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Correlation between risk factors, functional recovery and the health-related quality of life of stroke survivors

Повезаност фактора ризика, функционалног опоравка и квалитета живота болесника после можданог удара

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SUMMARY

Introduction/Objective It has been estimated that 50% of stroke are preventable through control of modifiable risk factors.

The aim of the paper was to determine the correlation between the risk factors, functional status and the health-related quality of life (HRQOL) of post stroke survivors.

Method The prospective cohort study was used. The study included 136 patients 30-79 years old. Functional recovery was assessed using Barthel index (BI) and the modified Rankin Scale (mRS). The HRQOL was evaluated by generic questionnaire Short Form 36 (SF-36). BI and mRS were determined at admission at the rehabilitation, one, three and six months after the stroke. SF-36 was filled in at the same time. The analysis of the repeated measure variance (Repeated Measures ANOVA) was applied, as well as the correlation analysis and Spearman's coefficient of rank correlation.

Results A total number of 136 patients (66(48.5%) male and 70(51.5%) female) were completed the questionnaire. The average age of post stroke survivors was 63.72 ± 8.73 . At admission mRS was 4.75 ± 0.55 and 6 months after the stroke onset it decreased 2.60 ± 1.08 . The average value of BI at admission was 25.00 ± 24.66 and within 6 months it increased to 83.75 ± 18.59 , ($p=0.001$). The ANOVA showed that the values of mRS significantly decreased ($p<0.001$) and the values of BI significantly increased, (ANOVA: $p<0.001$). All domains of SF-36 questionnaire, except the domain pain, significantly increased ($p<0.001$). The Physical Function ($r=0.238$; $p<0.01$), Role Physical ($r=0.199$; $p<0.05$), Emotional Role ($r=0.237$; $p<0.01$) and among alcohol addicts ($r=0.199$; $p<0.05$), Mental Health ($r=0.244$; $p<0.01$) and Social Relationships domains were significantly lower among smokers ($r=0.272$; $p<0.01$). The General Health ($r=-0.290$; $p<0.001$) and health condition change domain was significantly lower among smokers ($r=0.225$; $p<0.01$).

Conclusion The most important risk factor which was negatively correlated with the HRQOL was smoking. The patients who were smokers and alcohol addicts had a significantly smaller increase of all of the HRQOL domains. Six months after the stroke all domains of the HRQOL significantly increased. The significant improvement of patient's functional status was positively correlated to the increase of their HRQOL.

Keywords stroke; health-related quality of life; hypertension; smoking

САЖЕТАК

Увод/Циљ Процењује се да се око 50% можданих удара (МИ) може спречити изменом начина живота и контролом фактора ризика.

Рад је имао за циљ да утврди повезаност фактора ризика, функционалног опоравка и квалитета живота болесника после можданог удара.

Метод рада Примењена је проспективна кохортна студија којом је обухваћено 136 болесника старости 30-79 година. Функционални опоравак процењиван је Бартел индексом (БИ) и модификованом Ранкин скалом (мРС). Квалитет живота процењиван је генеричким упитником СФ36. БИ и мРС одређиване су на пријему на болничку рехабилитацију, један месец, три и шест месеци после можданог удара. Примењена је анализа поновљеног мерења варијансе (Repeated Measures ANOVA), корелациона анализа и одређиван је Спирманов коефицијент корелације.

Резултати Укупно 136 болесника (66-48.5%- мушкараца и 70-51.5%- жена) комплетно је попунило упитник. Просечна старост болесника била је 63.72 ± 8.73 . вредности мРС на пријему биле су 4.75 ± 0.55 а 6 месеци после МИ смањиле су се на 2.60 ± 1.08 . Вредности БИ на пријему износиле су 25.00 ± 24.66 а унутар 6 месеци су се повећале на 83.75 ± 18.59 , ($p=0.001$). Утврђене разлике у промени мРС и БИ су статистички значајне (ANOVA је показала значајан пад мРС ($p<0.001$) и значајан пораст БИ (ANOVA: $p<0.001$). Сви домени квалитета живота значајно су порасли, осим домена бол ($p<0.001$). Физичка функција ($r=0.238$; $p<0.01$), Физичка улога ($r=0.199$; $p<0.05$), Емотивна улога ($r=0.237$; $p<0.01$) била је статистички значајно нижа међу болесницима који пију ($r=0.199$; $p<0.05$). Вредност домена ментално здравље ($r=0.244$; $p<0.01$) и социјални односи били су значајно нижи код пушача ($r=0.272$; $p<0.01$). Домен опште здравље ($r=-0.290$; $p<0.001$) и промена здравственог стања били су значајно нижи код пушача ($r=0.225$; $p<0.01$).

