

## ASSESSMENT OF HEALTH-RELATED QUALITY OF LIFE OF POST-STROKE SURVIVORS

Milan Mandić<sup>1</sup>, Mirjana Arandjelović<sup>2</sup>, Maja Nikolić<sup>1,2</sup>, Nataša Rančić<sup>1,2</sup>

The objective of the paper was to assess the health-related quality of life (HRQOL) in post-stroke survivors. Method: A prospective cohort study was done. The study involved 136 post-stroke survivors who had inpatient rehabilitation. Their functional status was assessed by Barthel Index (BI) and modified Rankin scale (mRS). The Mini Mental State Examination (MMSE) was used for screening the cognitive function. HRQOL was assessed by the Medical Outcomes Study 36-item Short Form (SF-36). Functional status, cognitive function and HRQOL were assessed at the admission, one, and six months after the stroke. The repeated-measures analysis of ANOVA variance test was used as a correlation analysis. Results: There were marked declines in all eight SF-36 questionnaire domains at admission. After one month and after six months of follow-up, BI and MMSE scores increased and mRS decreased. All eight domains of the SF-36 improved, but six showed a statistically significant increase. The domains of bodily pain and vitality showed non-significant improvements. Six months after the stroke, five domains continued to increase significantly, except for vitality, bodily pain and mental health. ANOVA showed that the values of mRS significantly decreased during the investigation ( $p < 0.001$ ) while the BI and MMSE scores significantly increased ( $p < 0.001$ ). Conclusions: A strong correlation was found between higher BI scores and physical and social domains, and emotional role, mental and general health. Improvements in motor ability and improvements of cognitive function were statistically significantly associated with HRQOL increase. All the domains of SF 36 improved during the six-month follow-up. Bodily pain, vitality and mental health improved non-significantly during the six months after the stroke.

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<sup>1</sup>Clinic for physical medicine and rehabilitation, Clinical Center Niš, Niš, Serbia

<sup>2</sup>University of Niš, Faculty of Medicine, Niš, Serbia

<sup>3</sup>Institute for public health Niš, Niš, Serbia

Contact: Milan Mandić  
Clinic for physical medicine and rehabilitation,  
Clinical center Niš  
Blvd. dr Zoran Djindjić 48, 18000 Niš, Serbia  
E-mail: milanmandic69@gmail.com

### Introduction

Despite the advances in the diagnosis and treatment of cerebrovascular disease, stroke remains the third most common cause of death worldwide and leading cause of disability (1,2,3). The prevalence of stroke survivors who experience an incomplete recovery is 461 per 100,000, and one-third of these survivors require assistance with at least one activity of daily living (3).

Stroke remains one of the most devastating of all neurological diseases, often causing death or phy-

sical impairment or disability (4). According to the World Health Organization (WHO), 15 million people present with stroke annually, and of these five million die as a result of the event and a large part of the survivors present physical and/or mental sequelae (5).

Post-stroke functional deficits and psychological problems disrupt the patient's ability to perform activities of daily living, which negatively impacts their health-related quality of life (HRQOL) (5). The most important consequence of stroke for stroke survivors is decreased HRQOL (6, 7).

In many studies, stroke patient HRQOL scores were evaluated and some were reported as disrupted (8-18). Patients often experience a loss of self-identity following a stroke (19). Speech loss or difficulties with speech (19) are significant factors that reduce social interactions (20).

Several studies suggest that HQOL decreases after stroke because of functional impairments, depression and insufficient social support (17, 21), home circumstances and standard of living (21), and also gender and age, with women and older adults, as well as more dependent stroke survivors, reporting lower QOL (22).

HRQOL measurements reflect the physical, functional, psychologic, and social aspects of health (19). HRQOL is usually a reflection of the patients subjective and personal evaluation of their own health status (23). Rehabilitation helps stroke survivors maximize their HRQOL, including physical, cognitive, emotional and social aspects (24).

