

## POSTERS

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**RISK FACTORS AND PREVALENCE OF STROKE SUBTYPES IN SLAVONIA**Dikanović M<sup>1</sup>, Kadojić D<sup>2</sup>, Palić R<sup>2</sup>, Vuletić V<sup>1</sup>, Japundžić V<sup>3</sup>, Čengić Lj<sup>4</sup>

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Stroke is the leading cause of mortality and disability in Slavonia and Baranya. The aim of the study was to identify stroke risk factors and subtypes in the region. The study included 130 stroke patients, mean age 67 years, treated at neurology departments in Osijek and Slavonski Brod during 2003. On making the diagnosis of stroke, computed tomography of the brain was done in 100%, extracranial color Doppler sonography of blood vessels in 44.1%, transcranial Doppler sonography in 55.2%, and laboratory testing in all of the study patients. The patients were classified into the groups of hemorrhagic and ischemic stroke, the former being subdivided into those with subarachnoidal hemorrhage and those with intracerebral hemorrhage. On classifying the patients with ischemic stroke, we used TOAST classification with five subtypes: stroke involving large blood vessels, small blood vessels, cardioembolic, other known causes, and multiple causes and/or unknown causes of stroke. Study results showed arterial hypertension to be the most common risk factor for stroke, found in as many as 77.69% of patients, followed by cardiomyopathy (46.15%), hypercholesterolemia (45.28%), physical inactivity (39.23%), hypertriglyceridemia (34.62%), obesity (32.31%), cigarette smoking (28.46%), and positive family history and atrial fibrillation (16.92% each). It should be noted that as many as 50.10% of patients had three or more risk factors in their history. Hemorrhagic stroke was diagnosed in 17.69% of patients, i.e. subarachnoidal hemorrhage in 1.54% and intracerebral hemorrhage in 16.15%. The diagnosis of ischemic stroke was made in 82.31% of patients, i.e. of small blood vessels in 33.08%, large blood vessels in 22.31%, cardioembolic in 19.23%, other known causes in 2.31%, and unknown causes and/or multiple causes in 5.38%. The study revealed the area of Slavonia and Baranya to have a high prevalence of stroke

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**RIZIČNI ČIMBENICI I TIPIZACIJA MOŽDANIH UDARA U SLAVONIJI**Dikanović M<sup>1</sup>, Kadojić D<sup>2</sup>, Palić R<sup>2</sup>, Vuletić V<sup>1</sup>, Japundžić V<sup>3</sup>, Čengić Lj<sup>4</sup>

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Moždani udar je vodeći uzrok smrtnosti i invalidnosti u Slavoniji i Baranji. Cilj istraživanja je bio utvrditi rizične čimbenike te podtipove moždanih udara u regiji. U studiju je bilo uključeno 130 oboljelih od moždanog udara prosječne starosne dobi od 67 godina, liječenih na neurološkim odjelima u Osijeku i Slavonskom Brodu tijekom 2003. godine. Pri postavljanju dijagnoze moždanog udara kompjutorizirana tomografija mozga je učinjena kod 100%, ekstrakranijska obojena doplerska sonografija krvnih žila kod 44,1%, transkranijaska dopler sonografija kod 55,2% te laboratorijska obrada kod svih bolesnika. Bolesnike smo klasificirali na one koji su preboljeli hemoragični odnosno ishemični moždani udar. U skupini s hemoragičnim moždanim udarom izvršili smo podjelu u dvije podskupine, tj. na one koji su preboljeli subarahnoidno krvarenje i one koji su preboljeli intracerebralno krvarenje. Pri klasifikaciji bolesnika s ishemičnim moždanim udarom rabili smo klasifikaciju TOAST koja ima 5 podtipova: moždani udar velikih krvnih žila, malih krvnih žila, kardioembolični, ostalih poznatih uzroka, te više uzroka i/ili nepoznatih uzroka za nastanak moždanog udara. Rezultati su pokazali kako je najčešći čimbenik rizika kod ispitanika bila arterijska hipertenzija (čak 77,69%), te potom kardiomiopatija (46,15%), hiperkolesterolemija (45,28%), tjelesna neaktivnost (39,23%), hipertrigliceridemija (34,62%), debljina (32,31%), pušenje (28,46%), te pozitivno obiteljsko naslijeđe i atrijska fibrilacija (svaki po 16,92%). Treba osobito istaknuti kako je čak 50,10% bolesnika imalo 3 i više čimbenika rizika u anamnezi. Hemoragični moždani udar je preboljelo 17,69% ispitanika, i to subarahnoidno krvarenje 1,54%, a intracerebralno krvarenje 16,15%. Ishemični moždani udar je preboljelo 82,31% bolesnika, i to malih krvnih žila 33,08%, velikih krvnih žila 22,31%, kardioembolični 19,23%, ostalih poznatih uzroka 2,31%, te s ne-

risk factors, especially those known as “lifestyle factors”, which resulted in a high rate of lacunar stroke (associated with arterial hypertension) and cardioembolic stroke. Results of the study pointed to the need of intensified primary and secondary prevention of stroke as well as of continuous education of both physicians and patients on the role of a healthy lifestyle in the prevention of cerebrovascular disease.

2

### EVALUATION OF VARIOUS RISK FACTORS FOR STROKE IN A POPULATION WITH OCCLUSIVE CAROTID DISEASE

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Stroke is the third most common cause of death and the leading cause of disability in industrialized countries. In the present study, various risk factors for stroke were evaluated in a population of patients with a history of stroke, in order to identify the population at an increased risk of stroke. The Framingham risk index (FRI) was calculated in 78 subjects with symptomatic significant stenosis of internal carotid artery (16% of all patients hospitalized for stroke; mean age  $71 \pm 10$  yrs; 48 men, mean age  $68 \pm 12$  yrs; 30 women, mean age  $74 \pm 10$  yrs), and in an age- and sex-matched group of subjects with atherosclerotic lesions of the head and neck large vessels ruled out. The following risk factors were observed: age, sex, total plasma lipids, cholesterol, HDL, LDL, systolic and diastolic blood pressure, diabetes mellitus, and smoking. Study subjects were divided into the categories of very high, high, medium, low and very low risk according to FRI values calculated for each individual subject. Study results showed 80% of patients to have sustained a stroke (16% had occlusive carotid disease), 17% had intracerebral hemorrhage and 2.8% subarachnoidal hemorrhage. The patients with occlusive disease of carotid arteries were in the high risk group (34%; men 16% and women 18%) and very high risk group (60%; men 34% and women 30%), whereas only a few were in the medium risk group (6%; men 4%

poznatim uzrocima i/ili s više uzroka 5,38%. Istraživanje je pokazalo kako je Slavonija i Baranja područje s visokom incidencijom rizičnih čimbenika za moždani udar, osobito onih koje

znamo kao “čimbenike povezane s načinom života”, što je rezultiralo visokim udjelom lakunarnog moždanog udara (povezan s arterijskom hipertenzijom) te kardioemboličnog moždanog udara. Rezultati upućuju na daljnju što aktivniju primarnu i sekundarnu prevenciju moždanog udara, kao i na potrebu daljnje stalne edukacije kako liječnika tako i samih bolesnika o važnosti zdravog načina života u prevenciji cerebrovaskularne bolesti.

2

### EVALUACIJA RAZLIČITIH ČIMBENIKA RIZIKA ZA MOŽDANI UDAR U POPULACIJI S OKLUZIVNOM KAROTIDNOM BOLEŠĆU

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Moždani udar je treći uzrok smrtnosti i vodeći uzrok invalidnosti u razvijenim državama svijeta. U svrhu prepoznavanja populacije koja je pod povećanim rizikom da doživi moždani udar razmatrali smo različite čimbenike rizika u populaciji bolesnika koji su preboljeli moždani udar. Izračunavali smo Framinghamski indeks rizika (FIR) u 78 ispitanika sa simptomatskom značajnom stenozom unutarnje karotidne arterije (16% od svih hospitaliziranih bolesnika s moždanim udarom; srednja dob  $71 \pm 10$  godina; 48 muškaraca, srednje dobi  $68 \pm 12$  godina; 30 žena srednje dobi  $74 \pm 10$  godina) te dobno i spolno standardizirane skupine ispitanika kod kojih su isključene aterosklerotske promjene velikih krvnih žila glave i vrata. Razmatrali smo različite čimbenike rizika: spol, dob, ukupne lipide u plazmi, kolesterol, HDL, LDL, sistolični i dijastolični krvni tlak, šećernu bolest i pušenje. Izračunali smo FIR za svakog ispitanika i prema njemu su podijelili ispitanike u kategorije: vrlo visok, visok, srednji, mali, vrlo mali rizik. Ishemijski moždani udar imalo je 80% bolesnika (16% imalo je okluzivnu karotidnu bolest), 17% ih je imalo intracerebralno krvarenje, 2,8% subarahnoidno krvarenje. Bolesnici s okluzivnom bolešću karotidnih arterija bili su u skupini s visokim (34%; 16% muškaraca i 18% žena) i vrlo visokim (60%; 34% muškaraca i 30% žena) rizikom, samo nekoliko ih je imalo srednje visok rizik (6%; 4% muškara-

and women 2%). In the control group, subjects with very low risk (72%; men 37% and women 35%) and low risk (23%; men 12% and women 11%) prevailed, whereas only a few were in the group at a medium risk of stroke. Accordingly, FRI can be very useful in identifying population at an increased risk of stroke.

### 3

#### RISK FACTORS FOR STROKE AND ACUTE MYOCARDIAL INFARCTION: SIMILARITIES AND DIFFERENCES

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Epidemiologic studies have demonstrated that acute stroke and acute myocardial infarction (AMI) have some risk factors in common, e.g., age, sex and elevated blood pressure, that are differently associated with the two diseases. AMI is caused by ischemic changes in coronary arteries, whereas stroke includes a heterogeneous group of cerebrovascular diseases. The aim of the study was to analyze the presence of risk factors and treatment outcome for stroke and AMI in a population of the Bjelovar-Bilogora County hospitalized during a one-year period. Medical records of all patients hospitalized during 1999 for stroke at Department of Neurology, and for AMI at Department of Medicine, Bjelovar General Hospital, were retrospectively analyzed. The diagnoses of stroke and AMI were verified according to the World Health Organization criteria. The prevalence of individual risk factors and treatment outcome were determined in the two patient groups, and the results were compared by t-test and  $\chi^2$ -test. A total of 380 stroke patients (ischemic 82% and hemorrhagic 18%) and 106 AMI patients were treated during the study period. Stroke patients were older (stroke  $68.9 \pm 9.1$  yrs vs AMI  $62.8 \pm 11.7$  yrs;  $p < 0.001$ ), with equal sex distribution. AMI was significantly more common in subjects below age 65 (AMI 51% vs stroke 26%;  $p < 0.001$ ) and in men (70% men vs 30% women;  $p < 0.001$ ). Hypertension (stroke 69% vs AMI 58%;  $p = 0.043$ ) and previous stroke (stroke 29% vs AMI 9%;  $p < 0.001$ ) were more common in the group of stroke patients, whereas previous AMI (stroke 3% vs AMI 13%;  $p < 0.001$ ) and heart failure (stroke 18% vs AMI 31%;  $p = 0.006$ ) were more frequent in AMI group. During hospital stay, computed tomography was performed in 43% of all stroke patients (intracerebral hemorrhage 63% and

ca i 2% žena). U kontrolnoj skupini ispitanika prevladavali su oni s vrlo niskim (72%; 37% muškaraca i 35% žena) i niskim (23%; 12% muškaraca i 11% žena) rizikom, a samo nekoliko ih je bilo u skupini sa srednjim rizikom za obolijevanje od moždanog udara. Framinghamski indeks rizika može biti vrlo koristan u izdvajanju populacije koja je pod povećanim rizikom za obolijevanje od moždanog udara.

### 3

#### RIZIČNI ČIMBENICI ZA MOŽDANI UDAR I AKUTNI INFARKT MIOKARDA: SLIČNOSTI I RAZLIKE

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Epidemiološke studije dokazale su da akutni moždani udar (MU) i akutni infarkt miokarda (AIM) imaju zajedničke rizične čimbenike kao npr. dob, spol i povišen krvni tlak, povezanost kojih s objema bolestima je različita. AIM je uzrokovan ishemijskim promjenama u koronarnim arterijama, a MU obuhvaća heterogenu skupinu cerebrovaskularnih bolesti. Cilj rada bio je analizirati prisutnost rizičnih čimbenika i ishoda liječenja MU i AIM u populaciji Bjelovarsko-bilogorske županije koja je bolnički liječena tijekom jedne kalendarske godine. Retrospektivnim istraživanjem analizirali smo povijesti bolesti svih bolesnika koji su bolnički liječeni zbog MU u Djelatnosti za neurologiju i zbog AIM u Djelatnosti za interne bolesti Opće bolnice Bjelovar tijekom 1999. godine. Dijagnoza MU i AIM verificirana je prema kriterijima Svjetske zdravstvene organizacije. Učestalost pojedinačnih rizičnih čimbenika i ishod liječenja utvrđeni su u objema skupinama bolesnika, a dobiveni podaci uspoređeni su t-testom i  $\chi^2$ -testom. Tijekom navedenog razdoblja liječeno je 380 bolesnika s MU (82% ishemijski i 18% hemoragijski) i 106 bolesnika s AIM. Bolesnici s MU bili su stariji ( $68,9 \pm 9,1$  godina za MU i  $62,8 \pm 11,7$  za AIM;  $p < 0,001$ ), uz podjednaku zastupljenost obaju spolova. AIM je bio značajno češći u mladim od 65 godina (51% za AIM i 26% za MU;  $p < 0,001$ ) i u muškaraca (70% muškarci i 30% žene;  $p < 0,001$ ). Hipertenzija (69% za MU i 58% za AIM;  $p = 0,043$ ) i preboljeli moždani udar (29% za MU i 9% za AIM;  $p < 0,001$ ) bili su češći u bolesnika s MU, a preboljeli infarkt miokarda (3% za MU i 13% za AIM;  $p < 0,001$ ) i srčano zatajivanje (18% za MU i 31% za AIM;  $p = 0,006$ ) bili su češći u skupini bolesnika s AIM. Kompjutorizirana tomografija tijekom bolničkog liječenja učinjena je u 43% svih bolesnika s MU (63% kod intracerebralnog krvarenja i 39% s ishemijskim

ischemic stroke 39%;  $p < 0.001$ ). A significantly higher mortality was recorded in patients with hemorrhagic stroke relative to ischemic stroke (54% vs 26%;  $p < 0.001$ ). A significantly higher mortality was recorded in the group of stroke patients as compared with AMI patients (31% vs 12%;  $p < 0.001$ ). There was no significant age difference between the deceased stroke and AMI patients. A significant difference in the rate of lethal outcome according to diagnosis was only recorded for men (men: stroke 37% and AMI 5%;  $p < 0.001$ ; women: stroke 26% and AMI 28%;  $p = 0.775$ ). Study results showed the groups of patients with stroke and AMI to differ significantly according to age at admission, whereas no such age difference was found for those with lethal outcome. Stroke patients had a higher mortality rate, especially men, than those with AMI. Hypertension and previous stroke were more common in the group of stroke patients, whereas previous AMI and heart failure were more frequent in AMI patients.

4

#### REGIONAL DIFFERENCES IN THE PREVALENCE OF HYPERLIPIDEMIA IN ACUTE STROKE PATIENTS

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The aim of the study was to determine the prevalence of hyperlipidemia in stroke patients from the urban areas of Osijek, Zagreb and Split, to compare it and to analyze the association between hyperlipidemia and stroke subtype. We analyzed 709 patients: 236 in Osijek, 220 in Zagreb, and 253 in Split. The levels of cholesterol  $> 6.5$  mmol/L and triglycerides  $> 2.0$  mmol/L were taken as hyperlipidemia. Stroke subtyping was done according to the WHO International Classification, 10<sup>th</sup> Revision. Elevated cholesterol levels were found in 41.2%, 31.5% and 13.3% of patients from Osijek, Zagreb and Split, respectively. The difference in the prevalence of hypercholesterolemia between Osijek and Split was statistically significant ( $\chi^2 = 40.1$ ;  $df = 1$ ;  $p < 0.005$ ). Elevated triglycerides were found in 33.3%, 13.9% and 8.9% of patients from Osijek, Zagreb and Split, respectively. Statistically significant differences were recorded between Osijek and Split ( $\chi^2 = 36.3$ ;  $df = 1$ ;  $p < 0.005$ ), and Osijek and Zagreb ( $\chi^2 = 16.9$ ;  $df = 1$ ;  $p < 0.005$ ). In ischemic stroke subtype, the highest proportion of elevated cholesterol was recorded in Osijek, lower in Zagreb, and lowest in Split. The

MU;  $p < 0.001$ ). Zabilježena je značajno veća smrtnost bolesnika s hemoragijskim u odnosu na ishemijski MU (54% nasuprot 26%;  $p < 0.001$ ). U bolesnika s MU zabilježena je i veća smrtnost nego u skupini s AIM (31% za MU i 12% za AIM;  $p < 0.001$ ). Umrli bolesnici s MU i AIM nisu se značajno razlikovali prema dobi. Zabilježena je značajna razlika u učestalosti smrtnog ishoda ovisno o dijagnozi samo kod muškaraca (muškarci: 37% s MU i 5% s AIM,  $p < 0.001$ ; žene: 26% s MU i 28% s AIM,  $p = 0.775$ ). Dakle, dob kod prijma značajno se je razlikovala između skupine bolesnika s MU i onih s AIM. Kod umrlih bolesnika nije zabilježena razlika u prosječnoj dobi. Bolesnici s MU više umiru od bolesnika s AIM, poglavito muškarci. Hipertenzija i već preboljeli moždani udar češći su u bolesnika s MU, a preboljeli srčani udar i srčano zatajivanje u bolesnika s AIM.

4

#### REGIONALNE RAZLIKE U ZASTUPLJENOSTI HIPERLIPIDEMIJE KAO ČIMBENIKA RIZIKA U BOLESNIKA S AKUTNIM MOŽDANIM UDAROM

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Cilj rada bio je utvrditi zastupljenost hiperlipidemije u bolesnika s moždanim udarom (MU) na području grada Osijeka, Splita i Zagreba, usporediti zastupljenost u navedenim regijama, te analizirati povezanost hiperlipidemije i tipa MU. Analizirali smo ukupno 709 bolesnika, 236 u Osijeku, 220 u Zagrebu i 253 u Splitu. Bilježili smo zastupljenost hiperlipidemije, i to za kolesterol ako je vrijednost  $> 6.5$  mmol/L, a za trigliceride ako je vrijednost  $> 2.0$  mmol/L. Klasifikaciju pojedinih tipova MU učinili smo na temelju 10. revizije Međunarodne klasifikacije SZO. U Osijeku je povišen kolesterol imalo 41,2%, u Splitu 13,3%, a u Zagrebu 31,5% bolesnika. Razlika u pojavi povišenog kolesterola između Osijeka i Splita bila je statistički značajna ( $\chi^2 = 40,1$ ,  $df = 1$ ,  $p < 0,005$ ). Povišene trigliceride u Osijeku je imalo 33,3%, u Splitu 8,9%, a u Zagrebu 13,9% bolesnika. Nađena je statistički značajna razlika: Osijek/Split:  $\chi^2 = 36,3$ ;  $df = 1$ ;  $p < 0,005$ ; Osijek/Zagreb:  $\chi^2 = 16,9$ ;  $df = 1$ ;  $p < 0,005$ . U ishemijskom MU kolesterol je u najvećem postotku bio zastupljen u Osijeku, nešto manje u Zagrebu i najmanje u Splitu. Razlika između Osijeka i Splita bila je statistički značajna ( $\chi^2 = 34,9$ ;  $df = 1$ ;



difference between Osijek and Split was statistically significant ( $\chi^2=34.9$ ;  $df=1$ ;  $p<0.005$ ). The highest proportion of elevated triglycerides was found in Osijek, followed by Zagreb and lowest in Split. The difference between Osijek and Split was statistically significant ( $\chi^2=31.6$ ;  $df=1$ ;  $p<0.005$ ). In intracerebral hemorrhage, the proportion of elevated cholesterol was higher in Osijek and Zagreb than in Split. The prevalence of hypercholesterolemia was 37.9% in Osijek vs 7.4% in Split. The difference between Osijek and Split was statistically significant ( $\chi^2=5.7$ ;  $df=1$ ;  $p<0.005$ ), whereas the difference between Osijek and Zagreb did not reach statistical significance. Hypertriglyceridemia was most common in Osijek, followed by Zagreb and Split, yielding a statistically significant difference among the three areas ( $\chi^2=4.3$ ;  $df=1$ ;  $p<0.005$ ). Data analysis showed hyperlipidemia to be a significant risk factor for stroke. Therefore, in addition to the general principles of primary and secondary prevention, due attention should also be paid to regional differences in the prevalence of hyperlipidemia as a risk factor for stroke.

5

#### **BLOOD PRESSURE AND OUTCOME IN ACUTE STROKE: DIFFERENCES BETWEEN ISCHEMIC STROKE AND INTRACEREBRAL HEMORRHAGE**

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The aim of the study was to determine the difference in blood pressure (BP) changes and outcome between ischemic stroke (ISH) and intracerebral hemorrhage (ICH). It was a prospective study including patients with severe stroke (ISH and ICH) admitted to intensive care unit within 6 hours of stroke onset. Previously normotensive and hypertensive patients were included. BP was measured every 2 hours during the first 72 hours of stroke onset. Antihypertensive therapy was administered as needed. Stroke severity was assessed using Scandinavian Stroke Scale (SSS) at admission and discharge from the hospital. All results are presented descriptively. The study included 114 stroke patients, 60 female and 54 male, mean age  $73.1 \pm 12.9$  years. There were 85 patients with ISH and 29 with ICH. Prior hypertension was present in 63% of all stroke patients, 55% of ISH and 87% of ICH group. The mean systolic arterial BP at admission was  $157 \pm 16.8$  mm

$p<0.005$ ). Triglyceridi su bili najzastupljeniji u Osijeku, zatim u Zagrebu, a najmanje u Splitu. Razlika između Osijeka i Splita bila je statistički značajna ( $\chi^2=31.6$ ;  $df=1$ ;  $p<0.005$ ). Kod intracerebralnog krvarenja je kolesterol zastupljen u većem postotku u Osijeku i Zagrebu u odnosu na Split. Odnos povišenih vrijednosti kolesterola u Osijeku bio je 37,9% prema 7,4% u Splitu. Razlika je statistički značajna ( $\chi^2=5.7$ ;  $df=1$ ;  $p<0.005$ ). Između Osijeka i Zagreba nije bilo statistički značajne razlike. Trigliceridi su u Osijeku bili najzastupljeniji, zatim u Zagrebu, te u Splitu. Razlika između Osijeka, Zagreba i Splita je statistički značajna ( $\chi^2=4.3$ ;  $df=1$ ;  $p<0.005$ ). Kod subarahnoidnog krvarenja nije bilo statistički značajne razlike između Osijeka, Splita i Zagreba. Iz navedenih rezultata proizlazi da je hiperlipidemija značajan čimbenik rizika za nastanak akutnog MU. Stoga je uz opća načela za provođenje primarne i sekundarne prevencije potrebno obratiti pozornost i na regionalne razlike u zastupljenosti hiperlipidemije kao rizika za akutni MU.

5

#### **KRVNI TLAK I ISHOD KOD AKUTNOG MOŽDANOG UDARA: RAZLIKE IZMEĐU ISHEMIJSKOG MOŽDANOG UDARA I INTRACEREBRALNOG KRVARENJA**

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Cilj ovog ispitivanja bio je utvrditi razliku u promjeni krvnog tlaka i ishodu između ishemijskog moždanog udara (IMU) i intracerebralnog krvarenja (ICK). Bila je to prva prospektivna studija koja je obuhvatila bolesnike s teškim MU (IMU i ICK) primljene u jedinicu intenzivne skrbi unutar 6 sati od nastupa MU. Uključeni su bolesnici koji su prethodno bili normotenzivni i hipertenzivni. Krvni tlak je mjereno svaka 2 sata kroz prva 72 sata od nastupa MU. Antihipertenzivna terapija davana je prema potrebi. Težina MU procijenjena je pomoću Skandinavske ljestvice za moždani udar (SSS) kod prijma i otpusta iz bolnice. Svi rezultati prikazani su opisno. U studiju je bilo uključeno 114 bolesnika s MU, 60 žena i 54 muškaraca srednje dobi  $73.1 \pm 12.9$  godina. Bilo je 85 bolesnika s IMU i 29 bolesnika s ICK. Prethodna hipertenzija bila je prisutna u 63% svih bolesnika s MU, te u 55% onih s IMU i 87% onih s ICK.

Hg in ISH and  $163.4 \pm 19.3$  mm Hg in ICH patients. Monitoring of systolic BP changes during the first 72 hours showed a continuously higher BP in ICH than in ISH patients ( $162.6$  mm Hg vs  $146.5$  mm Hg). During the first 72 hours BP was higher in ICH patients who died than in survivors. Higher BP was present during the first 72 hours in patients with  $SSS \leq 15$  at admission, whereas in patients with  $SSS \geq 16$  at admission BP gradually normalized. SSS at admission was higher in ISH ( $>15$ ) than in ICH ( $<15$ ) patients. In ICH group 29% of patients died, however, survivors had better SSS at discharge than survivors from ISH group. BP is a very important factor in the prognosis of stroke course and outcome. Hypertension is associated with poor outcome and higher mortality rate, especially in patients with ICH.

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## STROKE IN DIABETIC PATIENTS

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Diabetes mellitus (DM) is a chronic disease associated with the development of vascular complications over time, in the form of microangiopathies (diabetic retinopathy, nephropathy and neuropathy) and macroangiopathies (cerebrovascular disease, coronary disease, peripheral arterial disease of lower extremities). Diabetic patients, especially those with DM type 2, have an increased incidence of stroke with a high mortality rate, and recovery is considerably retarded in relation to general population. The aim of the study was to assess the prevalence of particular stroke types (ischemic cerebral infarction or intracerebral hemorrhage) in patients with DM type 1 and type 2. The analysis included 120 patients with DM and acute stroke (73 M and 47 F) aged 51-85 years. Type 1 DM (insulin dependent) was present in 65 (37 M and 28 F), and type 2 in 55 (19 F and 36 M) patients. Of 65 patients with type 1 DM, ischemic cerebral infarction occurred in 56 (86.1%) and intracerebral hemorrhage in 9 (13.9%) patients. Of 55 patients with type 2 DM, ischemic cerebral infarction occurred in 39 (70.9%) and intracerebral hemorrhage in 16 (29.1%) patients. All study patients also had other risk factors for cerebrovascular disease, such as hypertension, hyperlipidemia and hypercoagulability, that obviously were

Srednji sistolični arterijski krvni tlak kod prijma bio je  $157 \pm 16,8$  mm Hg u bolesnika s IMU i  $163,4 \pm 19,3$  mm Hg u onih s ICK. Praćenje promjena sistoličnog krvnog tlaka tijekom prva 72 sata pokazalo je stalno viši krvni tlak u bolesnika s ICK nego u onih s IMU ( $162,6$  mm Hg vs  $146,5$  mm Hg). U skupini bolesnika s ICK krvni tlak je tijekom prva 72 sata bio viši kod onih bolesnika koji su umrli nego u onih koji su preživjeli. Tijekom prva 72 sata viši krvni tlak je zabilježen u bolesnika sa  $SSS \leq 15$  kod prijma, dok se je krvni tlak postupno normalizirao u bolesnika sa  $SSS \geq 16$  kod prijma. SSS je kod prijma bio viši u bolesnika s IMU ( $>15$ ) negoli u onih s ICK ( $<15$ ). U skupini s ICK umrlo je 29% bolesnika, ali su preživjeli imali bolji SSS kod otpusta negoli preživjeli iz skupine s IMU. Zaključuje se kako je krvni tlak vrlo važan čimbenik za prognozu tijeka i ishoda MU. Hipertenzija je udružena s lošim ishodom i višom stopom smrtnosti, poglavito u bolesnika s ICK.