Закључак Пушење је најважнији фактор који је био у негативној корелацији са квалитетом живота болесника после можданог удара. Значајно поправљање функционалног статуса болесника позитивно је корелирао са порастом квалитета живота.

Кључне речи: мождани удар; квалитет живота; пушење

INTRODUCTION

Stroke is the first cause of disability and second most common cause of death worldwide [1,2]. Age, gender, race, ethnicity, and heredity have been identified as markers of risk for stroke. Age is the single most important risk factor for stroke. For each successive 10 years after age 55, the stroke rate more than doubles in both men and women. An increased incidence of stroke in families has long been noted [3].

Potential reasons are a genetic tendency for stroke, a genetic determination of other stroke risk factors, and a common familial exposure to environmental or lifestyle risks. Earlier studies suggested an increased risk for men whose mothers died of stroke and women who had a family history of stroke [4]. In the Framingham Study an offspring analysis revealed that both paternal and maternal histories were associated with an increased risk of stroke [5].

Hypertension is the single most important modifiable risk factor for ischemic stroke. Most estimates for hypertension indicate a relative risk of stroke of approximately 4 when hypertension is defined as systolic blood pressure ≥ 160 mm Hg and/or diastolic blood pressure ≥ 95 mm Hg. Various cardiac diseases have been shown to increase risk of stroke. Atrial fibrillation (AF) is the most powerful and treatable cardiac precursor of stroke. The incidence and prevalence of AF increase with age [5,6].

Diabetes mellitus nearly triples while current cigarette smoking doubles this risk. Atrial fibrillation, although often asymptomatic and undetected, is an important risk factor for stroke, increasing stroke risk about 5-fold throughout all ages so that its relevance could be underestimated [7]. Patients with low concentrations of HDL cholesterol have been found to be at higher risk of stroke [8]. Further, depressive symptoms have been increasingly recognized as a risk factor (4-fold higher) for stroke/TIA [9].

Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity [10]. This statement defines health-related quality of life (HRQOL) as a construct that focusses on the respondent's subjective perception and consists of physical, mental, and social dimensions [11].

Health-Related Quality of Life (HRQOL) refers to the aspects of QOL affected by a disease [12], or the impact of the health condition or health care intervention on the individuals' subjective experience of their functional, cognitive, social and psychological processes [13].

The objective of the paper was to evaluate the correlation between the risk factors, functional status and the health-related quality of life of stroke survivors after the first stroke.

METHOD

The prospective cohort study was done. 216 patients who had a stroke were randomly chosen out of the whole number of 1598 patients. The prospective study included 216 patients 30-79 years

old who live on the territory of the city of Niš. 136 of them finished the study completely, 11 of them quit it, and 9 patients died. The observed period was 1.1.2011 to 15.8.2013.

The criteria used for including the patients who were included in the study were: the first acute stroke, 30–79 years old; according to the data from hospital-based register for stroke, and from hospital records, from official death certificate, persons from these age-groups have the highest specific age incidence and mortality rate for stroke in the Nišava District; the patient was hospitalized in Niš, communication was possible; written agreement to be included in the study; inpatient rehabilitation

The criteria used for excluding the patient from the study: previous stroke, insufficient ability to communicate, psycho organic syndrome, aphasia, new stroke in less than 90 days after the first one, complications after the stroke, another stroke or acute myocardial infarction, patient's death.

All of the patients were completely informed about the aims of the research. In order to be included in the study it was necessary to give their written agreement (two copies). The permission for making the research was issued by The Ethic Committee of the Medical Faculty of Nis on 18.1. 2010. Its number is 01-206-8. Another permission for making the research was also issued on 1.2. 2011. Its number is 2280/12.

