during the acute phase of care and at three years. The related samples Wilcoxon signed rank test was used to test for differences between both the MMSE and NCSE scores at baseline and at the year 3 follow-up. A paired t-test was used to test for differences in the FIM™ cognitive subscale scores at baseline and at the 3 year follow-up.

Results

Three years after a motor stroke follow-up data were available on 60 patients. Eleven had died, 30 consented to a home visit and 19 were interviewed by telephone. Details about patient demographics and stroke characteristics at the time of the three year follow-up were previously reported [8].

The median MMSE and NCSE scores and interquartile ranges at baseline as well at three years are presented in Table 1. The related samples Wilcoxon signed rank test showed significant differences for both the MMSE ($p < .001$) and Cognistat ($p = .011$) scores at baseline and at the year 3 follow-up. The mean FIM™ cognitive subscale scores at baseline and three years are shown in Table 1. There were significant differences between the FIM™ cognitive subscale scores at baseline and three years ($t = 3.99$, $df=59$, $p < .001$).

Table 1. Means and Standard Deviations for Three Cognitive Measures

Instrument	Baseline Median or *Mean* (Interquartile Range or SD)	Three Year Median or *Mean* (Interquartile Range or SD)	Potential Range
MMSE	26.00, *24.48* (22.25 to 28.00)	28.50, *27.53* (25.75 to 30.00)	0 to 30
Cognistat	65.00, *63.40* (58.00 to 73.75)	74.00, *69.67* (67.50 to 79.50)	0 to 80
FIM Cognitive Subscore	*33.43* (± 3.28)	*26.5* (± 13.25)	5 to 35

The median and interquartile ranges for six sub-tests within the MMSE are presented in Table 2. At the time of the motor stroke 96% of 100 patients were described as 'alert' on the level of consciousness continuum section of the MMSE and 4% were described as 'drowsy'. At the time of the year 3 follow-up all 29 patients interviewed were described as 'alert' on the level of consciousness continuum section of the MMSE.

Table 2. Median and Interquartile range for sub-tests of the MMSE

Subtest	Baseline (N = 100) Median (Range)	Tree Year (N = 29) Median (Range)	Maximum score
Orientation	9 (2)	10 (0)	10
Registration	3 (0)	3 (0)	3
Attention & Calculation	4 (2)	5 (1)	5
Recall	3 (1)	3 (1)	3
Language	7.5 (3)	8 (1)	9

The median and interquartile ranges for subscales of the Cognistat are presented in Table 3. At baseline only 92 or the 100 patients were able to complete all portions of the Cognistat while at the time of the 3 year follow-up all 29 patients interviewed were able to complete all subscales.

The mean and standard deviations for the five cognitive portions of the FIM are presented in Table 4. The FIM was completed on all 100 participants at baseline and 49 (29 in person and 20 with the telephone version) at three years.

Discussion

Cognitive status after stroke has been studied by multiple researchers from various angles. The major contribution of this study is that it provides a rich description of cognitive status 3 years after a motor stroke using the MMSE, Cognistat, and the cognitive subscore of the FIM™.

In this study the MMSE total scores at baseline and the 3 year follow-up were both within the range in which patients are considered to have no cognitive impairment. However, there was a statistically significant improvement in MMSE scores from a median of 26.00 at baseline to 28.50 at 3 years following a motor stroke. When a closer look is taken at the sub-tests of the MMSE scores (Table 2) particular improvement was in the areas of orientation (improved from a median of 9 at baseline to 10 at three years), attention and calculation (improved from 4 to 5) and language (7.5 at baseline to 8 at three years).

These finding are consistent with other researchers who have reported improvement in MMSE scores following stroke. One group reported that recovery of cognitive impairment three years after stroke in patients with right hemisphere strokes [18]. Another group reported a median increase of one point on the MMSE scores in patients with lacunar strokes one year following the event compared to 6 months [19]. Another group reported that the MMSE is insensitive to mild cognitive impairment and executive function in a population based study of nearly 500 patients 5 years after a stroke [20].