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## MOŽDANI UDAR U BOLESNIKA SA ŠEĆERNOM BOLEŠĆU

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Poznato je da je šećerna bolest (DM) kronična bolest te da se s vremenom razviju komplikacije na svim krvnim žilama, kao mikroangiopatije (dijabetična retinopatija, nefropatija i neuropatija) i makroangiopatije (cerebrovaskularna bolest, koronarna bolest, periferna arterijska bolest donjih ekstremiteta). U bolesnika s DM, poglavito tip 2, veća je učestalost moždanog udara (MU) s visokom stopom smrtnosti, a oporavak je sporiji u odnosu na opću populaciju. Cilj ovog istraživanja bio je utvrditi učestalost pojedinih vrsta MU (ishemijskog cerebralnog infarkta ili intracerebralnog krvarenja) kod bolesnika s DM tip 1 i tip 2. Analizirali smo ukupno 120 bolesnika s DM i akutnim MU (73 M i 47 Ž) u dobi od 51 do 85 godina. Tip 1 DM (ovisan o inzulinu) imalo je 65 bolesnika (37 M i 28 Ž), a tip 2 (neovisan o inzulinu) 55 bolesnika (19 Ž i 36 M). Od 65 bolesnika s DM tip 1, 56 (86,1%) ih je zadobilo ishemijski cerebralni infarkt, a 9 (13,9%) intracerebralnu hemoragiju. U skupini od 55 bolesnika s DM neovisnim o inzulinu ishemijski cerebralni infarkt je nastupio u 39 (70,9%) bolesnika, dok je 16 (29,1%) bolesnika imalo intracerebralno krvarenje. Kod svih analiziranih bolesnika dijagnosticirani su i drugi rizični čimbenici za cerebrovasku-

consequential to the high levels of glycemia and contributed to the development of stroke. Ischemic stroke showed a higher prevalence than intracerebral hemorrhage, irrespective of DM type, which is consistent with the mortality recorded in general population. Intracerebral hemorrhage was more common in patients with type 2 DM and poor glycemia control. According to sex, stroke was more common in men than in women, whereas the stroke mortality rate was higher in women. Complications of diabetes as well as stroke were found to occur after 5 years of the disease duration on an average.

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### IS PROLONGED HYPERGLYCEMIA ASSOCIATED WITH STROKE SEVERITY ON ADMISSION?

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High stroke severity is frequently associated with high blood glucose at the time of admission. The aim of the study was to investigate whether prolonged hyperglycemia before the incident had any influence on stroke severity on admission. It was a pilot study including all patients with ischemic stroke admitted to the University Department of Neurology, Sestre milosrdnice University Hospital. Stroke severity on admission was measured using NIHSS. We divided patients into two groups with NIHSS  $\leq 20$  and NIHSS  $> 20$ . Glycosylated hemoglobin ( $HbA_{1c}$ ) was used as an index of glycemic control during the preceding 6-12 weeks. At our laboratory, normal  $HbA_{1c}$  values are 4.8%-6.0% of total hemoglobin. On data analysis we used Student's t-test. The analysis included 24 patients, 9 male and 15 female, mean age  $74.6 \pm 11.6$  yrs. The mean NIHSS score on admission was  $18.1 \pm 10.8$  points. Only 3 patients had a positive history of diabetes. Mean blood glucose at admission was  $6.7 \pm 4.0$  mmol/L.  $HbA_{1c}$  was significantly higher in the group of patients with a more severe stroke (NIHSS  $\leq 20$ ) than in the group of patients with NIHSS score  $> 20$  ( $p=0.05$ ). Hyperglycemia was found to be associated with a more severe tissue damage, increase in infarct size, and worse clinical outcome. The preliminary study results indicated that, besides the level of blood glucose on admission, the hyperglycemia present over a prolonged period of time before the incident is also associated with stroke severity.

larnu bolest: hipertenzija, hiperlipidemija, hiperkoagulabilnost, što je svakako posljedica visokih vrijednosti glikemije, a doprinijelo je razvoju MU. Neovisno o tipu DM više je bio zastupljen ishemijski MU nego intracerebralna hemoragija, što je u korelaciji s pobolom u općoj populaciji. Uočeno je da se intracerebralno krvarenje češće javlja u bolesnika s DM tip 2 i slabo reguliranim vrijednostima glikemije. Prema spolu, MU se nešto češće javlja u muškaraca nego u žena, dok je stopa smrtnosti veća u žena. Zapaženo je da se komplikacije DM, a i MU javljaju nakon prosječno 5 godina trajanja bolesti.

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### JE LI DUGOTRAJNA HIPERGLIKEMIJA UDRUŽENA S TEŽINOM MOŽDANOG UDARA KOD PRIJMA?

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Težak moždani udar (MU) često je udružen s visokom razinom glukoze u krvi kod prijma u bolnicu. Cilj ovoga ispitivanja bio je utvrditi ima li dugotrajna hiperglikemija prije MU ikakvog utjecaja na težinu MU kod prijma. Ovo je bilo probno ispitivanje u koje su bili uključeni svih bolesnici s ishemijskim MU primljeni na Kliniku za neurologiju Kliničke bolnice "Sestre milosrdnice". Težina MU kod prijma mjerena je pomoću ljestvice NIHSS. Bolesnike smo podijelili u dvije skupine: s NIHSS  $\leq 20$  i s NIHSS  $> 20$ . Glikozilirani hemoglobin ( $HbA_{1c}$ ) primijenjen je kao pokazatelj glikemijske regulacije tijekom prethodnih 6-12 tjedana. U našem laboratoriju su normalne vrijednosti  $HbA_{1c}$  4,8%-6,0% ukupnog hemoglobina. U analizi podataka rabili smo Studentov t-test. U analizu smo uključili 24 bolesnika, 9 muškaraca i 15 žena srednje dobi  $74,6 \pm 11,6$  godina. Srednja vrijednost NIHSS kod prijma bila je  $18,1 \pm 10,8$  bodova. Samo je troje bolesnika imalo pozitivnu anamnezu šećerne bolesti. Srednja vrijednost glukoze u krvi kod prijma bila je  $6,7 \pm 4,0$  mmol/L. U skupini bolesnika s težim oblikom MU (NIHSS  $\leq 20$ ) zabilježena je značajno viša vrijednost  $HbA_{1c}$  nego u onih s NIHSS  $> 20$  ( $p=0,05$ ). Zaključeno je kako je hiperglikemija povezana s težim tkivnim oštećenjem, većim infarktom i lošijim kliničkim ishodom. Privremeni rezultati ove studije ukazuju na to da je, uz razinu glukoze u krvi kod prijma, hiperglikemija prisutna kroz duže vrijeme prije MU, također udružena s težinom MU.

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### FAKTOR V LEIDEN AND F II20210A MUTATIONS IN PATIENTS WITH ISCHEMIC STROKE

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Numerous risk factors for stroke influence the incidence of the disease: hypertension, diabetes mellitus, lipid metabolism disturbance, cardiac diseases, smoking, alcoholism, and obesity. The effect of mutation in the gene for the coagulation Factor V (Factor V Leiden) and in the gene for prothrombin (F II20210A) in the process of stroke evolution is contradictory. The frequency of these mutations greatly varies across different races and ethnic groups. The study included 88 patients with ischemic stroke of both sexes, aged <math>\geq 65</math>. Patients with secondary thrombophilia, those receiving blood transfusion in whom Factor VIII thrombolysis was detected, those with infectious conditions over the preceding two months, and those with heart valve implants were excluded from the study. Blood with EDTA as anticoagulant was used on DNA analysis. Genomic DNA was isolated according to the standard procedure using phenol-chloroform extractions. The presence of Factor V Leiden and FII20210A was determined by PCR-RFLP. A 2287-bp fragment encompassing position 1691 of Factor V was amplified with primers according to the procedure of Zoller et al. (J Clin Invest 1994;94:2521). Following digestion with MnlI (MBI Fermentas GmbH, Germany), the normal type allele (1691G) resulted in 157 bp, 93 bp and 37 bp fragments, whereas the mutant allele (1691 A) resulted in 157 bp and 130 bp fragments. Analysis for FII20210A was performed according to the method described by Poort et al. (Blood 1996;88:3698). After digestion of amplified 345 bp fragments with Hind III (Roche Diagnostics, Mannheim, Germany), the mutant A allele was cleaved into two 322 bp and 23 bp fragments, whereas the normal G allele remained undigested by the restrictive enzyme. Digested products were separated by electrophoresis in 1.5% agarose gel (Applied Biosystems, Foster City, CA, USA). The study detected 7 (7.9%) heterozygotes for Factor V Leiden and 5 (5.7%) heterozygotes for FII20210A. No homozygotes or dual heterozygotes were found. Previous studies in healthy Croatian population revealed a 3.9% frequency of F V Leiden and 3.9% frequency of FII20210A (Coen et al., Croat Med J 2001;42:488). The possible interaction with other risk factors for cerebrovascular diseases requires further research.

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### FAKTOR V LEIDEN I FII20210A MUTACIJE U BOLESNIKA S ISHEMIJSKIM MOŽDANIM UDAROM

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Brojni čimbenici rizika moždanog udara utječu na zastupljenost bolesti: hipertenzija, šećerna bolest, poremećaj metabolizma lipida, srčane tegobe, pušenje, alkoholizam, prekomjerna tjelesna težina. Utjecaj mutacije gena za koagulacijski faktor V (Faktor V Leiden) i gena za protrombin (FII20210A) u razvoju moždanog udara je proturječan. Učestalost navedenih mutacija u pojedinim rasama i narodima značajno varira. Ispitivanje je obuhvatilo 88 oboljelih s ishemijskim moždanim udarom obaju spolova i životne dobi do 65 godina. Iz ispitivanja su isključeni oboljeli sa sekundarnom trombofilijom, te oboljeli koji su primali transfuzije krvi, u kojih je utvrđena Faktor VIII tromboliza, bolesnici s infektivnim stanjima u posljednja dva mjeseca te oni s implantiranim srčanim zaliscima. Za analizu DNK uzeta je krv s EDTA kao antikoagulansom. Genomska DNK izolirana je pomoću standardnog protokola uporabom fenol-kloroform ekstrakcije. Prisutnost Faktora V Leiden i FII2210A dokazana je metodom PCR-RFLP. Fragment duljine 287 parova baza (pb) koji uključuje položaj 1691 gena za Faktor V umnožen je početnicama prema protokolu Zöllera i sur. (J Clin Invest 1994;94:2521). Nakon digestije MnII (MBI Fermentas GmbH, Njemačka) normalni alel (1691 G) daje fragmente duljine 157 pb, 93 pb i 37 pb, dok mutirani alel (1691 A) daje fragmente duljine 157 pb i 130 pb. Analiza FII20210A učinjena je primjenom metode koju su opisali Poort i sur. (Blood 1996; 88:3698). Nakon digestije umnoženih produkata veličine 345 pb s Hind III (Roche Diagnostics, Mannheim, Njemačka) mutirani A alel podijeli se na dva fragmenta veličine 322 pb i 23 pb, dok se normalni G alel ne cijepa restriktivnim enzimom. Produkti cijepanja razdvojeni su elektroforezom u 1.5%-tnom agaroznom gelu (Applied Biosystems, Foster City, CA, USA). Ispitivanjem je utvrđeno 7 (7,9%) heterozigota za Faktor V Leiden i 5 (5,7%) heterozigota za FII20210A. Homozigoti i dvostruki heterozigoti nisu nađeni. Dosadašnja istraživanja u zdravoj hrvatskoj populaciji utvrdila su učestalost od 3,9% za F V Leiden te 3,9% za FII20210A (Coen i sur. Croat Med J 2001;42:488). Moguća interakcija s drugim čimbenicima rizika za cerebrovaskularne bolesti zahtijeva daljnja istraživanja.



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### CORTISOL LEVELS AFTER ISCHEMIC STROKE

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The period following ischemic stroke can be considered as a reaction to a stressful event. Changes in cortisol secretion are one of the indicators of stress reaction. The aim of the study was to determine morning serum levels of cortisol in stroke patients within 48 h and 15 days of ischemic stroke onset. Study group included 40 patients, 20 of them female, mean age  $65.3 \pm 10.3$  years. The patients did not receive any corticosteroid agents or spironolactone, and did not suffer from Cushing's or Addison's syndrome. Ischemic stroke was verified by computed tomography of the brain. The fluorometric method with DELFIA<sup>®</sup> Cortisol immunoassay was used to determine morning serum cortisol levels. Reference values of the measured hormone were 201-681 nmol/l. The mean level of serum cortisol within 48 h of stroke was  $560.9 \pm 318.9$  nmol/l, and on day 15 it was  $426.2 \pm 159.3$  nmol/l, i.e. significantly lower ( $p < 0.02$ ). On the first measurement, the level of serum cortisol was elevated in 32%, and on the second measurement in only 7.5% of patients, which was also significantly lower ( $p < 0.001$ ). It was concluded that the stress reaction in ischemic stroke patients was more pronounced within the first 48 hours of stroke onset. Judging from the morning cortisol levels, the reaction to stress was considerably less pronounced 15 days after stroke onset.

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### THE ROLE OF ADHESION MOLECULES IN THE PATHOGENESIS OF ACUTE ISCHEMIC STROKE

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Sixty-seven patients with acute ischemic stroke and 76 healthy controls were enrolled in this study. On patient admission, the concentration of soluble adhesion molecules, C-reactive protein (CRP), erythrocyte sedimentation rate (ESR) and total leukocyte count were deter-

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### VRIJEDNOSTI KORTIZOLA NAKON ISHEMIJSKOG MOŽDANOG UDARA

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Razdoblje nakon nakon ishemijskog moždanog udara (MU) može se promišljati i kao reakcija na stresni događaj. Promjena u lučenju kortizola je jedan od pokazatelja reakcije na stres. Cilj studije bio je odrediti vrijednosti jutarnjeg kortizola u serumu pacijenata unutar 48 sati i 15 dana od ishemijskog MU. Analiziranu grupu je činilo 40 pacijenata prosječne starosti  $65,3 \pm 10,3$  godina, od toga 20 ženskog spola. Ispitanici nisu bili na terapiji kortikosteroidnim preparatima ili spironolaktonom, nisu bolovali od Cushingovog ili Addisonovog sindroma. Ishemijski MU je potvrđen nalazom kompjutorizirane tomografije mozga. Za određivanje vrijednosti jutarnjeg kortizola u serumu primijenjena je fluorometrijska metoda s imunitestom DELFIA<sup>®</sup> Cortisol. Referentne vrijednosti mjenenog hormona su bile 201-681 nmol/l. Prosječna vrijednost kortizola u serumu unutar 48 sati od ishemijskog MU bila je  $560,9 \pm 318,9$  nmol/l, a 15. dana  $426,2 \pm 159,3$  nmol/l, odnosno značajno niža ( $p < 0,02$ ). U 32% oboljelih vrijednost kortizola je bila povećana prilikom prvog mjerenja, a samo u 7,5% prilikom drugog mjerenja, što je također statistički značajno manje ( $p < 0,001$ ). Stresna reakcija u oboljelih od ishemijskog MU je izraženija unutar 48 sati od nastupa bolesti. Petnaest dana od početka bolesti reakcija na stres je, sudeći prema vrijednostima jutarnjeg kortizola, bila manje izražena.

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### ULOGA ADHEZIJSKIH MOLEKULA U PATOGENEZI AKUTNOG ISHEMIJSKOG MOŽDANOG UDARA

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U studiju je bilo uključeno 67 bolesnika s akutnim ishemijskim moždanim udarom (MU) i 76 zdravih ispitanika. Koncentracija topljivih adhezijskih molekula, C-reaktivni protein (CRP), sedimentacija i ukupni leukociti određeni su kod prijma bolesnika u bolnicu. Koncentracije topl-

mined. The concentrations of soluble adhesion molecules were determined using quantitative sandwich enzyme immunoassay. On the following morning, fasting blood glucose, triglycerides, total cholesterol, HDL-cholesterol and LDL-cholesterol were determined in patient sera. The mean levels of cell adhesion molecule -1 (ICAM-1), vascular cell adhesion molecule -1 (VCAM-1) and sE-selectin were higher in patients with acute ischemic stroke than in controls ( $p < 0.001$ ,  $0.034$ ,  $0.002$ , respectively), whereas sL-selectin was lower in patients ( $p = 0.043$ ). In patients, the levels of soluble adhesion molecules were independent of age, with the exception of sL-selectin, which inversely correlated with age ( $r = -0.260$ ,  $p = 0.034$ ). In controls, sICAM-1 and sVCAM-1 increased with age ( $r = 0.301$ ,  $p = 0.008$  and  $r = 0.524$ ,  $p < 0.001$ , respectively). sL-selectin was higher in diabetics ( $n = 14$ ;  $p = 0.004$ ). In patients, the levels of soluble adhesion molecules did not differ with respect to carotid atherosclerotic disease, smoking status, hypertension and hypercholesterolemia. Some soluble adhesion molecules correlated with blood glucose, lipid parameters and markers of inflammation. It is concluded that acute ischemic stroke is associated with elevated plasma levels of inflammatory adhesion molecules independently of age, sex and other recognized stroke risk factors. This increase is an indicator of inflammatory process and is most probably transient in nature. Increased triglycerides, cholesterol and glucose correlate with moderately elevated concentrations of adhesion molecules in asymptomatic individuals, pointing to chronic inflammatory activation of the endothelium.

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#### INCIDENCE AND PROGNOSTIC VALUE OF EPILEPTIC ATTACKS IN THE EARLY STAGE OF STROKE

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The aim of the study was to determine the incidence of early epileptic seizures in the first 24 hours of the onset of ischemic or hemorrhagic stroke symptoms, and to assess their potential prognostic value for stroke type and outcome. Medical records of 1587 patients hospitalized in the acute stage of stroke were retrospectively analyzed. Statistical analysis was done by use of EpiInfo Ver 5.0 software. Data on the mortality in stroke patients without epileptic

jivih adhezijskih molekula određene su primjenom kvantitativnog enzimskog „sendvič“ imunotesta. Slijedećega jutra izmjerene su razine glukoze u krvi natašte, triglicerida, ukupnog kolesterola, HDL-kolesterola i LDL-kolesterola u serumu bolesnika. Srednje razine stanične adhezijske molekule -1 (ICAM-1), vaskularne stanične adhezijske molekule -1 (VCAM-1) i sE-selektina bile su više u bolesnika s akutnim ishemijskim MU nego u kontrolnih osoba ( $p < 0,001$ ,  $0,034$  odnosno  $0,002$ ), dok je sL-selektin bio niži u bolesnika ( $p = 0,034$ ). U skupini bolesnika razine topljivih adhezijskih molekula nisu bile ovisne o starosnoj dobi, uz iznimku sL-selektina koji je obrnuto korelirao s dobi ( $r = -0,260$ ,  $p = 0,034$ ). U kontrolnoj skupini su sICAM-1 i sVCAM-1 rasle s dobi ( $r = 0,301$ ,  $p = 0,008$  odnosno  $r = 0,524$ ,  $p = 0,001$ ). sL-selektin je bio viši u dijabetičara ( $n = 14$ ;  $p = 0,004$ ). Kod bolesnika se razine topljivih adhezijskih molekula nisu razlikovale u odnosu na aterosklerotsku bolest karotida, pušenje, hipertenziju i hiperkolesterolemiju. Neke topljive adhezijske molekule korelirale su s glukozom u krvi, lipidnim parametrima i biljezima upale. Zaključuje se kako je akutni ishemijski MU udružen s povišenim razinama upalnih adhezijskih molekula u plazmi neovisno o dobi, spolu i drugim poznatim čimbenicima rizika za MU. Ovaj porast je pokazatelj upalnoga procesa i vjerojatno je prolazne naravi. Povišeni trigliceridi, kolesterol i glukoza koreliraju s umjerenom povišenim koncentracijama adhezijskih molekula kod asimptomatskih osoba, ukazujući tako na kroničnu upalnu aktivaciju endotela.

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#### INCIDENCIJA I PROGNOŠTIČKA VRIJEDNOST EPILEPTIČNIH NAPADAJA U RANOJ FAZI MOŽDANOG UDARA

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Cilj studije bio je odrediti incidenciju ranih epileptičnih napadaja u prva 24 sata od pojave simptoma ishemijskog ili hemoragijskog tipa moždanog udara (MU), te procijeniti njihovu potencijalnu prognostičku vrijednost za tip i ishod MU. Retrospektivna analiza povijesti bolesti učinjena je za 1587 bolesnika hospitaliziranih u akutnoj fazi MU. Statistička analiza provedena je u programu EpiInfo Ver. 5.0. Do podataka o mortalitetu bolesnika s MU koji nisu imali epileptične napadaje došli smo retrospektivnim

seizures were obtained by retrospective survey of 500 patient histories. Out of 1587 patients hospitalized in the early stage of stroke, 49 had one or more epileptic seizures within the first 24 hours of the onset of symptoms (incidence 3.08%). The mean age of patients with epileptic seizures was  $67.9 \pm 13.2$  (range 31-89) years, and the male to female ratio was 59%:41%. Out of 323 patients with hemorrhagic stroke, 15 patients experienced epileptic seizures (incidence 4.64%), the male to female ratio was 66%:33%, and mean age was  $58.8 \pm 14.1$  (range 31-84) years. In 1264 patients with ischemic stroke there were 34 patients with epileptic seizures (incidence 2.68%). The male to female ratio was 56%:44%, and mean age was  $72 \pm 10.7$  (range 49-89) years. Among patients without epileptic seizures, mortality rate was 49% in the group with hemorrhagic stroke and 14% in the group with ischemic stroke. In the group of 15 patients with hemorrhagic stroke and epileptic seizures, 8 (53.3%) patients died, whereas in the group of 34 patients with ischemic stroke lethal outcome was recorded in 10 (29.4%) patients. While in hemorrhagic stroke the mortality difference did not reach statistical significance, in ischemic stroke it was significant ( $p=0.04$ ). Study results showed the incidence of epileptic seizures in the early stage of stroke to be low. However, epileptic seizures were more frequently associated with hemorrhagic stroke than with ischemic stroke. The occurrence of epileptic seizures in the early stage of stroke may be prognostically useful in the early patient evaluation, prior to neuroimaging studies, for pointing to a hemorrhagic stroke with the expected high mortality or to an ischemic stroke associated with a mortality higher than expected.

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### KNOWLEDGE OF STROKE RISK FACTORS AND WARNING SIGNS AMONG ADULTS IN SLAVONSKI BROD REGION

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The increased incidence of stroke in Croatia is presumed to be the consequence of low awareness in the general population. Therefore, general knowledge of stroke risk factors and warning signs assessed. A randomized sample of symptom free inhabitants were administered a

uvidom u 500 povijesti bolesti. Od ukupno 1587 bolesnika hospitaliziranih u ranoj fazi MU 49 ih je imalo jedan ili više epileptičnih napadaja u prva 24 sata od nastanka simptoma (incidencija 3,08%). Prosječna dob bolesnika s epileptičnim napadajima bila je  $67,9 \pm 13,2$  (raspon 31-89) godina. Odnos muškog i ženskog spola bio je 59%:41%. Od 323 bolesnika s hemoragijskim MU bilo je 15 s epileptičnim napadajima (incidencija 4,64%). Odnos muškog i ženskog spola bio je 66%: 33%. Prosječna dob je bila  $58,8 \pm 14,1$  (raspon 31-84) godina. Od 1264 bolesnika s ishemijskim MU bilo ih je 34 s epileptičnim napadajima (incidencija 2,68%). Odnos muškog i ženskog spola bio je 56%:44%. Prosječna dob bila je  $72 \pm 10,7$  (raspon 49-89) godina. Smrtnost kod bolesnika bez epileptičnih napadaja bila je u skupini s hemoragijskim MU 49%, a u skupini s ishemijom 14%. Od 15 bolesnika s hemoragijskim MU i pojavom epileptičnih napadaja umrlo ih je 8 (53,3%), a od 34 bolesnika s ishemijskim MU umrlo ih je 10 (29,4%). Razlika u smrtnosti kod hemoragijskog MU nije statistički značajna, dok je razlika u smrtnosti kod ishemija značajna ( $p=0,04$ ). Na osnovi ovih rezultata možemo zaključiti kako je incidencija epileptičnih napadaja u ranoj fazi MU niska, no da se češće javljaju kod hemoragijskog nego kod ishemijskog MU. Pojava epileptičnih napadaja u ranoj fazi MU ima potencijalno prognostičku vrijednost u ranoj evaluaciji stanja bolesnika, prije učinjenih neuroslikovnih metoda, jer tada pobuđuje sumnju na hemoragijski MU s očekivano visokom smrtnošću ili na ishemiju povezanu sa smrtnošću višom od očekivane.

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### POZNAVANJE ČIMBENIKA RIZIKA I ZNAKOVA UPOZORENJA ZA MOŽDANI UDAR MEĐU ODRASLIMA U SLAVONSKO BRODSKOM PODRUČJU

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Pretpostavlja se da je povećana incidencija moždanog udara (MU) u Hrvatskoj posljedica niske svijesti o ovoj bolesti u pučanstvu. Provedena je procjena općeg poznavanja rizičnih čimbenika i znakova upozorenja za MU. Ispi-

multiple choice questionnaire used to assess their knowledge of stroke risk factors, warning signs, anticipated action and sources of information. Statistical analyses were performed using the SigmaStat (Version 2.0) statistical software. All participants filled in the questionnaire completely. Between the offered correct and incorrect answers, 42% of the subjects identified more than four correct stroke warning signs, mostly speech problems (72.5%), whereas 41.1% identified more than seven correct stroke risk factors, mostly hypertension (73.5%). Television (73.1%) was the most common source of information identified. The results of this study point to inadequate public awareness of stroke risk factors and warning signs, which could be improved through mass media campaigns.

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#### POST-STROKE COGNITIVE FUNCTIONAL DEFICITS

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Stroke is usually accompanied by cognitive deficits that are frequently permanent, and along with motor deficits cause disability in the affected individuals. The aim of the present study was to analyze the prevalence and characteristics of cognitive impairments following stroke. The study included a sample of 50 patients treated at University Department of Neurology, Osijek University Hospital, for first ever stroke sustained at least 6 months before. Cognitive functioning was assessed by use of Raven Progressive Matrix (RPM and RCPM, a nonverbal test of intellectual capacity), and Mini Mental State (MMS) scale. Deficit characteristics were analyzed according to sex, cerebral lesion lateralization, and type of stroke. Cognitive deficits were recorded in most of the study patients. There were no sex and stroke type differences, however, deficit differences were observed according to cerebral lesion lateralization. Study results confirmed the presence of permanent cognitive deficits following stroke, pointing to their role in the process of stroke patients' resuming their daily functioning.

tivanje je provedeno uživo u randomiziranom uzorku stanovnika bez simptoma MU. Za procjenu poznavanja rizičnih čimbenika i znakova upozorenja za MU primijenili smo anketne listove s višestrukim odgovorima na pitanja, zatim o tome što treba poduzeti i o izvoru informacija. Statističku analizu proveli smo pomoću statističkog programa SigmaStat (verzija 2,0). Svi ispitanici su u potpunosti ispunili anketne listove. Između ponuđenih točnih i netočnih odgovora 42% ispitanika je odabralo više od četiri ispravna znaka upozorenja za MU, uglavnom probleme s govorom (72,5%), 41,1% ih je prepoznalo više od sedam ispravnih rizičnih čimbenika za MU, uglavnom hipertenziju (73,5%). Televiziju su ispitanici najčešće navodili kao izvor obavijesti (73,1%). Rezultati ovog ispitivanja ukazuju na nedostatnu svijest u pučanstvu o rizičnim čimbenicima i znakovima upozorenja za MU, što se može poboljšati odgovarajućom akcijom kroz sredstva javnog priopćavanja.