Stroke was diagnosed by a neurologist at the moment the patient was hospitalized at the Neurology Clinic of Niš Clinical Centre. This study includes the patients who were hospitalized at the Neurology Clinic of Niš Clinical Centre at this period of time, and after that they were hospitalized and cured at the Clinic for Physical Medicine and Rehabilitation of Niš, Clinical Centre.

Their functional recovery was surveyed using Barthel index (BI) and the modified Rankin Scale (RS), [13]. Disability was evaluated using the BI and the mRS. The BI measures the degree of autonomy in daily living activities and gives a score ranging from 0 (total dependence) to 100 (total independence). The BI mean scores were categorized as follows: BI <30 was classified as needing "institutional care"; 30 to 70 was classified as "help needed"; and patients having a BI >70 were classified as being "functionally independent" [14].

The mRS assesses the patients' ability to perform the activities they carried out previously and any assistance in doing so. It ranges from 0 (no symptoms at all) to 6 (dead). Patients scoring 0 to 2 on the mRS were classified as independent; patients scoring 3 to 6 were categorized as experiencing severe disability or death [14].

The quality of life was investigated using a generic questionnaire for estimating the quality of life Short Form 36 (SF-36).

Quantitative statistical analysis was made using computer. Microsoft Office Excel 2010 computer program was used for the input, ranking, grouping, table and graphic presentation of the obtained data. Program R version 2.12.0 (R Foundation for Statistical Computing, Vienna, Austria) was used for the calculations.

The analysis of the repeated measure variance (Repeated Measures ANOVA) was applied for testing statistical importance of values changes in the characteristics of the quality of life and the

characteristics of the health status during the research. The estimation of the characteristics correlation between the values of the quality of life and the factors of interest was obtained using the correlation analysis, and the values of Spearman's coefficient of rank correlation (r) were also calculated.

RESULTS

A total number of 136 patients were included in the research; 48,5% male, and 51,5% female. Their average age was $63,72 \pm 8,73$. The ischemic stroke was present among 77,2%, and the hemorrhage was present among 22,8% patients. Stroke was the most often located in the left hemisphere (45,6%), then in the right hemisphere (44,1%), and the other locations were present among 10,3% of the patients.

Table 1. Distribution of risk factors among the patients.

Risk factors	Group n (%)
Previous TIA episode	8 (5,9%)
Current smoker	22 (16,2%)
Ex-Smoker	22 (16,2%)
Diabetes Mellitus	46 (33,8%)
Cholesterol	66 (48,5%)
Alcohol addict	48 (35,3%)
SYS Blood pressure	118 (86,8%)
DIA blood pressure	118 (86,8%)
Carotid stenoses	38 (27,9%)

The largest number of patients had two risk factors for stroke, 27 patients (45%), 17 patients (28,3%) had one risk factor, 9 patients (15%) had three risk factors, 4 patients (6,7%) had four risk factors, and two patients (3,3%) had no risk factors present (Table 1).

Among the patients who had their first stroke, previous TIA episodes were present in 8(5,9%), 22(16,2%) were current and ex-smokers, DM was present among 46(33,8%) of patients, and hypercholesterolemia was present in 48,5% of the cases, more than one third 48(35,3%) were alcohol addicts, 118(86,8%) had a high both systolic and diastolic blood pressure and carotid stenoses were noted in 38 (27,9%) of the cases (Table 2).

Table 2. The values of mRs and BI at the admission at Clinic for rehabilitation 1, 3 and 6 months after discharge.

Time period	Post stroke survivors	
	mRs (n=136)	BI (n=136)
At the admission at the Clinic for physical medicine and rehabilitation	4,75±0,55	25,00±24,66
1 month later	3,82±0,73	57,28±24,88
3 months later	3,16±0,92	74,49±20,21
6 months later	2,60±1,08	83,75±18,59

decreased ($p < 0,001$) among the patients, and the values of BI significantly increased, (ANOVA: $p < 0,001$). The average value of BI at admission was $25,00 \pm 24,66$ and within 6 months it increased to $83,75 \pm 18,59$, ($p = 0,001$) (Table 3).

ANOVA showed that during the investigation of all the domains of SF 36 questionnaire, except for the pain domain values, significantly increased among the patients ($p < 0,001$).

