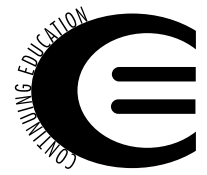


Outcome Three Years After Motor Stroke

Janice L. Hinkle, PhD RN CNRN



KEY WORDS

function
mortality
motor stroke
psychological outcome

There are few well-designed descriptive studies that focus exclusively on the long-term outcomes of patients after motor stroke. This study reports mortality rates and describes the psychological and functional outcomes 3 years after motor stroke. A description of the variables during acute care and at 3 months that best explain function 3 years after motor stroke is also provided. Home visits were made to 30 patients and another 19 were interviewed by phone. The four instruments used to measure the outcomes were the Center for Epidemiological Studies Depression Scale (CES-D), the Neurobehavioral Cognitive Status Examination (COGNISTAT), the Mini-Mental State Examination (MMSE), and the Functional Independence Measure (FIM™). Eleven of the 60 patients contacted had died by the 3-year follow up. The main outcome measures were 3-month FIM of 117.07 (\pm 12.53) and 3-year outcomes for CES-D (6.70 [\pm 7.29]), COGNISTAT (69.67 [\pm 15.62]), MMSE (27.53 [\pm 2.74]), and FIM (114.57 [\pm 19.00]). A number of multiple regression models were examined; in the best model, the FIM at 3 months accounted for 46% of the variance in function 3 years following the stroke. It is important for rehabilitation nurses to know that the mortality rate was low, psychological outcome was improved, and function was stable 3 years after a motor stroke.

Every 45 seconds someone has a stroke, and approximately 90% of stroke survivors are left with some residual deficit (American Heart Association, 2008). One particular subtype of stroke, *pure motor stroke*, is characterized by a hemiparesis 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 (Bronstein, Popovich, & Stewart-Amidei, 1991). Pure motor strokes account for approximately 12%–14% of the total stroke population (Arboix et al., 2001; Melo, Bogousslavsky, van Melle, & Gegli, 1992) and 25% of ischemic strokes (Moncayo, Devuyt, van Melle, & Bogousslavsky, 2000). Comparisons of patients with ischemic stroke need to be made within, rather than among, various etiologic groups such as those with motor stroke.

Mortality, psychological, and functional outcome variables after stroke rehabilitation have been studied extensively in the general population of patients who have had a stroke (Jeffery & Good, 1995; Kelly-Hayes & Paige, 1995). New therapies and decreasing mortality rates for acute ischemic stroke have increased expectations for favorable outcomes and rapid functional recovery following care. One review of the literature summarized how demographic variables, risk factors, clinical examination findings, laboratory test results, and imaging studies affect outcome (mostly mortality) during the acute phase of stroke care (Demchuk & Buchan, 2000). However, patients with motor stroke were not included, nor were the psychological or functional outcomes.

This article reviews a 3-year follow-up study that was conducted to provide clinicians and researchers

with descriptive data on a unique group of patients who had a motor stroke. The mortality rate and psychological, and functional outcomes are reported and nursing implications are discussed.

Review of Literature

The variables included in this study were based on recommendations of the Task Force on Stroke Impairment Disability and Handicap (TFSIDH; 1990) and were further reiterated by clinical practice guidelines (Gresham et al., 1995). Variables assessed were both dichotomous (mortality) and continuous (psychological and functional outcomes) in this unique group of patients who had had a motor stroke. This brief review of the literature is restricted to the dichotomous and continuous variables included in this study.

The first variable recommended for inclusion in stroke outcome measures by the TFSIDH (1990) is whether the patient is dead or alive. Mortality is a common outcome variable that has been assessed at 1 (Aben et al., 2002; Wellwood, Dennis, & Warlow, 1995), 2 (Glader, Stegmayr, Johansson, Hulter-Asberg, & Wester, 2001), 3 (Bonita, Ford, & Stewart, 1988; El-neihoum, Goransson, Falke, & Janzon, 1998; Hallstrom, Norving, & Lindgren, 2002) 5 (Bravata et al., 2003), and 10 (Wolf, D'Agostino, Belanger, & Kannel, 1991) years after stroke. A wide range of mortality rates has been reported at 3 years following the stroke, ranging from a low of 24% (Hallstrom et al.) to a high of 65% (Bonita et al.). An array of methodological issues and the lack of inclusion of patients with motor stroke impede cross study comparisons and make the current study of mortality at 3 years pertinent.