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#### OŠTEĆENJA KOGNITIVNIH FUNKCIJA NAKON MOŽDANOG UDARA

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Moždani udar u velikoj mjeri prate kognitivna oštećenja koja nerijetko ostaju trajna, te su uz motorne deficite uzrokom onesposobljenja osobe. Cilja našega rada bio je analizirati učestalost i značajke spoznajnih oštećenja nakon moždanog udara. Uzorak je činilo 50 bolesnika liječenih na Klinici za neurologiju Kliničke bolnice Osijek s preboljevim prvim moždanim udarom od kojega je prošlo najmanje 6 mjeseci. Spoznajno funkcioniranje procijenjeno je Ravenovim progresivnim matricama (RPM i RCPM, neverbalni test intelektualnih sposobnosti), te ljestvicom MMS (Mini Mental State). Analizirali smo značajke deficita s obzirom na spol, lateralizaciju mozgovnog oštećenja i tip moždanog udara. Kod većine obrađenih bolesnika zabilježeni su kognitivni deficiti. Nije bilo razlika prema spolu i tipu moždanog udara, ali su zabilježene razlike u deficitima oštećenjima s obzirom na lateralizaciju lezije. Rezultati potvrđuju prisutnost trajnih spoznajnih oštećenja nakon moždanog udara te ponovno ističu njihovo značenje u procesu povratka u svakodnevno funkcioniranje oboljele osobe.



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### DEPRESSIVE SYNDROME IN STROKE PATIENTS

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Depressive episodes quite frequently occur in stroke patients during their hospital treatment, and in some patients may require medicamentous therapy in addition to psychotherapeutic support due to their severity and duration of symptoms. Depressive episodes were observed to more commonly occur in patients having the problem of smoking along with other risk factors. Therefore we analyzed the prevalence and severity of depressive syndrome according to smoking habit in patients treated for stroke at Department of Vascular Neurology, University Department of Neurology, Sestre milosrdnice University Hospital. Recent studies have demonstrated close relationship between depression and smoking. Nearly one third of smokers use nicotine for its action *via* dopaminergic system as a “drug” for depression, i.e. as an artificial behavior modulator. On attempting to quit smoking, in this group of smokers depressive disturbances develop already after a short period of abstinence. As a rule, patients stop smoking when they suffer a stroke. In the first stage of the disease, during hospitalization, patients generally neither tend to verbalize their desire for cigarette nor exhibit other symptoms of the nicotine withdrawal syndrome. However, in smokers who have managed their depression by nicotine, the presence of latent or manifest depression can frequently be observed when they suffer a stroke and quit smoking. It is important to diagnose and treat depression as a disorder because, on the one hand, it retards the process of neurorehabilitation, and on the other hand, the disease may progress and lead to fatal outcome if not properly treated. The most common symptoms are a feeling of sadness, loss of interest, loss of satisfaction, insomnia, appetite disturbance, concentration difficulties, memory difficulties, feeling of guilt, thoughts of death, etc. The experience and options in the diagnosis (depression screening test) and treatment (nicotine replacement therapy, bupropion) of depression in smokers with stroke are presented.

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### DEPRESIVNI SINDROM KOD BOLESNIKA S MOŽDANIM UDAROM

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Tijekom bolničkog liječenja bolesnika s moždanim udarom često se javljaju depresivne smetnje koje kod nekih bolesnika s obzirom na intenzitet i dužinu trajanja simptoma uz psihoterapijsku potporu zahtijevaju i medikamentnu terapiju. Zapazili smo da se depresivne poteškoće češće javljaju kod bolesnika koji su uz ostale rizične čimbenike imali i problem pušenja. Stoga smo analizirali učestalost i težinu depresivnog sindroma u odnosu na prisutnost pušenja kod bolesnika liječenih zbog moždanog udara na Odjelu vaskularne neurologije Klinike za neurologiju KB “Sestre milosrdnice”. Prema rezultatima novijih istraživanja depresija je usko povezana s pušenjem. Gotovo jedna trećina pušača rabi nikotin zbog njegovog djelovanja preko dopaminergičnog sustava kao “lijek” za depresiju, odnosno kao umjetni modulator ponašanja. Pri pokušaju prestanka pušenja već nakon kraće apstinencije kod ove skupine pušača javljaju se depresivne smetnje. Gotovo je pravilo da bolesnici prestaju pušiti kad dožive moždani udar. U prvoj fazi bolesti tijekom boravka u bolnici uglavnom ne verbaliziraju želju za cigaretom niti su u znatnijoj mjeri zastupljeni drugi simptomi iz kruga nikotinskog apstinencijskog sindroma. Međutim, kod pušača koji su pomoću nikotina liječili depresiju, kad dožive moždani udar i prestanu pušiti, često se može prepoznati prisutnost latentne ili manifestne depresije. Depresiju kao bolest je važno dijagnosticirati i liječiti, jer s jedne strane ona usporava proces neurorehabilitacije, a s druge strane, ne poduzme li se odgovarajuće liječenje, bolest napreduje i može fatalno završiti. Najčešći simptomi su osjećaj žalosti, gubitak interesa, gubitak zadovoljstva, besanica, smetnje apetita, smetnje koncentracije, smetnje pamćenja, osjećaj krivnje, misli o smrti itd. U radu su iznesena iskustva i mogućnosti u dijagnostici (test probira na depresiju) i liječenju (nikotinska zamjenska terapija, bupropion) depresije kod pušača s moždanim udarom.

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### SPECIFIC FEATURES OF URINARY TRACT INFECTIONS IN STROKE PATIENTS

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The aim of the study was to determine the prevalence and characteristics of urinary tract infections (UTI) in stroke patients with urethral catheter. Medical records of stroke patients with urethral catheter placement performed at our institution during 2003 were retrospectively analyzed. The diagnosis of UTI was made on the basis of microbiologic, laboratory and clinical criteria. Bacteriologic criteria were significant bacteriuria ( $\geq 10^5$  CFU/mL) and pyuria ( $\geq 50$ -100 polymorphonuclears in urinary sediment). Laboratory parameters included elevated values of inflammatory markers (leukocyte count, polymorphonuclear count, CRP). Clinical symptoms included febrility ( $>38$  °C), and change in urine color and appearance. Of the factors that can be involved in the development of UTI, the analysis included age, sex, comorbidities such as diabetes mellitus, liver cirrhosis, prostate adenoma and renal insufficiency. The exogenous factors included chronic use of urethral catheter ( $>30$  days) and data on antimicrobial therapy (for 10 days before admission). Placement of the catheter was performed at our institution in 120 of the total number of stroke patients with urethral catheter included in the analysis. UTI was demonstrated in 6/120 (5.0%), whereas in another 9/120 (7.5%) patients it was only suspected because two of the above listed criteria were not met. In these cases, colonization must have occurred. The occurrence of hospital UTI was definitely demonstrated after 7-day use in patients with urethral catheter placed at our institution. The types of etiologic agents in verified infections as well as in catheter colonization were identical, only their incidence varied. The following agents were isolated: *Escherichia coli*, *Enterococcus faecalis*, *Proteus mirabilis*, *Klebsiella pneumoniae* and *Acinetobacter anitratus*. The presence of comorbidity factors was significantly higher ( $p < 0.1$ ) in patients with active hospital infection than in those without it. Accordingly, the diagnosis of hospital UTI is dubious and difficult to make because of the impossibility to obtain history data from the patient (speech and consciousness impairments), development of a clinical picture with inflammatory states, use of analgo-antipyretics, and development of pneumonia as a primary infection complication. Therefore, standardized criteria

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### OSOBITOSTI INFEKCIJA MOKRAČNOG SUSTAVA U BOLESNIKA S MOŽDANIM UDAROM

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Cilj rada bio je odrediti učestalost i značajke infekcija mokraćnog sustava (UTI) kod bolesnika s moždanim udarom i postavljenim uretralnim kateterom. Provedena je retrospektivna analiza povijesti bolesti bolesnika s moždanim udarom i uvedenim uretralnim kateterom liječenih u našoj ustanovi tijekom 2003. godine. Dijagnoza UTI postavljena je na osnovi mikrobioloških, laboratorijskih i kliničkih kriterija. Bakteriološki kriteriji bili su značajna bakteriurija ( $\geq 10^5$  CFU/mL) i piurija ( $= 50$ -100 polimorfonukleara u sedimentu). Laboratorijski parametri bili su povišene vrijednosti upalnih biljega (vrijednosti leukocita, polimorfonukleara, CRP). Od kliničkih simptoma značajni su bili samo febrilitet ( $>38,2$  °C), te promjena boje i izgleda mokraće. Od čimbenika koji mogu utjecati na razvoj UTI analizirani su dob, spol, komorbiditetni čimbenici kao šećerna bolest, ciroza jetre, adenom prostate i bubrezna insuficijencija. Od egzogenih čimbenika to su bili kronična primjena uretralnog katetera ( $>30$  dana) i podaci o antimikrobnoj terapiji (10 dana prije prijma). Od ukupnog broja analiziranih bolesnika s uretralnim kateterom kateter je bio uveden u našoj ustanovi u 120 bolesnika. UTI je dokazana kod 6/120 (5,0%) bolesnika, dok je u 9/120 (7,5%) bolesnika postavljena sumnja na infekciju, jer nisu bila zadovoljena 2 od prije navedenih kriterija. Vjerojatno se je radilo o kolonizaciji. Učestalost bolničkih infekcija mokraćnog sustava sa sigurnošću je dokazana u bolesnika s uvedenim uretralnim kateterom u našoj ustanovi nakon primjene od 7 dana.

Vrste etioloških uzročnika kod dokazanih infekcija, ali i kolonizacije katetera bile su jednake, samo je učestalost bila različita. Izolirane vrste bile su *Escherichia coli*, *Enterococcus faecalis*, *Proteus mirabilis*, *Klebsiella pneumoniae* i *Acinetobacter anitratus*.

U bolesnika s aktiviranom bolničkom infekcijom prisutni komorbiditetni čimbenici bili su značajno viši ( $p < 0,1$ ) nego u bolesnika bez dokazane infekcije. Zbog nemogućnosti dobivanja anamnestičkih podataka od bolesnika (poremećaji govora i svijesti), razvoja kliničke slike s upalnim stanjima, primjene analgoantipiretika, te razvoja pneumonije kao primarne infekcijske komplikacije dijagnoza bolničke UTI teška je i dvojbena. Zbog toga je nužna

need to be used in the diagnosis of these infections, along with targeted monitoring of clinical and laboratory parameters from admission to the hospital. Precise data on comorbidity factors, duration of urethral catheter use, and antimicrobial therapy are crucial factors to determine the preventive measures and surveillance for successful prevention of nosocomial UTI.

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#### **MAGNETIC RESONANCE IMAGING AND MAGNETIC RESONANCE ANGIOGRAPHY IN EVALUATION OF ISCHEMIC STROKE IN VERTEBROBASILAR CIRCULATION**

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Vertebrobasilar occlusion is a life-threatening event that requires prompt diagnostic evaluation and subsequent therapy. Advanced magnetic resonance imaging (MRI) methods, including diffusion-weighted imaging (DWI) and magnetic resonance angiography (MRA), are highly sensitive for the detection of ischemic tissue injury, and the detection and localization of intracranial arterial occlusion and stenosis. In the era of thrombolytic therapy, MRI and MRA provide useful information for therapeutic decision making in the early stage of stroke evaluation. We conducted a retrospective review of patients with posterior circulation symptomatology examined at our Department between July 2002 and July 2004, and chose 15 representative cases (8 female and 7 male, mean age 53.86 years) to present the possibilities of MRI and MRA in the management of patients with the ischemic stroke in the posterior circulation. In 15 patients with an ischemia in the vertebrobasilar circulation detected by MRI of the brain, on MRA we identified 7 (46.67%) cases of basilar artery occlusion (BAO), 1 case (6.67%) of middistal basilar artery stenosis (BAS), 2 (13.33%) cases of multiple atherosclerotic stenoses of the vertebrobasilar arteries, 2 (13.33%) cases of vasculitis in the posterior circulation, 2 (13.33%) cases of vertebral artery occlusion (VAO), and 1 (6.67%) case of proximal posterior cerebral artery occlusion. In 7 patients with BAO, the site of occlusion was proximal in 3 (42.85%) cases, proximal and middle in 2 (28.57%) cases, middle and distal in 1 (14.29%) case, and distal in 1 (14.29%) case, while the pathogenesis was local atherothrombosis in 5 (71.43%) and embolism in 2 (28.57%)

primjena standardiziranih kriterija u dijagnostici infekcija, ciljano praćenje kliničkih i laboratorijskih parametara od časa prijma bolesnika u bolnicu. Precizni podaci o komorbiditetnim čimbenicima, trajanju primjene uretralnog katetera, te antimikrobnoj terapiji bitni su čimbenici koji određuju preventivne mjere i nadzor u cilju sprječavanja bolničke UTI.

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#### **MAGNETSKA REZONANCIJA MOZGA I MAGNETSKA ANGIOGRAFIJA U PROCJENI ISHEMIJSKOG MOŽDANOG UDARA U VERTEBROBAZILARNOJ CIRKULACIJI**

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Vertebrobazilarna okluzija je za život opasno stanje koje zahtijeva brzu dijagnostičku obradu i terapiju. Suvremene metode magnetske rezonancije (MR) mozga, uključujući difuzijski mjerenu sliku i magnetsku angiografiju (MRA), imaju visoku osjetljivost u otkrivanju ishemijske lezije moždanog parenhima, te u otkrivanju i lokalizaciji okluzije i stenoze intrakranijskih arterija. U doba trombolitične terapije MR mozga i MRA daju korisne podatke bitne za donošenje odluke o izboru terapije u procjeni ranog stadija ishemijskog moždanog udara (MU). Proveli smo retrospektivni pregled bolesnika sa simptomatologijom stražnje cirkulacije koji su na našem Zavodu pregledani u razdoblju od srpnja 2002. do srpnja 2004. godine, i izdvojili 15 reprezentativnih slučajeva (8 žena i 7 muškaraca srednje životne dobi od 53,86 godina) kako bismo pokazali mogućnosti MR mozga i MRA u zbrinjavanju bolesnika s ishemijskim MU stražnje cirkulacije. U 15 bolesnika s ishemijskim MU vertebrobazilarnog sliva koji je dokazan pomoću MR mozga, MRA je otkrila 7 (46,67%) okluzija bazilarne arterije, 1 (6,67%) stenozu mediodistalnog dijela bazilarne arterije, 2 (13,33%) slučajeva višestrukih aterosklerotskih stenoza vertebrobazilarnih arterija, 2 (13,33%) slučajeva vaskulitisa u stražnjoj cirkulaciji, 2 (13,33%) okluzije vertebralne arterije i 1 (6,67%) slučaj okluzije proksimalnog dijela stražnje moždane arterije. U 7 bolesnika s okluzijom bazilarne arterije mjesto okluzije bilo je proksimalni dio arterije u 3 (42,85%) slučajeva, proksimalni i srednji dio u 2 (28,57%) slučajeva, srednji i distalni dio u 1 (14,29%) slučaju i distalni dio bazilarne arterije u 1 (14,29%) slučaju, dok se etiološki radilo o lokalnoj aterotrombozi kod 5

cases. MRI is a powerful tool to detect ischemic changes in stroke immediately upon stroke onset, while MRA is highly sensitive for the detection of occlusive disease in large intracranial arteries as well as in the posterior circulation. In the acute stroke setting MRI and MRA are useful for: 1) early and reliable identification of ischemic stroke; 2) improved choice of treatment modality by helping exclude from thrombolysis patients at high risk of hemorrhage and by identifying those patients most likely to benefit from it; 3) pinpointing the vascular origin of ischemic stroke; 4) determination of neurologic consequences of the stroke, including final infarct size, clinical outcome and hemorrhagic risk.

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### COMPARISON OF CT AND MR FINDINGS IN STROKE PATIENTS

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The aims of the study were to present the sensitivity of early brain CT compared to brain MR in acute stroke patients, and to present sensitivity of nonacute brain CT compared to brain MR in patients with TIA or minor stroke and carotid or vertebral high grade stenosis or occlusion. Data of 14 patients (9 male, 5 female) with a clinical picture of transient ischemic attack (TIA) or stroke were evaluated. History data were obtained; clinical examination and laboratory work up were done, followed by noncontrast brain CT within 24 hours of stroke onset and brain MR 4-11 days later. Data are presented descriptively. Three patients presented with TIA and 11 with stroke. Early brain CT scan showed ischemic lesions in 4 patients (in one in combination with lacunae), one patient had only lacunae, and one white matter hypoxic changes. Brain MR showed ischemic lesions in 8 patients, white matter changes in 5 patients and ischemic changes compared to brain MR, and MR showed ischemic changes even in patients who presented with TIA. Brain MR is a highly sensitive method to detect ischemic changes in patients who presented only with TIA.

(71,43%) i emboliji kod 2 (28,57%) bolesnika. MR mozga je moćno sredstvo u otkrivanju ishemijskih promjena neposredno nakon nastupa MU, dok MRA ima visoku osjetljivost za otkrivanje okluzivne bolesti velikih intrakranijskih arterija. Kod zbrinjavanja akutnog MU su MR mozga i MRA korisne zbog: 1) brzog i sigurnog otkrivanja ishemijske; 2) sigurnijeg izbora oblika terapije pomažući da se tromboliza ne primijeni kod bolesnika s visokim rizikom za razvoj krvarenja i da se otkriju bolesnici koji će imati najviše koristi od iste; 3) mogućnosti točnog određivanja vaskularnog podrijetla ishemijskog MU; 4) određivanja neuroloških posljedica MU, uključujući konačnu veličinu ishemijske lezije, klinički ishod i rizik od krvarenja.

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### USPOREDBA NALAZA CT I MR KOD BOLESNIKA S MOŽDANIM UDAROM

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Kompjutorizirana tomografija (CT) se upotrebljava u rutinskoj dijagnostici cerebrovaskularnih bolesti, osobito u akutnoj fazi moždanog udara (MU). Unatoč jasne neurološke slike CT mozga može biti negativan, dok je nalaz magnetske rezonancije (MR) često pozitivan. Cilj rada je pokazati specifičnost i osjetljivost CT mozga učinjenog u ranoj fazi u usporedbi s MR. Kod ovih bolesnika dodatno je i ultrazvukom ustanovljena ili stenoza visokog stupnja karotidnih arterija ili okluzija vertebralnih arterija ili okluzija intracerebralnih arterija. Analizirali smo 14 bolesnika (M 9, Ž 5) u dobi od 33 do 76 godina, liječenih na Klinici za neurologiju KB "Sestre milosrdnice", koji su se klinički manifestirali kao TIA ili MU. Analizirali smo anamnestičke podatke, neurološki status, laboratorijsku obradu; nativni CT mozga učinili smo unutar prvih 24 sata, a MR mozga 4 do 11 dana kasnije. Rezultati su uključeni u PC i formiran je matriks odluke za izražavanje osjetljivosti i specifičnosti. Troje bolesnika se je prezentiralo kao TIA, a 11 kao MU. CT mozga učinjen 12 do 24 sata od pojave simptoma bio je negativan kod 3 bolesnika. U 5 slučajeva nađena je atrofija, a kod 6 bolesnika nalaz je bio pozitivan (kod 4 bolesnika nađene su ishemijske lezije: kod 1 u kombinaciji s lakunama, 1 bolesnik je imao lakunarne lezije, a 1 hipoksične promjene bijele tvari periventrikularno obostrano). MR pregled učinjen je 4 do 11 dana od pojave neuroloških simptoma. Ishemijske infarktne lezije nađene su kod 8 bolesnika, lezije bijele tvari kod 5 bolesnika, a lakune u 3



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### MORPHOLOGICAL AND HEMODYNAMIC CHARACTERISTICS OF VERTEBRAL ARTERIES (HYPOPLASTIC VS NORMAL)

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Studies have shown that vertebral arteries (VA) may differ in diameter. However, the impact of diameter differences has not been compared with hemodynamic changes. The aim of the study was to compare mean blood flow velocities (MBFV) through VA between individuals with hypoplastic vertebral artery (HVA) and controls, and to assess sex differences. We examined 122 patients with HVA (50 male and 72 female) using a linear 10 MHz probe on an Aloka Prosound SSD-5500. Control group included 155 subjects (68 male and 87 female) with normal VA diameter; the VA with a smaller diameter was defined as "narrower" VA. The criteria defining HVA were as follows: lumen diameter  $\leq 2$  mm in V2 segment, blood flow velocity  $\leq 40$  m/s, and a higher resistance pattern. We compared mean values of VA diameter in the HVA group and between the HVA and control group, and MBFV in both VA. Hypoplasia of the right VA was more common (right VA 64% and left VA 36%). The mean diameter of HVA in women was 1.75 mm and on the contralateral normal side 3.55 mm. In female control group, the "narrower" VA diameter was 2.88 mm and "wider" VA diameter 3.49 mm. The mean diameter of HVA in men was 1.71 mm and mean diameter on the nonhypoplastic side was 3.97 mm. In the male control group the diameter of the "narrower" VA was 3.02 mm and of the "wider" VA 3.67 mm. The cumulative diameter of the right and left VA in the HVA group was 5.30 mm (women) and 5.68 mm (men), whereas in the control group it was 6.37 mm (women) and 6.69 mm (men). MBFV in the hypoplastic right VA were lower than in the hypoplastic left VA (women: right VA 0.37 m/s and left VA 0.43 m/s; men: right VA 0.34 m/s and left VA 0.39 m/s). The mean diameter of normal VA in the HVA group showed no statistically significant difference compared with the control group in women, however, a statistically significant difference was

bolesnika. MR mozga je visoko osjetljiva metoda u otkrivanju ishemičnih promjena, čak i kod bolesnika koji su se klinički manifestirali kao TIA. Ultrazvuk krvnih žila može pokazati točnu lokalizaciju okluzivnih bolesti. TIA je samo klinička dijagnoza koja ukazuje na ishemične promjene.

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### MORFOLOŠKA I HEMODINAMSKA OBILJEŽJA VERTEBRALNIH ARTERIJA

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Istraživanja su pokazala da promjeri vertebralnih arterija (VA) mogu biti različiti. Malo je istraživanja posvećenih utjecaju razlika u promjerima VA s promjenama u hemodinamici. Cilj ovoga istraživanja bio je usporediti srednje brzine strujanja krvi (SBSK) kroz VA u osoba s hipoplazijom vertebralne arterije (HVA) i zdravih osoba, kao i razlike među spolovima. U istraživanje su bila uključena 122 bolesnika s HVA (50 muškaraca i 72 žene). Pregled je izvršen linearnom sondom od 10 MHz na Aloka Prosound SSD-5500. U kontrolnoj skupini je bilo 155 ispitanika (68 muškaraca i 87 žena) s urednim promjerima VA, gdje je VA manjeg promjera definirana kao "uža" arterija. Dijagnoza HVA postavljena je na osnovi ranije utvrđenih kriterija: promjer VA  $\leq 2$  mm u segmentu V2, brzina strujanja krvi  $\leq 40$  m/s i povišen cirkulacijski otpor. Usporedili smo srednje vrijednosti promjera VA unutar skupine s HVA i kontrolne skupine, kao i SBSK u VA obiju skupina. Hipoplazija desne VA bila je češća od hipoplazije lijeve VA (64% prema 37%). Srednja vrijednost promjera HVA kod žena je bila 1,75 mm, a srednja vrijednost kontralateralnih urednih VA bila je 3,55 mm. U kontrolnoj skupini je kod žena promjer "uže" VA bio 2,88 mm, a promjer "šire" VA 3,49 mm. Srednja vrijednost promjera HVA kod muškaraca je bila 1,71 mm, a srednja vrijednost nehipoplastične VA bila je 3,97 mm. U kontrolnoj skupini je kod muškaraca promjer "uže" VA bio 3,02 mm, a promjer "šire" VA 3,67 mm. Srednja vrijednost ukupnog promjera (zbroj lijeve i desne) VA u skupini HVA bila je 5,30 mm kod žena i 5,68 mm kod muškaraca. U kontrolnoj skupini su žene imale ukupan promjer od 6,37 mm, a muškarci 6,69 mm. SBSK u hipoplastičnoj desnoj VA su bile niže u odnosu na lijevu stranu (žene: desna VA 0,37 m/s, lijeva VA 0,43 m/s; muškarci: desna VA 0,34 m/s, lijeva VA 0,39 m/s). Srednja vrijednost promjera normalne VA u skupini HVA nije pokazala statistički značajnu razliku u odnosu na kontrolnu skupinu kod

recorded for men. MBFV were higher in the HVA group in women than in men. Examination of VA with CDFI may be useful in the evaluation of patients with cerebrovascular diseases.

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### PREVALENCE OF MIGRAINE IN PATIENTS WITH VERTEBRAL ARTERY HYPOPLASIA

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The role of vertebral artery hypoplasia in migraine has not been extensively studied. Migraine with aura has a higher incidence of vertebral artery hypoplasia. Since migraine with aura is a heritable condition, we evaluated 30 families with at least one member diagnosed with hypoplastic vertebral artery. Vertebral artery hypoplasia (VAH) was defined as  $\leq 2$  mm in diameter. Vertebral arteries of 97 members of 30 families were examined with CDFI (Color Doppler Flow Imaging). Hypoplasia of vertebral arteries was found in 41 patients (14 men and 26 women). Right vertebral artery hypoplasia was present in 25, left in 14, and bilateral hypoplasia in 2 patients. Migraine and VAH was present in 8 patients (in 6 families; 7 women, 1 man), whereas migraine without VAH was present in 13 patients (in 9 families). The prevalence of migraine in the study group was 13.4%. In patients with VAH, the prevalence of migraine was 19.5% (8 out of 41 patients). Aura was present in 5 out of 8 patients with both migraine and VAH. Our preliminary results show that VAH has a higher incidence in migraine with aura.

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### VERTEBRAL ARTERY HYPOPLASIA – A NEW MENDELIAN CONDITION?

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žena, ali je statistički značajna razlika zabilježena unutar navedenih dviju skupina kod muškaraca. Žene u skupini HVA su imale brže SBSK u usporedbi s muškarcima. Pregled VA uz pomoć obojenog doplera mogao bi biti koristan u procjeni bolesnika s cerebrovaskularnom bolešću.