The results of treatment are assessed applying the tests that evaluate physical limitations and/or functional impairments (25).

The objective of the paper was to assess the impact of physical and mental factors on HRQOL during and after inpatient rehabilitation in post-stroke survivors.

## Methods

A prospective study was done. The study involved 216 post-stroke survivors aged 30-79 from the Nishava District, out of which 196 completed the study. Dropping-out was caused by the following: 11 patients declined to participate; 60 patients had outpatient rehabilitation; and 9 died. Only 136 post-stroke survivors had inpatient rehabilitation after stroke. The observed period was January 1, 2011 to August 15, 2013. The HRQOL was assessed by means of the Medical Outcomes Study 36-item Short Form (SF-36), which is a self-administered questionnaire. The Mini Mental State Examination (MMSE) was used for screening the cognitive function. Functional status was assessed by the Barthel Index (BI) and modified Rankin Scale (mRS). Functional status and questionnaires were assessed at the admission to the Clinic, after one month of follow-up, and after six months of follow-up.

The criteria for inclusion in the study were the first-ever stroke (cerebral infarction or hemorrhage), confirmed by either brain CT or MRI findings consistent with the clinical presentation, patient willingness to participate, and availability of a complete Mini-Mental State Examination (MMSE), mRS, BI score and SF-36 questionnaire.

The exclusion criteria were the second stroke or personal history of stroke, severe cognitive impairment, aphasia.

All the patients were informed in detail about the aims of the study. The Ethics Committee of the Faculty of Medicine in Nis and the Ethics Committee of the Clinical center Niš gave their approval for the study.

## Questionnaires

The patients' functional status was assessed using the modified Barthel Index (BI) and modified Rankin Scale (mRS) (26-30).

The BI was developed in 1965 (27) and later modified by Granger and coworkers (28) as a scoring technique that measures the patient's performance in 10 activities of daily life. The BI is considered a reliable disability scale for stroke patients (29). The items can be divided into two groups, one related to self-care (feeding, grooming, bathing,

dressing, bowel and bladder care, and toilet use) and the other related to mobility (ambulation, transfers, and stair climbing). The maximal score is 100 if 5-point increments are used, indicating that the patient is fully independent in physical functioning. The lowest score is 0, representing a totally dependent, bedridden state.

The mRS measures independence rather than performance of specific tasks. In this way, mental as well as physical adaptations to the neurological deficits are incorporated. The scale consists of 6 grades, from 0 to 5, with 0 corresponding to no symptoms and 5 corresponding to severe disability (29).

Cognitive function was assessed using the mini mental state examination (MMSE). The MMSE is a widely used, reliable and validated instrument used in screening for cognitive impairment. The exam assesses the aspects of cognition and is easily performed. The contents include orientation, attention, learning, calculation, abstraction, information, construction and delayed recall. The MMSE provides measures of orientation, registration (immediate memory), short-term (but not long-term) memory, as well as language functioning. The examination has been validated in a number of populations. The scores of 25-30 out of 30 are considered normal; the National Institute for Health and Care Excellence (NICE) classifies 21-24 as mild, 10-20 as moderate, and < 10 as severe impairment. The MMSE may not be an appropriate assessment tool if the patient has learning, linguistic/communication or other disabilities (sensory impairments) (31).

HRQOL was assessed by means of the Medical Outcomes Study 36-item Short Form (SF-36), which is a self-administered questionnaire containing 36 items that, when scored, yield 8 domains. The physical functioning domain assesses limitations in physical activities such as walking and climbing stairs. The role physical and emotional role domains measure the problems with work or other daily activities as a result of physical health or emotional problems. Bodily pain assesses the limitations resulting from pain; vitality measures energy and tiredness. Social function domain examines the effect of physical and emotional health on normal social activities, and mental health assesses the feelings of happiness, nervousness, and depression. General health perception domain evaluates the personal opinion of one's health compared with that of one's peers, as well as the expectation of health changes. All the domains are scored on a scale from 0 to 100, with 100 representing the best possible health state (32).

