Predicting Response to Rehabilitation in Elderly Patients with Stroke Using the Orpington Prognostic Scale and Selected Clinical Variables

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ABSTRACT

Purpose: Prediction of outcome and response to rehabilitation in patients with stroke can be difficult, especially in the elderly. The purpose of this study was to determine the ability of the Orpington Prognostic Scale (OPS) to predict outcome and response to subacute rehabilitation in older patients with stroke. **Methods:** Twenty-two subjects in the subacute care setting diagnosed with acute stroke were prospectively studied. The OPS was scored within 2 weeks of stroke, and the Functional Independence Measure (FIM) motor subscale was scored at admission and discharge. **Results:** Strong Spearman correlations with OPS scores were found for improvement in FIM score [r_s = -.74, 95% CI: (-.88, -.45), p = .0007] and discharge FIM score [r_s = -.81, 95% CI: (-.92, -.58), p = .0002]. **Conclusions:** The OPS scores were strong predictors of response to subacute rehabilitation and discharge FIM motor subscale scores. The OPS may warrant a broader application as a prognostic indicator for patients with stroke.

Key Words: Orpington Prognostic Scale, stroke, prognosis, rehabilitation, outcome

INTRODUCTION

Stroke is the most common cause of chronic neurological impairment and disability for older Americans.[1] Following an emphasis on medical management during the acute stage, rehabilitation becomes crucial in helping patients restore function and minimize disability.[2] However, prediction of outcome and response to rehabilitation in patients with stroke can be difficult, especially in the elderly. Functional outcomes following rehabilitation for patients with stroke is a common area of study.[3] Numerous scales and instruments have been developed to measure a patient's functional status at admission, discharge, and at some point in time after discharge, thereby allowing the clinician to objectively measure improvement and outcome of rehabilitation interventions. The most widely used instruments are the Barthel Index and the Functional Independence Measure (FIM).[3]

The FIM encompasses 18 items, each scored using a 7-level ordinal scale.[4] The motor subscale of the FIM, which is comprised of self-care, sphincter control, transfer, and locomotion components, has been shown to have excellent reliability.[5] Concurrent validity has been established in a number of studies.[6]

These outcome measures have been used in studies employing multiple regression to predict outcomes based on a variety of clinical variables. Clinical variables typically used are age, gender, type, location, and side of stroke, prior level of function, cognition, and presence of aphasia, dysphagia, depression, pusher syndrome and hemi-neglect, and number of comorbidities.[7-12] While these clinical variables can assist the clinician in forming a prognosis for functional recovery, they do not provide an objective measure for the quantification of either overall severity of impairment or expected level of function after rehabilitation.[8,13]

Prognostic scales used to quantify severity of stroke and predict recovery following stroke have been studied and used in clinical practice in other countries for several years.[8,9,13] It is only recently that prognostic scales have been used in the United States, the most prominent of which is the National Institutes of Health Stroke Scale (NIHSS).[14,15] This scale has been shown to strongly predict the likelihood of an excellent, good, or poor recovery after stroke.[14] The NIHSS is also used to help determine degree of impairment in those patients who are candidates for tissue plasminogen activator (tPA), as well as to assess recovery following tPA administration.

The Orpington Prognostic Scale (OPS) is another prognostic scale for stroke outcome that has recently begun to be used in the United States. The OPS is an impairment-based scale

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developed by Kalra and Crome, who combined 2 existing tests, the Edinburgh and the Hodgkins Mental.[13] It scores patients on upper extremity motor function, proprioception, balance, and cognition. Kalra and Crome demonstrated that the OPS had a strong correlation with ADL scores at discharge using the Barthel activities of daily living Index (BI).[13] Kalra et al also demonstrated that OPS was able to discriminate between levels of dependency at discharge.[16] The OPS was first used in the United States by Lai et al[15] in a study comparing the OPS to the NIHSS in a sample of patients with primarily mild and moderate stroke. They demonstrated that the OPS was a slightly better predictor of ADL and higher level functioning at 6 months following stroke than the NIHSS, again using the BI. They also concluded that it was simpler to use and required less training. A distinct advantage of the OPS is that it includes a simple measure of cognition, which is a key element to recovery of function. Studenski et al[17] recently proposed a slight modification in the OPS score ranges used for stratification of severity. They used receiver operating characteristic curves with both development and validation datasets to assess the predictive ability of the OPS for 5 patient-focused functional outcomes, including independence in meal preparation, medication administration, community mobility, personal care, and dependence in personal care.