The analysis of the repeated measure variance showed that during the research the values of Rankin scale significantly

Table 3. Correlation between the domain value changes of the SF-36 questionnaire from the inpatient rehabilitation up to 6 months after discharge and the values of the investigated patients' descriptive characteristics.

Characteristic	Domains								
	PF	PR	ER	V	MH	SR	Pain	GH	HC
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
BS Type	0,030	0,015	0,081	0,061	-0,106	-0,024	-0,044	0,035	-0,016
Basal ganglia	0,132	0,140	0,006	-0,091	-0,086	0,134	0,127	-0,023	0,121
Right hemisphere	-0,052	-0,086	-0,017	0,060	0,158	0,031	0,005	-0,167	-0,055
Infratentorial	0,044	-0,082	-0,092	-0,122	-0,096	0,086	-0,048	0,100	0,020
Left hemisphere	-0,007	0,037	0,034	0,003	-0,099	-0,104	-0,102	0,095	-0,050
Brain stem	0,078	0,107	0,095	-0,154	-0,096	0,152	-0,048	0,080	0,078
Both hemispheres	-0,145	-0,116	-0,131	0,165	0,067	-0,115	0,100	-0,018	-0,098
Previous TIA episodes	0,011	-0,043	-0,069	-0,097	-0,129	-0,044	-0,097	0,072	0,122
Current smoker	-0,238†	-0,199*	-0,237†	-0,018	-0,244†	-0,272†	0,069	-0,290†	-0,225†
DM	0,016	-0,039	-0,019	0,034	-0,011	-0,002	0,080	0,023	-0,039
HOL	0,079	-0,166	-0,025	-0,125	0,114	0,029	0,052	0,099	-0,074
Alcohol addict	-0,147	-0,127	-0,199*	-0,089	-0,137	-0,087	-0,015	-0,067	-0,123
SIS blood pressure	-0,110	-0,031	0,035	0,129	0,048	-0,087	0,019	-0,046	-0,050
DIA blood pressure	-0,110	-0,031	0,035	0,129	0,048	-0,087	0,019	-0,046	-0,050
Carotid stenoses	-0,126	-0,137	-0,096	0,094	0,012	-0,095	0,058	-0,108	-0,062
Rankin at admission	-0,207*	-0,397†	-0,287†	0,085	0,087	-0,221†	-0,031	-0,013	-0,212*
Barthel at admission	0,346†	0,341†	0,315†	-0,008	0,037	0,262†	0,167	0,220*	0,443†
Barthel changes	0,296†	0,123	0,203*	-0,032	0,013	0,357†	0,013	0,070	0,203*

*-p<0,05; † -p <0,01; PF- physical function; PR- physical role ;ER- emotional role; VI- vitality; MH- mental health; SR- social relationships, GH- general health; HCC- health condition changes.

Significant positive correlation was confirmed between the values increase of PF and the value increase of mRs ($r=0,346$; $p<0,01$) during the research, as well the increase of BI values ($r=0,296$; $p<0,01$) at admission. Significant negative correlation was confirmed between the values increase of PF and the decrease of BI values during the research ($r=0,457$; $p<0,01$), as well as between the values decrease of mRs ($r=0,207$; $p<0,05$). The values increase of the PF domain is significantly lower among smokers ($r=0,238$; $p<0,01$).

Significant negative correlation was confirmed between the values increase of PR domain and the values decrease of BI during the research ($r=0,415$; $p<0,01$) as well as between the values decrease of mRs ($r=0,397$; $p<0,01$). Values increase of PR domain is significantly lower among smokers ($r=0,199$; $p<0,05$).

Significant positive correlation was confirmed between the values increase of the ER domain and the values increase of mRs ($r=0,315$; $p<0,01$) during the research, as well as between the values increase of BI ($r=0,203$; $p<0,05$) at admission. Significant negative correlation was confirmed between the values increase of the ER domain and the values decrease of BI during the research ($r=0,423$; $p<0,1$), as well as between the values decrease of mRs ($r=0,287$; $p<0,01$). Values increase

of the ER domain is significantly lower among smokers ($r=0,237$; $p<0,01$) and among alcohol addicts ($r=0,199$; $p<0,05$).