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### UČESTALOST MIGRENE KOD BOLESNIKA S HIPOPLAZIJOM VERTEBRALNE ARTERIJE

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Uloga hipoplastične vertebralne arterije kod osoba s migrenom nije sasvim jasna. Ustanovljena je viša incidencija hipoplazije vertebralne arterije kod osoba s migrenom. S obzirom na to da je migrena s aurom nasljedna, istražili smo 30 obitelji s barem 1 članom koji ima hipoplaziju vertebralne arterije. Pod hipoplazijom vertebralne arterije smatrali smo arteriju promjera  $\geq 2$  mm. Vertebralne arterije kod 97 članova iz 30 obitelji pregledane su pomoću ekstrakranijskog obojenog doplera. Hipoplazija vertebralnih arterija ustanovljena je kod 41 bolesnika (14 muških i 26 žena). Hipoplazija desne vertebralne arterije je ustanovljena kod 25, lijeve kod 14, a obostrana hipoplazija kod 2 bolesnika. Migrena i hipoplazija vertebralne arterije bile su prisutne kod 8 bolesnika (u 6 obitelji: 7 žena i 1 muškarac), dok je migrena s urednim promjerom vertebralnih arterija bila prisutna kod 13 bolesnika (u 9 obitelji). Učestalost migrene u istraživanoj skupini bila je 13,4%. Kod bolesnika s hipoplazijom vertebralne arterije učestalost migrene bila je 19,5% (kod 8 od ukupno 41 bolesnika). Aura je bila prisutna kod 5 od 8 bolesnika s migrenom i hipoplazijom vertebralne arterije. Naši preliminarni rezultati pokazuju da je incidencija hipoplazije vertebralne arterije viša kod osoba s migrenom i aurom.

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### HIPOPLAZIJA VERTEBRALNE ARTERIJE – NOVO MENDELIJANSKO STANJE?

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The aim of the study was to investigate the mode of inheritance of vertebral artery (VA) hypoplasia. Color Doppler (CD) of VA was performed to confirm VA hypoplasia according to already established criteria. We investigated 33 families (97 individuals) with at least one member having hypoplastic VA. A higher prevalence of VA hypoplasia among relatives of probands was found, i.e. 15.6% in comparison to 2.34% in the general population. Genetic analysis was performed using sex-specific frequencies of 36 Parent-Offspring (PO) pairs composed only of affected parents and their (affected or nonaffected) offspring. The hypothesis of X-linked dominant inheritance of VA hypoplasia was assumed and three variants of X-linked model were designed and tested. Goodness-of fit statistics showed the codominant model with healthy allele being stronger (60% effect on phenotype) to be the most probable one ( $\chi^2=1.94$ ;  $p<0.96$ ), followed by codominant variant (50%:50% effects) with  $\chi^2=4.17$ ;  $p<0.76$ , and less probable complete dominant variant ( $\chi^2=11.85$ ;  $p<0.11$ ). Preliminary results suggest the mode of inheritance of VA hypoplasia as a condition determined by X-linked inheritance with codominant effect. Further research encompassing more completed family sample is needed.

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### IMT IN SMOKERS

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Smoking is the single most harmful habit that causes direct damage to vascular cell wall. The aim of the study was to evaluate possible differences between smokers' common carotid artery (CCA) intima-media thickness (IMT) *versus* nonsmokers' IMT. The study included 121 healthy volunteers. Smoking was the only apparent risk factor for cerebrovascular disease. IMT measurement was performed on an Aloka 5500 Prosound ultrasound platform using B mode investigation on CCA 1.5 cm proximal to the carotid bifurcation. IMT was then used for calculation of CCA midwall strain (MS). Mann-Whitney statistics was performed to determine possible difference between groups. There were 80 women and 41 men aged  $47.43 \pm 14.15$ . There were 23 (19%) active smokers, 17 (14%) occasional smokers, 11 (9%) past smokers and 70 (58%) nonsmokers. The highest mean age group was that

Cilja rada bio je istražiti način nasljeđivanja hipoplazije vertebralne arterije (VA). Hipoplazija VA potvrđena je obojenim doplerom VA prema utvrđenim kriterijima. Ispitali smo 33 obitelji (97 osoba) u kojima najmanje jedan član ima hipoplastičnu VA. Našli smo veću učestalost hipoplazije VA među rođacima probanda (15,6%) u usporedbi s općom populacijom (2,34%). Genetska analiza je izvedena uz primjenu za spol specifičnih frekvencija 36 parova roditelja-potomaka (*Parent-Offspring*, PO) sastavljenih samo od zahvaćenih roditelja i njihovih (zahvaćenih ili nezahvaćenih) potomaka. Pretpostavljena je hipoteza X-vezanog dominantnog nasljeđivanja hipoplazije VA, te su izrađene i ispitane tri inačice X-vezanog modela. Statistika *Goodness-of fit* pokazala je da je najvjerojatniji kodominantni model sa snažnijim zdravim alelom (60%-tni učinak na fenotip) ( $\chi^2=1,94$ ;  $p<0,96$ ), a nakon njega slijedi kodominantna inačica (50%:50%-tni učinak) ( $\chi^2=4,17$ ;  $p<0,76$ ) te najmanje vjerojatna potpuno dominantna inačica ( $\chi^2=11,85$ ;  $p<0,11$ ). Preliminarni rezultati ukazuju na način nasljeđivanja hipoplazije VA kao stanja određenog X-vezanim nasljeđivanjem s kodominantnim učinkom. Potrebna su daljnja istraživanja na potpunijim obiteljskom uzorku.

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### IMT KOD PUŠAČA

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Pušenje je pojedinačno jedan od najštetnijih čimbenika za zdravlje koji uzrokuje izravno oštećenje stijenke krvne žile. Cilj ovoga istraživanja bio je ustanoviti postoji li razlika u zadebljanju i funkciji stijenke zajedničke karotidne arterije (ACC) kod pušača u odnosu na nepušače. U istraživanje je bio uključen 121 zdravi ispitanik. Pušenje je bio jedini zajednički čimbenik rizika za nastanak moždanog udara u skupini ispitanika. Vrijednosti intimalnog zadebljanja stijenke (IMT) mjerene su na ultrazvučnom uređaju Aloka 5500 Prosound ultrasound uz pomoć B prikaza na ACC 1,5 cm proksimalno od karotidne bifurkacije. Uz mjerenje, IMT se je rabila za izračunavanje napora stijenke ACC (NS). Statističke metode rabile su se za obradu podataka i usporedbu prema skupinama. U istraživanje je bilo uključeno 80 žena i 41 muškarac (srednja dob  $47,43 \pm 14,15$ ). Bilo je 23 aktivnih pušača (19%), 17 povremenih

of past smokers. In the group of active smokers the mean number of pack-years was 18.65 (range 4-50). In active smokers the mean IMT was  $0.47 \pm 0.08$  in the right CCA and  $0.49 \pm 0.14$  in the left CCA, whereas in the group of nonsmokers it was  $0.45 \pm 0.1$  in the right CCA and  $0.47 \pm 0.11$  in the left CCA. In occasional smokers the mean IMT was  $0.44 \pm 0.08$  in the right CCA and  $0.45 \pm 0.05$  in the left CCA, whereas in the group of past smokers it was  $0.5 \pm 0.1$  in the right CCA and  $0.55 \pm 0.1$  in the left CCA. There was no between group difference when IMT alone was analyzed. The difference was significant when MS calculations were performed for different groups of smokers *versus* the group of nonsmokers ( $p < 0.05$ ). The study has proved that there is a more significant association of IMT increase with age than with smoking. Also, IMT can be used to express vessel wall function when applied to the midwall strain equation.

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#### INCREASED CCA STIFFNESS IN WOMEN WITH GREATER BODY MASS INDEX

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Common carotid artery (CCA) decrease in elasticity is a strong predictor for atherosclerosis. Most studies were conducted in middle-aged men due to the fact that men are more prone to early atherosclerosis. Women with increased body mass index (BMI) proved to have greater values of CCA intima-media thickness (IMT). Our aim was to assess possible differences in CCA elasticity between the groups of middle-aged women with different BMI. We evaluated 10 female volunteers with 10 controls, age and risk factors adjusted, using high-resolution B-mode and M-mode analysis on an Aloka 5500 Prosound ultrasound platform. Two parameters were used: luminal strain (LS) and midwall strain (MS). Dividing the difference between systolic and diastolic diameters with diastolic diameter the two parameters were assessed, the latter considering the IMT. Kolmogorov-Smirnov one sample test using exponential distribution was used on data analysis. Twenty women aged  $52.5 \pm 7.9$  (range 39-69) were included. BMI value determining obesity was set at  $27.3 \text{ kg/m}^2$ .

pušača (14%), 11 bivših pušača (9%) i 70 nepušača (58%). Skupina bivših pušača u prosjeku je imala najveću životnu dob. U skupini aktivnih pušača prosječni broj cigareta-godina bio je 18,65 (raspon 4-50). U skupini aktivnih pušača IMT u desnoj ACC mjerila je  $0,47 \pm 0,08$  mm, a u lijevoj ACC  $0,49 \pm 0,14$  mm, dok je u skupini nepušača IMT u desnoj ACC mjerila je  $0,45 \pm 0,10$  mm, a u lijevoj ACC  $0,47 \pm 0,11$  mm. U skupini povremenih pušača IMT u desnoj ACC mjerila je  $0,44 \pm 0,08$  mm, a u lijevoj ACC  $0,45 \pm 0,05$  mm, dok je u skupini bivših pušača u desnoj ACC IMT mjerila  $0,50 \pm 0,10$  mm, a u lijevoj ACC  $0,55 \pm 0,10$  mm. Kad su se usporedbe izvodile samo mjerenjem IMT nije bilo statistički dokazane razlike među ispitanicima. Razlika je postojala kad se među skupinama pušača i nepušača uspoređivao napor stijenke ( $p < 0,05$ ). Ovo istraživanje potvrdilo je da je debljina IMT jače povezana s dobi nego s pušenjem. Uz to, IMT se može uzeti kao parametar funkcije stijenke ako se uvrsti u jednadžbu napora stijenke.

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#### POVEĆANA KRUTOST ACC U ŽENA S VEĆIM INDEKSOM TJELESNE TEŽINE

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Smanjenje elastičnosti u zajedničkoj karotidnoj arteriji (ACC) značajan je prediktor za nastanak ateroskleroze i moždanog udara. Većina istraživanja provedena je na muškarcima srednje dobi uglavnom stoga što su muškarcima sklonniji nastanku rane ateroskleroze. Dosad se je utvrdilo da žene s povećanim vrijednostima indeksa tjelesne težine (ITT) imaju zadebljani intimalni dio (IMT) u ACC. Cilj istraživanja bio je utvrditi postoji li u našoj skupini ispitanika razlika u krutosti u žena srednje dobi koje imaju različite vrijednosti ITT. U istraživanje je bilo uključeno 10 žena dobrovoljaca koje su imale odgovarajuću kontrolu prema dobi te čimbenicima rizika. Istraživanje se je provelo uz pomoć B prikaza visoke rezolucije i M prikaza na ultrazvučnom uređaju Aloka 5500 Prosound. Za ispitivanje elastičnosti upotrebljena su dva parametra: luminalni napor (LN) i napor stijenke (NS). Oni se izračunavaju tako da se razlika promjera arterijske stijenke u sistoličnom i dijastoličnom dijelu srčanog ciklusa podijeli s dijastoličnim promjerom, a NS pritom uključuje i debljinu intimalnog



The mean IMT was  $0.54 \pm 0.13$  in women with higher BMI and  $0.46 \pm 0.13$  in the control group ( $p < 0.05$ ). CCA LS in women with higher BMI was  $10.75 \pm 3.52$  and in the control group it was  $11.41 \pm 6.29$  ( $p < 0.05$ ). CCA MS in women with higher BMI was  $4.45 \pm 4.5$  ( $p < 0.05$ ) and in the control group  $9.59 \pm 3.67$  ( $p < 0.05$ ). There was a significant difference in CCA IMT, LS and MS between the women with higher BMI and control group. Therefore, LS and MS can be used as markers of early atherosclerosis in women.

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### CATHEDRAL-LIKE HEMODYNAMIC SPECTRUM AS THE ONLY SIGN OF AORTIC ARCH DISSECTION

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In the absence of sudden chest pain, aortic arch dissection remains unrecognized. We report on a patient with aortic arch dissection presenting as encephalopathy following a comatose state. A 55-year-old patient suddenly became comatose with apneic crisis and severe hypotension. Glasgow Coma Scale was 6 (1+4 withdraws to pain stimuli on the left+1). Two days before admission, he complained of chest pain. The history on hypertension was negative. He had rheumatic fever 45 years before. Smoker. Twenty minutes after therapy, blood pressure was stabilized without asymmetry, the patient turned conscious, without lateralization, oriented but strongly agitated, with strong psychomotor restlessness despite sedation therapy. No cardiac murmurs could be recorded. Blood tests were normal, electrocardiography, repeat chest radiography, brain computed tomography and electroencephalography were normal. Toxicologic analysis was negative. Cerebrospinal fluid analysis was normal. Antiepileptic and sedative therapy was started, however, without effect. On day 6 of hospitalization the patient developed dyspnea accompanied by sweating and restlessness. On day 7, blood pressure could not be measured on the left arm. Carotid color

dijela prednje i stražnje stijenke. Odgovarajuće statističke metode upotrebene su za usporedbu među skupinama. U istraživanje je bilo uključeno ukupno 20 žena u dobi od  $52,5 \pm 7,9$  godina (raspon 39-69). Granica vrijednosti ITT za pretilost je bila  $27,3 \text{ kg/m}^2$ . Prosječne vrijednosti IMT kod žena s povišenim ITT bila je  $0,54 \pm 0,13 \text{ mm}$ , a u kontrolnoj skupini  $0,46 \pm 0,13 \text{ mm}$  ( $p < 0,05$ ). LN u ACC u pretilih žena bio je  $10,75 \pm 3,52\%$ , a u kontrolnoj skupini  $11,41 \pm 6,29\%$  ( $p < 0,05$ ). LN u ACC u pretilih žena bio je  $4,45 \pm 4,5\%$  ( $p < 0,05$ ), a u kontrolnoj skupini  $9,59 \pm 3,67\%$  ( $p < 0,05$ ). Usporedbom LN i NS među skupinama pretilih žena i žena normalnih vrijednosti ITT dokazana je statistički značajna razlika pa se ovi parametri mogu rabiti u istraživanju rane ateroskleroze u žena.

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### HEMODINAMSKI SPEKTAR POPUT KATEDRALE KAO JEDINI ZNAK DISEKCIJE LUKA AORTE

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Kad nagla bol u prsnom košu nije prisutna disekcija luka aorte često ostaje neprepoznata. Prikazati ćemo bolesnika s disekcijom luka sorte koji je u početku imao kliničku sliku encefalopatije nakon komatoznog stanja. Bolesnik u dobi od 55 godina naglo je izgubio svijest s apneičnim krizama i jakom hipotenzijom. Glasgowska ljestvica kome je bila 6 (1+4 povlači lijevu nogu na bolni podražaj +1). Dva dana prije prijma u bolnicu bolesnik je javljao bol u prsnom košu. Nije bolovao od hipertenzije. Prije 45 godina prebolio je reumatsku groznicu. Pušač. Dvadeset minuta nakon primjene terapije krvni tlak se je stabilizirao bez asimetrije, bolesnik je postao svjestan, bez lateralizacije, orijentiran, ali izrazito agitiran s jakim psihomotornim nemirom usprkos sedativima. Nisu se čuli nikakvi šumovi na srcu. Krvni nalazi su bili u granicama normale, elektrokardiografija i ponavljane rendgenske slike srca i pluća te CT mozga i elektroencefalografija su bili bez osobitosti. Toksikološka analiza je bila negativna. Analiza cerebrospinalnog likvora je bila normalna. Započela se je terapija sedativima i anti-epilepticima, ali nije bilo učinka. Šestoga dana od početka hospitalizacije bolesnik je postao dispneičan uz znojenje i nemir. Sedmoga dana nije se više mjerio krvni tlak na lijevoj ruci. Obojeni Doppler karotidnih arterija pokazao je

Doppler revealed normal morphologic finding of carotid arteries, but the hemodynamic spectrum was changed with a cathedral-like appearance, and negative deflection during the diastole. The subclavian steal syndrome in the left vertebral artery was present. Transcranial Doppler revealed the same hemodynamic spectrum in the circle of Willis. Echocardiography showed dilatation of the supraaortic aorta with intimal flapping, bicuspid aortic valve with massive aortic regurgitation and pericardial effusion. Chest CT confirmed aortic arch dissection, and the patient was transferred to Department of Cardiology and compensated upon therapy. Control Doppler revealed similar findings. After one month, neurologic and psychiatric examination yielded normal findings. Accordingly, aortic arch dissection usually remains underdiagnosed. Carotid and transcranial Doppler should be used in patients with unusual clinical picture, because the spectra may indicate proximal disease.

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#### MEAN REACTION TIME IN POSTERIOR CEREBRAL ARTERY IN PATIENTS WITH CAROTID OCCLUSIVE DISEASE

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Although posterior circulation may play an important role as a collateral channel in patients with significant carotid occlusive disease, attention has been mainly focused on evaluating the hemodynamic effect of ICA stenosis on the middle cerebral artery (MCA), showing a significantly reduced vasomotor reactivity of the MCA in patients with high-grade stenosis or occlusion of the ICA. We evaluated the hemodynamic features of the posterior circulation by assessing visual evoked response in posterior cerebral artery (PCA) by means of functional transcranial Doppler (fTCD) (2 MHz probe MultiDop X4 DWL). Mean reaction time (MRT) in each PCA was measured successively in the dark and during white light stimulation, three times, 1 minute period each. Our findings showed prolonged visual evoked response in patients with severe carotid disease compared to healthy subjects.

In carotid disease patients MRT values did not differ significantly among the three measurements ( $p < 0.1$ )

normalan morfološki nalaz, ali je hemodinamski spektar bio promijenjen, nalik katedrali, s negativnom defleksijom u dijastoli. U lijevoj vertebralnoj arteriji postojali su znakovi sindroma potpune krađe krvi lijeve potključne arterije. Transkranijalni Doppler pokazao je isti hemodinamski spektar na žilama Willisova kruga. Ehokardiografija je pokazala dilataciju supraaortalnog dijela aorte s prisutnim ljuštenjem intimalnog dijela stijenke, bikuspidni aortni zalistak s masivnom regurgitacijom i perikardijalnim izljevom. CT toraksa potvrdio je da se radi o disekciji luka aorte pa je bolesnik premješten na Odjel za kardiologiju Klinike za internu medicinu te se stanje popravilo nakon terapije. Kontrolni obojeni Doppler karotidnih arterija pokazao je sličan nalaz. Nakon jednog mjeseca kontrolni neurološki i psihijatrijski nalazi bili su u granici normale. Disekcija luka aorte često bude previđena. Ultrazvuk karotidnih arterija i TCD treba rabiti kod bolesnika koji imaju neobičnu kliničku sliku, jer hemodinamski spektar može ukazivati na proksimalnu žilnu bolest.

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#### SREDNJE VRIJEME REAGIRANJA U STRAŽNJOJ MOŽDANOJ ARTERIJI U BOLESNIKA S KAROTIDNOM OKLUZIVNOM BOLEŠĆU

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U procjenjivanju moždane vazoreaktivnosti bolesnika s karotidnom bolešću rabljeni su različiti podražaji: inhalacija CO<sub>2</sub>, test zadržavanja daha, kognitivni testovi, slušni podražaji. Rezultati tih istraživanja govore o oslabljenoj cerebrovaskularnoj reaktivnosti kod bolesnika sa značajnom stenozom ili okluzijom ACI. Međutim, dosad su se sva ta istraživanja provodila u irigacijskom području ACM. Saznanja o hemodinamskim zbivanjima u stražnjem dijelu Willisova kruga još uvijek su oskudna. Cilj ovoga istraživanja bio je utvrditi hemodinamska zbivanja u stražnjem dijelu moždanog krvotoka ispitivanjem vidnog evociranog odgovora u stražnjoj moždanoj arteriji (ACP) pomoću funkcionalnog TCD (fTCD) (sonda od 2 MHz; MultiDop X4 DWL) u 16 bolesnika s uznapredovalom karotidnom bolešću. Mjereno je srednje vrijeme reagiranja (SVR) (vrijeme do postizanja maksimalne brzine) u obje ACP, sukcesivno podraživanjem bijelom svjetlošću i sa zatvorenim očima, u tri navrata, u razdoblju od 1 minute

during the white light stimulation, whereas in the dark the difference was statistically ( $p < 0.02$ ) but not clinically significant. In healthy subjects the difference between the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> measurement was statistically significant both during the white light stimulation and in the dark. MRT was significantly prolonged in the 2<sup>nd</sup> and 3<sup>rd</sup> measurement compared to the 1<sup>st</sup> measurement. Prolonged vasoreactive response in PCA in healthy subjects during the repetitive measurements may indicate the exhaustion of the vasoreactive mechanisms in healthy subjects. In carotid disease patients stable vasoreactive response may indicate that the compensatory mechanisms of the posterior circulation are always maximally engaged to compensate for the carotid insufficiency.

svaki. U skupini zdravih ispitanika bila je prisutna razlika u SVR između prvog, drugog i trećeg mjerenja pri izlaganju bijelom svjetlu. Prilikom 2. i 3. mjerenja u skupini zdravih ispitanika dolazi do statistički značajnog produljenja SVR u ACP ( $p < 0,0005$ ; Friedman Anova test) u usporedbi s prvim mjerenjem pri izlaganju bijelom svjetlu. Usporedba vrijednosti SVR između prvog, drugog i trećeg mjerenja u skupini bolesnih ispitanika u mraku pokazala se je statistički značajnom ( $p < 0,02$ ; Friedman Anova test), ali je bez kliničkog značenja. U skupini zdravih ispitanika bila je prisutna razlika u SVR u ACP i u mraku. U usporedbi s prvim mjerenjem, prilikom 2. i 3. mjerenja u skupini zdravih ispitanika došlo je do statistički značajnog produljenja SVR u ACP u mraku ( $p < 0,00054$ ; Friedman Anova test).

Usporedba vrijednosti SVR u skupini bolesnih ispitanika pri izloženosti bijelom svjetlu nije pokazala značajnijih razlika između 1., 2. i 3. mjerenja, dok se u mraku pokazala statistički značajnom u smislu postojanja trenda ka produljenju SVR, ali bez kliničkog značenja, jer su razlike u SVR bile premale, što može upućivati ili na premali uzorak ispitanika ( $n = 16$ ) ili na grješku mjerenja. U skupini zdravih ispitanika bila je prisutna razlika SVR između 1., 2. i 3. mjerenja u svim uvjetima ispitivanja. U usporedbi s prvim mjerenjem prilikom 2. i 3. mjerenja došlo je do značajnog produljenja vazoreaktivnog odgovora. Iz navedenih rezultata može se zaključiti kako, s obzirom na to da u skupini bolesnih ispitanika pri izlaganju bijelom svjetlu ne dolazi do značajnih promjena u SVR u ACP, bolesnici s karotidnom bolešću imaju nepromijenjen vazoreaktivni odgovor tijekom opetovanih ispitivanja te da su njihovi cirkulacijski kompenzacijski mehanizmi najvjerojatnije stalno maksimalno angažirani u održavanju moždanog protoka stalnim. Blago produljenje SVR u ACP u 2. i 3. mjerenju u odnosu na 1. u mraku, koji su s obzirom na male vrijednosti bez kliničkog značenja, može se protumačiti i pojavom habituacije kod opetovanog mjerenja, ali i kao znak iscrpljenja vazomotorne rezerve. U skupini zdravih ispitanika dolazi do produljenja vazoreaktivnog odgovora u ACP tijekom opetovanih mjerenja, što predstavlja znakove zamora vazoreaktivnih mehanizama u zdravih do kojeg kod bolesnih ispitanika ne dolazi, jer su kod njih kompenzacijski mehanizmi iz stražnje cirkulacije očito angažirani na maksimalnoj razini u prevladavanju karotidne insuficijencije.

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### **CORRELATION BETWEEN SEVERE CAROTID STENOSIS AND POSTERIOR CIRCULATION – FUNCTIONAL TRANSCRANIAL DOPPLER STUDY**

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Up to now attention has been mainly focused on evaluating the hemodynamic effect of internal carotid stenosis (ICA) stenosis on the middle cerebral artery (MCA). We evaluated visual evoked response in posterior cerebral artery (PCA) during the white light stimulation and in the dark by means of functional transcranial doppler (fTCD) in patients with severe carotid disease in order to determine the hemodynamic effect of severe carotid disease on posterior circulation. Forty-nine patients with high-grade (70%-99%) internal carotid artery (ICA) stenosis or occlusion were studied. We analyzed the correlation between the degree of carotid stenosis and mean blood flow velocities (MBFV) and mean reaction time (MRT) in PCA. Correlation between right (RT) ICA stenosis and MBFV in ipsilateral RT PCA or left (LT) PCA as well as between RT ICA stenosis and MRT in ipsilateral RT PCA or LT PCA was not statistically significant (linear regression analysis;  $p > 0.05$ ) either during the white light stimulation or in the dark. Negative correlation was found between LT ICA stenosis and MBFV in RT PCA or ipsilateral LT PCA as well as between LT ICA stenosis and MRT in RT PCA or ipsilateral LT PCA, however, it was not statistically significant (linear regression analysis;  $p > 0.05$ ) either during the white light stimulation or in the dark.

Visual evoked response of the posterior circulation remained similar regardless of carotid stenosis, suggesting an independent cerebral vascular reserve capacity of the posterior circulation.

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### **POVEZANOST STENOZE KAROTIDNE ARTERIJE I HEMODINAMIKE STRAŽNJEG MOŽDANOG KRVOTOKA**

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Dosad se je većina istraživanja bavila proučavanjem hemodinamskog učinka stenozе ACI u srednjoj moždanoj arteriji (ACM) te su pokazala značajno oslabljenu vazomotornu reaktivnost (VMR) u bolesnika sa značajnom stenozom ACI. U ovom istraživanju metodom fTCD mjereno je vaskularni odgovor ACP na neuronsku aktivnost izazvanu podraživanjem bijelim svjetlom kod bolesnika sa značajnom stenozom ili okluzijom ACI, u svrhu utvrđivanja eventualnih promjena vidnog evociranog odgovora BSK i vremena postizanja odgovora u ACP te procjene hemodinamskog učinka značajne stenozе ili okluzije ACI na stražnju moždanu cirkulaciju. Ispitivanje vidnog evociranog odgovora u stražnjoj moždanoj arteriji (ACP) pomoću funkcionalnog TCD (fTCD) (sonda od 2 MHz; MultiDop X4 DWL) izvršeno je u 49 bolesnika s uznapredovalom karotidnom bolešću (70%-99%-tna stenozа ACI). Mjerene su srednje brzine strujanja krvi (SBSK) u obje ACP, sukcesivno podraživanjem bijelom svjetlošću i sa zatvorenim očima, u tri navrata, u razdoblju od 1 minute svaki. Analizirana je povezanost stupnja stenozе lijeve i desne karotidne arterije sa srednjim vrijednostima SBSK u lijevoj i desnoj ACP u uvjetima izlaganja bijelom svjetlu i u mraku. Kod usporedbe stupnja stenozе desne karotidne arterije nije nađena statistički značajna povezanost (linearna regresijska analiza;  $p > 0,05$ ) ni sa SBSK u istostranoj desnoj ACP niti sa SBSK u kontralateralnoj lijevoj ACP ni u jednom od uvjeta ispitivanja. Kod usporedbe stupnja stenozе u lijevoj karotidnoj arteriji nađena je negativna korelacija sa SBSK i u istostranoj lijevoj ACP i u kontralateralnoj desnoj ACP u svim uvjetima ispitivanja koja, međutim, nije statistički značajna (linearna regresijska analiza;  $p > 0,05$ ).

Analizirana je povezanost stupnja stenozе lijeve i desne karotidne arterije sa srednjim vremenom reagiranja u lijevoj i desnoj ACP u uvjetima izlaganja bijelom svjetlu i u mraku.