No previous study, to our knowledge, has examined the ability of the OPS to predict patients' outcome scores on the FIM scale, commonly used by many facilities. Validation of the OPS has exclusively used the BI. In our experience, especially in patients with moderate to severe strokes, the BI tends to have a strong floor effect. The BI uses fewer possible scores for each item. Thus, patients with greater functional limitations are given the same score, whereas the FIM allows for better gradation of level of assistance. Additionally, Garraway et al[18] and Prescott et al[8] have indicated that a good predictive tool for patients with stroke should be able to identify the 'middle-band' of patients for whom rehabilitation interventions would have the most impact. We believe that the OPS has not yet been sufficiently validated to predict which patients will respond most to rehabilitation. Therefore, the purpose of this study was to determine the ability of the OPS to predict outcome and response to subacute rehabilitation as measured by the FIM motor subscale in a population of patients with mostly moderate and severe strokes.

METHODS

Subjects

Subjects were considered for inclusion upon admission to 1 of 2 skilled nursing facility-based subacute care units within the same large metropolitan health system if a new diagnosis of stroke (based on CT or MR scanning) was made within 2 weeks of admission, and if they were able to complete a rehabilitation program. Subjects were excluded if they required transfer back to acute care.

Procedures

The OPS was scored by trained raters at 2 weeks poststroke. The prognostic ability of the OPS is maximized at 2 weeks post-stroke[13,16] and was the timeframe used in 2 other studies[15,17] that have helped validate the predictive ability of the OPS. Additional medical record information was recorded, including location and type of stroke, as well as presence of depression, aphasia, dysphagia, and hemi-neglect. Type and location of stroke were categorized as found in Table 1. The FIM Motor Subscale was administered by certified raters at admission and prior to discharge. This study protocol was approved by the Spectrum Health Institutional Review Board.

Statistical Analysis

Nonparametric Spearman correlation coefficients (r_s) were calculated for OPS and improvement in FIM motor subscale scores, as well as for OPS and discharge FIM scores. A correla-

Table 1. Descriptive Statistics on Admission to Subacute Setting

Characteristic	Statistic
Age (mean [std dev])	80.5 (7.7)
Orpington Prognostic Scale (mean [std dev])	4.8 (1.3)
Length of Stay(mean [std dev])	46.5 (26.6)
Gender	
female (percent [n])	68 (15)
male (percent [n])	32 (7)
Type of stroke	
thrombic (percent [n])	68 (15)
embolic (percent [n])	5 (1)
hemorrhagic (percent [n])	27 (6)
Location of stroke	
middle cerebral artery (percent [n])	45 (10)
posterior cerebral artery (percent [n])	5 (1)
cerebellar (percent [n])	5 (1)
brainstem (percent [n])	9 (2)
lacunar (percent [n])	36 (8)
Aphasia	
expressive (percent [n])	9 (2)
receptive (percent [n])	13.6 (3)
global (percent [n])	13.6 (3)
Apraxia (percent [n])	32 (7)
Dysphagia (percent [n])	86 (19)
Discharge Location	
community independent (percent [n])	27 (6)
community with assistance (percent [n])	9 (2)
assisted living (percent [n])	23 (5)
long term care (percent [n])	41 (9)

Total number (n) of subjects = 22

tion matrix using Spearman correlation coefficients was also calculated between the OPS, FIM, and several clinical variables known to be associated with outcome. Because categorical variables must be dichotomous, the clinical variables were entered into the correlation analysis as follows: age (actual value), gender (male = 0, female = 1), location of stroke (other = 0, middle cerebral artery = 1), type of stroke (thrombic/embolic = 0, hemorrhagic = 1), and presence of depression (no = 0, yes = 1), aphasia (no = 0, yes = 1), dysphagia (no = 0, yes = 1), apraxia, (no = 0, yes = 1), and hemi-neglect (no = 0, yes = 1). Improvement in FIM score, indicating rehabilitation effectiveness, is defined as (discharge score-admission score) ÷(maximum score-admission score) x 100%. This method is recommended by Vanclay[19] to adjust for the variability between patients at admission.

RESULTS

During the study period, at least 25 subjects were excluded due to being admitted later than 2 weeks post-stroke. Another 11 were excluded due to transfer back to acute care. Twenty-two subjects met criteria for inclusion and were able to complete the study. Descriptive statistics of these subjects are shown in Table 1.

Strong correlations were found between the OPS and improvement in FIM score [r_s = -.74, 95% CI: (-.88, -.45), p = .0007], as well as for OPS and discharge FIM score [r_s = -.81, 95% CI: (-.92, -.58), p = .0002]. The presence of aphasia demonstrated a moderate, inverse correlation with FIM scores and improvement in FIM scores. The presence of aphasia was also moderately correlated with the presence of apraxia. The presence of depression was associated with lower FIM scores. Older age was associated with higher OPS scores (Table 2).

DISCUSSION

Following stroke in the elderly, the ability to predict a patient's outcome and response to rehabilitation at various stages of rehabilitation is important in helping establish goals and discharge plans, as well as educating patients and families. The results of this study demonstrated strong correlations with both outcome and improvement in functional status as measured by the FIM motor subscale.