Outcome Three Years After Motor Stroke

Psychological Outcome

Depression as a psychological outcome variable has been examined in the stroke inpatient rehabilitation population (Jeffery & Good, 1995; Kelly-Hayes & Paige, 1995). Rates of depression in the general stroke population are between 25% and 60% (Hinkle, 1998). Studies during the stroke rehabilitation phase of care have documented that depression negatively affects functional recovery, and, in addition, treatment of depression enhances outcome (Williams, Ghose, & Swindle, 2004). No studies have documented the rate of depression 3 years after motor stroke nor explored the relationship between depression and functional recovery in this unique patient group.

Initial alterations of cognitive function in patients presenting with motor stroke, although suspected, have not been well documented or researched (Hinkle, 2002).

A mean Mini-Mental State Examination (MMSE) score of 24.38 ($SD \pm 13$; range = 9–30) and a mean Neurobehavioral Cognitive Status Examination (COGNISTAT) score of 64.29 ($SD \pm 12.9$; range = 12–82) during the first 3 days of hospital admission for an acute motor stroke have been reported (Hinkle, 2002). The COGNISTAT in the same study identified cognitive deficits in the specific domains of construction of designs, memory, and identification of similarities during acute care in the original participants of this study (Hinkle, 2002). Cognitive impairment has been reported in approximately half of nursing home placements in the general stroke population (Hughes & Lapane, 2004). An analysis of the stroke rehabilitation literature concluded that cognitive impairment in stroke patients was associated with a less favorable functional recovery (Jeffery & Good, 1995). Additional studies have linked cognitive decline after stroke to negative functional outcomes in the general stroke population (Tatemichi et al., 1994). However, most reviews have failed to include patients with the subtype of motor stroke.

Functional Outcome

In the inpatient stroke-rehabilitation literature, strong links exist between functional ability at the time of admission and functional recovery. Admission total Functional Independence Measure (FIMTM) scores for 520 general stroke patients were significantly correlated with the discharge total FIM scores ($r = .80$; Alexander, 1994). Others concur that the admission total FIM score influences the change in the total FIM score during the rehabilitation stay ($F [1,374] = 8.39$; $p = .004$; Ween, Alexander, D'Esposito, & Roberts, 1996a). Studies have not addressed the unique group of motor stroke patients.

The long-term function in 100 patients who had a lacunar infarction (53 of whom had a motor stroke)

revealed that 1 year after stroke 12% of subjects were dependent in personal activities of daily living, and at 3 years this increased to 24% (Samuelsson, Soderfeldt, & Olsson, 1996). Other research found that age, cognitive status, and poststroke FIM scores accounted for 42% of the variance in functional recovery 3 months after motor stroke (Hinkle, 2006). There are no reports detailing which variables best account for function 3 years following motor stroke.

In summary, the dichotomous variable of mortality, as well as the continuous variables of psychological and functional outcomes, have been examined by multiple researchers but primarily concentrate on the general stroke population during the rehabilitation phase of care. There is a clear gap in the current understanding of these variables at the 3-year mark following motor stroke. Therefore, this study was undertaken to assess mortality, psychological, and functional outcomes of patients 3 years after a motor stroke. A secondary purpose was to determine the relative strength of variables measured during acute care and at 3 months to explain the variance in function 3 years after motor stroke.

Methods

Approval was obtained for this study from the institutional review board of Villanova University. Informed consent was obtained from all participants. Those who participated in a home visit were given an incentive—a \$20 gift certificate to a local restaurant or grocery store—in return for their time. The value of incentives in exchange for the research participant's time and effort and to offset any inconvenience is documented in psychology, marketing, and nursing research (Guyll, Spoth, & Redmond, 2003).

Study Design and Procedure

A prospective, descriptive follow-up study was conducted using an existing database that included participants from a previous study of 100 patients who had had a motor stroke. A National Institute of Health Stroke Scale (NIHSS) score of 1, 2, or 3 on the motor subscale and 0 or 1 on the sensory portion defined motor stroke and measured motor strength in the original study. A description of these patients during acute care and 3 months after motor stroke has been published previously (Hinkle, 2006).

Attempts were made to contact each of the known surviving patients by phone, provide an explanation of the study, and invite them to participate. If the patient had already died, this outcome information was recorded. Subjects who had 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 from the 3-year follow

up because self-report data from these subjects would not be valid. Home visits were arranged if the patient was available and willing to participate. During the home visit, demographic variables and all four outcome measures were collected. If the patient did not have time for a home visit, a phone interview was conducted, during which demographic variables and the telephone version of the FIM were collected.

