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Categorization of Ischemic Stroke Patients Compared with National Institutes of Health Stroke Scale

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ABSTRACT

Introduction: Scientific guidelines recommend the National Institutes of Health Stroke Scale (NIHSS) for ischemic stroke (IS) assessment. In Clinical Department of Neurology of Split University Hospital Center nurses use the categorization of patients (COP) according to individual needs for health care. **Aim:** The aim of this study was to demonstrate that there is a positive correlation between the COP and the NIHSS in IS patients. **Methods:** We analyzed NIHSS scores and COP findings in 325 participants (median age 77 years, min-max: 37-95 years) with acute ISs. **Results:** There is a statistically significant correlation between the NIHSS score at admission and COP at admission ($p=0.717$; $P<0.001$). There is a statistically significant correlation between the NIHSS score at discharge and COP at discharge ($p=0.762$; $P<0.001$). Median of NIHSS scores at admission is higher in females than in males for 2 ($Z=4.45$, $P<0.001$) and at discharge is higher for 2 ($Z=4.1$, $P<0.001$). Median of COP at admission is higher in females than in males for 1 ($Z=4.7$, $P<0.001$) and at discharge is the same ($Z=4.7$, $P<0.001$). **Conclusion:** There is a significant association of NIHSS scores and COP in IS patients. This association exists at admission and at discharge from the hospital.

Key words: ischemic stroke, nursing care, categorization of patient, The National Institutes of Health Stroke Scale.

1. INTRODUCTION

Ischemic stroke (IS) is a common disease, often resulting in death or disability (1). Monitoring of changes of clinical symptoms during acute stage is important. There are many assessment scales used for measuring stroke severity, confined to either neurological, functional, or disability measures (2-4).

The National Institutes of Health Stroke Scale (NIHSS) is widely used to evaluate the severity of neurological deficit of stroke patients and predict the outcome of stroke in the clinical practice. It examines the level of consciousness, language function, neglect, visual field, eye movements,

facial palsy, motor strength, sensory function, and coordination (5, 6).

Nurses in Clinical Department of Neurology of Split University Hospital Center use the categorization of patients (COP) according to Šepić et al. Depending on the amount of necessary medical care, 16 critical factors are defined. The nurse assesses the patients on a daily basis according to these factors, and depending on their needs classifies patients in a particular category on a scale from 1 to 4 (the number of points for each factor is equal to the category in which the patient is placed; category 2 = 2 points). Depending on the total number of points determines the

final category into which the patient will be placed (category 1 = 16-26 points; category 2 = 27-40; category 3 = 41-53; category 4 = 54-64) (7).

Critical factors are:

- Hygiene,
- Dressing,
- Feeding,
- Elimination,
- Walking and standing,
- Sitting,
- Moving and turning (each of these activities are individually estimated by the amount of help that nurse provides to the patient, depending on the need of using aids; category 1 = independent patients; category 4 = totally dependent) (7),
- Fall risk (if there is no fall risk, the patient is classified into the category 1; if there is a fall risk, it is estimated using the Morse fall scale; category 2 = low risk = 0-24 points; category 3 = moderate risk = 25-44 points; category 4 = high risk = 45 or more points) (7, 8),
- Pressure ulcer risk (estimated by using the Braden Scale; category 1 = no risk = 19-23 points; category 2 = a risk is present = 15-18 points; category 3 = moderate risk = 13-14 points = high risk = 10-12 points; category 4 = very high risk = 9 points or less) (7, 9),
- State of consciousness (category 1 = conscious patients, oriented in time and space; category 2 = bemused patients; category 3 = stupor, category 4 = pre-coma and coma) (7, 10),
- Communication (category 1 = no difficulties; category 2 or 3 = dyslalia or gibberish depending on the intensity of difficulties; category 4 = sensory or motor aphasia),
- Education (category 1 = oral or written instructions about new lifestyle adaptations; category 2 = instructions, demonstrations, and verification of understanding; category 3 = work with the guardian or family member; category 4 = practice the patients and families knowledge and skills and verification of complete independence in the application of knowledge),
- Vital signs (category 1 = vital signs are assessed 1-2 times daily; category 2 = 3-4 times daily; category 3 = 6 times daily; category 4 = constant monitoring),
- Specific procedures in the health care (category 1 = the patient is self-contained; category 2 = requires specific processes and minimal nursing; category 3 = requires specific processes twice or more daily and a significant nursing; category 4 = procedures are fully performed by nurse),
- Understanding of the diagnostic methods (category 1 = it is necessary to explain procedure, without specific preparation, or patient monitoring after procedure; category 2 = explanation of procedures, psychic preparation of the patient and equipment, and nurse presence during the procedure; category 3 = explanation of procedures,