Table 2. Matrix of Spearman Correlations Between Orpington Prognostic Scale (OPS) Scores, Functional Independence Measure (FIM) Scores, and Clinical Variables

	OPS	FIM	Improvement	Age	Gender	Location	Type	Depression	Aphasia	Dysphagia	Apraxia
Hemineglect	.30	-.25	-.24	-.19	.20	.05	.31	.11	.17	-.35	.24
Apraxia	.16	-.29	-.30	-.18	.05	.16	-.19	-.17	**.50***	-.01	
Dysphagia	.30	-.16	-.11	.00	-.27	-.17	-.35	.06	.30		
Aphasia	.38	**-.47***	**-.45***	-.07	.11	.07	-.25	.05			
Depression	.35	**-.43***	-.37	-.04	.37	.35	-.09				
Type	-.22	.21	.32	.05	-.24	-.35					
Location	**.43***	-.30	-.37	**-.51***	.23						
Gender	.12	-.15	-.19	-.23							
Age	**-.48***	.12	.06								
Improvement	**-.74****	**.97****									
FIM	**-.81****										

Improvement=Improvement in FIM score adjusted for admission score
* Significant at the $P \leq .05$ level
** Significant at the $P \leq .001$ level

These results not only support those of previous studies demonstrating the OPS's ability to predict outcome, they also support the hypothesis that the OPS can be used to predict response to rehabilitation. More specifically, with greater impairment as measured by the OPS, less improvement in FIM motor subscale scores can be expected within the timeframe typical of subacute rehabilitation. It should be noted that the high correlation between OPS scores and discharge FIM scores was expected, given the previously established relationship between the OPS and the BI. However, it is important to establish this relationship with the FIM due to its common use and to demonstrate that the OPS is also able to predict change in FIM scores.

The matrix (Table 2) of Spearman coefficients demonstrates relationships among the variables studied. In the present study, presence of aphasia was associated with poorer outcome (measured by discharge FIM score) and response to rehabilitation (less improvement in FIM scores). Similar results have been found in several previous studies.[20-22] Additionally, presence of depression was associated with poorer outcome but not with response to rehabilitation. This association between depression and outcome is consistent with the results of previous studies.[20,22]

A moderate correlation (Table 2) was found between stroke location and OPS score. More specifically, middle cerebral artery stroke was associated with higher OPS scores (greater impairment) and with younger age. Pohjasvaara et al[23] reported a difference in stroke location and risk factors with age. However, they found that middle cerebral artery stroke was more common in older patients, which is the reverse of the results in the present study. They did, however, find that older age was associated greater impairment and change in ADL status. This is in agreement with the present study in that we found older age to be associated with higher OPS scores. Additionally, Falconer et al[24] noted that older patients admitted to a rehabilitation hospital with stroke had worse motor function at admission and discharge, as well as an increased rate of nursing home placement at discharge.

Caution should be used when clinically applying the results of the current study to patients with severe stroke who will likely show the least amount of change in FIM scores. These patients should still be given rehabilitation opportunities. However, an emphasis should be placed on long-term planning and utilization of various caregivers in the performance of maintenance programs. The skilled rehabilitation therapist's role then serves to monitor, revise, and progress the maintenance program to achieve clinically significant changes in basic ADL function, such as reduced assistance with transfers and basic self-cares over a longer period of time. It is our experience that those patients with severe stroke are still able to make functionally significant progress beyond 6 months poststroke, especially those improvements that reduce caregiver burden. These improvements, such as progressing from ambulation with skilled staff to ambulating with unskilled staff are consequential, but have not been studied because the outcomes examined in most studies focus on attaining independence or a specific discharge disposition. Future studies should prospectively follow these patients with severe stroke who do not attain independence and quantify the improvements that are made over time.

One significant limitation of this study is the small sample size. However, given the strength of the correlations between OPS scores and both the discharge FIM and FIM improvement scores, similar results would likely be found in larger sample sizes. Further validation with larger sample sizes, however, is needed. Additionally, the small sample size in this study did not allow for multiple regression analysis, which would have provided additional insight into how stroke severity and other clinical variables interact and contribute to outcome and response to rehabilitation.

A second limitation of this study is that only patients admitted to a skilled nursing facility for subacute rehabilitation were included, and thus a selection bias is already inherent in this group of patients, precluding generalization of the results to an acute rehabilitation environment.

A third limitation of this study is that only FIM motor subscale scores were included in the analysis of response to rehabilitation and outcome. The motor subscale comprises tasks that typically are used in goal setting for physical and occupational therapy intervention. Further study that involves more global measures of function should be undertaken.

CONCLUSION

This study has demonstrated that OPS scores were strong predictors of response to rehabilitation and discharge FIM motor subscale scores. The OPS may warrant broader use for stratifying patients poststroke according to severity and to provide the clinician, patient, and family with prognostic information regarding response to rehabilitation and outcome following subacute rehabilitation.

ACKNOWLEDGEMENTS

No grant support was provided for this study.

The authors thank Amber Crenshaw, PT, MS for her efforts in assisting with data collection.

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