Stroke rehabilitation: Which factors influence the outcome?

Sir,
Some patients after ischemic stroke show significant functional recovery after a very short period of time, while others show minimal progress.[1,2] Although a lot of research has been undertaken on this subject, authors still disagree on the effect of different factors on rehabilitation outcome.[3-5] Therefore, the purpose of this study was to evaluate the impact of age, gender, cognitive status, depression, subtype of ischemic stroke based on the Trial of ORG 10172 in Acute Stroke Treatment (TOAST) classification,[6] and co-morbidity on rehabilitation outcome of stroke patients.

This prospective study included 150 patients with ischemic stroke treated at the Rehabilitation Clinic in Novi Sad between June 2012 and May 2014. The following clinical data were collected: Type of stroke and impairment, the presence of cardiac co-morbidities (hypertension, atrial fibrillation, myocardial infarction and dilated cardiomyopathy), presence of diabetes mellitus, length of waiting (LOW; time from stroke onset to admission to our hospital) and length of stay (LOS).

A patient's performance in ADLs was evaluated by the Barthel Index (BI), ambulation ability by the Rivermead Mobility Index (RMI) and degree of disability by modified Rankin Scale (mRS). We defined successful rehabilitation as the value of BI at discharge ≥80 or the difference between BI value at discharge and admission ≥40. Cognitive condition was evaluated using Mini Mental State Evaluation (MMSE), and the presence of depression was registered by Hospital Anxiety and Depression Scale (HADS) after seven days of an admission to our institution.

In the study population (N = 150; mean age 63.6 ± 10.5; range

29-90), there were less women (N = 54 [36%]) than men (N = 96 [64%]). Breakdown of patients by the type of impairment and stroke etiology are shown in Table 1. The most prevalent co-morbidities in the study group were hypertension (N = 126 [84.0%]) and diabetes mellitus (N = 50 [33.3%]) [Figure 1].

According to the criteria we have established, 70% of the patients had successful rehabilitation (N = 105), and 30% had unsuccessful rehabilitation (N = 45). A statistically significant difference was found between the average values of BI, RMI and mRS at admission and discharge (P < 0.001) [Figure 2].

Statistically significant difference was found regarding the rehabilitation success in relation to the type of stroke based on the TOAST classification [Table 1]. Also, the presence of hypertension, atrial fibrillation, myocardial infarction and dilated cardiomyopathy had a statistically significant impact on the success of rehabilitation, but not diabetes mellitus (P = 0.571; 74.0% vs. 68.0%) [Table 2]. Relation between rehabilitation outcome and MMSE, HAD scale, RMI, BI and mRS on admission and discharge are shown in Table 3.

In order to analyze the impact of cognitive status and depression on rehabilitation outcome, we performed correlation and regression analysis. Correlation between MMSE and BI, as well as MMSE and RMI at discharge was moderate and the coefficient of linear regression was positive and statistically significant (P < 0.001). The correlation between the values of HAD D and BI, and HAD D and RMI at discharge were moderate, and the coefficient of linear regression was negative and statistically significant (P < 0.001) [Table 4].
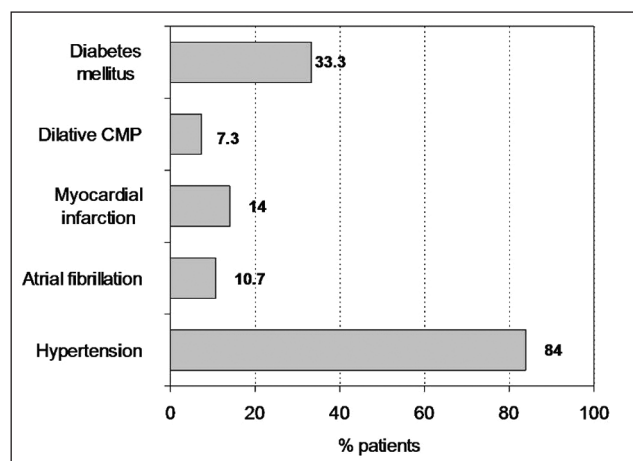

Figure 1: Comorbid disorders
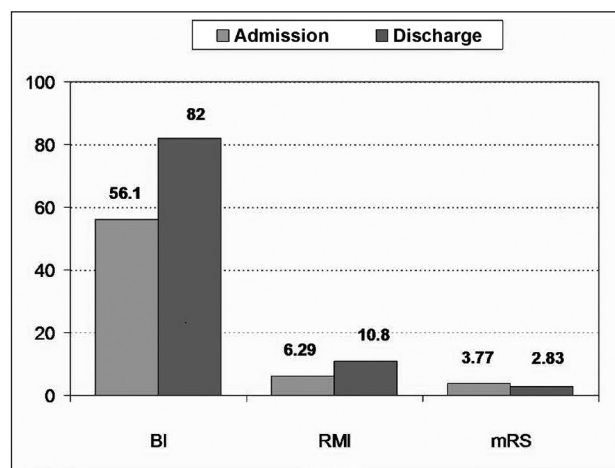

Figure 2: Average values of BI, RMI and mRS on admission and discharge

Table 1: Relation between rehabilitation outcome andgender, type of impairment and stroke subtype