patient psychological and physical preparation, preparation of equipment, accompaniment, nurse participates in procedure, patient monitoring up to 12 hours after the procedure; category 4 = patient requires the same actions as in the 3rd category except that patient monitoring takes 12-24 hours after the procedure),

- Therapeutic procedures (category 1 = oral therapy, inhalation, local therapy up to 4 times daily, and oxygen therapy; category 2 = oral therapy, inhalation, or local therapy 5 or more times daily, injections (i.c., s.c., i.m., i.v.), abdominal and pleural puncture, radiotherapy, self, group and family therapy; category 3 = intermittent therapy (enteral and parenteral), application of the 24 hour infusion in the order to maintenance of the central venous way, CAPD; category 4 = continuous 24 hours therapy (enteral and parenteral), i.v. cytostatic therapy, hemodialysis, plasmapheresis, biofiltration, continuous supervision over blood components transfusion, continuous supervision over blood-forming cells transplantation) (7).

The aim of this study was to demonstrate that there is a positive correlation between the COP and NIHSS in IS patients.

2. MATERIALS AND METHODS

The study was conducted at the Clinical Department of Neurology of Split University Hospital Center. Data were collected in the period from September, 2014 until May, 2015. A diagnosis of stroke was confirmed after both a careful critical neurological examination and a positive neuroimaging result using computerized tomography (CT) or magnetic resonance imaging (MRI) according to the International Classification of Diseases, 10th Revision. (I63-I63.3) (11).

We excluded patients below 18 years of age. Clinical data included age, gender, NIHSS scores (at admission and at discharge), COP (at admission and at discharge), and duration of the hospitalization.

The inclusion criteria were medical diagnosis of IS definitely diagnosed by CT or MRI scan, and the arrival of the patient in the hospital within 24 h of stroke onset. The exclusion criteria for this study were the presence of other types of cerebrovascular disease (intracranial hemorrhage, subarachnoid hemorrhage, transient ischemic attack, cerebral aneurysm, cerebrovascular malformation), and comorbidities with severe diseases such as cancer, inflammatory diseases (rheumatoid arthritis), serious chronic diseases (heart or kidney failure), and patients with mental disorder or severe dementia.

This study was approved by the Ethics committee of Split University Hospital Center. All participants provided informed consent. If participants were unable to communicate, written consent was obtained from their legal guardians.

The data were analyzed by SPSS statistical software version 23.0 (SPSS Inc, Chicago, USA).

Categorical variables were expressed as numbers (percentage) and ordinal variables as a median. We used the

χ^2 test for independent samples to compare categorical variables and Mann-Whitney U-test for age distribution by gender. Related samples were analyzed by Wilcoxon test. Dependence between the groups was analyzed by Spearman's rank correlation coefficient (95% CI). Predictors affecting the length of hospitalization were tested by multiple regressions. All tests were carried out with a statistical significance of 95% ($P < 0.05$).

3. RESULTS

There were 699 participants with ISs in the observed period. Participants with a fatal outcome 130 (35%) and those without complete documentation 244 (65%) were excluded. The remaining 325 participants were included (median age 77 years, min-max: 37-95 years). There was a total of 169 (52%) males (median age 73 years, min-max: 37-90 years) and 156 (48%) females (median age 79 years, min-max: 48-95 years).