Participants were asked about any changes in demographic information, such as marital status, since the time of the acute-care admission for the motor stroke. Data were collected on cognitive status, depression, and functional recovery. Due to the advanced age of this population and the presence of neurological deficits affecting vision and strength, all instruments were read to the subjects. Instructions for the administration of both the Center for Epidemiological Studies Depression Scale (CES-D) and COGNISTAT instruments included using printed response cards (Wilcox & Gonzales, 1995) as needed with the participants. Total time for administration of the study instruments was approximately 1 hour. Breaks were taken during the interviews as needed to relieve subject fatigue.

Outcome Measures

Instruments included the CES-D to measure depression, the COGNISTAT (also referred to as the NCSE; Kiernan, Mueller, Langston, & Van Dyke, 1987; Toedter et al., 1995), and the MMSE to measure cognitive status. The FIM was used to measure function. These four instruments have been identified in clinical practice guidelines as reliable and valid tools to use in stroke outcome research (Gresham et al., 1995).

Symptoms of depression include grief, profound discouragement, irritability, despair, dejection, persistent sadness, rambling incoherent speech, apraxia, diminished intellect, hallucinations, fatigue, insomnia, poor appetite, early morning awakening, memory loss, decreased interest in activities, and a negative world view (Kaye, Morton, Bowcutt, & Maupin, 2000). The CES-D is a widely used, 20-item self-report scale designed to evaluate symptoms of depression in the general population. A score of 16 or higher is generally used to identify patients with probable depression. The CES-D is considered a reliable and valid tool for screening in the stroke population (Gresham et al., 1995; Kelly-Hayes, 2004). The Cronbach alpha for the CES-D in this study was 0.82.

Cognitive status is the intellectual functioning of the individual involving level of consciousness, orientation, attention, language, visual construction, verbal memory, calculations, and verbal reasoning (Cammermeyer & Evans, 1988). COGNISTAT scores range from 20, indicating severe impairment, to 82, indicating normal cognitive functioning (Cammermeyer &

Key Practice Points

1. Pure motor strokes (which are characterized by hemiparesis or hemiplegia) account for approximately 12%–14% of the total stroke population and 25% of ischemic strokes.
2. Mortality and psychological and functional outcome variables after stroke rehabilitation have been studied extensively in the general population of patients who have had a stroke, but not in patients who have had a motor stroke.
3. This study's findings showed that mortality was low, psychological outcomes improved, and function was stable 3 years after a motor stroke.
4. After a motor stroke, most patients demonstrate a good prognosis and benefit from rehabilitation.

Prendergast, 1997; Gresham et al., 1995). The Cronbach alpha for the COGNISTAT on the original group was 0.81 (Hinkle, 2002). The criterion validity of the COGNISTAT has been evaluated by comparing it with two other tools, the MMSE (Kiernan et al., 1987) and the Cognitive Capacity Status Examinations (CCSE; Schwamm, Van Dyke, Kiernan, Merrin, & Mueller, 1987). Examinations were performed on 30 neurosurgical patients with lesions confirmed on computed tomography (CT) scans. The COGNISTAT identified 97% of subjects as having changes in cognitive functioning, compared to 57% with the MMSE and 47% with the CCSE (Schwamm et al., 1987).

Function is the ability of individuals to perform activities of daily living, communicate, and be mobile within their environment (Gresham et al., 1995). The FIM instrument was derived from the Barthel Index and has seven levels of function, two of which indicate that no human help is required and five of which indicate that progressive degrees of help from another person are required (Keith, Granger, Hamilton, & Sherwin, 1987). Scores range from 18, indicating low functional ability, to a 126, indicating functional independence. Cronbach alphas for the total instrument range from .87 to .97 in research specific to stroke patients (Hinkle, 2000). The FIM, with seven levels, is sensitive to change compared to other disability scales and is widely used in the stroke population (Hinkle, 2000). In addition, there is a reliable and valid telephone version that contains the same 18 items and is also referred to as the FIM self-report (Masedo, Hanley, Jensen, Ehde, & Cardenas, 2005). The Cronbach alpha for the FIM at 3 months was .94, and .97 at 3 years in this study.