Kod usporedbe stupnja stenozе desne karotidne arterije nije nađena statistički značajna povezanost (linearna regresijska analiza;  $p > 0,05$ ) ni sa SVR u istostranoj desnoj ACP niti sa SVR u kontralateralnoj lijevoj ACP ni u jednom



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### GJURO ARMENO BAGLIVI - RATIO, EXPERIMENT AND EXPERIENCE

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Born in 1668 in Dubrovnik, Croatia, and adopted by the physician Pier Angelo Baglivi, he studied medicine in Naples and went to Rome in 1692. In 1696 he was appointed Professor of Anatomy at the Papal College, in 1701 he became Professor of Theoretical Medicine. His medical work was based on the critical reading and interpretation of previous writings; authentic clinical observation of patients; inventive animal experiments *in vivo*; and systematic postmortal findings. His principal medical discoveries are: medulla oblongata is a site of vital functions; influence of vagal nerve on digestion; and fact that brain injuries cause palsy on the contralateral side of the body. He misapprehended the role of dura mater but was the first to admit the superiority of the brain to all neural events. He was among the first to recognize the vegetative nervous system function, a precedent of the concept of the hematoencephalic barrier, and the first to define the features of irritability and sensitivity. He explicitly distinguished sensory (afferent) from motor (efferent) parts of the nervous system and created the concept of pathogenesis of periodical headache. "... such a novel and comprehensive work I would hopefully be able to complete only when, as an 80-year-old man, I collect, may God help me,

od uvjeta ispitivanja. Kod usporedbe stupnja stenozе u lijevoj karotidnoj arteriji nađena je negativna korelacija sa SVR i u istostranoj lijevoj ACP i u kontralateralnoj desnoj ACP u svim uvjetima ispitivanja koja, međutim, nije statistički značajna (linearna regresijska analiza;  $p > 0,05$ ). Rezultati analize pokazuju da stupanj stenozе desne karotidne arterije ne utječe ni na SBSK ni na SVR ni u istostranoj desnoj ACP niti u kontralateralnoj lijevoj ACP ni u jednom od uvjeta ispitivanja. Kod usporedbe stupnja stenozе u lijevoj karotidnoj arteriji nađena je blaga negativna korelacija sa SBSK i sa SVR u istostranoj lijevoj ACP i u kontralateralnoj desnoj ACP u svim uvjetima ispitivanja koja, međutim, nije statistički značajna. Rezultati ovoga istraživanja ukazuju na postojanje zasebne i neovisne cerebrovaskularne rezerve stražnjeg moždanog krvotoka u bolesnika s uznapredovalom karotidnom bolešću.

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### GJURO ARMENO BAGLIVI – RAZUM, ISTRAŽIVANJE, ISKUSTVO

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Rodio se u Dubrovniku 1668. godine. Posvojio ga je talijanski liječnik Pier Angelo Baglivi. Medicinu je studirao u Napulju u Italiji, a svjetsku slavu kao liječnik postigao je u Rimu, kamo se preselio 1692. godine. Godine 1696. proglašen je profesorom anatomije u rimskom Papinskom sveučilištu, a 1701. postao je profesor teoretske medicine. Njegov medicinski rad temeljio se je na kritičkom proučavanju i interpretaciji pisanih djela, autentičnom kliničkom promatranju bolesnika, domišljatim pokusima na životinjama *in vivo* i sistematičnim postmortalnim nalazima. Njegova glavna otkrića na području medicine su: glavna uloga produljene moždine kao mjesta vitalnih funkcija, utjecaj X moždanog živca na proces probave te činjenica da ozljede mozga uzrokuju slabost na suprotnoj strani tijela. Nažalost, pogrešno je protumačio ulogu tvrde moždane ovojnice, ali je istodobno prvi shvatio nadređenost mozga svim živčanim funkcijama. Bio je među prvima koji je prepoznao ulogu vegetativnog živčanog sustava, osmislio je koncept krvno-moždane barijere te je prvi definirao pojmove iritabilnosti i senzitivnosti. Jasno je razgraničio osjetne ( aferentne) od motornih ( eferentnih) dijelova živčanog sustava te postavio koncept patogeneze periodičnih glavobolja. "... ovako sveobuhvatan i nadasve inovativan

an adequate amount of experience." He died in Rome in 1707, at the age of 39.

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### CARDIOEMBOLIC STROKE IN A YOUNG FEMALE PATIENT

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A 42-year-old woman was admitted to the Department for vertigo, weakness and tingling sensation in the right extremities that had first occurred 3 months before. The patient had hypercholesterolemia, and had used oral contraceptives at a younger age. Two ischemic lesions in the pons and parieto-occipitally were verified by brain MR and MR angiography. Echocardiography revealed mitral and tricuspid valve prolapse. Holter ECG showed heart rate disturbance with ventricular and supraventricular extrasystoles. Neuroangiosonographic studies were normal. Genetic analysis revealed a homozygous mutation of the MTHFR coagulation factor. The disorder was considered as a cardioembolic stroke, thus anticoagulant therapy was introduced upon consultation with a cardiologist. In three months, however, this therapy had to be reduced for the occurrence of metrorrhagia. The patient took hormone therapy, recommended by a gynecologist, for one month. Six months later she complained of deep intraocular pain and impaired vision on the right eye. Control brain MR and MR angiography showed two new ischemic lesions in the frontal lobe. Multiple sclerosis was ruled out by immunologic testing of the cerebrospinal fluid. This case confirms the results of international studies indicating that stroke in young patients is quite frequently of a cardioembolic genesis, pointing to the need of echocardiographic studies and making genetic testing an obligatory part of the diagnostic algorithm. Anticoagulant therapy to prevent stroke may occasionally be limited by its side effects.

posao mogao bih, barem se nadam, uspješno završiti tek, ukoliko mi Bog da da poživim 80 godina, kada sakupim dovoljnu količinu iskustva". Umro je u Rimu 1707. godine, u 39. godini života.

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### KARDIOEMBOLIJSKI INZULT U MLADE BOLESNICE

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Četrdesetdvogodišnja bolesnica primljena je na Kliniku zbog vrtoglavice, slabosti i trnjenja desnih ekstremiteta koji su se pojavili 3 mjeseca ranije. Bolesnica ima hiperkolesterolemiju, a u mladosti je rabila oralne kontraceptive. Pomoću MR mozga i MR angiografije verificirane su dvije ishemijske lezije u ponsu te parijetookcipitalno. Ehokardiografskom obradom je nađen prolaps mitralne i trikuspidne valvule. Holter EKG je pokazao poremećaje srčanog ritma uz ventrikularne i supraventrikularne extrasistole. Neuroangiosonografska obrada je bila uredna. Genetskom analizom utvrđena je homozigotna mutacija faktora koagulacije MTHFR. Smetnje su shvaćene kao kardioembolijski inzult te je u konzultaciji s kardiologom započeta antikoagulantna terapija koja je nakon tri mjeseca smanjena zbog pojave metroragija. Bolesnica je na preporuku ginekologa uzimala hormonsku terapiju kroz mjesec dana. Nakon šest mjeseci počela se je žaliti na bol u dubini oba oka te na slabiji vid na desnom oku. Kontrolni MR mozga i MR angiografija pokazali su dvije nove ishemijske lezije u frontalnom režnju. Imunološkom obradom likvora isključena je multipla skleroza. Slučaj ove bolesnice potvrđuje rezultate svjetskih studija da je moždani udar u mladih bolesnika vrlo često kardioembolijske geneze, što ističe nužnost ehokardiografske obrade, a svakako i genetskog testiranja kao dijela algoritma dijagnostičkih pretraga. Antikoagulantna terapija kao sredstvo prevencije inzulata je ponekad ograničena nuspojavama.

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### ASEPTIC CEREBRAL VENOUS SINUS THROMBOSIS IN A PATIENT WITH MULTIPLE SCLEROSIS

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Aseptic cerebral venous sinus thrombosis (CVT) is one of the rare causes of stroke which may frequently proceed unobserved due to a variable clinical picture. A number of risk factors for the development of CVT have been described in the literature, e.g., puerperium, oral contraceptives, malignant diseases and congenital thrombophilia. In face of the very sophisticated methods for early diagnosis of this disease (brain CT, DSA, MRV) and broad diagnostic workup to detect its etiology, the cause remains unknown in 20%-35% of patients. There are several literature reports on the association of CVT with multiple sclerosis (MS), however, the causal relationship between these two entities has not yet been definitely determined. A case is presented of a 31-year-old male patient in whom the relapse-remitting form of MS was verified by complete clinical workup. The patient was admitted to the Department of Neurology for the underlying disease relapse, for which he was prescribed pulsed methylprednisolone therapy. Two weeks of therapy introduction, the patient developed consciousness disturbance and right-sided palsy accompanied by sensorimotor aphasia. Radiologic examination confirmed the suspected aseptic thrombosis of the sagittal and left transverse sinus with consequential brain infarction. The patient underwent complete laboratory, clinical and radiologic examination to identify the cause of CVT. All findings were normal. The patient was administered a therapeutic dose of parenteral anticoagulant heparin therapy for 7 days, followed by peroral anticoagulant therapy with Marivarin according to INR for 9 days. He was discharged from the hospital in a considerably improved condition, and then received low-molecular heparin for the next 9 months. A case of rare association of CVT and MS is presented, with special reference to the procoagulant effect of pulsed methylprednisolone dose as a possible factor for the occurrence of CVT. According to the current knowledge, prophylaxis with low-molecular heparin is advisable in all neurologic patients who receive pulsed corticosteroid therapy while being burdened with risk factors for the development of aseptic thrombosis.

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### ASEPTIČNA TROMBOZA VENSKIH SINUSA MOZGA U BOLESNIKA S MULTIPLIM SKLEROZOM

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Aseptična tromboza venskih sinusa mozga (CVT) spada u rijetke uzroke moždanog udara, a nerijetko se i prevodi zbog različite kliničke slike. U literaturi je opisan cijeli niz čimbenika rizika za nastanak CVT, kao što su puerperij, oralni kontraceptivi, maligne bolesti te prirodne trombofilije. Unatoč izrazito sofisticiranim metodama ranog dijagnosticiranja ove bolesti (CT mozga, DSA, MRV) i široke dijagnostičke obrade u cilju otkrivanja etiologije, u 20%-35% oboljelih uzrok ostane neotkriven. U literaturi je u više navrata opisana združenost CVT s multiplom sklerozom (MS), no uzročna povezanost ovih dvaju entiteta još nije sa sigurnošću utvrđena. Prikazan je slučaj 31-godišnjeg bolesnika u kojeg je kompletnom kliničkom obradom potvrđen relapsno-remitirajući oblik MS. Na Kliniku za neurologiju KBC Rijeka je primljen zbog relapsa osnovne bolesti, zbog čega je uvedena pulsna terapija metilprednizolonom. Dva tjedna nakon uvođenja terapije u bolesnika je došlo do postupnog razvoja poremećaja svijesti i desnostrane kljenuti praćene senzomotornom afazijom. Radiološkom obradom potvrđena je sumnja na aseptičnu trombozu sagitalnog i lijevog transverzalnog sinusa s posljedničnim infarktom mozga. Učinjena je kompletna laboratorijska, klinička i radiološka obrada u cilju otkrivanja uzroka nastanka CVT. Svi nalazi su bili uredni. Bolesnik je dobio terapijsku dozu parenteralne antikoagulantne terapije heparinom kroz 7 dana, a potom je prema INR nastavljena kroz 9 dana peroralna antikoagulantna terapija Marivarinom. Otpušten je s Klinike u znatno poboljšanom stanju, te je kroz slijedećih devet mjeseci primao zaštitu niskomolekularnim heparinom. Prikazan je slučaj bolesnika s rijetkom združenošću CVT i MS s posebnim osvrtom na prokoagulantni učinak pulsne doze metilprednizolona kao mogućeg čimbenika nastanka CVT. Prema sadašnjim spoznajama u svih neuroloških bolesnika koji primaju pulsnu terapiju kortikosteroidima, a opterećeni su čimbenicima rizika za nastanak aseptičnih tromboza, preporuča se profilaksa niskomolekularnim heparinom.

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### **BASILAR ARTERY THROMBOSIS AS A CAUSE OF ISCHEMIC STROKE**

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A man born in 1952 was hospitalized for headache that had occurred a week before admission. From admission, the patient had vertigo and unstable gait, complaining of right-sided paresthesias. Long-lasting hypertension, smoker, occasionally taking greater amounts of alcohol. Organic-neurologic status on admission: conscious, in Romberg unstable with dextropulsion and anteropulsion. In anti-gravity position, mild oscillation of the left arm and lowered mouth angle on the left side. Discrete horizontal nystagmus on the left and right gaze. On day 6 of hospital stay, the patient's neurologic status deteriorated and he developed consciousness disturbance, somnolence, moderate right-sided hemiparesis, n. VII paresis of central type, internuclear ophthalmoplegia; he reported diplopia on gaze to the left. Diagnostic workup was performed. Basilar artery occlusion was demonstrated using a neuroimaging method. Ultrasonographic vascular studies revealed intracranial occlusion of the right vertebral artery. The patient was treated by heparin infusions with gradual introduction of oral anticoagulant therapy and other therapy indicated, which led to basilar artery recanalization, consciousness improvement and partial recovery of the right-sided motor deficit. The treatment was continued by inpatient rehabilitation therapy.

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### **INTRACEREBRAL HEMORRHAGE IN PREGNANCY**

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A 35-year-old pregnant women in 32<sup>nd</sup> week of pregnancy was admitted for sudden weakness of the right extremities and consciousness disturbance. Heterohistory data: no major disease in personal medical history, mother to two children, uncontrolled pregnancy, suspected alcoholism. Organic-neurologic status on admission: shallow somnolence, sensorimotor aphasia, hypertensive crisis.

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### **TROMBOZA BAZILARNE ARTERIJE KAO UZROK ISHEMIJSKOG MOŽDANOG UDARA**

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Bolesnik rođen 1952. godine primljen je na bolničko liječenje zbog glavobolje koja je nastupila tjedan dana prije prijma. Od dana prijma bolesnik ima vrtoglavicu i nestabilan hod, žali se na parestezije na desnoj strani. Dugogodišnji hipertoničar, pušač, povremeno uzima veće količine alkoholnih pića. Organsko neurološki status kod prijma: pri svijesti, prema Rombergu nestabilan s dekstropulzijom i anteropulzijom. U antigravitacijskom položaju blaže oscilira lijeva ruka, te ima niže položen usni kut lijevo. Diskretn horizontalni nistagmus pri pogledu ulijevo i udesno. Šestoga dana hospitalizacije dolazi do pogoršanja neurološkog statusa, poremećaja svijesti, somnolencije, razvija se umjerena desnostrana hemipareza, pareza n. VII. centralnog tipa, internuklearna oftalmoplegija, bolesnik opisuje dvoslike pri pogledu ulijevo. Učinjena je dijagnostička obrada. Metodom slikovnog prikazivanja dokazana je okluzija a. basilaris. Ultrazvučna vaskularna obrada pokazala je intrakranijsku okluziju desne vertebralne arterije. Bolesnik je liječen heparinskim infuzijama uz postupno uvođenje oralne antikoagulantne terapije i ostalu potrebnu terapiju, nakon čega dolazi do rekanalizacije a. basilaris i poboljšanja stanja svijesti te djelomičnog oporavka desnostranog motornog deficita. Liječenje se nastavlja stacionarnom rehabilitacijskom terapijom.

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### **INTRACEREBRALNO KRVARENJE U TRUDNOĆI**

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Tridesetpetogodišnja trudnica u 32. tjednu trudnoće primljena je zbog naglo nastale slabosti desnih ekstremiteta te poremećaja svijesti. Iz heteroanamnestičkih podataka: dosad nije teže bolovala, majka dvoje djece, nekontrolirana trudnoća, suspektan potus. Organsko-neurološki status pri prijmu: bolesnica je pliće somnolentna, senzomotorno afatična, hipertenzivna kriza. Devijacija glave i bulbusa



Leftward head and bulb deviation. Right n. VII paresis, central type. Severe right-sided hemiparesis. Babinski positive on the right. The patient underwent brain CT, MR and MRA, which verified an intracerebral hematoma, 4.5x2.6x6.3 cm in size, in the left hemisphere, without penetration to the ventricular system, and with signs of middle cerebral artery amputation in the region of bifurcation. A neurosurgeon was consulted, who indicated conservative treatment. A gynecologist was consulted on several occasions, amniocentesis was performed, and cesarean section was indicated. On day 6 of admission, a female baby, birth weight 1400 g, Apgar score 9/9, was born. On day 4 of cesarean section, a profound consciousness disturbance developed, so control brain CT was performed to reveal rehemorrhage in the left hemisphere. The patient was comatose (GCS 4), with wide pupils unreactive to light, all four extremities falling flaccidly upon the support, Babinski positive bilaterally.

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#### **BRAIN STEM LESION – A VASCULAR OR INFLAMMATORY ETIOLOGY? – CASE REPORT**

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A 47-year-old male patient presented with symptoms of postmicturition syncope accompanied by fatigue, nausea and vomiting. He reported symptoms of vertigo, muscular weakness and vomiting for two weeks prior to the admission. His medical history was as follows: renal tuberculosis 30 years before; excision of thoracic spine neurinoma 20 years before; nonsmoker, no alcohol consumption, no medication. On the day of admission to the hospital he was fully conscious (Glasgow Coma Scale: 15), he had slight nystagmus on the left gaze, hyperactive myotic reflex, Romberg test revealed mild instability. He reported heaviness in all extremities in antigravity position. No other abnormalities were detected. Brain CT scan was normal. EEG showed nonspecific changes. Laboratory tests were normal. Lung x-ray was normal. The patient developed paraplegia, acute urine retention and fecal incontinence. He had hyperactive myotic reflex. Babinski sign was positive on both sides. Brain MRI showed possible inflammatory lesions in the region of medulla oblongata. EMNG showed conductive changes at L2-S1 level, consistent with upper motor neuron lesion (H reflex mild facilitation on the right side). The patient became hypotensive and had

ulijevo. Pareza n.VII. desno po centralnom tipu. Desnostrana teška hemipareza. Babinski pozitivan desno. Učinijen je CT mozga te MR i MRA kojima je verificiran intracerebralni hematom veličine 4,5x2,6x6,3 cm u lijevoj hemisferi bez prodora u ventrikularni sustav uza znakove amputacije srednje moždane arterije u području bifurkacije. Konzultiran je neurokirurg koji je indicirao konzervativno liječenje. U više navrata konzultiran je ginekolog, učinjena je amniocenteza te je indiciran porod carskim rezom. Šestoga dana od prijma u bolnicu rođeno je žensko novorođenče porođajne mase 1400 grama, Apgar 9/9. Četvrtoga dana nakon učinjene sekcije nastaje dublji poremećaj stanja svijesti te je učinjen kontrolni CT mozga koji je pokazao ponovljeno krvarenje u lijevoj hemisferi. Bolesnica je komatozna (GCS 4), zjenice široke bez reakcije na svjetlo, sva 4 ekstremiteta mlohavo padaju na podlogu, Babinski obostrano pozitivan.

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#### **LEZIJA MOŽDANOG DEBLA – VASKULARNA ILI UPALNA ETIOLOGIJA? – PRIKAZ SLUČAJA**

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Bolesnik star 47 godina hospitaliziran je na Klinici za neurologiju zbog postmikcijske sinkope praćene slabošću, mučninom i povraćanjem. Dva tjedna prije hospitalizacije osjećao se je loše, imao je mučninu i vrtoglavicu te slabost u mišićima. Anamnestički se doznaje da je pred 30 godina prebolio tuberkulozu bubrega, da je pred 20 godina imao operaciju neurinoma torakalne kralješnice. Nije pušač, ne konzumira alkohol, ne uzima lijekove. Organsko neurološki nalaz pri prijmu: pri svijesti, kardiorespiracijski kompenziran, nistagmus pri pogledu ulijevo. U AG položaju navodi subjektivni osjećaj težine u ekstremitetima. MTR diskretno življi. Patološki se ne izazivaju. Tijekom boravka na Klinici dolazi do zadržavanja mokraće i razvoja parapareze. Tijekom noći bolesnik više nije kontrolirao niti stolicu. Učini se MRI mozga koja pokaže leziju otvorene etiologije (moguće upalne lezije u području medule oblongate). Rtg pluća u više je navrata pokazivao znakove upalnih promjena. Dolazi do razvoja bolova u prsima, bolesnik je orošen hladnim znojem, bolovi se šire u glavu i ruke, RR 80/60 min. U neurološkom statusu se potvrđuje kvadripareza, povišeni MTR na donjim ekstremitetima, Babinski obostrano pozitivan, dizartrija. EKG pokaže znakove koji ukazuju na

chest pain. He developed quadraparesis and had dysarthric speech. His ECG showed anterior myocardial ischemia. Troponin T was raised. Echocardiogram showed dilatation of the left ventricle. Ejection fraction was reduced to 25%. He had respiratory arrest, was intubated and ventilated, and became tetraplegic with GSC 3. Blood tests were performed as well as immunoelectrophoresis, C3 and C4 complement, C-ANC, P-ANCA, dsDNA antibody tests, which all were normal. There was a slight increase in total protein in CSF. Immunoglobulin therapy was started for suspicion of Guillain-Barre syndrome, however, with no response. Corticosteroid therapy was also introduced for the possible multisystemic inflammatory disease, also with no response. Cardiac ECHO showed normalization of the chamber size, improved kinesis of both ventricles, EF 60% and small pericardial effusion, which all pointed to the diagnosis of myopericarditis in regression. The patient's condition was not changed. He was quadriplegic, with GSC 3, artificially ventilated. He developed respiratory infection and was administered antibiotics according to the antibiogram. In spite of intensive treatment the patient died. Autopsy findings showed pulmonary embolism as a direct cause of death, lung sarcoidosis as a primary disease, bilateral lung infection, and generalized vascular atheloscrotic changes of the heart and brain, especially affecting vessels in the pons and medulla oblongata.

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### STROKE IN YOUNG ADULTS

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Stroke is the leading cause of morbidity and mortality in Croatia, thus posing a big public health problem, especially as recent international studies also point to an ever rising prevalence of stroke among young individuals. The aim of the study was to assess the presence of risk factors, etiopathogenesis and outcome of stroke in individuals below age 45. Data on patients aged 19-45 hospitalized at

ischemiju prednje stijenke te porast troponina u krvi. Nakon prijma na Internu kliniku učini se UZV srca koji pokaže dilataciju lijevog ventrikla uz višestruke segmentalne ispade te smanjenje minutnog volumena, a EF je 25%. Zbog prijetućeg kardiogenog šoka uvode se u terapiju pozitivne inotropne tvari te antibiotik zbog bronhopneumonije. Dolazi do progresije neurološkog deficita te se razvije tetrapareza, znaci bulbarne simptomatologije, kome i konačno respiracijskog aresta zbog čega se bolesnik intubira. Postavi se sumnja na razvoj teškog oblika Guillain-Barreova sindroma te se primijeni terapija imunoglobulinima, ali bez uspjeha. Verificira se pad u krvnoj slici, učini se gastroskopija kojom se nađe ulkus na duodenumu te se postave tri kopče. Dolazi do regresije laboratorijskih vrijednosti kardioselektivnih enzima te nalaza ehokardiografije koji upućuje na mioperikarditis u regresiji. Postavi se sumnja na multisistemska upalna zbivanja nejasne etiologije te se uvede terapija kortikostereoidima, ali bez bitnijeg poboljšanja. Kontrolni MR mozga je bez promjena. U više navrata se učini LP kojom se nađu samo diskretno povišene vrijednosti proteina. Učini se imunoelektroforeza koja je bila uredna, te analiza C-ANCA, P-ANCA, protutijela na dsDNA, a nalazi su bili uredni. Od trenutka intubacije bolesnik je cijelo vrijeme priključen na respirator. Nakon ponovnog premještanja na Kliniku za neurologiju učini se EMNG koji ne pokaže znakova u prilog poliradikuloneuritisa. Suspektne su lagane promjene od strane gornjeg motoneurona. EEG rađen u više navrata bio je nespecifično graničan. Bolesnik je bio na stalnoj antibiotskoj terapiji. Unatoč svim poduzetim mjerama intenzivnog liječenja dolazi do smrtnog ishoda. Nalaz obdukcije pokaže obilnu emboliju plućne arterije kao osnovni uzrok smrti. Osnovna bolest bila je sarkoidoza pluća s popratnom obostranom upalom pluća te teške vaskularne promjene s hijalinozom stijenka krvnih žila, osobito u ponsu i meduli oblongati.