Median of NIHSS scores at admission is higher in females than in males for 2 ($Z=4.45$, $P < 0.001$) and at discharge is higher for 2 ($Z = 4.1$, $P < 0.001$). Median of COP at admission is higher in females than in males for 1 ($Z=4.7$, $P < 0.001$) and at discharge is the same ($Z=4.7$, $P < 0.001$) (Table 1).

	Total	Males	Females	P
NIHSS (admission)	6 (0-35)	5 (0-21)	7 (0-35)	<0.001*
NIHSS (discharge)	3 (0-25)	2 (0-25)	4 (0-25)	<0.001*
P	<0.001**	<0.001**	<0.001**	
COP (admission)	2 (1-4)	1 (1-4)	2 (1-4)	<0.001*
COP (discharge)	1 (1-4)	1 (1-4)	2 (1-4)	<0.001*
P	<0.001**	<0.001**	<0.001**	
Duration of the hospitalization (days)	8 (2-26)	8 (2-21)	9 (2-26)	0.346*

Table 1. Number (%) of participants according to the qualitative variables and median (min-max) of quantitative variables at admission and discharge, total and in relation to gender. *Mann-Whitney U-test; ** Wilcoxon test.

In 223 (69%) participants the value of NIHSS score at the discharge is decreased compared to the value at the admission, in 39 (12%) participants is increased, and in 63 (19%) remained the same ($Z=9.4$, $P < 0.001$). In 83 (25.5%) participants the value of COP at discharge is decreased compared to the value at the admission, in 20 (6%) participants is increased, and in 222 (68.5%) remained the same ($Z=5.9$, $P < 0.001$).

In 125 (74%) males the value of NIHSS score at discharge is decreased compared to the value at the admission, in 10 (6%) is increased, and in 34 (20%) remained the same ($Z=8.6$; $P < 0.001$). In 39 (23%) males the value of COP at discharge is decreased compared to the value at the admission, in 7 (4%) is increased, while in 123 (73%) remained the same ($Z=4.5$; $P < 0.001$).

In 98 (63%) females the value of NIHSS score at discharge is decreased compared to the value at the admission, in 29 (18.5%) is increased, and in 29 (18.5%) remained the same ($Z=4.9$, $P < 0.001$). In 44 (28%) females the value of COP at discharge is decreased compared to the value at the admission, in 13 (8%) is increased, and in 99 (64%) of them remained the same ($Z=4.0$, $P < 0.001$).

There is a statistically significant correlation between the NIHSS score at admission and COP at admission ($\rho=0.717$; $P < 0.001$). NIHSS score is statistically significant, but poorly associated to duration of the hospitalization ($\rho=0.240$; $P < 0.001$) and age ($\rho=0.149$; $P=0.007$). COP is statistically significant associated to duration of the hospitalization ($\rho=0.314$; $P < 0.001$) and age ($\rho=0.173$; $P < 0.002$). Duration of the hospitalization and age are not statistically significant associated ($\rho=-0.099$; $P=0.074$) (Table 2).

	NIHSS score	COP	Duration of the hospitalization
NIHSS score			
COP	0.717 ($P < 0.001$)		
Duration of the hospitalization	0.240 ($P < 0.001$)	0.314 ($P < 0.001$)	
Age	0.149 ($P=0.007$)	0.173 ($P < 0.002$)	-0.099 ($P=0.074$)

Table 2. Correlation of research variables at admission: Spearmans rho (ρ).

There is a statistically significant correlation between the NIHSS score at discharge and COP at discharge ($\rho=0.762$; $P < 0.001$). NIHSS score is statistically significant, but poorly associated to duration of the hospitalization ($\rho=0.287$; $P < 0.001$) and age ($\rho=0.138$; $P=0.013$). COP is statistically significant, but poorly associated to duration of the hospitalization ($\rho=0.321$; $P < 0.001$) and age ($\rho=0.161$; $P < 0.004$) (Table 3).