Outcome Three Years After Motor Stroke

Data Analysis

Data were coded and entered into the statistical package for the social sciences (SPSS), version 14 (SPSS, 2005). Descriptive summary statistics were used to provide a description of motor stroke at the 3-month and 3-year follow up. The group with 3-year follow-up data was compared with the group without data; categorical variables were assessed with chi-squares and means with *t*-tests.

Multiple regression was used to determine the relative strength of variables measured during acute care and at 3 months to explain the variance in function 3 years after motor stroke. The required sample size of 49 participants was determined by a power analysis for multiple regression using a maximum of six independent variables, an alpha of .05, and a power of .80.

Results

Figure 1 shows the flow of patients included in the original data collection through the 3-year follow-up study. Of the 60 patients available, 11 had died, 30 had consented to a home visit, and 19 were interviewed by telephone at the 3-year follow-up.

Table 1 contains the demographic and stroke characteristics of patients at the time of the 3-year

follow-up. There were no statistically significant differences in those who were located for follow-up ($n = 60$) compared to those who could not be located ($n = 40$) when demographic and stroke characteristics were compared ($p > .05$). The only significant difference in baseline demographic and stroke characteristics for the patients who had died ($n = 11$) by the time of the 3-year follow up was that more had been married ($n = 7$) than not married ($X^2 = 5.23, df = 1, p = .045$) at the time of the stroke event.

At the time of the 3-year follow-up, 41 interviews were conducted at home or by telephone with the patient, one was with a spouse, one was with a caretaker, and six were with relatives (typically grown children living with the patient). Forty-eight of those interviewed were living at home at the time of the interview and one was living in a nursing home. One person reported a change in marital status since the time of the motor stroke. The mean years of education were $12 (\pm 2.76)$ years. Of those interviewed, 50% reported no new complications since the initial event. The most common complication reported was a new stroke or transient ischemic attack ($n = 6$), heart problems ($n = 6$), syncopal episodes ($n = 3$), abdominal problems ($n = 3$), and a variety of other medical problems.

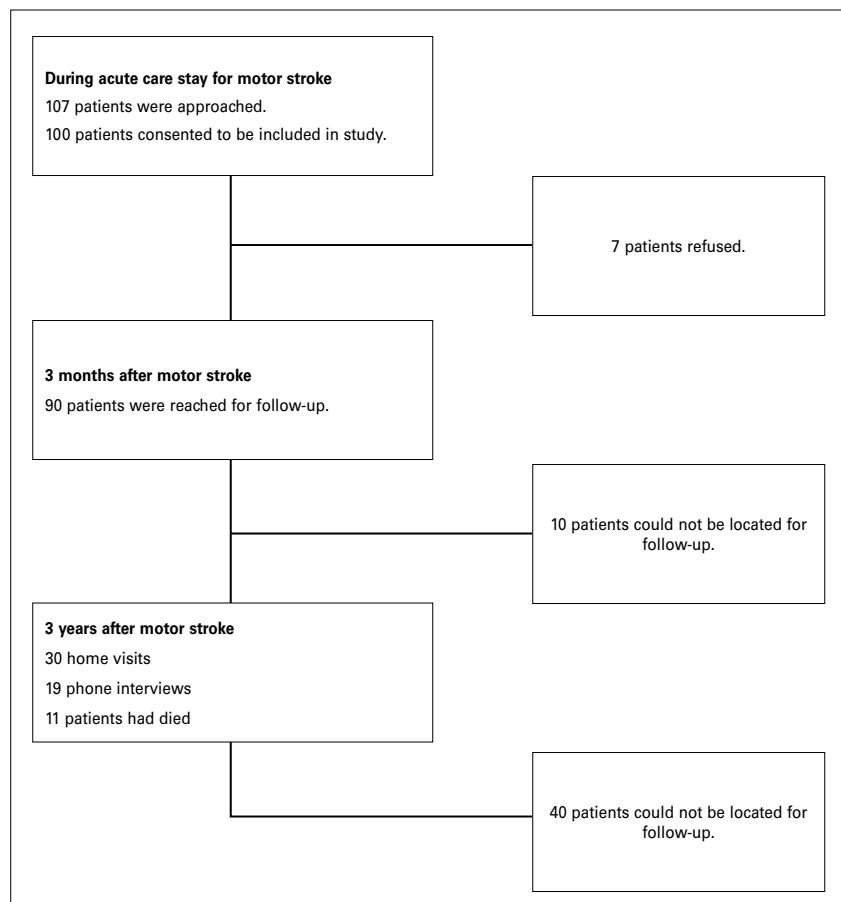
Table 2 presents the mean, standard deviation, and range of the main outcome measures at 3 years. The CES-D, COGNISTAT, and MMSE were all completed at the time of the home visit ($n = 30$), but two patients did not answer the question about medications ($n = 28$). The FIM scores reported are those performed in person for the home visits and via telephone for the remainder of the patients ($n = 49$).