Variable	Type of ischemic stroke
Unsuccessful rehabilitation	LAA
Successful rehabilitation	20 (54.1%)
Gender	17 (45.9%)
Male	P < 0.001 *
25 (26.0%)	CE
71 (74.0%)	10 (71.4%)
P = 0.221	4 (28.6%)
Female	SVD
20 (37.0%)	9 (13.2%)
34 (63.0%)	59 (86.8%)
Side of hemiparesis/hemiplegia	Ischemic stroke of other origin
Left-sided	2 (15.4%)
29 (42.6%)	11 (84.6%)
39 (57.4%)	Ischemic stroke of unknown origin
P = 0.006 *	4 (22.2%)
Right-sided	14 (77.8%)
14 (21.9%)	
50 (78.1%)	

*P < 0.05 significant

Table 2: Relation between rehabilitation outcome and co-morbidity

Co-morbidity	16 (76.2%)
Present	5 (23.8%)
Unsuccessful rehabilitation	P < 0.001 *
Successful rehabilitation	No
Hypertension	29 (22.5%)
Yes	100 (77.5%)
45 (35.7%)	Dilated cardiomyopathy
81 (64.3%)	Yes
P = 0.001 *	8 (72.7%)
No	3 (27.3%)
0 (0.0%)	P = 0.004 *
24 (100.0%)	No
Atrial fibrillation	37 (26.6%)
Yes	102 (73.4%)
9 (56.3%)	Diabetes mellitus
7 (43.8%)	Yes
P = 0.033 *	13 (26.0%)
No	37 (74.0%)
36 (26.9%)	P = 0.571
98 (73.1%)	No
Myocardial infarction	32 (32.0%)
Yes	68 (68.0%)

*P < 0.05 significant

Table 3: Relation between rehabilitation outcome and MMSE, HAD scale, RMI, BI and mRS on admission and discharge

Variable	Rehabilitation outcome	N	Average value	SD	Min-Max	P
Rehabilitation outcome	Unsuccessful	45	6.53	2.05	3-11	P < 0.001 *
	Successful	105	12.6	1.97	6-15	
MMSE	Unsuccessful	45	22.7	3.47	16-29	P < 0.001 *
	Successful	105	25.8	3.37	16-30	
HAD D	Unsuccessful	45	8.93	4.52	0-15	P < 0.001 *
	Successful	105	4.70	3.76	0-13	
HAD A	Unsuccessful	45	7.51	3.68	1-15	P < 0.001 *
	Successful	105	4.00	3.24	0-13	
BI admission	Unsuccessful	45	39.9	16.9	10-65	P < 0.001 *
	Successful	105	63.0	17.4	15-75	
BI discharge	Unsuccessful	45	59.1	15.0	25-75	P < 0.001 *
	Successful	105	91.7	9.51	65-100	
RMI admission	Unsuccessful	45	3.40	2.19	0-9	P < 0.001 *
	Successful	105	7.53	2.79	0-12	
RMI discharge	Unsuccessful	45				
mRS admission	Unsuccessful	45	4.58	0.543	3-5	P < 0.001 *
	Successful	105	3.43	0.663	3-5	
mRS discharge	Unsuccessful	45	3.76	0.609	3-5	P < 0.001 *
	Successful	105	2.43	0.569	1-4	

*P < 0.05 significant

Table 4: Correlation between MMSE, HAD D subscale and BI and RMI on discharge

Value X	Value Y	R	constant	Coefficient	P
MMSE	BI discharge	0.498	18.6	2.52	<0.001
HAD D	BI discharge	0.529	95.4	−2.24	<0.001
MMSE	RMI discharge	0.521	−1.27	0.483	<0.001
HAD D	RMI discharge	0.584	13.4	−0.449	<0.001

*P < 0.05 significant

Our results suggest that the presence of cognitive decline and depression in patients with ischemic stroke are negative determinants of rehabilitation outcome, which is consistent with several recent studies.[7-9] Furthermore, cardiac co-morbidities (arterial hypertension, myocardial infarction, atrial fibrillation, and dilated cardiomyopathy) show significant clinical relevance and have strong influence on rehabilitation outcome. On the other hand, our findings imply that gender and the presence of diabetes mellitus are not related to functional outcome of stroke rehabilitation. A negative association was observed between patients' age and functional gain after rehabilitation treatment. The etiological stroke subtype should be taken into account when setting rehabilitation goal since patients with large-artery atherosclerosis (LAA) and cardioembolic (CE) ischemic stroke have worse functional outcomes compared to patients with small-vessel disease (SVD) ischemic stroke. The main highlight and purpose of this study is to shed some new light on factors that determine rehabilitation success so that rehabilitation goals are set according to patients' potentials. However, to strengthen this observation, further large multi-centric studies have to be done in future. To have a simple, easy to administer system for predicting stroke rehabilitation outcome would be an ideal step forward in planning feasible rehabilitation treatment in future.

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