Despite the frequent use of the MMSE and the recommendation for its use with stroke patients, by the admission of the originators, it is designed as a screening tool and is best combined with other tools for a more comprehensive assessment of cognitive status [10]. Many authors assert that abnormal scores on the MMSE should be followed by a more in-depth testing [11,20]. This study with two additional cognitive measures provides a more in-depth snapshot of the cognitive status of this group of patients following motor stroke.

The current study found a total mean Cognistat score of 70 (± 15.6), range 6-82. The total mean score at baseline for this group of patients was 64 for the Cognistat [9]. Patients followed up at 3 years showed an improved cognitive status compared to baseline.

Table 3. Median and Interquartile ranges for Cognitive Domains on Cognistat

Domain	Baseline (N = 92) Median (Range)	Three Year (N = 29) Median (Range)	Potential Range
Orientation	12 (2)	12 (1)	10-12
Attention	8 (1)	8 (0)	6-8
Comprehension	6 (1)	6 (1)	5-6
Repetition	12 (4)	12 (4)	11-14
Naming	10 (0)	10 (0)	7-10
Construction	2 (5)	4 (5)	4-6
Memory	6 (7)	11 (6)	10-12
Calculation	4 (2)	4 (0)	3-4
Similarities	5 (3)	6 (3)	5-8
Judgment	5 (0)	5 (0)	4-6

When a closer look is taken at the cognitive domains of the Cognistat (Table 3) improvement was specifically in the areas of construction (improved from a median of 2 at baseline to 4 at three years), memory (6 to 11) and similarities (5 to 6).

In contrast to the MMSE and Cognistat findings the FIM™ cognitive subscale scores considered as a whole show a statistically significant decline in cognitive status from a mean of 33 to a mean of 25. At baseline memory had the lowest mean cognitive subscale scores with the widest standard deviation among the five subscales. The three areas that had decreased at three years were social interaction, problem solving, and memory

Table 4. Means and Standard Deviations for Cognitive Items of FIM™

Item	Baseline (N = 100) Mean (SD)	Three Year (N = 49) Mean (SD)	Potential Range
Comprehension	6.8 (±.60)	6.8 (±.50)	1-7
Expression	6.6 (±.72)	6.6 (±.70)	1-7
Social intercation	6.7 (±.60)	6.2 (±1.50)	1-7
Problem Solving	6.7 (±.90)	6.4 (±1.20)	1-7
Memory	6.5 (±1.00)	6.3 (±1.00)	1-7

Other researchers have reported FIM™ cognitive subscale scores within ranges similar to those found in this study. Researchers have reported an overall increase in FIM™ cognitive subscale scores during rehabilitation for stroke [21]. One group reported a mean cognitive subscale score of 30 at 6 month follow-up for a stroke rehabilitation population [16]. No comparison scores could be located for the five individual cognitive subscale scores.

In summary, cognitive decline after stroke has been well documented [7,22], yet the results of this study show no decline in cognitive function on two of the 3 measures used at 3 years after motor stroke. Further study with a larger sample is needed to confirm these findings.

Conclusions

This study provides a beginning understanding of which areas of cognitive function patients have recovered (or not) three years after motor stroke. It provides normative data and a rich description of the cognitive status of a group of individuals using 3 different measures at baseline and again at 3 years after motor stroke. Significant differences between baseline and three years on each of the three cognitive measures were found. Further large scale descriptive studies that include an assessment for pre-stroke cognitive impairment are warranted to understand cognitive changes and to identify whether identified changes are due to rehabilitation efforts or the natural process of recovery.

Implications for nursing practice

This study has several important implications for nursing practice. All health care professionals need to be aware that cognitive status may differ for different subtypes of stroke. Patients with motor stroke generally have a good prognosis and are worth nurses and other health care professionals investing their precious time and resources in their acute and long term care. Further larger scale, well designed studies are clearly warranted to continue to understand the cognitive status of patients who have had a motor stroke.

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