A number of multiple regression models were explored using the FIM at 3 years as the dependent variable. **Table 3** shows the regression model when the baseline variables (collected during acute care) of age, lesion volume, NIHSS, COGNISTAT, and FIM were entered. The three variables of age, NIHSS, and the acute-care FIM accounted for 41% of the variance in functional recovery 3 years after stroke ($p = .06$). **Table 4** shows the best model in which the FIM at 3 months accounts for 46% of the variance in functional recovery 3 years after stroke ($p = .001$).

Discussion

The current study reports mortality, describes the psychological and functional outcome, and describes which variables help explain function 3 years after a motor stroke. One positive aspect of this study was the ability to obtain information on 60% of the original sample in our highly mobile American society. This compares favorably with other researchers who followed up with 40 patients of their original sample of 101 at 3 years (Johnston, Pollard, Morrison, &

Figure 1. Chart of the Progress of Participants



MacWalter, 2004). Widespread implementation of stroke registries has the potential to further increase follow-up rates. Researchers in one study examined 657 ischemic and hemorrhagic stroke events in 635 individuals 15 years or older who were registered during 1 year and were able to locate all but 16 people for a 3-year follow up (Bonita et al., 1988). Swedish researchers reported obtaining exact dates of death on all but 19 patients in a registry of more than 2,000 patients in the years studied (Hallstrom et al., 2002).

Mortality

The current study found a low (11%) mortality rate. This compares favorably with other research. A stroke registry in Auckland, New Zealand, reported that 63% of males and 65% of females had died within 3 years following a stroke (Bonita et al., 1988). A Swedish registry of 2,290 patients reported a 43% mortality rate at 3 years with 55.6% of the strokes identified as

ischemic (Elneihoum et al., 1998). Another study that used a Swedish registry calculated the case fatality of different types of stroke and reported that for the 566 patients who had been diagnosed with a Lacunar syndrome, the mortality rate at 3 years was 24.2% (Hallstrom et al., 2002).

Psychological Outcome

The current study found a mean CES-D score of 6.70 at 3 years following motor stroke. This is well below the score of 16 or higher that is generally used to identify patients with probable depression (Meijer et al., 2005). One patient did report depression and was under treatment for the condition, which included taking antidepressant medication. This is a positive finding that suggests depression may not be a major factor 3 years following motor stroke. Other researchers found the presence of poststroke depression (despite being younger) and other mental health diagnoses were linked to increased mortality rates following ischemic stroke, even after chronic conditions were controlled (Williams et al., 2004). Although other researchers suggest that depression should be reduced, a study that used multiple

Table 1. Demographic Data and Characteristics of Stroke for Patients at 3-Year Follow-Up

Variable	Follow-Up (N = 60)
Gender	
Male	50%
Female	50%
Race	
Caucasian	72%
Black	28%
Marital status	
Married	48%
Not married	52%
Employment status	
Retired	50%
Employed at time of stroke	50%
Previous stroke	
Yes	34%
No	66%
Type of stroke	
Lacune	36%
Embolic	32%
Unknown/other	32%
Location of stroke	
Supratentorial	86%
Other	14%
Side of lesion	
Left	35%
Right	56%
Bilateral/brainstem	9%

Table 2. Outcome Variables

Variable	Mean (SD); Range
Age (N = 60)	64.72 (±13.8); 20–87
3-month FIM (N = 90)	117.07 (±12.53); 70–126
CES-D (N = 30)	6.70 (±7.29); 0–28
COGNISTAT (N = 30)	69.67 (±15.62); 6–82
MMSE (N = 30)	27.53 (±2.74); 18–30
Total FIM score (N = 49)	114.57 (±19.0); 53–126
Medications (N = 28)	5.29 (±2.5); 2–11

Note. CES-D = Center for Epidemiologic Studies Depression Scale; MMSE = Mini-Mental State Examination; FIM = Functional Independence Measure.