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### MOŽDANI UDAR U MLADIH OSOBA

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Moždani udar zauzima vodeće mjesto u pobolu i smrtnosti u Republici Hrvatskoj i predstavlja velik javnozdravstveni problem, poglavito što novije studije i u svijetu ukazuju na sve veću učestalost moždanog udara u mlađih osoba. Cilj ove studije bio je ispitati prisutnost rizičnih čimbenika, etiopatogenezu te ishod moždanog udara u

the University Department of Neurology, Sestre milosrdnice University Hospital, from January 1, 2002 till December 31, 2003 were retrospectively analyzed. During the two-year period, a total of 1153 stroke patients, 39 (3.4%) of them younger than 45, and 75 patients with subarachnoidal hemorrhage, 24 (32.0%) of them younger than 45, were admitted. Ischemic stroke was verified in 26 (66.7%) patients, 15 (57.7%) men and 11 (42.3%) women, whereas one female patient had internal jugular vein thrombosis. According to etiopathogenesis, atherothrombosis induced stroke was present in 8 (30.7%) and cardioembolic stroke in 4 (15.3%) patients, hemodynamically induced stroke in 6 (23.1%) patients, dissection caused stroke in 1 (3.8%) case, whereas in 7 (26.9%) patients the cause of stroke remained undefined. Immunologic testing for antiphospholipid syndrome was done in 7 patients, with negative results. Considering risk factors, hyperlipidemia was present in 15 (57.7%), hypertension in 10 (38.5%), smoking in 7 (26.9%), alcoholism in 5 (19.2%), oral contraceptives in 2 (7.7%) patients, and migraine and diabetes in 1 (3.8%) patient. The majority of patients (92.3%) had minimal neurologic deficit on discharge, without major disablement incompatible with independent living, whereas 7.7% of patients were discharged with major neurologic deficit. Among 12 patients with hemorrhagic stroke there were 9 (75%) women and 3 (25%) men. Hypertensive hemorrhage was diagnosed in 3 (25%), rupture of AV malformation in 2 (16.7%), multiple aneurysms, postpartal coagulopathy and drug abuse in 1 (8.3%) patient each, whereas in 3 (25%) patients the cause of stroke could not be identified. Considering risk factors, hypertension and alcoholism predominated (25% of patients). On discharge, 33% of patients had minimal neurologic deficit, whereas more severe deficits requiring other person's help were present at a considerably higher rate (77% of patients). One female patient died. Among 24 patients hospitalized for subarachnoidal hemorrhage, there were 13 (54%) men and 11 (56%) women. Angiographic studies (MRA and/or DSA) revealed aneurysm of the anterior and posterior communicating arteries in 8 (33.3%) and 1 (4.2%) patients, respectively, aneurysm of basilar artery in 1 (4.2%), aneurysm of internal carotid artery in 2 (8.3%), of middle in 3 (12.5%) patients, and of posterior cerebral artery, a. callosum marginalis and vertebral artery in 1 (4.2%) patient. One (4.2%) patient had venous angioma, whereas in 5 (20.8%) patients the cause of hemorrhage could not be identified even by control angiography after 3 months. Seventeen (70.8%) patients were operated on. It is concluded that besides primary prevention as the most effi-

osoba mlađih od 45 godina. Retrospektivno su analizirani podaci o bolesnicima u dobi od 19 do 45 godina koji su bili hospitalizirani na Klinici za neurologiju KB "Sestre milosrdnice" u razdoblju od 1.1. 2002. do 31.12.2003. godine. Tijekom dvogodišnjeg razdoblja bilo je primljeno ukupno 1153 bolesnika s moždanim udarom, od kojih je 39 (3,4%) bilo mlađe od 45 godina, te 75 bolesnika zbog subarahnoidnog krvarenja, među kojima ih je 24 (32,0%) bilo ispod dobne granice od 45 godina. Ishemijski moždani udar verificiran je u 26 bolesnika (66,7%), od čega 15 (57,7%) muškaraca te 11 (42,3%) žena, a 1 bolesnica je imala trombozu unutarnje jugularne vene. Prema etiopatogenezi u 8 (30,7%) bolesnika se je radilo o aterotrombotski uzrokovanom moždanom udaru, u 4 (15,3%) o kardioembolijskom infarktu, u 6 (23,1%) bolesnika je moždani udar bio hemodinamski uvjetovan, disekcija je bila uzrokom u 1 (3,8%) slučaju, a u 7 (26,9%) bolesnika je uzrok ostao nerazjašnjen. Imunološka obrada u smislu antifosfolipidnog sindroma učinjena je u 7 bolesnika, a rezultati su bili negativni. Od čimbenika rizika hiperlipidemija je bila prisutna u 15 (57,7%), hipertenzija u 10 (38,5%), pušenje u 7 (26,9%), alkoholizam u 5 (19,2%), uzimanje oralnih kontraceptiva u 2 (7,7%) bolesnika, a migrena i šećerna bolest bile su prisutne u 1 (3,8%) bolesnice. Najveći broj bolesnika, 92,3%, je kod otpusta bio s minimalnim neurološkim deficitom te bez značajnije onesposobljenosti za samostalan život, a 7,7% bolesnika je otpušteno s većim neurološkim deficitom. Među 12 bolesnika s hemoragijskim moždanim udarom bilo je 9 (75%) žena i 3 (25%) muškarca. U 3 (25%) bolesnika se je radilo o hipertenzivnom krvarenju, u 2 (16,7%) o rupturi AV malformacije, 1 (8,3%) bolesnica je imala višestruke aneurizme, 1 postpartalnu koagulopatiju, kod 1 bolesnika je uzrok bio uživanje opojnih droga, a u 3 (25%) bolesnika uzrok nije nađen. Od čimbenika rizika najzastupljeniji su bili hipertenzija i alkoholizam (25% bolesnika). S minimalnim neurološkim deficitom je otpušteno 33% bolesnika, dok je u znatno većeg broja (77%) deficit bio izraženiji te su zahtijevali pomoć druge osobe. Jedna bolesnica je umrla. Među 24 bolesnika hospitalizirana zbog subarahnoidnog krvarenja bilo je 13 (54%) muškaraca i 11 (56%) žena. Angiografskom obradom (MRA i/ili DSA) kod 8 (33,3%) bolesnika je nađena aneurizma prednje, a kod 1 (4,2%) aneurizma stražnje komunikantne arterije, u 1 (4,2%) aneurizma bazilarne arterije, u 2 (8,3%) aneurizma unutarnje karotidne arterije, u 3 (12,5%) srednje, a u 1 bolesnika (4,2%) aneurizma stražnje moždane arterije, a. callosum marginalis te vertebralne arterije. U 1 (4,2%) bolesnika utvrđen je venski angiom, a u 5 (20,8%) bolesnika uzrok krvarenja nije nađen niti kontrol-

cient method in the management of stroke, there is a need of search for etiopathogenetic factors. Although international studies also show that the cause of stroke in younger adults remains obscure in 4% to 45% of cases in spite of extensive diagnostic workup, the algorithm of examinations should definitely include echocardiography, evaluation of thrombotic factors, and immunologic tests for antiphospholipid syndrome, while control angiography reduces the number of unexplained causes of intracerebral and subarachnoidal hemorrhage.

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### SHORT-TERM OUTCOME OF DIFFERENT STROKE SUBTYPES COMPARED

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The aim of the study was to determine and compare short-term outcome of different stroke subtypes in east Croatia. The study included a randomized series of 130 stroke patients treated at two hospitals in east Croatia, University Department of Neurology, Osijek University Hospital in Osijek and Department of Neurology, Dr. Josip Benčević General Hospital in Slavonski Brod. Patients were grouped according to type of stroke as follows: hemorrhagic stroke (HS) with subtypes of intracerebral hemorrhage (ICH) and subarachnoidal hemorrhage (SAH), and ischemic stroke (IS) with subtypes defined according to TOAST classification, i.e. large vessel infarction (LVS), small blood vessel infarction/lacunar infarction (SMS), cardioembolic stroke (CES), strokes due to other causes (OCS), and strokes of unknown causes (US). The rate of particular stroke subtypes was as follows: HS in 23 (17.69%), LVS in 29 (22.1%), SMS in 43 (33.08%), CES in 25 (19.23%), OCS in 3 (2.31%), and US in 7 (5.38%) patients. First-ever stroke was recorded in the majority of patients, whereas recurrent strokes included ICH in 7.69%, LVS in 27.27%, SMS in 22.22% and CES in 25% of cases. We analyzed age and sex distribution of patients, disease complications and functional outcome of particular stroke subtypes graded according to the modified Rankin scale

nom angiografijom nakon 3 mjeseca. Operirano je 17 (70,8%) bolesnika. Uz primarnu prevenciju kao najučinkovitije sredstvo u liječenju moždanog udara nameće se nužnost traganja za etiopatogenetskim čimbenicima. Iako i svjetske studije pokazuju da unatoč širokoj dijagnostičkoj obradi uzrok moždanog udara u mlađih odraslih ostaje nerazjašnjen u 4%-45% slučajeva, u algoritam pretraga svakako treba uključiti ehokardiografiju, procjenu protrombotskih čimbenika te imunološke testove za antifosfolipidni sindrom, a kontrolnom angiografijom smanjuje se broj nerazjašnjenih uzroka intracerebralnog i subarahnoidnog krvarenja.

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### USPOREDBA KRATKOROČNOG ISHODA RAZLIČITIH PODTIPOVA MOŽDANOG UDARA

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Cilj studije bio je utvrditi i usporediti kratkoročni ishod različitih podtipova moždanog udara (MU) na području istočne Hrvatske. Analizirali smo randomiziranu skupinu od 130 bolesnika s MU koji su liječeni u dvjema bolnicama istočne Hrvatske: na Klinici za neurologiju Kliničke bolnice Osijek i na Odjelu za neurologiju Opće bolnice u Slavonskom Brodu. Bolesnike smo klasificirali u skupine prema vrsti MU kao hemoragijski MU (HS) s podtipovima intracerebralna hemoragija (ICH) i subarahnoidna hemoragija (SAH) i ishemijski moždani udar (IS) s podtipovima prema klasifikaciji TOAST klasifikaciji: infarkti velikih krvnih žila (LVS), infarkti malih krvnih žila/lakunarni infarkti (SMS), kardioembolijski udari (CES), udari uzrokovani ostalim poznatim uzrocima (OCS), udari nepoznatog uzroka (US). U analiziranoj skupini bila je slijedeća zastupljenost pojedinih podtipova MU: HS u 23 (17,69%), LVS u 29 (22,1%), SMS u 43 (33,08%), CES u 25 (19,23%), OCS u 3 (2,31%) i US u 7 (5,38%) bolesnika. U većini slučajeva radilo se je o prvom MU, a o recidivni MU bili su u slijedećim postocima: 7,69% u ICH, 27,27% u LVS, 22,22% u SMS i 25% u CES. Analizirali smo dobnu i spolnu distribuciju bolesnika, komplikacije bolesti i funkcionalni ishod različitih podtipova MU stupnjevan prema modificiranoj Rankinovoj ljestvici (mRS). Prosječna životna dob za sve tipove MU je bila 67,33 godine; najnižu



(mRS). The mean age for all stroke subtypes was 67.33 yrs, being lowest in LVS patients (63.00 yrs) and highest in CES patients (75.33 yrs). The analysis of sex distribution showed a higher prevalence of HS and SMS in male population (69.23% and 51.85%, respectively), and of LVS and CES in female population (81.82% and 90.01%, respectively). The most common stroke complications were urinary tract infections, especially in the CES and ICH groups (41.67% and 30.77%, respectively), and consciousness disturbance, which was also most common in the CES and ICH groups (33.33% and 69.23%, respectively). Functional improvement in 28 days of the disease onset was best in SMS patients and poorest in ICH patients. Highest lethality was recorded in the ICH group (37.05%) and lowest in the LVS group (0.00%). Accordingly, comparison of particular stroke subtype outcomes yielded some important indicators that can prove useful for clinical prognosis of the disease as well as for planning and performing treatment and prevention of stroke in east Croatia.

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#### EARLY POST-STROKE MORTALITY IN KARLOVAC GENERAL HOSPITAL

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The analysis of early death after stroke is important, since some deaths may be preventable. Autopsy series of early stroke fatality indicate that death within the first week after stroke is attributable primarily to the direct effects of stroke such as brain edema with transtentorial herniation. Subsequent mortality in the first month is probably attributable to potentially preventable causes such as pulmonary embolism and respiratory infections. Some authors suggest that the majority of patients who survived longer than one week and died of noncerebral and thus potentially preventable causes had poor functional grades. Their neurologic deficit left them totally dependent or unresponsive. The high incidence of pneumonia and pulmonary embolism between the second and fourth weeks reflects the complications of relative immobilization. A series of 554 patients who had a stroke in the period between January 2003 and January 2004 were included in the research. The diagnosis was infarction in 437 patients and hemorrhage in 40 patients, and 77 had the diagnosis of disease I 64 according to ICD. Data were collected from medical records of the Department of Neu-

rosjeću životnu dob imali su bolesnici s LVS (63,00 g), a najvišu bolesnici s CES (75,33 g). Analiza spolne zastupljenosti pokazuje veću zastupljenost HS i SMS kod muške populacije (69,23% i 51,85%), dok su LVS i CES zastupljeniji kod žena (81,82% i 90,01%). Najučestalije komplikacije MU bile su mokraćna infekcija, osobito u skupinama CES i ICH (41,67% i 30,77%) i poremećaj svijesti koji je također bio najčešći u skupinama CES i ICH (33,33% i 69,23%). Funkcionalno poboljšanje unutar 28 dana od početka bolesti bilo je najbolje u bolesnika sa SMS, a najlošije u bolesnika s ICH. Letalitet je bio najviši u skupini ICH (37,05%), a najniži u LVS (0,00%). Usporedba ishoda pojedinih tipova MU dala je značajne pokazatelje koji su korisni za postavljanje kliničke prognoze bolesti, te za planiranje i provođenje liječenja i prevencije MU na području istočne Hrvatske.

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#### RANA SMRTNOST NAKON MOŽDANOG UDARA U OPĆOJ BOLNICI KARLOVAC

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Analiza rane smrtnosti nakon moždanog udara (MU) može doprinijeti boljem preživljavanju bolesnika nakon MU. Poznato je da je smrtnost tijekom prvog tjedna nakon MU rezultat izravnog oštećenja moždanog tkiva. Najčešće je to edem mozga s transtentorijalnom hernijacijom. Mogućem preživljenju unutar mjesec dana nakon MU može doprinijeti sprječavanje i liječenje potencijalno izlječivih bolesti, npr. dišnih infekcija i plućne embolije kod nepokretnih bolesnika. Postoji mišljenje kako bolesnici koji prežive prvi tjedan od MU najčešće imaju velik funkcijski deficit i zbog toga često umiru od sekundarnih komplikacija bolesti, a ne od izravnih cerebralnih posljedica MU. Povećana učestalost upale pluća i plućne embolije kod umrlih u razdoblju od 2-4 tjedna nakon MU najvjerojatnije je posljedica nepokretnosti bolesnika. U ovo istraživanje bilo je uključeno 554 bolesnika koji su doživjeli MU u razdoblju od siječnja 2003. do siječnja 2004. godine. Infarkt mozga bio je prisutan u 437 bolesnika, moždano krvarenje u 40 bolesnika, a 77 bolesnika imalo je dijagnozu bolesti I 64 prema MKB. Tijekom 2003. godine umro je 121 (22%) bolesnik unutar mjesec dana od MU, tj. 100 na Neurološkom odjelu, a 21 u Jedinici intenzivnog liječenja. Podaci

rology, Karlovac General Hospital. Early post-stroke mortality was observed. During 2003, 121 (22%) patients died, 100 at the Department of Neurology and 21 at Intensive Care Unit. Eighty (66%) patients died in the first week after stroke, and another 41 (34%) in the period of 2-4 weeks of stroke. According to brain CT scan, 55% of those who died within a month had large brain lesions. Thirty-nine percent of them died within the first week of stroke and had severe brain lesions verified by CT scan. About 6% of patients did not undergo brain CT. The majority of patients who survived longer than one week had poor functional grades. Their neurologic deficit left them totally dependent or unresponsive in 24 (66%) of cases; 22% had consciousness disturbance. Fatal outcome was amplified by noncerebral and thus potentially preventable causes, i.e. chest infection and respiratory complications (44%) and febrile state (14%) that developed within 2-4 weeks of stroke. The occurrence of these complications is frequently a consequence of the patient's immobility due to consciousness disorder or motor deficit. Fifty-five percent of cardiac deaths occurred at any time beyond one-month period independently of the patients' functional deficit. This confirms the proposed theory that neurologic complications are the leading cause of death in the period of 2-4 weeks after stroke.

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### PROGNOSIS OF FIVE-YEAR SURVIVAL FOLLOWING ISCHEMIC STROKE

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The aim of the study was to assess the 5-year survival prognosis in patients with ischemic stroke. The study included data on 613 patients with first-ever stroke treated at University Department of Neurology, Tuzla University Hospital Center from January 1, 1997 till December 31, 1998. Patient data were obtained from the Department medical records, and survivors were examined between April and July 2003. The mean age of study patients was  $65 \pm 10$  (38-90) years. There were 333 (54%) women. Based on clinical and neuroradiologic findings, ischemic stroke was classified as follows: (a) insult in anterior cerebral circulation; (b) insult in posterior circulation; and (c) multiple lacunar ischemic insults. Ischemic stroke of anterior circulation was diagnosed in 410 (67%) and of posterior circulation in 62 (10%), whereas multiple infarcts

su prikupljeni iz povijesti bolesti s Neurološkog odjela Opće bolnice Karlovac. Promatrali smo ranu smrtnost nakon MU. U prvom tjednu nakon MU umrlo je 80 (66%) bolesnika. U razdoblju od 2 do 4 tjedna nakon MU umro je slijedeći 41 (34%) bolesnik. Prema nalazu CT mozga, masivne lezije mozga imalo je 55% umrlih unutar mjesec dana od MU; 39% ovih bolesnika umrlo je unutar prvog tjedna nakon MU. U 6% ukupno umrlih bolesnika tijekom 2003. uopće nije napravljen CT mozga; 55% umrlih unutar mjesec dana nakon MU bili su srčani bolesnici ili je nastupila dekompenzacija srca neovisno o funkcijskom deficitu. Većina bolesnika koji su umrli od 2 do 4 tjedna nakon MU imala je velik neurološki deficit; 66% ovih bolesnika bilo je nepokretno i ovisno o tuđoj pomoći, 22% ih je imalo poremećaj svijesti. Smrtni ishod bolesti potencirala je pojava pneumonije i pogoršanja plućnih bolesti (44%), te febrilna stanja (14%) u razdoblju nakon prvog tjedna od MU. Pojava tih bolesti nerijetko je posljedica nepokretnosti bolesnika zbog poremećaja svijesti ili motornog deficita. To potvrđuje spoznaju da su neurološke komplikacije, kao potencijalno izlječive, vodeći uzrok smrti u razdoblju od 2 do 4 tjedna nakon MU.

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### PROGNOZA PREŽIVLJAVANJA PACIJENATA PET GODINA NAKON ISHEMIJSKOG MOŽDANOG UDARA

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Cilj rada je bio ispitati prognozu preživljavanja pacijenata pet godina nakon ishemijskog moždanog udara (IMU). Ispitivanje je uključilo 613 pacijenata sa prvim IMU koji su liječeni na Klinici za neurologiju Univerzitetskog kliničkog centra Tuzla u periodu od 1.1.1997. do 31.12.1998. godine. Potrebni podaci su pribavljeni iz medicinske dokumentacije, a preživjeli pacijenti su pregledani u periodu april-juli 2003. godine. Prosječna dob pacijenata je bila  $65 \pm 10$  (38-90) godina, a 54% ( $n=333$ ) su bile žene. Na osnovi kliničkog i neuroradiološkog nalaza IMU je klasificiran na: a) inzult u prednjoj cerebralnoj cirkulaciji; b) inzult u stražnjoj cirkulaciji; i c) multipli lakunarni ishemijski inzulti. Ishemijski inzult u prednjoj cirkulaciji je dijagnosticiran kod 410 (67%) ispitanika, u stražnjoj kod

were verified in 141 (23%) patients. One-month survival was recorded in 426 (70%) patients (case-fatality 30%), i.e. 66% with ischemic stroke of anterior circulation, 65% with ischemic stroke of posterior circulation, and 82% with multiple lacunar infarcts. One-year survival was recorded in 56.5% of patients, 52% of them with anterior circulation infarcts, 53% with posterior circulation infarcts, and 70% with multiple infarcts. Five-year survival after first-ever stroke was recorded in 188 (31%) patients. The majority of survivors had multiple lacunar infarcts (n=64; 45%), followed by those with ischemic stroke of posterior circulation (n=18; 29%) and those with ischemic stroke of anterior circulation (n=16; 26%). There was a significant difference in survival between patients with multiple lacunar infarcts and those with ischemic stroke of anterior or posterior circulation ( $p < 0.01$ ). There was no significant sex difference in post-stroke survival (32% male vs 29% female;  $p = 0.3$ ). Accordingly, 5-year survival is recorded in one-third of patients after first-ever ischemic stroke. Patients with lacunar ischemic stroke have better longterm survival prognosis than those with ischemic stroke of anterior or posterior cerebral circulation. The prognosis of 5-year survival is comparable for men and women.

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#### ASYMPTOMATIC SIGNIFICANT CAROTID ARTERY STENOSES

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The aim of the study was to analyze a group of asymptomatic patients with significant occlusive disease of internal carotid artery in the extracranial course (>75% stenosis), treated at University Department of Neurology, Rijeka University Hospital Center, during the year 2003. Therefore, only patients in the asymptomatic stage of the disease and burdened with risk factors for cerebrovascular disease were included in the study. Risk factors were assessed according to the presence of hypertension, cardiac disease, lipid status and diabetes mellitus. Stenoses were detected by routine ultrasonographic color doppler study of carotid arteries in risk patients. In addition to this examination, all patients underwent brain CT, transcranial doppler (TCD), magnetic angiography (MRA) and digital subtraction angiography (DSA). There were 22 patients, 14 (64%) male and 8 (35%) female, mean age 65.2

62 (10%), dok su multipli infarkti verificirani kod 141 (23%) ispitanika. Nakon prvog mjeseca preživjelo je 426 (70%) pacijenata (*case-fatality* 30%) i to 66% sa IMU prednje cirkulacije, 65% stražnje, te 82% pacijenata sa multiplim lakunarnim infarktima. Nakon godinu dana je preživjelo 56,5% pacijenata, od toga 52% sa infarktima u prednjoj cirkulaciji, 53% sa IMU stražnje cirkulacije i 70% sa multiplim infarktima. Pet godina nakon prvog moždanog udara preživjelo je 188 (31%) ispitanika. Najveći broj preživjelih je imao multiple lakunarne infarkte (64 ili 45%), a slijede ispitanici sa IMU u stražnjoj cirkulaciji (18 ili 29%), te pacijenti sa infarktom prednje cerebralne cirkulacije (106 ili 26%). Postoji značajna razlika u pogledu preživljavanja pacijenata sa multiplim lakunarnim inzultima naspram preživljavanja nakon IMU prednje ili stražnje cirkulacije ( $p < 0,01$ ). Nije bilo značajne razlike u stopi preživljavanja između muškaraca i žena (32% naspram 29%,  $p = 0,3$ ). Nakon prvog ishemijskog moždanog udara jedna trećina pacijenata preživi pet godina. Dugoročno je bolja prognoza preživljavanja pacijenata sa lakunarnim ishemijskim inzultima u odnosu na IMU prednje i stražnje cerebralne cirkulacije. Prognoza preživljavanja pet godina nakon IMU je slična kod muškaraca i žena.

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#### ASIMPTOMATSKE ZNAČAJNE STENOZE KAROTIDNIH ARTERIJA

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Cilj rada bio je analizirati skupinu asimptomatskih bolesnika sa značajnom okluzivnom bolešću unutarnje karotidne arterije u ekstrakranijskom toku (stenoza preko 75%) liječenih na Klinici za neurologiju KBC Rijeka tijekom 2003. godine. Stoga su u analizu uključeni samo bolesnici u asimptomatskoj fazi bolesti opterećeni čimbenicima rizika za cerebrovaskularnu bolest. Čimbenici rizika procijenjeni su na osnovi prisutnosti hipertenzije, srčane bolesti, lipidnog statusa i postojanja šećerne bolesti. Stenoze su otkrivene rutinskom ultrasonografskom pretragom obojenim doplerom karotidnih arterija kod rizičnih bolesnika. U svih bolesnika su uz ovu pretragu načinjeni i CT mozga, transkranijски dopler (TCD), magnetska angiografija (MRA) i digitalna suptrakcijska angiografija (DSA). Studija je uključila 22 bolesnika, 14 (64%) muških i 8 (36%) ženskih prosječne životne dobi od 65,2 godine. U 12 bolesni-

years. Internal carotid artery stenosis of >75% was found in 12, and of >90% in 10 patients. Hypertension was the most common risk factor, followed by cardiac disease and hyperlipidemia. Multiple risk factors were present in one-third of patients. Ischemic stroke is one of the leading causes of mortality and disability. This fact indicates the need of the disease prevention. In addition to detection and reduction of the risk factors that contribute to the disease development, our aim also was to point to the necessity of large-scale, routine use of noninvasive ultrasonographic diagnosis in those patients burdened with stroke risk factors who are in the asymptomatic stage of the disease because the risk of stroke can be reduced by medicamentous or surgical therapy.

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### PROSPECTIVE FOLLOW-UP OF PATIENTS WITH MODERATE CAROTID STENOSIS

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Patients with moderate carotid stenosis are not considered to be in the high risk stroke group and their treatment usually is conservative. The aim of this study was to follow-up patients with moderate carotid stenosis over a 5-year period. Of 1284 stroke patients hospitalized during 1999, 78 (6%) patients (48 men, mean age 68, and 30 women, mean age 74) had moderate carotid artery stenosis (50%-70%) of at least one artery, and 20% had bilateral moderate stenosis or occlusion of the other artery. A total of 58 patients completed the study; 10 patients dropped out during the follow-up; and 10 patients died early during hospital stay. In 1999, 62 (79%) patients had stroke, 39 (50%) men and 22 (29%) women; TIA was recorded in 15 (19%) patients, 8 (10%) men and 7 (9%) women; and 2 (3%) patients had subarachnoidal hemorrhage. In 1999, mortality was 13%. First-ever stroke had 39 (50%) patients, of whom 41% sustained a stroke ipsilateral to moderate carotid stenosis and 22 (28%) had recurrent stroke. The most common risk factor was hypertension (91%), whereas other risk factors were present at a rate of 35%-40%. Atrial fibrillation was present in 17%, symptomatic stenosis in 59%, asymptomatic stenosis in 11%, and ipsilateral amaurosis fugax in 31% of patients. At the end of the follow-up, mortality was 38%. Recurrent stroke ipsilateral to carotid stenosis occurred in 39% and TIA in 18%; in other patients,

ka nađena je stenoza unutarnje karotidne arterije od preko 75%, a u 10 bolesnika od preko 90%. Najčešći čimbenik rizika bila je hipertenzija, a slijede srčane bolesti i hiperlipidemija. Više čimbenika rizika imala je trećina bolesnika. Ishemični moždani udar jedan je od vodećih uzroka smrtnosti i invalidnosti. Ta činjenica upućuje na neophodnost prevencije ove bolesti. Uz otkrivanje i smanjenje čimbenika rizika koji doprinose razvoju bolesti cilj nam je bio ukazati na nužnost široke, rutinske primjene neinvazivne ultrasonografske dijagnostičke pretrage kod onih bolesnika opterećenih čimbenicima rizika koji su u asimptomatskoj fazi bolesti, jer se medikamentnim ili kirurškim liječenjem može smanjiti rizik od moždanog udara.

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### PROSPEKTIVNO PRAĆENJE BOLESNIKA S UMJERENOM STENOZOM KAROTIDNIH ARTERIJA

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Smatra se da bolesnici s umjerenom stenozom karotidnih arterija nisu u skupini visokog rizika za moždani udar i njihovo liječenje je uglavnom konzervativno. Cilj ove studije bio je praćenje bolesnika s umjerenom stenozom karotidne arterije tijekom 5 godina. Od 1284 bolesnika hospitaliziranih 1999. godine zbog moždanog udara 78 (5%) bolesnika (48 muškaraca srednje dobi 68 godina i 30 žena srednje dobi 74 godine) imalo je umjerenu stenozu (50%-70%) barem jedne karotidne arterije, a 20% ih je imalo obostranu umjerenu stenozu ili okluziju jedne karotidne arterije. Ukupno je 78 bolesnika ušlo u studiju, od kojih je 58 praćeno tijekom 5 godina, 10 ih je umrlo rano tijekom hospitalizacije, a za 10 bolesnika podaci nisu potpuni. Godine 1999. ukupno je 62 (79%) bolesnika imalo moždani udar, i to 39 (50%) muških i 22 (29%) žena; TIA je nastupila u 15 (19%) bolesnika, i to 8 (10%) muških i 7 (9%) žena; 2 (3%) bolesnika je imalo SAH. Smrtnost je 1999. godine iznosila 13%. Prvi moždani udar je imalo 39 (50%) bolesnika, od kojih 41% ipsilateralno umjerenom karotidnoj stenozu i 22 (28%) je imalo recidiv moždanog udara. Najčešći čimbenik rizika bila je hipertenzija (91%), a ostali čimbenici rizika bili su zastupljeni u rasponu od 35% do 40%. Atrijska fibrilacija bila je prisutna kod 17%, simptomatska stenoza kod 59%, asimptomatska stenoza kod 11%, a ipsilateralna prolazna sljepoća kod 31% bolesnika. Na kraju razdoblja praćenja smrtnost je bila 38%. Recidiv



stroke and TIA occurred in 2% of patients each. Carotid endarterectomy during the follow-up period was performed in 50% of patients, of whom 12% had stroke. Thus, moderate carotid stenosis in older age groups, especially in men, may represent a more significant risk factor for stroke than previously believed.