Change scores were calculated in such a way that positive change scores indicated improvement and negative change scores indicated deterioration.

## Statistical analysis

All the calculations were done using the SPSS version 10.0 and S-PLAS programme, version 2000. The analyses included descriptive statistics (mean, SD, frequencies), independent Student's t-test to compare the numerical differences of normal distri-

bution. The Mann-Whitney U test was used to compare two values when the dependent variable is either ordinal or continuous, but not normally distributed.

The repeated-measures analysis of variance ANOVA test was used to gain an understanding of how the changes in independent variables were associated with changes in quality of life one and six months after the stroke. A correlation analysis was used for the relationships among the continuous variables (sex, age, side of stroke, mRS, BI and MMSE score) and domains, and Spearman coefficient of rang correlation was calculated. The p-value below 0.05 ( $p < 0.05$ ) was considered as statistically significant.

## Results

A total number of 136 post-stroke survivors completed the questionnaires at admission, one month, and six months after the stroke. The average age of post-stroke survivors was  $63,72 \pm 8,73$ . There were 66 (48,5%) men and 70 (51,5%) women. The determined differences were not statistically significant in gender distribution. Ischaemic brain damage was present in 105 patients (77,2%) and hemorrhagia was present in 31(22,8%). The basic characteristics of the patients are shown in Table 1.

**Table 1.** Basic characteristics of the studied post-stroke survivors

Characteristics	Number	Percentage (%)
<b>Sex</b>		
Male	66	48.5
Female	70	51.5
<b>Type of stroke</b>		
Ischaemia	105	77.2
Hemorrhagia	31	22.8
<b>Side of stroke</b>		
Right hemisphere	60	44.1
Left hemisphere	62	45.6
Other (brainstem)	10	7.6
Both hemispheres	4	2.9

of all post-stroke survivors, 62(46,9%) had stroke in the left hemisphere, 60 (45,5%) had stroke in the right hemisphere and 10 patients (7,6%) had stroke of the brainstem.

Table 2 describes the changes in SF 36 at admission, one month, and six months after the stroke.

**Table 2.** Changes in SF-36, from admission to one-month and to six-month follow-up

Measure	Scores		Significance p
	admission	to one month follow up	
<b>Changes in SF-36</b>			
Physical Functioning	1.91 $\pm$ 6.72	18.53 $\pm$ 24.21	0.05
Role Physical	0.00 $\pm$ 0.00	2.02 $\pm$ 9.65	
Role Emotional	0.00 $\pm$ 0.00	4.17 $\pm$ 19.22	
Vitality	60.55 $\pm$ 22.29	68.68 $\pm$ 20.12	n.s.
Mental health	60.55 $\pm$ 22.29	77.00 $\pm$ 19.20	0.05
Social Functioning	2.76 $\pm$ 12.33	13.42 $\pm$ 21.76	0.05
Bodily Pain	90.63 $\pm$ 25.65	93.64 $\pm$ 20.12	n.s.
General Health Perceptions	1.10 $\pm$ 5.15	6.62 $\pm$ 11.07	0.05
<b>Changes in SF-36</b>	<b>one month follow up</b>	<b>to six month follow up</b>	
Physical Functioning	18.53 $\pm$ 24.21	56.54 $\pm$ 34.79	0.05
Role Physical	2.02 $\pm$ 9.65	6.84 $\pm$ 41.57	0.05
Role Emotional	4.17 $\pm$ 19.22	28.19 $\pm$ 40.75	0.05
Vitality	68.68 $\pm$ 20.12	74.60 $\pm$ 17.48	n.s.
Mental health	77.00 $\pm$ 19.20	78.82 $\pm$ 20.46	n.s.
Social Functioning	13.42 $\pm$ 21.76	57.35 $\pm$ 36.97	0.05
Bodily Pain	93.64 $\pm$ 20.12	95.72 $\pm$ 10.14	n.s.
General Health Perceptions	6.62 $\pm$ 11.07	23.90 $\pm$ 18.48	0.05

At admission, RF and RE summary scores were both zero. All other domains were significantly lower compared with the average domain scores one month later. During rehabilitation, in the first month after the stroke there were improvements in all 8 domains, but in two domains, that of vitality and bo-

dily pain, the improvements were non-significant.