Table 3. Regression Model for Variables Predicting Functional Recovery 3 Years After Motor Stroke

Variable	β	SE β	β
Entered model			
Age	-0.389	0.503	-0.183
NIHSS	-0.766	2.881	-0.056
Initial FIM	0.349	0.077	0.515
Excluded			
COGNISTAT	-	-	-
Lesion volume	-	-	-

Note. Values represented are beta, standard error of beta, and adjusted beta; FIM = Functional Independence Measure; NIHSS = NIH Stroke Scale.

Outcome Three Years After Motor Stroke

regression identified no psychological variables that predicted survival 3 years after stroke (Johnston et al., 2004). Collectively these studies suggest the need for further research to better understand the link between depression and mortality, particularly in motor stroke.

The current study found a total mean COGNISTAT score of 70 (± 15.6), with a range of 6–82. The total mean score at baseline for this group of patients was 64 for the COGNISTAT and 24 for the MMSE (Hinkle, 2006). Patients who followed up at 3 years showed an improved cognitive status compared to baseline. Cognitive decline after stroke has been well documented (Tatemichi et al., 1994), but the results of this study show no decline in cognitive function 3 years after motor stroke. Additional study with a larger sample is needed to confirm these findings.

It is interesting that in this study, the COGNISTAT at baseline did not help predict FIM at 3 years following motor stroke. The COGNISTAT at baseline did help predict FIM at 3 months following motor stroke (Hinkle, 2006). Other studies found that the COGNISTAT accounted for 62.77% of the variance in functional recovery in Hong Kong (Man, Tam, & Hui-Chan, 2006) and accounted for 16%–40% of the variance in recovery at 3 years (Johnston et al., 2004). It may be that cognitive deficits play a more important role in the early recovery from stroke than they do in long-term recovery.

Functional Outcome

When assessing severity of deficits using the FIM, researchers use the functional groups of <40, 40–60, 61–80, or >80 for the total FIM score (Ween et al., 1996a; Ween, Alexander, D'Esposito, & Roberts, 1996b). This study, with mean scores of 117.07 (± 12.53) at 3 months and 114.57 (± 19.00) at 3 years, showed stability over time and scores remained well

Table 4. Best Regression Model for Variables Predicting Functional Recovery 3 Years After Motor Stroke

Variable	β	SE β	β
Entered model			
3-Month FIM	1.501	0.407	0.459
Excluded			
Age	–	–	–
NIHSS	–	–	–
COGNISTAT	–	–	–
MMSE	–	–	–
Initial FIM	–	–	–

Note. Values are beta, standard error of beta, and adjusted beta; NIHSS = NIH Stroke Scale; MMSE = Mini-Mental State Examination; FIM = Functional Independence Measure.

within the highest functional group of >80, which represents those patients with the least amount of functional impairment. It is interesting that this group did not continue to recover functionally according to their FIM scores. This may be explained by the ceiling effect of the FIM (Richmond, McCorkle, Tulman, & Fawcett, 1997).

This study showed function measured with the FIM is a strong predictor of outcome when measured at baseline and at 3 months after motor stroke. This provides validity for the fairly widespread use of measuring function as an indicator of readiness for rehabilitation. These results are consistent with the findings of other research that show function on admission to be a strong predictor of discharge from both acute care and rehabilitation (Hinkle, 2006; Saxena, Ng, Yong, Fong, & Gerald, 2006). This study is the first report of prediction of function at 3 years following motor stroke. Further study of the complex interaction between psychological outcome and function at 3 years following motor stroke is clearly warranted. Further study of these variables in other subtypes of stroke is also needed.

Limitations

This study does have some limitations. First, depression was not measured during the acute phase of stroke care. Others have reported that levels of depression decrease over time following stroke (Morrison, Pollard, Johnston, & MacWalter, 2005). Future studies need to document depression at baseline and investigate if there is an increase or decrease in depression over time following motor stroke. Second, neither health-related quality of life nor life satisfaction were measured in the current study. It is becoming increasingly apparent, particularly in patients with less severe strokes and high functional levels, that there may be diminished quality of life (Duncan et al., 1997) and decreased satisfaction with life (Edwards, Hahn, Baum, & Dromerick, 2006). These are very important areas for further rehabilitation nursing research that were not studied here. The current study, with a relatively small sample focusing on patients with a motor stroke, is neither representative of, nor generalizable to, patients with other stroke subtypes.