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### TERAPEUTIC APPROACH TO ISCHEMIC STROKE, AND CORRELATION WITH ATRIAL FIBRILLATION AND COMPLICATIONS

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Current therapeutic approach to ischemic stroke includes the use of anticoagulant therapy, especially in patients with atrial fibrillation. The aim of the study was to assess the correlation between the therapeutic approach with the use of anticoagulant therapy in ischemic stroke in patients with and without atrial fibrillation, and complications (pulmonary embolism, thrombosis), and patient recovery evaluation by use of NIH scale. Forty patients were observed, 24 (60%) men and 16 (40%) women with ischemic stroke who had atrial fibrillation, and 30 patients, 11 (37%) men and 19 (63%) women without atrial fibrillation. In both patient groups, the finding of ischemic lesion was verified by CT finding. NIH scale was determined in all patients at the beginning and at the end of treatment, along with change in neurologic finding. Anticoagulant therapy was used in all patients with atrial fibrillation. In the group of patients with atrial fibrillation, lethal outcome was recorded in 13 (32.5%), and in the group of patients without atrial fibrillation in 8 (32%) patients. Among patients with atrial fibrillation who received anticoagulant therapy, 10 (25%) patients were free from complications. In the group without atrial fibrillation 18 (45%) patients were free from complications. In the group with atrial fibrillation, pulmonary embolism developed in one (2.5%) patient, thrombosis in 3 (7.5%) patients, and pulmonary embolism and thrombosis in one (2.5%) patient. In the group without atrial fibrillation, 18 (45%) patients had no complications, pulmonary embolism developed in 2 (5%) and thrombosis in 5 (12.5%) patients. In the group with atrial fibrillation, NIH scale showed improvement of neurologic status in 4 (27%), unchanged neurologic status in

moždanog udara ipsilateralno karotidnoj stenozi iznosio je 39%, a TIA 18%; kod ostalih bolesnika su moždani udar i TIA bili zastupljeni svaki u 2%. Karotidna endarterektomija izvedena je kod 50% bolesnika, od kojih je 12% imalo moždani udar. Dakle, umjerena stenoza karotidnih arterija kod starijih bolesnika, osobito kod muškaraca, možda predstavlja značajniji čimbenik rizika negoli se je dosad smatralo.

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### TERAPIJSKI PRISTUP ISHEMIJSKOM MOŽDANOM UDARU TE POVEZANOST S ATRIJSKOM FIBRILACIJOM I KOMPLIKACIJAMA

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U suvremenom terapijskom pristupu u praksi je i primjena antikoagulantne terapije, osobito kod bolesnika s atrijskom fibrilacijom. Cilj ovoga istraživanja je bio ustanoviti povezanost terapijskog pristupa primjenom antikoagulantne terapije kod ishemijskog moždanog udara u bolesnika bez atrijske fibrilacije i s njom, i pojave komplikacija (plućne embolije, tromboze) te procjene oporavka bolesnika primjenom ljestvice NIH. Promatrano je 40 bolesnika, 24 (60%) muškarca i 16 (40%) žena s ishemijskim moždanim udarom koji su imali atrijsku fibrilaciju i 30 bolesnika, 11 (37%) muškaraca i 19 (63%) žena bez atrijske fibrilacije. Kod obje skupine bolesnika nalaz ishemijske lezije potvrđen je i CT nalazom. Utvrđena je i ljestvica NIH kod svih bolesnika na početku i završetku liječenja, te promjena u neurološkom nalazu. Kod svih bolesnika s atrijskom fibrilacijom primijenjena je antikoagulantna terapija. Kod bolesnika s atrijskom fibrilacijom smrtni ishod je zabilježen kod 13 (32,5%) bolesnika, a kod bolesnika bez atrijske fibrilacije u 8 (32%) bolesnika. Među bolesnicima s atrijskom fibrilacijom koji su primali antikoagulantnu terapiju 10 (25%) ih nije imalo komplikacija, a kod onih bez atrijske fibrilacije bez komplikacija je bilo njih 18 (45%). Među bolesnicima s atrijskom fibrilacijom kod jednog (2,5%) bolesnika javila se plućna embolija, kod 3 (7,5%) bolesnika došlo je do pojave tromboze, a kod jednog (2,5%) do plućne embolije i tromboze. U skupini bolesnika bez atrijske fibrilacije 18 (45%) bolesnika nije imalo komplikacija. Plućna embolija javila se kod 2 (5%) bolesnika, tromboza kod 5 (12,5%) bolesnika. Ljestvica NIH je u bolesnika s atrijskom fibrilacijom pokazivala poboljšanje u neurološkom statusu kod 4 (27%) bolesnika, kod 2 (13%) bolesnika neurološki status je bio isti na

2 (13%) and exacerbation of neurologic status in 9 (60%) patients at the end of treatment. In the group without atrial fibrillation, NIH scale indicated improvement of clinical findings in 7 (28%), no change in 6 (24%) and exacerbation of neurologic finding in 12 (48%) patients. Study results suggest that the use of anticoagulant therapy is highly important for successful treatment and prevention of complications, especially in patients with atrial fibrillation, whereas patient recovery and neurologic finding improvement depend on the size and localization of the lesion.

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### SUCCESSFUL IV HEPARIN THERAPY FOR SIGMOID SINUS THROMBOSIS WITH HEMORRHAGIC VENOUS STROKE

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Dural sinus thrombosis and the resulting venous hemorrhagic or nonhemorrhagic stroke most commonly occur in the 20-35 age group. The mortality rate is about 10% or lower, mostly owing to the improved early detection (attributable to the wide availability of CT and MRI) and improved i.v. heparin or microcatheter-directed thrombolytic therapy. Treatment approach for central venous thrombosis has undergone significant reappraisal, especially over the last decade, with the advent of novel strategies like selective sinus catheterization and thrombolysis. Current therapeutic options include antithrombotic therapy with unfractionated heparin, low-molecular-weight heparin, oral anticoagulants, intravenous thrombolysis, local thrombolysis by selective sinus catheterization, and a combination of thrombolysis and anticoagulation in addition to symptomatic therapy. However, in patients with hemorrhagic infarctions, worsening of bleeding was traditionally feared but the risk of hemorrhagic complications due to heparin has been overestimated. A number of individual case reports, uncontrolled series, retrospective studies and randomized trials have demonstrated the efficacy and safety of heparin in central venous thrombosis, even in the presence of hemorrhagic infarctions. Here we describe a case of a 21-year-old female who presented with a 3-week history of headache complicated with a new onset of weakness on the left side. Head CT and MRI were performed and the diagnosis of right sigmoid sinus throm-

kraju liječenja, a kod 9 (60%) bolesnika ljestvica NIH je pokazivala pogoršanje. U skupini bez atrijske fibrilacije kod 7 (28%) bolesnika je ljestvica NIH pokazivala poboljšanje kliničkog nalaza, kod 6 (24%) je bila bez promjene, a kod 12 (48%) bolesnika NIH je ukazivao na pogoršanje neurološkog nalaza. Dobiveni rezultati pokazuju da je za uspjehnost terapije i prevenciju komplikacija važna primjena antikoagulantne terapije, osobito kod bolesnika s atrijskom fibrilacijom, dok oporavak bolesnika i poboljšanje neurološkog nalaza ovisi o veličini i lokalizaciji lezije.

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### USPJEŠNA TROMBOLIZA TROMBOZE SIGMOIDNOG SINUSA KOMPLICIRANOG HEMORAGIJSKIM MOŽDANIM UDAROM

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Tromboza duralnih sinusa i posljedični hemoragijski ili nehemoragijski moždani udar najčešći su u dobi od 20-35 godina. Smrtnost je danas oko 10%, što je najviše posljedica uspješnijeg ranijeg otkrivanja zahvaljujući širokoj dostupnosti CT i MR te poboljšanoj trombolitičnoj i.v. ili transkateterskoj terapiji. Liječenje centralne venske tromboze (CVT) je posljednjih godina doživjelo značajne promjene uvođenjem novih metoda poput selektivne kateterizacije sinusa i trombolize. Današnje metode liječenja uključuju antitrombotičnu terapiju nefrakcioniranim heparinom, niskomolekularnim heparinom, oralnim antikoagulantima, intravensku trombolizu, lokalnu trombolizu selektivnom kateterizacijom, te kombinaciju trombolitičnih i antikoagulantnih lijekova. Međutim, kod bolesnika s hemoragijskim moždanim udarom tradicionalno je postojao strah od dodatnog krvarenja uz trombolitičnu terapiju. Značajan broj pojedinačnih opisa slučajeva, nekontroliranih studija, retrospektivnih i randomiziranih istraživanja pokazao je kako je taj strah bio neprimjeren, te potvrdio učinkovitost i sigurnost trombolize kod CVT, čak i u slučajevima kompliciranim krvarenjem. Ovdje prikazujemo slučaj bolesnice u dobi od 21 godine, primljene zbog lijevostrane hemiplegije koja je nastupila nakon trotdne glavobolje. CT i MR su potvrdile dijagnozu tromboze desnog sigmoidnog sinusa komplicirane hemoragijskim infarktorn kortikalno/subkortikalno temporobazalno desno. Započeta je i.v. heparinska trombolitična terapija. Tijekom razdoblja od mjesec dana šest puta je učinjen MR mozga kako bi se pratio re-

bosis with hemorrhagic venous stroke in the right temporobasal cortical/subcortical area was made. Thrombolytic therapy with i.v. heparin was introduced. Six consecutive MRI studies over the next one-month period were performed to monitor therapeutic result. Complete restitution of the sigmoid sinus patency and complete resolution of the hemorrhagic venous stroke were achieved.

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#### EFFECT OF BETAHISTIN ON TINNITUS AND VERTIGO IN PATIENTS WITH CEREBROVASCULAR DISEASE

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Treatment for tinnitus and vertigo is one of the major difficulties encountered in audioneurologic therapy and rehabilitation. The experiences acquired to date indicate that tinnitus and vertigo may be the first symptoms of cerebrovascular disease, and may be due to lesion at any level of the auditory and vestibular pathway. The leading risk factors for cerebrovascular disease are also present in patients with tinnitus and/or vertigo. Rapid and targeted topodiagnostic examination of patients with tinnitus and/or vertigo will enable timely therapeutic measures, and acting upon identified risk factors will reduce the risk of cerebrovascular disease progression. Animal studies point to a beneficial effect of betahistin on the labyrinthine blood flow. The aim of the study was to assess the effect of betahistin on receptor tinnitus and central vertigo. The study included 20 subjects aged 20-60 years with receptor tinnitus and central vertigo. They undergo complete audioneurologic workup including doppler diagnosis of carotid and vertebrobasilar basin, and electronystagmography. Upon diagnostic examinations, the patients received betahistin *per os*, 3x16 mg, for two months. Ten patients simultaneously attended functional tinnitus therapy at our institution. Study results showed the patients to present for diagnostic examination 8.5 months of the onset of complaints on an average. A greater number of risk factors for cerebrovascular disease is associated with a higher likelihood for the onset of tinnitus and vertigo. Betahistin had a marked favorable effect on vertigo regression (in 14 of 20 patients) and tinnitus reduction, however, only in the patients at the same time included in functional tinnitus therapy (in 6 of 10 patients). The length of tinnitus was a significant factor for therapeutic outcome, as successful tinnitus resolution was achieved in two patients with tinnitus duration of less than a month.

zultat liječenja. Postignuta je kompletna rekanalizacija sigmoidnog sinusa, kao i potpuna regresija hemoragijskog moždanog udara.

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#### UČINAK BETAHISTINA NA ŠUM I VRTOGLAVICU U BOLESNIKA S CEREBROVASKULARNOM BOLEŠĆU

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Terapija šuma i vrtoglavice jedna je od vodećih teškoća u audioneurološkoj terapiji i rehabilitaciji. Dosadašnja istraživanja ukazuju na to da šum i vrtoglavica mogu biti prvi simptomi cerebrovaskularne bolesti, te da mogu nastati oštećenjem na bilo kojoj razini slušnog i vestibularnog puta. Vodeći rizični čimbenici za cerebrovaskularnu bolest prisutni su i u bolesnika sa šumom/vrtoglavicom. Brza i usmjerena topodijagnostička obrada bolesnika sa šumom i/ili vrtoglavicom omogućava pravodobno terapijsko djelovanje, a djelovanjem na utvrđene rizične čimbenike smanjuje se rizik od napredovanja cerebrovaskularne bolesti. Studija na životinjama ukazuju na povoljan utjecaj betahistina na krvni protok u labirintu. Cilj ovoga rada bio je ispitati utjecaj betahistina na receptorni šum i središnju vrtoglavicu. Ispitali smo 20 osoba s receptornim šumom i središnjom vrtoglavicom u dobi od 30 do 60 godina. Učinjena je cjelovita audioneurološka obrada uključujući doplerovu dijagnostiku karotidnog i vertebrobazilarnog sliva, te elektronistagmografija. Bolesnici su nakon dijagnostičke obrade uzimali betahistin oralno 3x16 mg kroz dva mjeseca. Desetero bolesnika je istodobno pohađalo funkcijsku terapiju šuma u našoj ustanovi. Rezultati pokazuju da se bolesnici na dijagnostičku obradu u prosjeku javljaju 8,5 mjeseci od početka smetnja. Veći broj rizičnih čimbenika za cerebrovaskularnu bolest povećava vjerojatnost nastanka šuma i vrtoglavice. Povoljno djelovanje betahistina očituje se značajnim učinkom na nestanak vrtoglavice (u 14 od 20 bolesnika), te na ublažavanje šuma, ali samo kod bolesnika uključenih u funkcijsku terapiju šuma (u 6 od 10 bolesnika). Značajnim čimbenikom za terapijski učinak pokazalo se je i trajanje šuma, jer se je kod dvoje bolesnika sa šumom kraćim od mjesec dana postiglo uspješno rješavanje ove tegobe.

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### USE OF NONPHARMACOLOGICAL MEASURES IN THE TREATMENT AND PREVENTION OF STROKE AND HEART ATTACK

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Stroke and heart attack rank high on the morbidity and mortality scale both in Croatia and worldwide. As these are diseases from which a part of patients die, a part continue living with lower or higher degree of disability, and only a minor part recover completely, the problem of treatment and prevention of these diseases is in the very focus of interest of a large number of researchers. New potential risk factors that contribute to the development of cerebrovascular and cardiovascular diseases are discovered on an almost daily basis. It seems, however, that more effort has been invested in the detection of risk factors than in the use of efficient measures for their removal or control. It is by no means infrequently that individuals with a history of stroke or heart attack, after the early phase of recovery, resume smoking habit, fail to follow the principles of healthy nutrition, neglect light physical activity, unnecessarily get exposed to stressful situations or those that cannot be avoided tend to solve in an inappropriate manner, and eventually sustain recurrent stroke or heart attack in spite of regular use of pharmacological agents. Therefore, during patient hospitalization and posthospital follow-up, in addition to the usual control neurologic and cardiologic examinations, patients should be provided appropriate assistance in the process of lifestyle modification, in cooperation with their family members, in order to reduce the possibility of the disease recurrence. The professionally justifiable, available and cost-effective non-pharmacological measures that are relevant for both prevention and efficient therapy of cerebrovascular and cardiovascular diseases are discussed.

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### PRIMJENA NEFARMAKOLOŠKIH MJERA U LIJEČENJU I PREVENCIJI MOŽDANOG I SRČANOG UDARA

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Moždani i srčani udar nalaze se visoko na ljestvici pobola i smrtnosti kako na razini svijeta, tako i u Hrvatskoj. Kako se radi o bolestima od kojih dio bolesnika umire, dio ostaje živjeti s manjim ili većim stupnjem invaliditeta, a samo manji dio se potpuno oporavlja, problem liječenja i prevencije ovih bolesti u žarištu je zanimanja velikog broja istraživača. Svakim se danom otkrivaju novi potencijalni rizični čimbenici koji doprinose razvoju cerebrovaskularnih i kardiovaskularnih bolesti. Čini se da se više čini na otkrivanju rizičnih čimbenika negoli na primjeni učinkovitih mjera kojima bi se oni otklonili ili kontrolirali. Nije rijetka pojava da pojedinci s preboljelim moždanim udarom ili srčanim udarom nakon rane faze oporavka prekinu apstinenciju od pušenja, ne poštuju načela zdrave prehrane, zanemaruju redovitu laganu tjelesnu aktivnost, nepotrebno se izlažu stresnim situacijama ili one neizbježne rješavaju na krivi način i tako usprkos redovitom uzimanju farmakoloških sredstava dožive ponovni moždani ili srčani udar. Tijekom bolničkog liječenja i poslijebolničkog praćenja bolesnika neophodno je uz uobičajene kontrolne neurološke i kardiološke preglede u suradnji s članovima obitelji pružiti bolesnicima odgovarajuću pomoć u procesu promjene načina življenja, kako bi se mogućnost recidiva bolesti smanjila. U radu se raspravlja o stručno opravdanim, dostupnim i ekonomski isplativim nefarmakološkim mjerama važnim kako za prevenciju tako i za učinkovito liječenje cerebrovaskularnih i kardiovaskularnih bolesti.



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## QUALITY OF LIFE AFTER STROKE

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Stroke is the leading cause of disability in modern society, and the leading cause of death in Croatia. Stroke is defined as a neurologic deficit of abrupt onset which occurs due to central nervous system circulatory disorder, i.e. ischemia or hemorrhage. Among stroke patients, 20% die within the first month of the disease onset, 30% are dependent on other's person's help, 25% continue special institutionalized care, and 10% are left bed-ridden. Therefore, stroke is major health care as well as economic and social problem. Having sustained a stroke, patients have to learn living with a series of limitations in various fields of life, which is frequently by no means easy. In more than 40% of cases, patients are left with minor or major dependence on other persons' help in performing daily activities due to severe deficit and functional limitations of movement and perception. Even performing routine activities may pose great difficulties, which is highly frustrating for most individuals. For many of them, the disease and non-acceptance of the disease are a source of chronic stress, which in turn has unfavorable impact upon the course of treatment and can entail disturbance in family psychodynamics or even decompensation. Post-stroke rehabilitation should be initiated immediately upon stable condition has been achieved; it should be initiated on an interdisciplinary basis at stroke units. Most stroke patients require evaluation and management by a physiotherapist, a speech therapist and a work therapist, and in some cases a neuropsychologist. Early treatment, continuous encouragement and orientation towards external environment are of paramount importance. While the initial steps in rehabilitation begin in the setting of acute care, a plan has to be made for continuous inpatient and outpatient rehabilitation. The process of rehabilitation is favorably influenced by younger age, limited sensory and motor deficit, preserved mental function and amiable home setting. Work therapy and physical therapy should be focused on the use of the affected extremities and achieving skills at having meals, putting clothes on, personal hygiene and other basic needs. Care for these patients is a demanding and exhaustive job. However, close family members can considerably increase the patient's motivation and they only can convince the patient that he is wanted, loved and needed. Unfortunately, there are sad situations when the fam-

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## KVALITETA ŽIVOTA NAKON MOŽDANOG UDARA

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Moždani udar (MU) je vodeći uzrok invaliditeta u suvremenom društvu, a u Hrvatskoj je vodeći uzrok smrtnosti. Definira se kao naglo nastali neurološki deficit koji nastaje kao posljedica poremećaja cirkulacije središnjeg živčanog sustava, tj. ishemije ili hemoragije. Od posljedica MU umire 20% bolesnika unutar prvih mjesec dana od nastanka bolesti, 30% bolesnika ovisno je o tuđoj pomoći, 25% bolesnika nastavlja njegu u specijaliziranim ustanovama, a 10% bolesnika ostaje vezano uz krevet. Stoga je MU veliki, ne samo zdravstveni, već i ekonomski i socijalni problem. Nakon MU bolesnici trebaju naučiti živjeti s nizom ograničenja u različitim područjima života, što često nije lako. U više od 40% preživjelih od MU zaostane veća ili manja ovisnost o pomoći drugih osoba u obavljanju dnevnih aktivnosti, jer nastaju teška oštećenja i funkcionalna ograničenja kretanja i percepcije. Čak i obavljanje rutinskih aktivnosti može biti vrlo teško, što kod većine osoba djeluje izrazito frustrirajuće. Za mnoge od njih bolest i neprihvatanje bolesti postaju izvorom kroničnog stresa, što pak nepovoljno utječe na tijek liječenja i može uzrokovati poremećaje obiteljske psihodinamike, pa čak i dekompenzacije. Rehabilitaciju bolesnika nakon MU treba započeti odmah nakon što je bolesnik u medicinski stabilnom stanju, a treba ju započeti interdiscipliniski u jedinicama za liječenje MU. U većine bolesnika potrebna je procjena i liječenja fizioterapeuta, logopeda i radnog terapeuta, a u nekim slučajevima je potrebna usluga neuropsihologa. Važno je rano liječenje, stalno ohrabivanje i orijentacija prema vanjskoj okolini. Dok uvodni koraci u rehabilitaciji počinju u okruženju akutne skrbi, treba načiniti plan za neprekidnu bolničku i izvanbolničku rehabilitaciju. Na rehabilitaciju povoljno utječu mlađa životna dob, ograničen senzorni i motorni deficit, neporemećena mentalna funkcija i susretljiva kućna okolina. U radnoj i fizikalnoj terapiji naglasak treba biti na uporabi zahvaćenih ekstremiteta i postizanju spretnosti pri jelu, oblačenju, osobnoj higijeni i drugim osnovnim potrebama. Briga za takve bolesnike je zahtjevan i iscrpljujući posao. No, najbliži članovi obitelji mogu jako povećati motiviranost bolesnika i samo oni mogu bolesnika uvjeriti da je željen, voljen i potreban. Nažalost, ima situacija gdje obitelj ne želi preuzeti brigu i skrb o nepokretnoj osobi, nego nastoji što duže bolesnika držati izvan vlastitog doma, bilo da ga sele iz bolnice u bolnicu ili

ily do not want to take care of a bed-ridden person, and try to keep him away from home as long as possible, either by transferring him from one hospital to another, or by placing him to nursing homes or substitute families. The situation is even worse if the patients are aware of their disease and disability. Education of the patient and his family about stroke and its sequels is an important step in rehabilitation. The patient, his family and friends have to comprehend the nature of the disablement as well as the likelihood of potential improvement, however, only with time, patience and perseverance. The ultimate goal of rehabilitation should be to ensure continuous, longterm medical treatment and rehabilitation, which will meet the needs and wishes of the patient and his family. Post-stroke recovery depends on appropriate care, general health condition and shape of the patient as well as on his character, behavior and emotional state, and the emotional state of his environment, especially close persons.

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#### MULTIDISCIPLINARY THERAPY OF YOUNG APHASIC WOMEN

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The SUVAG Polyclinic deals with rehabilitation of post-stroke individuals. The multidisciplinary team performing therapy for this population consists of a neurologist, a psychiatrist-psychotherapist, a speech therapist – diagnostician and a speech therapist – therapist. During 2003, 38 stroke patients were included in this form of rehabilitation, 23 of them below age 50, and 16 of the latter women aged 23-24. A specific group and individual program has been designed for the group of young women with a history of stroke, because of their specific difficulties in family and social communication. The program has been designed in the form of group supportive workshops tailored to the patients' health, social and communication difficulties considering their multifaceted role of a mother, a wife, and an employee (self-supporting mothers with preschool- or school-children, unemployed or retired women/mothers, unemployed self-supporting mothers, married employed women, etc.). The initiative for the organization of supportive-educational workshops was launched as a contribution to the efforts towards improved quality of life and social status of women with disability, especially young women/mothers.

ih smještavaju u domove ili udomiteljske obitelji. Situacija je teža ako su bolesnici svjesni svoje bolesti i nemoći. Obrazovanje bolesnika i njegove obitelji o MU i njegovim posljedicama važan je korak u rehabilitaciji. Bolesnik, njegova rodbina i prijatelji moraju shvatiti narav onemoćalosti i vjerojatnost da je poboljšanje moguće, ali tek s vremenom uz strpljenje i ustrajnost. Konačan cilj rehabilitacije treba biti osiguranje neprekidnog dugotrajnog medicinskog liječenja i rehabilitacije koji će ispuniti želje i potrebe bolesnika i njegove obitelji. Oporavak nakon MU ovisiti će o dobroj njezi, općem zdravstvenom stanju i kondiciji bolesnika, kao i o njegovim karakternim osobinama, ponašanju i emocionalnom stanju, te o emocionalnom stanju okoline, osobito onoj koja dolazi od bliskih osoba.

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#### MULTIDISCIPLINSKA TERAPIJA MLADIH ŽENA S AFAZIJOM

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Poliklinika SUVAG bavi se rehabilitacijom osoba koje su preboljele moždani udar. Multidisciplinski tim koji provodi terapiju sastoji se od slijedećih stručnjaka: neurologa, psihijatra-psihoterapeuta, logopeda-dijagnostičara i logopeda-terapeuta. Godine 2003. rehabilitacijom je bilo obuhvaćeno 38 bolesnika s moždanim udarom, od kojih je 23 bilo mlađe od 50 godina, od njih 16 žena u dobi od 23-24 godine. Za skupinu žena koje su preboljele moždani udar organiziran je poseban grupni i individualni program rada zbog njihovih specifičnih teškoća u komunikaciji u obitelji i društvu. Program je izrađen u obliku grupnih potpornih radionica s obzirom na njihove zdravstvene, socijalne i komunikacijske teškoće u ulozi majke, supruge, zaposlenice (samohrane majke s predškolskom ili školskom djecom, nezaposlene ili umirovljene žene/majke, nezaposlene samohrane majke, udate zaposlene žene itd.). Poticaj za organiziranje potporno-obrazovnih radionica nastao je kao prilog borbi za poboljšanje kvalitete života i društvenog statusa žene s invaliditetom, poglavito mladih žena/majka.

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### ReAktiva – AN INTERDISCIPLINARY THERAPEUTIC CONCEPT IN NEUROLOGIC REHABILITATION

Ožegović M<sup>1</sup>, Vlašić S<sup>1</sup>, Dizdarević A<sup>2</sup>, Ivkić M<sup>1,3</sup>, Ivkić G<sup>1,4</sup>

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Rich experience and practice in rehabilitation of patients with neurologic disorders point to the quite poor coverage in the field of posthospital rehabilitation of the outpatient and partially inpatient type. The individuals who have sustained some type of brain damage of either developmental or traumatic nature, or most commonly stroke, are faced with a series of difficulties, especially psychosocial ones, on attempting functional reintegration in their social and work setting. At ReAktiva Center, the patients and their families are offered professional help to overcome the problems of reintegration in the family as well as in the wider, social environment. The professional activities are designed by a team of experienced clinical therapists in the fields of physical therapy, work therapy, speech therapy, along with consultant neurologist and physiatrist. The activities are designed and performed so as to be adjusted to the individuals with neurologic disorders, trying to provide comprehensive assistance in functioning and resocialization in the late phase of rehabilitation. Using current concepts of central nervous system neurophysiology as well as those on brain plasticity and restructuring abilities, the latest experience and concepts currently employed in the world (Bobath concept methods) are implemented in practice, e.g., peripheral pathway stimulation with information on normal movement patterns, resulting in motor function improvement. The process of neurologic rehabilitation requires interdisciplinary and individual approach to solving the sensorimotor problems and a very high degree of therapeutic team “plasticity”. The aim of ReAktiva is to upgrade the motivation of the user and his family for rehabilitation through joint efforts of all rehabilitation team members, thus to reinforce the efficacy of therapeutic procedures.