Six months after hospital discharge, 5 domains continued to show a significant increase, but 3 domains, that of mental health, vitality and bodily pain, showed non-significant improvement.

**Table 3.** The values of mRS, BI and MMSE scores in stroke survivors at admission, one month and six months after the stroke onset

Time	Post stroke survivors Number 136		
	mRS	BI	MMSE
At admission	4,75±0,55	25,00±24,66	22,84±6,01
One month after	3,82±0,73	57,28±24,88	25,34±4,73
Six months after	2,60±1,08	83,75±18,59	27,40±4,20

The value of mRS at admission was 4,75 ± 0,55 and six months after the stroke it was 2,60 ± 1,08. The average value of mRS was 1,8 times lower after six months than at admission.

There was a continued decrease of mRS during the study.

BI score was lowest at admission (25,00 ± 24,66) and highest six months after the stroke - 83,75 ± 18,59. BI score was 3,35 times higher than at admission.

The average MMSE score in the period from

admission to six months after admission increased from 22,84 ± 6,01 up to 27,40 ± 4,20. Mild impairments were seen in post-stroke survivors only at admission to the Neurological Unit MMSE (< 24), and there was no cognitive dysfunction one and six months after the stroke.

Analysis of variance for repeated measures showed that mRS values significantly decreased during the investigation ( $p < 0,001$ ), while BI and MMSE scores significantly increased ( $p < 0,001$ ).

**Table 4.** Correlation between changes of domain in SF 36 questionnaire from admission up to six months after stroke

Characteristics	Domains								
	PF	RF	RE	VT	MH	SF	BP	GH	CGH
Sex	0,039	0,048	0,081	0,174*	0,096	0,113	0,036	0,100	0,164
Age	-0,026	-0,041	-0,001	0,013	0,017	-0,055	0,042	-0,035	0,036
Type of stroke	0,030	0,015	0,081	0,061	-0,106	-0,024	-0,044	0,035	-0,016
Right hemisphere	-0,052	-0,086	-0,017	0,060	0,158	0,031	0,005	-0,167	-0,055
Left hemisphere	-0,007	0,037	0,034	0,003	-0,099	-0,104	-0,102	0,095	-0,050
Both hemisphere	-0,145	-0,116	-0,131	0,165	0,067	-0,115	0,100	-0,018	-0,098
mRS at admission	-0,207*	-0,397†	-0,287†	0,085	0,087	-0,221†	-0,031	-0,013	-0,212*
Change of mRS	0,346†	0,341†	0,315†	-0,008	0,037	0,262†	0,167	0,220*	0,443†
BI score at admission	0,296†	0,123	0,203*	-0,032	0,013	0,357†	0,013	0,070	0,203*
Changes of BI score	-0,457†	-0,415†	-0,423†	0,126	-0,219*	-0,440†	0,098	-0,256†	-0,446†
MMSE score at admission	-0,721†	-0,475†	-0,592†	-0,014	-0,352†	-0,631†	0,117	-0,590†	-0,590†
Change of MMSE score	0,255†	-0,037	0,052	0,265†	0,312†	0,281†	-0,151	0,208*	0,115

\* -  $P < 0,05$ ; † -  $P < 0,01$ ; PF – Physical Function; RF – Role Physical; ER – Role Emotional; VT – Vitality; MH – Mental Health; SF – Social Functional; GH – General Health; Change of General Health

A significant positive correlation was found between the increase of PF and mRS and MMSE

scores during the investigation ( $r = 0,346$ ;  $p < 0,01$ ) and BI score ( $r = 0,296$ ;  $p < 0,01$ ) at admis-

sion. A significant negative correlation was established between the increase of RF and increase of mRS ( $r = 0,341$ ;  $p < 0,01$ ) and BI scores during the study. A significant negative correlation was found between the increase of PF and decrease of BI score during the investigation ( $r = -0,457$ ;  $p < 0,01$ ). A significant negative correlation was found between the increase of PF and decreased values of mRS ( $r = -0,207$ ;  $p < 0,05$ ) at admission.