Conclusions

This study contributes to the understanding of long-term outcomes in patients 3 years after motor stroke. It provides normative data on mortality as well as long-term psychological outcomes and function following motor stroke. The poststroke prognosis is important for planning at the individual and societal levels (Meijer et al., 2005). A low mortality rate, low

levels of depression, and high levels of functional and cognitive functions all imply that patients with motor stroke have a good prognosis and may benefit from rehabilitation.

Acknowledgments

Financial support for this research was provided by a summer faculty research grant from Villanova University's Office of Research and Sponsored Programs.

About the Author

Janice L. Hinkle, PhD RN CNRN, is an associate professor at the Catholic University of America in Washington, DC.

References

- Aben, I., Denollet, J., Lousberg, R., Verhey, F., Wojciechowski, F., & Honig, A. (2002). Personality and vulnerability to depression in stroke patients. *Stroke*, 33, 2391-2395.
- Alexander, M. (1994). Stroke rehabilitation outcome: A potential use of predictive variables to establish levels of care. *Stroke*, 25(1), 128-134.
- American Heart Association. (2008). *Heart Disease and Stroke Statistics*. Dallas: American Heart Association.
- Arboix, A., Padilla, I., Massons, J., Garcia-Eroles, L., Comes, E., & Targa, C. (2001). Clinical study of 222 patients with pure motor stroke. *Journal of Neurology, Neurosurgery and Psychiatry*, 71(2), 239-242.
- Bonita, R., Ford, M. A., & Stewart, A. W. (1988). Predicting survival after stroke: A three-year follow-up. *Stroke*, 19(5), 669-673.
- Bravata, D. M., Ho, S., Brass, L. M., Concato, J., Scinto, J., & Meehan, T. P. (2003). Long-term mortality in cerebrovascular disease. *Stroke*, 34, 699-704.
- Bronstein, K. S., Popovich, J. M., & Stewart-Amidei, C. (1991). Promoting stroke recovery. St. Louis: Mosby.
- Cammermeyer, M., & Evans, J. (1988). A brief neurobehavioral exam useful for early detection of postoperative complications in neurosurgical patients. *Journal of Neuroscience Nursing*, 20(5), 314-323.
- Cammermeyer, M., & Prendergast, V. (1997). Profiles of cognitive functioning in subjects with neurological disorders. *Journal of Neuroscience Nursing*, 29(3), 163-169.
- Demchuk, A. M., & Buchan, A. M. (2000). Predictors of stroke outcome. *Neurologic Clinics*, 19(2), 455-473.
- Duncan, P. W., Samsa, G. P., Weinberger, M., Goldstein, L. B., Bonito, A., Witter, D. M., et al. (1997). Health status of individuals with mild stroke. *Stroke*, 28(4), 740-745.
- Edwards, D. F., Hahn, M., Baum, C., & Dromerick, A. W. (2006). The impact of mild stroke on meaningful activity and life satisfaction. *Journal of Stroke and Cerebrovascular Diseases*, 15(4), 151-157.
- Elneihoum, A. M., Goransson, M., Falke, P., & Janzon, L. (1998). Three-year survival and recurrence after stroke in Malmo Sweden. *Stroke*, 29, 2114-2117.
- Glader, E., Stegmayr, B., Johansson, L., Hulter-Asberg, K., & Wester, P. O. (2001). Differences in long-term outcome between patients treated in stroke units and in general wards. *Stroke*, 32(9), 2124-2130.
- Gresham, G. E., Duncan, P. W., Stason, W. B., Adams, H. P., Adelman, A. M., Alexander, D. N., et al. (1995). *Clinical practice guideline: Post-stroke rehabilitation* (Vol. 16). Rockville, MD: U.S. Department of Health and Human Services.
- Guyll, M., Spoth, R., & Redmond, C. (2003). The effects of incentives and research requirements on participation rates for a community-based preventive intervention research study. *Journal of Primary Prevention*, 24(1), 25-41.
- Hallstrom, B., Norving, B., & Lindgren, A. (2002). Stroke in Lund-Orup, Sweden: Improved long-term survival among elderly stroke patients. *Stroke*, 33(6), 1624-1629.
- Hinkle, J. L. (1998). Biological and behavioral correlates of stroke and depression. *Journal of Neuroscience Nursing*, 30(1), 25-31.