Significant negative correlation was confirmed between the values increase of the MH domain and the values decrease of BI during the research ($r=0,219$; $p<0,05$). The values increase of the MH domain was significantly lower among smokers ($r=0,244$; $p<0,01$). Significant positive correlation was confirmed between the values increase of the SR domain and the values decrease of mRs ($r=0,262$; $p<0,01$), as well as between the values increase of BI ($r=0,357$; $p<0,001$) at admission. Significant negative correlation was confirmed between the values increase of the SR domain and the values decrease of BI during the research ($r=0,440$; $p<0,01$), as well as between the values decrease of mRs ($r=0,221$; $p<0,01$). The values increase of SR domain was significantly lower among smokers ($r=0,272$; $p<0,01$). No significant correlations between the values of the domain pain and all the other investigated factors were confirmed.

Significant positive correlation was confirmed between the GH domain and the values increase of mRs ($r=0,220$; $p<0,05$). Significant negative correlation was confirmed between the values increase of GH domain and the values decrease of BI during the research ($r=0,256$; $p<0,01$). The values increase of GH domain is significantly lower among smokers ($r=-0,290$; $p<0,001$). Significant positive correlation was confirmed between the values increase of health condition change domain and the values increase of mRs ($r=0,443$; $p<0,01$) during the research, as well as between the values increase of BI ($r=0,203$; $p<0,05$) at admission.

Significant negative correlation was confirmed between the health condition change domain and the values decrease of BI during the research ($r=0,446$; $p<0,01$) as well as between the values decrease of mRs ($r=0,212$; $p<0,05$). The values increase of health condition change domain is significantly lower among smokers ($r=0,225$; $p<0,01$).

DISCUSSION

According to the presented results the most frequent risk factors in post stroke survivors factors were: hypertension, diabetes and smoking. There were more women among post stroke survivors than men. The post stroke survivors were younger at the time they got the first stroke in this study compared with participations in other studies. The average age of stroke survivors in Taiwan was $64,5\pm 11,8$ [15]. The average age of post stroke survivors in the Northern Manhattan Study was $69,2 \pm 10,3$ years [16], participations in Marburg was $71,1\pm 11,3$ [17]. In Italy, participants were 70 years old on average (age range 34– 85) [18].

Women represented 51,5% of all stroke survivors in this study. In the Northern Manhattan Study there were 62,9% women; [16], in Taiwan there were 43,1% post stroke women [15].

According to the national study made in 2006. there were 44,5% of adults who suffered from hypertension; it was more frequent among male population older than 45 years, 48,9%, people who lived in the southeastern part of Serbia 49,9%, people who were less educated 62,7%, and among the

people with less income 53.1% In 2000. it was estimated that 40.5% of adult population in Serbia were smokers, 46.5% of male and 30.9% of female adults. Most of the smokers were up to 44 years old. Smoking habit was most frequent among male adults who lived in towns and who had graduated from secondary schools [19].

The review article by Carod-Artal et al. provides an overview of the predictors of HRQOL in stroke survivors reported by longitudinal studies. These are age, sex, stroke severity, physical impairment, functional status, and mental impairment [12].

There are conflicting data regarding sex differences and stroke outcome. While some studies found that men were more likely than women to have poor outcomes after ischemic stroke, others found that women had worse outcomes, and still others found no significant difference in outcomes according to gender [5,15]

The patients who had had this risk factor had a stroke 2-4 times more often than those who didn't [17]. Dwyer [18] emphasize that smoking is a big risk factor for stroke and that stroke among young population who are passionate smokers without any other risk factor is not rare.

Patients who survived stroke need rehabilitation because of their limitations or disabilities to perform their daily activities. The efficiency of performances after stroke is very often represented by measuring the level of abilities decrease (functional research). Improving HRQOL is the desired outcome for patients with stroke undergoing inpatient rehabilitation. Recovery in stroke patients receiving rehabilitation primarily occurs in the first 3 months after stroke and continues in the following 3 months [20].