A statistically significant correlation between the role physical, lower mRS values ( $r = 0,315$ ;  $p < 0,01$ ) and higher BI scores ( $r = 0,203$ ;  $p < 0,05$ ) at admission was determined. A negative significant correlation was determined between the increase of RF and decreased BI score during the study ( $r = -0,415$ ;  $p < 0,01$ ), as well as with decreased mRS values ( $r = -0,397$ ;  $p < 0,01$ ) and MMSE score ( $r = -0,475$ ;  $p < 0,01$ ) at admission.

A positive correlation was found between the increase of domain RE and increase of mRS ( $r = 0,315$ ;  $p < 0,01$ ) during the study and higher BI score at admission ( $r = 0,203$ ;  $p < 0,05$ ). A significant negative correlation was determined between the increase of RE and decreased BI score during the study ( $r = -0,423$ ;  $p < 0,01$ ), and with lower mRS values ( $r = -0,287$ ;  $p < 0,01$ ) and MMSE ( $r = -0,592$ ;  $p < 0,01$ ) score at admission.

A significant positive correlation was found between the increase of vitality domain and increased MMSE score ( $r = 0,265$ ;  $p < 0,01$ ) during the study. The domain of vitality showed a statistically significant improvement in women than in men ( $r = 0,174$ ;  $p < 0,05$ ).

A statistically significant negative correlation was found between the domain of MH and decreased BI score during the study ( $r = -0,219$ ;  $p < 0,05$ ).

A statistically significant positive correlation was found between the domain SF and increased mRS during the investigation ( $r = 0,262$ ;  $p < 0,01$ ) and between SF and decreased BI score at admission ( $r = 0,357$ ;  $p < 0,01$ ). A statistically significant negative correlation was found between the domain of SF and decreased BI during the study ( $r = -0,440$ ;  $p < 0,01$ ), and between decreased mRS at admission ( $r = -0,221$ ;  $p < 0,01$ ).

A statistically significant positive correlation was found between the domain of GH and increased mRS ( $r = 0,220$ ;  $p < 0,05$ ) and with increased MMSE score ( $r = 0,208$ ;  $p < 0,05$ ) during the study.

There were statistically significant correlations between the domain of bodily pain and all examined factors.

A statistically significant negative correlation was found between the increase of GH domain and decrease of BI score during the study ( $r = -0,256$ ;  $p < 0,01$ ), and with the decreased MMSE score ( $r = -0,590$ ;  $p < 0,01$ ) at admission.

A statistically significant positive correlation was found between the domain of CGH and mRS increase ( $r = 0,443$ ;  $p < 0,01$ ) during the study and with a higher BI score ( $r = 0,203$ ;  $p < 0,05$ ) at admission. A statistically significant positive correlation was found between the domain of CGH and BI

score decrease ( $r = -0,446$ ;  $p < 0,01$ ) during the study and with the lower values of mRS ( $r = -0,212$ ;  $p < 0,05$ ) at admission.

## Discussion

In this investigation, HRQOL was assessed using the SF-36, as an adequate measure for assessing post-stroke function (8). The importance of post-stroke QOL measurement has been increasingly accepted (19). We investigated possible associations between demographic characteristics, functional status, cognitive function and HRQOL.

During the six months of follow-up HRQOL constantly increased. During the investigation, all eight domains of SF-36 increased, but the domains of bodily pain, vitality and mental health showed a non-significant improvement.