	NIHSS score	COP	Duration of the hospitalization
NIHSS score			
COP	0.762 ($P < 0.001$)		
Duration of the hospitalization	0.287 ($P < 0.001$)	0.321 ($P < 0.001$)	
Age	0.138 ($P=0.013$)	0.161 ($P < 0.004$)	-0.099 ($P=0.074$)

Table 3. Correlation of research variables at discharge: Spearmans rho (ρ).

By multiple regression analysis in which the dependent variable was duration of the hospitalization, and the independent variables were gender, age, NIHSS score and COP we obtained that these independent variables are predictors of duration of the hospitalization ($F=14.6$, $P < 0.001$). Multiple correlation coefficient $R=0.391$, determination coefficient $R^2=0.154$, $SEE=3.8$. The change in duration of the hospitalization is by 15.4% explained by gender, age, NIHSS score, and COP, and all other

Predictors	The regression coefficients (SE)	P
Gender	0.114 (0.46)	0.803
Age	-0.06 (0.02)	<0.001
NIHSS score	0.11 (0.06)	0.065
COP	1.3 (0.42)	<0.001
Section	10.6 (1.5)	<0.001

Table 4. Predictors that affect the duration of hospitalization.

changes are due to predictors that are not included in these analyses (Table 4).

4. DISCUSSION

Stroke is a kind of disease with the characteristics of obvious stage change of symptoms (1). However, the change of clinical symptoms during acute stage is consistently neglected. A comprehensive and precise prognosis scale of IS still needs to be further developed (5).

The present study showed that NIHSS score (at admission and at discharge) in IS patients was associated with COP, which is associated with a higher demand for health care. However, searching the literature we did not find any study that examines the connection between these two scales.

The NIHSS is a valid, efficient, and reliable measure of the patient's status after a stroke and in assessing outcome after treatment. Among neurologists and nurses, it is the most widely used stroke deficit scale. The NIHSS contains parameters for observing changes in the patient's neurological status and measuring stroke severity (12). In contrast to NIHSS score COP contains much more data about the total physical condition, affecting the prognosis and outcome of IS patients (7).

There is a significant association of NIHSS scores and vessel occlusions, and increased baseline NIHSS score is associated with an increased risk of neurological and medical complications (5, 6). Stroke patients require intensive care at some moment during hospitalization. In addition, difficulties exist to deliver care to people with multiple care needs. It is highlighted that, the larger the number of patient needs are affected, the greater the urgency to plan care, as the systemization of actions aims for the organization, effectiveness and validity of care delivery (13). Taking into account our results, IS patients with higher NIHSS score require a higher nursing level due to poor total somatic condition (e.g. increasing the likelihood of developing pressure ulcers, poorer physical activity, increasing dependence on nurse's assistance...). Our findings underscore the importance of using the NIHSS not only as a measure of stroke severity, but also as part of the assessment of needs for health care that are in correlation with COP.

Stroke is a complex disease that requires the efforts and skills of all members of the multidisciplinary team (12). Even in specialized stroke units, up to 63% of patients experience 1 or more complications after IS (14). Medical and nursing management are often responsible for the coordination of care throughout the continuum and both are focus on the prevention of subacute complications of stroke (12). As for interventions related with complication and trauma prevention, nurses should enhance the maintenance of the normal function, preventing complications and traumas, assessing patient's basic needs and guaranteeing the patient's best condition to benefit from rehabilitation (15). All these needs are summarized in the COP (7).

This study has several potential limitations. Our data were obtained from a single hospital setting and therefore may not be generalizable to other settings. Our re-

sults are also obtained from a retrospective analysis in a small sample size, and therefore prospective validation is required before NIHSS score can be considered as a predictor of health care needs.

5. CONCLUSION

Despite some methodological limitations, the present study shows that, in IS patients, higher NIHSS score is associated with an increased COP which predict higher health care needs. Our findings suggest that NIHSS assessment may be a useful approach to predict the need for health care, because it can alert the physician to the anticipated risk of somatic and neurological complications in an individual patient and can thus affect early decisions about further surveillance and diagnostics.

- **Author's contribution:** all authors were included in all phases of preparing this article, including final proof reading.
- **Conflict of interest:** none declared.

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