In this study the average value of BI while inpatient rehabilitation was $25,00 \pm 24,66$, and within 6 months after discharge it increased to $83,75 \pm 18,59$. According to a similar investigations which was made in Novi Sad, after the inpatient rehabilitation average values of BI at the beginning of rehabilitation were 57,53, and six months after the release they were 78,92 [9].

In this study the patients had a significantly decreased BI at the time of admission at the hospital rehabilitation, much less than 40 (25 vs 22). It shows a complete patients' dependence on other people's help. Stroke side predicted 11.6 % of the variance in the emotion domain, which was greater than was explained by depression. Right hemisphere stroke has a lower HRQOL in the emotion domain than left hemisphere stroke in our study [22].

Concerning the sex of the patients, the physical dimension of life quality is larger among male patients, but the differences are not statistically important. The patients who had the increase of BI also experienced the increase of strength, movements, communication, memory, emotions, and hands domain. The increase of physical functions led to the increase of some HROQL. The post stroke survivors have significant physical and psychological sequels which make their lives difficult or make them completely disable to perform their everyday activities. Extremity motor function predicted various HRQOL domains [22].

The researches of stroke effects that deal with basic daily activities (ADL; activities that must be accomplished in order to live an independent everyday life) include measuring functional independence; they are Katz index of ADL and BI [22]. A close correlation was estimated between the average values of BI and the physical function, emotional role and mental health domains. The patients suffering from greater disabilities complained about greater decrease of physical abilities, which was a bigger problem to them because of the limitation in performing their everyday activities and it led to emotional problems and lower average grades for the mental health domain.

In general, even little improvements in rehabilitation yielded the feeling and perception of having reached a good level of performance [20].

Concerning the sex of the patients, both men and women experienced the increase of average values of BI after the discharge from the hospital 3 months after the stroke. Similar investigations made in this area in the neighboring countries showed an increase of BI among men during all of the four periods of the research; yet they become statistically important 6 months after the stroke ($p < 0,05$), [23].

According to the results given by Granger, greater values of BI were found among male patients if compared to the results of female patients. Concerning the lateralization of the hemiplegia at hospitalization there is a statistically greater average value of BI among right side hemiplegiae 64, and 51,17 ($p < 0,029$) among the left side ones, whereas at the release from the hospital, 3 and 6 months after the release there are no statistically significant differences [24]. The works of Wade show no statistically significant values of BI concerning the side of hemiplegia [25].

Concerning the etiology of stroke, the values of BI are smaller among hemorrhage if compared to ischemia during all of the four periods of the research; yet those differences have no statistical importance. The data concerning the changes in Rankin scale showed that even though the rehabilitation was being conducted, the recovery of the arm was not possible before 6 months elapsed and that its recovery contributed to the increase of HRQL [24].

The decreased values of all SF-36 questionnaire domains increased during the 6 months of the survey, except that of pain domain. They were significantly increased ($p < 0,001$). All the values of SF-36 questionnaire domain had a statistically smaller increase among smokers, and the values of emotional role domain had a smaller increase among the patients who were alcohol addicts. Functional status were the major independent determinant affecting quality of life [26,27]. Factors including perceptions of overall stroke recovery are significant for HRQOL [21,17].

Women have worse quality of life than men at the end of the study. There are similar results in the literature [28-30].

There are several limitations of this study. A small sample size, which reduces the generalizability of the results. Some patients refused to participate or were excluded from the study because of dementia or aphasia. Some of the patients died.

Potential limitations of the other studies are different sample size of stroke survivors. Different questionnaires were used for the evaluation of the HRQOL. Weaknesses include lack of a detailed assessment of depression, as well as absence of data on cerebrovascular or other main new events, and the use of antidepressant medication during follow-up.

CONCLUSION

The quality of life of post stroke survivors was significantly decreased at the admission at the inpatient rehabilitation and it was lower both at the early stage of recovery and 6 months after the stroke. The most important factor which was negatively correlated with the HRQOL was smoking. The patients who were smokers and alcohol addicts had a significantly smaller increase of all of the domains of HRQOL. Six months after the stroke the values of all examined domains significantly increased. The significant improvement of patients' functional status was positively correlated to the increase of their quality of life.

NOTE

This paper is from doctoral thesis of Milan Mandić: "Quality of life and functional recovery of patients after the first-ever stroke".

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