Hopman and Verner (2003) found statistically significant declines in 5 domains (emotional role, mental health, social functioning, bodily pain and general health perceptions) of the SF-36 in the six months after the discharge (except for the physical role, physical functioning) (34).

According to the presented results positive changes in physical function and role function were strongly positively associated with increased HRQOL. During the six-month follow-up, a HRQOL improvement was seen.

Physical function was higher at admission in those survivors with right hemisphere stroke but these differences were no longer present one month and six months after the stroke. Physical function was higher, but non-significantly, in survivors with ischaemic stroke.

At admission, men had higher scores of physical function domain than women, but this difference was not significant. Hopman and Verner (2003) found that after six-month follow-up, there were no significant differences between men and women, but the differences in vitality ( $p < 0,001$ ) and mental health ( $p < 0,001$ ) became more pronounced (34).

Granger, Deric, and Denham found higher BI scores in post-stroke men compared with women (35). Similar results in post-stroke survivors a year after the stroke were reported by Wilkinson-a (36), Bethoux-a (37), Santus-a (38), Johansson-a (39).

In this study, a strong correlation was found between higher BI scores and higher scores of physical function, emotional role, mental health and general health.

There were more of post-stroke survivors with stroke located in the left hemisphere (46,9%: 45,5%). The side of stroke at admission had non-significant impact on BI score (32). The side of hemiplegia had little impact on HRQOL (39). At admission, physical function of SF 36 was higher in patients with right-side haemiplegia, but after one month and six months there were no statistically significant differences.

A study of 46 stroke survivors 4 years after their first stroke showed that despite a good outcome in terms of hospital discharge, ADL, and return

to work, the HRQOL of 83% of the patients had not been restored to the pre-stroke level (18).

In one study, mean QOL scores decreased in the domain of physical function between 4 to 16 months after the stroke and the important determinants of QOL after 16 months were functional status, age and gender (41). Another study showed that neither age, gender, comorbidities, nor baseline disability was an important determinant of change in HRQOL from 1 to 6 months following an acute stroke (42).

Hackett et al. (2006) reported a decreased HRQOL in patients 4 years after stroke and found that the important determinants were physical state and cognitive impairment (22). Poor physical health 1 year after the stroke was independently associated with being female and having diabetes mellitus, right hemispheric lesions and cognitive impairment. In another study, poor mental health 1 year after the stroke was independently associated with being under 65 years, the presence of ischemic heart disease and cognitive impairment (22).

According to the data from one study that assessed 63 stroke survivors during inpatient rehabilitation, one month after the stroke and again at home 6 months after the stroke, it was found that functional independence and HQOL improved over time, but this improvement was strongly correlated with self-care and self-efficacy (32).

Cognitive impairment (CI) is a frequent complication in stroke survivors and predicts post-stroke death, dependency, and institutionalization (33).

According to presented results, post-stroke survivors had only mild impairments at admission to the Neurological Unit MMSE ( $< 24$ ), and there were no cognitive dysfunctions one and six months after the stroke onset.

There was not any statistically significant difference in MMSE score at admission by gender. De Paulo (43) i Folstein (31) stated that in relation to gender, a greater decrease of cognitive function was noticed in women.

The social dimension of quality of life was ass-

essed through the domains of social support, social role and loneliness. In post-stroke survivors, the domain of social function was statistically significantly increased a month after the stroke onset compared to the status at admission ( $p < 0,01$ ).

Domain social function didn't show statistically significant differences related to gender, side of hemiplegia, etiology of stroke and localisation of stroke.

Longitudinal data about HRQOL in post-stroke survivors are limited (34).