- Hinkle, J. L. (2000). The use of the FIM™ in the poststroke population. *Topics in Stroke Rehabilitation*, 7(3), 1-21.
- Hinkle, J. L. (2002). A descriptive study of cognitive status in acute motor stroke. *Journal of Neuroscience Nursing*, 34(4), 191-197.
- Hinkle, J. L. (2006). Variables explaining functional recovery following motor stroke. *Journal of Neuroscience Nursing*, 38(1), 6-12.
- Hughes, C. M., & Lapane, K. L. (2004). Factors associated with the initiation and discontinuation of secondary stroke prevention agents in nursing homes. *Journal of Stroke and Cerebrovascular Diseases*, 13(4), 164-170.
- Jeffery, D. R., & Good, D. C. (1995). Rehabilitation of the stroke patient. *Current Opinion in Neurology*, 8(1), 62-68.
- Johnston, M., Pollard, B., Morrison, V., & MacWalter, R. (2004). Functional limitations and survival following stroke: Psychological and clinical predictors of 3-year outcome. *International Journal of Behavioral Medicine*, 11(4), 187-196.
- Kaye, J., Morton, J., Bowcutt, M., & Maupin, D. (2000). Depression: The forgotten diagnosis among hospitalized adults. *Journal of Neuroscience Nursing*, 32(1), 7-16.
- Keith, R. A., Granger, C. V., Hamilton, B. B., & Sherwin, F. S. (1987). The functional independence measure: A new tool for rehabilitation. In M. G. Eisenberg & R. C. Grzesiak (Eds.), *Advances in Clinical Rehabilitation* (Vol. 1, pp. 6-18). New York: Springer-Verlag.
- Kelly-Hayes, M. (2004). Stroke outcome measures. *Journal of Cardiovascular Nursing*, 19(5), 301-307.
- Kelly-Hayes, M., & Paige, C. (1995). Assessment and psychologic factors in stroke rehabilitation. *Neurology*, 45(Suppl. 1), S29-S32.
- Kiernan, R. J., Mueller, J., Langston, W., & Van Dyke, C. (1987). The neurobehavioral cognitive status examination: A brief but differentiated approach to cognitive assessment. *Annals of Internal Medicine*, 107, 481-485.
- Man, D. W., Tam, S. F., & Hui-Chan, C. (2006). Prediction of functional rehabilitation outcomes in clients with stroke. *Brain Injury*, 20(2), 205-211.
- Masedo, A. I., Hanley, M., Jensen, M. P., Ehde, D., & Cardenas, D. D. (2005). Reliability and validity of a self-report FIM (FIM-SR) in persons with amputation or spinal cord injury and chronic pain. *American Journal of Physical Medicine & Rehabilitation*, 84(3), 167-176.
- Meijer, R., van Limbeek, J., Peusens, G., Rulkens, M., Dankoor, K., Vermeulen, M., et al. (2005). The stroke unit discharge guideline, a prognostic framework for the discharge outcome from the hospital stroke unit. A prospective cohort study. *Clinical Rehabilitation*, 19(7), 770-778.
- Melo, T., Bogousslavsky, J., van Melle, G., & Gegli, F. (1992). Pure motor stroke: A reappraisal. *Neurology*, 42, 789-798.
- Moncayo, J., Devuyt, G., van Melle, G., & Bogousslavsky, J. (2000). Coexisting causes of ischemic stroke. *Archives of Neurology*, 57(8), 1139-1144.
- Morrison, V., Pollard, B., Johnston, M., & MacWalter, R. (2005). Anxiety and depression 3 years following stroke: Demographic, clinical, and psychological predictors. *Journal of Psychosomatic Research*, 59(4), 209-213.
- Richmond, T., McCorkle, R., Tulman, L., & Fawcett, J. (1997). Measuring function. In M. Frank-Stromborg & S. Olsen (Eds.), *Instruments for Clinical Health-Care Research* (2nd ed.). Boston: Jones & Bartlett.
- Samuelsson, M., Soderfeldt, B., & Olsson, G. B. (1996). Functional outcome in patients with lacunar infarction. *Stroke*, 27(5), 842-846.
- Saxena, S. K., Ng, T. P., Yong, D., Fong, N. P., & Gerald, K. (2006). Total direct cost, length of hospital stay, institutional discharges and their determinants from rehabilitation settings in stroke patients. *Acta Neurological Scandinavica*, 114(5), 307-314.
- Schwamm, L. H., Van Dyke, C., Kiernan, R., Merrin, E., & Mueller, J. (1987). The neurobehavioral cognitive status examination: Comparison with the cognitive capacity screening examination and the mini-mental state examination in a neurosurgical population. *Annals of Internal Medicine*, 107, 486-491.