Limitations of the study must be taken into account when these results are interpreted. One limitation was the sample size, which was relatively small. Another issue was the inpatient rehabilitation, which was too short. Inpatient rehabilitation have a strong, positive impact on HRQOL. However, not all of the patients could have inpatient rehabilitation. Another 60 post-stroke survivors had rehabilitation in their homes or did not have any. The lack of assessment of Depression in post-stroke survivors was not assessed, while cognitive status was assessed only by the MMSE. MMSE is known to be insensitive to mild CI. Although acceptable validity is found in some studies, other studies reported that MMSE is not an appropriate screening test for cognitive dysfunction in cerebrovascular diseases due to shortcomings regarding right-sided lesions (41).

## Conclusion

Changes in physical function and role function were strongly associated with changes of BI scores. A strong correlation between higher BI scores and physical, social domains, emotional role, mental and general health was found. Improvements in motor disability and improvement of cognitive function were statistically significantly associated with increased HRQOL. All the domains of SF 36 improved during the six month follow-up. The domains of pain and mental health improved non-significantly during the six months after the stroke onset.

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## PROCENA KVALITETA ŽIVOTA BOLESNIKA POSLE MOŽDANOG UDARA

*Milan Mandić<sup>1</sup>, Mirjana Arandžević<sup>2</sup>, Maja Nikolić<sup>1,2</sup>, Nataša Rančić<sup>1,2</sup>*<sup>1</sup>Klinika za fizikalnu medicinu i rehabilitaciju, Klinički centar Niš, Srbija<sup>2</sup>Univerzitet u Nišu, Medicinski fakultet Niš, Niš, Srbija<sup>3</sup>Institut za javno zdravlje Niš, Niš, Srbija**Kontakt:** Milan Mandić

Bul. dr Zorana Đinđić 48, 18000, Niš, Srbija

E-mail: jasminap@medfak.ni.ac.rs

Cilj rada bio je da proceni uticaj fizičkih i mentalnih faktora na kvalitet života bolesnika posle moždanog udara (MI) i to za vreme i posle bolničke rehabilitacije. Primenjena je prospektivna kohortna studija. Studijom je obuhvaćeno 136 bolesnika koji su bili na bolničkoj rehabilitaciji u trajanju od 30 dana. Funkcionalno stanje bolesnika procenjivano je modifikovanim Bartelovim indeksom (BI) i modifikovanim Rankinovom skalom (mRs). Za skrining kognitivne funkcije primenjena je »Mini-mental state examination« (MMSE) skala. Za procenu kvaliteta života primenjen je generički upitnik SF-36. Kvalitet života procenjivan je pri prijemu na Kliniku za rehabilitaciju i fizikalnu medicinu, mesec dana i šest meseci posle MI. Primenjen je test ponovljenih analiza varijanse (ANOVA) i korelaciona analiza. Prosečan BI skor na prijemu iznosio je  $25,00 \pm 24,66$ , a posle šest  $83,75 \pm 18,59$ . Vrednosti mRs na prijemu bile su  $4,75 \pm 0,55$ , a šest meseci posle moždanog udara  $2,60 \pm 1,08$ . Prosečni skorovi na skali MMSE na prijemu iznosili su  $22,84 \pm 6,01$ , a šest meseci posle MI,  $27,40 \pm 4,20$ . Prema ANOVA analizi vrednosti mRs značajno su se smanjile tokom istraživanja, a vrednosti BI ( $p < 0,001$ ) i MMSE značajno su porasle ( $p < 0,001$ ). Utvrđen je značajan pad svih osam domena kvaliteta života bolesnika na prijemu. Šest meseci posle MI, svih osam domena imalo je veće vrednosti, ali je samo 6 imalo statistički značajno veće vrednosti. Domeni za bol i vitalnost nisu imali statistički značajni porast. Došlo je do statistički značajnog porasta 6 domena kvaliteta života šest meseci posle Mi. Domeni za bol i vitalnost nisu imali statistički značajan porast. Porast kvaliteta života bio je statistički značajno povezan sa oporavkom fizičke i kognitivne funkcije. Utvrđena je jaka korelacija između većih vrednosti BI i fizičkog i socijalnog domena, emotivne uloge, mentalnog i opšteg zdravlja.

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