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### REAKTIVA – INTERDISCIPLINSKI TERAPIJSKI KONCEPT U NEUROLOŠKOJ REHABILITACIJI

Ožegović M<sup>1</sup>, Vlašić S<sup>1</sup>, Dizdarević A<sup>2</sup>, Ivkić M<sup>1,3</sup>, Ivkić G<sup>1,4</sup>

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Dugogodišnje iskustvo i praksa u rehabilitaciji bolesnika s neurološkim problemima ukazuju na slabu pokrivenost područja poslijestacionarne rehabilitacije, ambulantnog i djelomice stacionarnog tipa. Osobe koje su pretrpjele neki oblik moždanog oštećenja, bilo razvojnog tipa, traumatskog ili najčešće nakon moždanog udara, suočavaju se s nizom poteškoća, poglavito psihosocijalne naravi, prilikom pokušaja funkcionalnog integriranja u društvenu i radnu sredinu. Unutar Centra ReAktiva bolesnici i njihove obitelji mogu dobiti stručnu pomoć koja ima za cilj upravo prevladavanje integracijskih problema u obiteljske okvire, a tako i u širu okolinu. Stručni rad osmislio je tim iskusnih kliničkih terapeuta iz područja fizioterapije, radne terapije, logopedске rehabilitacije te suradnog liječnika-neurologa i fizijatra. Rad u ReAktivi sadržajno je osmišljen i prilagođen odraslim osobama s neurološkim smetnjama i nastoji u kasnoj fazi rehabilitacije pružiti cjelovitu pomoć u funkcioniranju i resocijalizaciji. Rabeći suvremene spoznaje iz neurofiziologije središnjeg živčanog sustava, kao i spoznaje o plastičnosti i reorganizacijskim sposobnostima mozga kroz praktičnu terapijsku primjenu nastoje se primijeniti najnovija iskustva i koncepti koji se danas primjenjuju u svijetu (metode koncepta Bobath). Tako se, primjerice, provodi stimulacija perifernih putova informacijama normalnog obrasca pokreta, što u konačnici dovodi do poboljšanja motorne funkcije. Proces neurološke rehabilitacije traži interdisciplinski i individualan pristup rješavanju senzomotornih problema i vrlo visok stupanj „plastičnosti“ terapijskog tima. Cilj ReAktive je putem zajedničkog rada svih čimbenika rehabilitacijskog tima podići motiviranost korisnika i obitelji za rehabilitaciju, čime bi se pojačala i učinkovitost terapijskih postupaka.

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### INTERDISCIPLINARY APPROACH IN STROKE REHABILITATION

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The consequences of stroke are multiple, depending on the degree of physical, cognitive and psychosocial disability. Patient recovery will depend on the impairment severity, rehabilitation program applied, and maintaining of the therapeutic progress achieved, along with support from the rehabilitation team, family and close friends. It is of utmost importance to set short-term and long-term goals of rehabilitation activities, whereby the patient's interests are most important, however, neither should the family and social ones be overlooked when trying to find most appropriate solutions. A functionally independent individual can perform daily activities without others' help and be appropriately socialized, thus being able to take part in family activities and social events. A female patient with a history of severe stroke is presented. Owing to the interdisciplinary approach to stroke rehabilitation, she has achieved a high level of independence in all daily activities and is socially active despite severe speech disorder. Also, our own experience in stroke rehabilitation relative to previously published data is presented.

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### IMPACT OF EARLY PRIMARY REHABILITATION ON STROKE PATIENT RECOVERY

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Stroke is an acute or subacute onset of neurologic symptoms caused by impairment in the cerebral arterial circulation. In most European Union countries, stroke ranks as third most common cause of death, whereas in Croatia it is the leading cause of death. Stroke is the leading cause of disability in the modern society. Rehabilitation is a complex procedure of regaining abilities for daily and professional life as well as for emotional and social stability in the individuals who have lost this ability due to a disease or an injury. Early rehabilitation is crucial in the management of stroke patients. In more than 40% of survi-

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### INTERDISCIPLINSKI PRISTUP U REHABILITACIJI MOŽDANOG UDARA

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Kao posljedica moždanog udara može nastati različit stupanj fizičkog, spoznajnog i psihosocijalnog premećaja. Oporavak će ovisiti o težini onesposobljenosti, programu rehabilitacije, održavanju postignutih funkcija, a uz rehabilitacijski tim značajnu ulogu ima potpora obitelji i okoline. Neophodno je postaviti kratkoročne i dugoročne ciljeve rehabilitacije, važno je odrediti interese samog bolesnika, ali i obiteljske i društvene, tražeći najprikladnije izlaze iz situacija svakodnevnog života. Funkcijska neovisnost bolesnika podrazumijeva samostalnost pri svakodnevnim aktivnostima i dobru socijaliziranost, što bi uz obiteljsko okruženje trebalo podrazumijevati i sudjelovanje u društvenim događajima. Prikazana je bolesnica s kliničkom slikom hemipareze koja je zahvaljujući interdisciplinarnom pristupu u rehabilitaciji postigla zavidan stupanj samostalnosti u svim aktivnostima svakodnevnog života, a uz to je i vrlo dobro socijalizirana iako je njena verbalna komunikacija minimalna. Također su prikazana neka vlastita iskustva u rehabilitaciji nakon moždanog udara u odnosu na ranije objavljene podatke.

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### UTJECAJ RANE PRIMARNE REHABILITACIJE NA OPORAVAK BOLESNIKA S PREBOJELIM MOŽDANIM UDAROM

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Moždani udar (MU) je akutni ili subakutni nastanak neuroloških simptoma uzrokovanih poremećajima arterijske cirkulacije mozga. U većini zemalja Europske zajednice MU je na trećem mjestu među najčešćim uzrocima smrti, dok je u Hrvatskoj vodeći uzrok smrti. MU je vodeći uzrok invaliditeta u suvremenom društvu. Rehabilitacija je složen postupak ponovnog osposobljavanja za aktivnosti svakodnevnog i profesionalnog života, te za emotivnu i socijalnu stabilnost osoba koje su tu sposobnost izgubile zbog bolesti ili ozljede. Rana rehabilitacija je ključna u



vors, stroke entails major or minor dependence on other people's help in performing daily activities, about 25% of patients need hospitalization, 10% are not able to move without help, whereas two-thirds of survivors are not fit to work. Early physical therapy greatly improves functional recovery and reduces the proportion of those depending on other person's help. The team engaged in stroke patient rehabilitation is multidisciplinary and consists of a neurologist, a nurse, a physiotherapist, a speech therapist, a neuropsychologist and a social worker. Primary rehabilitation in stroke patients has a fundamental role; the patient's survival and quality of life quite frequently depend on primary rehabilitation. Barthel's index (BI) belongs to the parameters used to assess the level of functional independence in the process of primary rehabilitation. Strictly defined by the scoring system, the examiner evaluates the ability to perform given tasks and daily living functions, and summing them up obtains a final result, i.e. BI. By using BI we try to evaluate the patient's current state and need of further treatment as accurately as possible, to quantify the success of rehabilitation procedures and eliminate the possible therapist's subjectivity in assessing the patient's functional state. The aim of the present study was to assess the efficiency of primary rehabilitation according to the BI pattern. The study initially included 60 patients with verified ischemic stroke. Ten patients died before day 15 of hospital stay, so they were not included in analysis. Of the remaining 50 patients, there were 21 men and 29 women, mean age  $67 \pm 9$  and  $77 \pm 11$  years, respectively. The patients were monitored for 15 days, and BI value was evaluated on day 1, 7 and 15. BI values were significantly higher at the end than at the beginning of treatment. The mean BI value was  $27 \pm 19$ ,  $41 \pm 25$  and  $56 \pm 27$  on day 1, 7 and 15, respectively. Mann-Whitney test showed the BI value to be statistically significantly higher on day 15 as compared with the values recorded on day 1 and day 7 ( $p < 0.0001$  both) in both sexes. Rehabilitation programs do not modify the patient's neurologic deficit but can contribute considerably to the patient's regaining independence and ability to perform daily activities. It has already been demonstrated that treatment intensity is a key factor influencing rehabilitation in stroke patients. Primary rehabilitation is an extremely important and useful process, and evaluation of this process yields multiply useful information. Thus, the intensive care measures at stroke units, early rehabilitation and multidisciplinary approach should warrant successful rehabilitation and capacitating patients for daily living. The methods of primary rehabilitation should be further up-

zbrinjavanju bolesnika s preboljelim MU. U više od 40% preživjelih od MU zaostaje veća ili manja ovisnost o pomoći drugih osoba u obavljanju dnevnih aktivnosti, oko 25% bolesnika biva hospitalizirano, 10% ih nije u mogućnosti samostalno se kretati, a dvije trećine preživjelih više nisu radno sposobni. Rana fizikalna terapija uvelike poboljšava funkcijski oporavak i smanjuje broj bolesnika ovisnih o tuđoj pomoći. Tim koji sudjeluje u provođenju rehabilitacije bolesnika s preboljelim MU je multidisciplinski i uključuje neurologa, medicinske sestre, fizioterapeuta, logopeda, neuropsihologa i socijalnog radnika. Primarna rehabilitacija bolesnika nakon MU ima osnovnu važnost, pa o njoj vrlo često ovisi hoće li bolesnik preživjeti i kakva će mu biti kvaliteta života. Barthelov indeks (BI) ubrajamo u parametre kojima provodimo procjenu stupnja funkcijske samostalnosti u procesu primarne rehabilitacije. Strogo definiran načinom bodovanja, ispitivač ocjenjuje mogućnost izvedbe zadanih radnja i obavljanja životnih funkcija kako bi se njihovim zbrajanjem dobio konačan rezultat koji predstavlja BI. Pomoću BI nastojimo što točnije ocijeniti bolesnikovo trenutno stanje, kao i potrebu daljnjeg liječenja, kvantificirati uspješnost postupaka rehabilitacije te ukloniti moguću subjektivnost terapeuta u procjeni funkcijskog stanja bolesnika. Cilj ovoga rada bio je procijeniti učinkovitost primarne rehabilitacije promatrajući promjenu vrijednosti BI. U studiju je bilo uključeno 60 bolesnika s verificiranim ishemijskim MU. Desetero bolesnika je preminulo prije petnaestog dana boravka u bolnici te nisu bili uključeni u analizu. Od 50 bolesnika 21 su bili muškarci, a 29 žene. Prosječna starost muškaraca bila je  $67 \pm 9$  godina, a žena  $77 \pm 11$  godina. Bolesnici su praćeni kroz 15 dana, a vrijednost BI je ocjenjivana prvog, sedmog i petnaestog dana boravka u bolnici. Vrijednosti BI bile su znatno više na kraju nego na početku liječenja. Srednja vrijednost BI iznosila je prvoga dana  $27 \pm 19$ , sedmoga dana  $41 \pm 25$ , a petnaestog dana  $56 \pm 27$ . Mann-Whitneyevim testom dokazali smo statistički značajno višu vrijednost BI petnaestog dana ispitivanja u odnosu na sedmi dan, kao i u odnosu na prvi dan ( $p < 0,0001$  oba), i to u oba spola. Rehabilitacijski programi ne mijenjaju neurološki deficit bolesnika, ali mogu puno pridonijeti osamostaljivanju i osposobljavanju bolesnika za svakodnevne životne aktivnosti. Već je ranije dokazano da je intenzitet liječenja ključni čimbenik koji utječe na rehabilitaciju bolesnika s MU. Primarna rehabilitacija je izrazito važan i koristan proces evaluacijom kojega se dobivaju višestruko korisni podaci. Mjere intenzivnog liječenja u jedinicama za MU, rana rehabilitacija i multidisciplinski pristup trebali bi jamčiti uspješnu rehabilitaciju i osamostaljivanje bolesni-

graded, along with continuously pointing to the necessity and importance of team approach in the treatment of stroke patients.

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#### BREATH HOLDING INDEX IN EVALUATION OF PATIENTS WITH SEVERE SYMPTOMATIC OCCLUSIVE CAROTID ARTERY DISEASE

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Cerebrovascular reactivity in severe carotid artery disease depends on the functional capacity of collateral pathways. The aim of the study was to apply Breath Holding Index (BHI) method in the evaluation of cerebrovascular reactivity in patients with severe carotid stenosis. Using transcranial Doppler ultrasonography, cerebrovascular reactivity to hypercapnia in the middle cerebral artery was evaluated by calculating BHI of 120 symptomatic patients, mean age  $71 \pm 10$  yrs (73 men, mean age  $66 \pm 12$  yrs and 57 women, mean age  $74 \pm 10$  yrs) with different collateral pathways. There were 20% of patients who suffered TIA (10% men and women each), 38% with first-ever stroke (15% men and 23% women), and 21% of patients with recurrent stroke (15% men and 6% women). Anterior collateral pathway (ACoA) was present in 16%, posterior collateral pathway (PCoA) and inversed flow in ophthalmic artery (OA) in 12%, ACoA/PCoA in 30%, ACoA/OA in 21%, ACoA/PCoA/OA in 12% and cortical collaterals in 9% of patients. All BHI mean values were below 0.7 and there was a statistically significant difference ( $p < 0.05$ ) depending on activation of different collateral pathways: ACoA BHI =  $0.52 \pm 0.16$ ; PCoA/OA BHI =  $0.33 \pm 0.11$ ; ACoA/PCoA BHI =  $0.41 \pm 0.12$ ; ACoA/OA BHI =  $0.35 \pm 0.10$ ; ACoA/PCoA/OA BHI =  $0.27 \pm 0.1$ ; and cortical collaterals BHI =  $0.13 \pm 0.11$ . Transcranial Doppler is a reliable non-invasive tool in evaluation of patients with severe symptomatic occlusive carotid disease. Transcranial Doppler can detect different number and type of collateral pathways that influence BHI values and patient prognosis.

ka za svakodnevni život. Potrebno je dalje unaprjeđivati metode rada u liječenju bolesnika s preboljelim MU.

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#### INDEKS ZADRŽAVANJA DAHA U PRAĆENJU BOLESNIKA S UZNAPREDOVALOM SIMPTOMATSKOM OKLUZIVNOM KAROTIDNOM BOLEŠĆU

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Moždana vazoreaktivnost u bolesnika s uznapredovalom karotidnom bolešću ovisna je o funkcioniranju kolateralne mreže. Cilj ovoga istraživanja bio je uvesti indeks zadržavanja daha (IZD) u svakodnevno praćenje bolesnika s uznapredovalom karotidnom bolešću. Moždana vazoreaktivnost bila je praćena transkranijalnim doplerom (TCD) kao reakcija na hiperkapniju. Indeks zadržavanja daha bio je izračunat u 120 ispitanika (srednja dob  $71 \pm 10$ ) sa simptomatskom karotidnom stenozom (73 muškarca srednje dobi  $66 \pm 12$  i 57 žena srednje dobi  $74 \pm 10$ ) uz aktivaciju različitih kolateralnih putova. U studiju su bili uključeni ispitanici sa simptomatskom karotidnom bolešću: 20% s prolaznim ishemijskim napadajem (TIA), 10% muškarci i 10% žene; 38% s moždanim udarom koji su preboljeli prvi puta, 15% muškarci i 23% žene; te 21% s recidivom moždanog udara, 15% muškarci i 6% žene. Prednji kolateralni put (ACoA) imalo je 16%, stražnji kolateralni put (PCoA) i kolateralni put preko oftalmične arterije (AO) imalo je 12%, ACoA/PCoA imalo je 30%, ACoA/OA je imalo 21%, ACoA/PCoA/OA imalo je 12% te kortikalne kolaterale je imalo 9% ispitanika. Sve vrijednosti IZD bile su ispod granice od 0,7, a statistički značajna razlika pronađena je s obzirom na aktivaciju različitih kolateralnih putova: ACoA IZD =  $0,52 \pm 0,16$ ; PCoA/OA IZD =  $0,33 \pm 0,11$ ; ACoA/PCoA IZD =  $0,41 \pm 0,12$ ; ACoA/OA IZD =  $0,35 \pm 0,10$ ; ACoA/PCoA/OA IZD =  $0,27 \pm 0,1$ ; i kortikalne kolaterale IZD =  $0,13 \pm 0,11$ . Transkranijalski dopler pouzdano je sredstvo u ispitivanju bolesnika sa značajnom stenozom unutarnje karotidne arterije. Transkranijalski dopler može otkriti različite kolateralne putove koji utječu na vrijednosti IZD i sam tijek bolesti.

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### BREATH HOLDING INDEX IN EVALUATION OF CEREBRAL VASOREACTIVITY

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The aim of the study was to establish normal values of the middle cerebral artery (MCA) breath holding index (BHI) in healthy males and females. Healthy volunteers (180 male and 180 female) were divided into 6 age groups for each sex. All basal cerebral arteries were evaluated by transcranial Doppler (TCD) in a standardized manner. The breath holding method was used in evaluation of cerebrovascular vasoreactivity in MCA, and 720 BHI values were obtained. MCA mean velocity was continuously monitored for at least 5 minutes to determine baseline values. Breath was held for 20-30 seconds and mean blood flow velocities (MBFV) during the last 3 seconds of breath hold were taken in calculation as  $V_{\text{mx}}$  velocity value. BHI was calculated as a percent of velocity increase from resting baseline values divided by breath holding time. BHI values were calculated for all subjects and for each sex in separate. Statistical analysis was performed by use of non-parametric  $\chi^2$ -test and Fisher test (statistical significance was set at  $p < 0.05$ ). Variation coefficient for each age group and Pearson's linear correlation coefficient were calculated for MBFV and BHI. The majority of subjects (95%) were in the group of BHI values within the range of 1.03-1.65. There was no statistically significant decrease in BHI values with age ( $p > 0.05$ ). In contrast, an age dependent decrease in MBFV was recorded in all subjects ( $p < 0.01$ ). BHI is a noninvasive, well tolerated, real-time, reproducible screening method for studying cerebral hemodynamics.

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### TRANSCRANIAL DOPPLER SONOGRAPHY IN MONITORING CEREBRAL HEMODYNAMICS AFTER SUBARACHNOID HEMORRHAGE

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The aim of the study was to assess the value of transcranial Doppler sonography (TCD) in monitoring the cir-

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### INDEKS ZADRŽAVANJA DAHA U ISPITIVANJU MOŽDANE VAZOREAKTIVNOSTI

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Cilj ovoga rada bio je standardizirati vrijednosti indeksa zadržavanja daha (IZD) u zdravih ispitanika (muškaraca i žena) te predložiti raspon normalnih vrijednosti. Zdravi dobrovoljci (180 muškaraca i 180 žena) bili su podijeljeni u 6 dobnih skupina za svaki spol. Sve bazalne moždane arterije bile su praćene transkranijalnim doplerom (TCD) na standardizirani način. IZD izračunat je za srednju moždanu arteriju (ACM), a u studiji se je razmatralo 720 vrijednosti. Srednja brzina strujanja krvi (SBSK) u ACM bila je praćena tijekom 5 minuta i ta vrijednost je uzeta kao bazalna, potom je ispitanik zamoljen da na 20-30 sekunda zadrži dah iz normalnog disanja (kako bi se izbjegao Valsalvin manevar) te je vrijednost na kraju ciklusa uzeta kao maksimalna. Razlika maksimalne brzine i bazalne vrijednosti podijeljena s vremenom uzeta je kao vrijednost IZD. Vrijednosti su izračunate i razmatrane za svaki spol i dobnu skupinu zasebno. Većina ispitanika (95%) imala je vrijednost IZD u intervalu od 1,03-1,65; nije pronađena statistički značajna razlika ovisno o dobi, naprotiv, zamijećen je statistički značajan pad SBSK vrijednosti s dobi.

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### TRANSCRANIJSKI DOPLER U PRAĆENJU MOŽDANE CIRKULACIJE NAKON SUBARAHNOIDNOG KRVARENJA

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Cilj ovoga rada bio je razmotriti značenje transkranijalnog doplera (TCD) u praćenju vazospazma žila Will-

cle of Willis vasospasm after subarachnoid hemorrhage (SAH). The hemodynamics of the circle of Willis was observed in a standardized manner by means of TCD in 15 patients (7 male and 8 female, mean age  $46 \pm 8$ ) on day 1, 3 and 7 of SAH onset. Lindegaard index was calculated and a value over 4 was taken as a parameter of cerebral vasospasm. On day 1 of monitoring, 3 patients had Lindegaard index over 4 indicating the presence of vascular spasm. On day 3 of monitoring, 8 patients had Lindegaard index over 4 indicating the presence of vascular spasm and 1 patient had MBFV under normal values indicating poor cerebral perfusion. On day 7 of monitoring 5 patients had Lindegaard index over 4 indicating the presence of vasospasm and 1 patient had MBFV under normal values indicating poor cerebral perfusion. TCD is a noninvasive, well tolerated, real-time, reproducible method to monitor patients with cerebrovascular spasm, which can be used in different stages of SAH to demonstrate functional and pathologic status of cerebral blood vessels and to predict SAH outcome.

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#### TRANSCRANIAL DOPPLER TCD STUDY OF INTRACRANIAL VASCULAR DISEASE IN POST-STROKE APHASIA

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Since stroke is frequently resulting from extracranial carotid artery disease as well as intracranial atherosclerosis, early noninvasive diagnostics of these atherosclerotic changes is indispensable in classification, prevention, prognosis and follow up of cerebrovascular disease and its consequences. The purpose of this study was to investigate the importance of transcranial Doppler sonography (TCD) in determination of intracranial vascular disease causing post-stroke aphasia. The insonation of intracranial vessels was performed on a Transcranial Doppler DWL Multi Dop XL with a 2-MHz sector transducer in 97 patients (37 male, 60 female, mean age 72 years) with acute stroke and aphasia in the first 3 days of the symptom onset. Extracranial imaging of carotid arteries was performed on an Aloca 5500 Prosound with 7.5-MHz linear transducer. Each patient was evaluated by clinical examination, blood tests, brain CT scan, and a protocol determined by speech pathologist.

isova kruga nakon subarahnoidnog krvarenja (SAH). Cirkulacija žila Willisova kruga praćena je pomoću TCD na standardizirani način u 15 ispitanika (7 muškaraca i 8 žena srednje dobi  $46 \pm 8$  godina) prvog, trećeg i sedmog dana nakon SAH. Kao kriterij za mjerenje intenziteta vazospazma uzeta je vrijednost Lindegaardova indeksa iznad 4. Tijekom prvog dana praćenja 3 ispitanika su imali Lindegaardov indeks iznad 4, što je govorilo u prilog vazospazma. Tijekom trećeg dana praćenja 8 ispitanika je imalo Lindegaardov indeks iznad 4, a jedan ispitanik je imao vrijednosti niže od normale, što je ukazivalo na hipoperfuziju. Tijekom sedmog dana praćenja 5 ispitanika je imalo Lindegaardov indeks iznad 4, a jedan ispitanik je imao vrijednosti niže od normale, što je ukazivalo na hipoperfuziju. TCD je neinvazivna, lako provediva metoda u stvarnom vremenu koja može poslužiti za praćenje različitih faza SAH, ilustrirajući pritom trenutni status i funkcionalnost možane cirkulacije te procjenu ishoda SAH.

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#### AFAZIJA I CEREBROVASKULARNA BOLEST – ISTRAŽIVANJE TRANSKRANIJSKIM DOPLEROM

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Trideset i tri posto bolesnika s moždanim udarom (MU) kao jedan od simptoma bolesti ima afaziju. MU kao jedna od najčešćih bolesti u neurologiji danas može nastati zbog ateroskleroze intra- ili ekstrakranijskih krvnih žila mozga te kao rezultat smanjenog protoka krvi u mozgu. Cilj našega istraživanja bio je pokazati vrijednost transkranijске dopler sonografije (TCD) u dijagnosticiranju krvožilnih bolesti mozga koje dovode do nastanka afazije nakon MU. U 97 bolesnika s akutnim MU i afazijom TCD Willisova kruga i vertebrobazilarnog sliva izvodila se je na uređaju Transcranial Doppler MultiDop X4 DWL sa sondom od 2 MHz držanom u ruci. Arterije Willisova kruga insonirane su kroz temporalni prozor, a vertebralne arterije i bazilarne arterija kroz okcipitalni prozor standardnim tehnikama u prva 3 dana od nastanka simptoma. Pregled ekstrakranijskog dijela karotidnih arterija izvođen je metodama CDFI i PDI ultrazvučnim bojom kodiranim dupleks uređajem ALOKA Prosound 5500 s linearnom sondom od 7,5 MHz za morfološki prikaz i 5 MHz pulsirajućim doplerom



TCD findings were highly compatible with the etiology, anatomic location of lesions, type of aphasia and motor disorders. Significant changes were found in cerebrovascular hemodynamics in the language areas of the brain. Classic aphasic syndromes are considered cerebral arterial occlusion syndromes and TCD as a method is important for noninvasive assessment of cerebral hemodynamics and for evaluation of intracranial cerebral vascular disease causing post-stroke aphasia. TCD is not sensitive enough to detect changes in small cerebral arteries and it does not provide information on the lesions located on the small branches of the MCA that are associated with various types of aphasia in stroke patients.

za ispitivanje hemodinamike. Svakom bolesniku izvršen je detaljan neurološki pregled, krvne pretrage, kompjutorizirana tomografija (CT) mozga i logopedski pregled. U 76% bolesnika TCD metodom nađene su značajne promjene moždane hemodinamike u područjima mozga odgovornim za jezik. Globalna afazija bila je najčešći simptom akutnog MU. Nalazi CT mozga pružili su vrijedne informacije o lokalizaciji i veličini MU unutar područja mozga odgovornim za jezik kod bolesnika s afazijom kao vodećim simptomom MU. Rezultati ovoga istraživanja pokazali su visoku povezanost nalaza intrakranijskog moždanog krvotoka na TCD, etiologije i anatomske lokalizacije MU, vrste afazije kao i motornih poremećaja u bolesnika s akutnim MU i afazijom. TCD je kao metoda vrlo korisna kod neinvazivnog ispitivanja moždane hemodinamike i otkrivanja intrakranijske cerebrovaskularne bolesti u bolesnika s akutnim MU i afazijom.

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#### **FUNCTIONAL TRANSCRANIAL DOPPLER OF THE POSTERIOR CIRCULATION IN PATIENTS WITH ADVANCED CAROTID OCCLUSIVE DISEASE**

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Posterior circulation may play an important role as a collateral channel in patients with advanced internal carotid artery (ICA) stenosis. Up to now, attention has been mainly focused on evaluating the hemodynamic effect of ICA stenosis on the middle cerebral artery (MCA), with a significantly reduced vasomotor reactivity of the MCA having been demonstrated in patients with high-grade stenosis or occlusion of the ICA. Data on the hemodynamic features of the posterior part of the circle of Willis in patients with carotid occlusive disease are still scanty. We evaluated the hemodynamic features of the posterior circulation by assessing visual evoked response in the posterior cerebral artery (PCA) by means of functional transcranial Doppler (fTCD; 2 MHz probe MultiDop X4 DWL). Mean blood flow velocities (MBFV) in each PCA were measured successively in the dark and on white light stimulation on three occasions 1 minute each. The MBFV in PCA did not differ between the affected and unaffected side of ICA either during white light stimulation or in the dark. Difference between MBFV in ICA (white light stim-

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#### **FUNKCIJSKI TRANSKRANIJSKI DOPLER STRAŽNJEG MOŽDANOG KRVOTOKA U BOLESNIKA S UZNAPREDOVALOM KAROTIDNOM BOLEŠĆU**

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Stražnji moždani krvotok je važan kolateralni put u bolesnika sa značajnom stenozom unutarnje karotidne arterije (ACI). Dosad se većina istraživanja bavila proučavanjem hemodinamskog učinka stenozne ACI u srednjoj moždanoj arteriji (ACM), te su pokazala značajno oslabljenu vazomotornu reaktivnost (VMR) u bolesnika sa značajnom stenozom ACI. Podaci o hemodinamskom učinku karotidne okluzivne bolesti na stražnji dio Willisova kruga još su uvijek oskudni. Cilj ovoga istraživanja bio je utvrditi hemodinamska zbivanja u stražnjem dijelu moždanog krvotoka ispitivanjem vidnog evociranog odgovora u stražnjoj moždanoj arteriji (ACP) funkcionalnim transkranijalnim doplerom (fTCD; sonda od 2 MHz; MultiDop X4 DWL) u 49 bolesnika s uznapređovalom karotidnom bolešću. Mjerene su srednje brzine strujanja krvi (SBSK) u objema ACP sukcesivno podraživanjem bijelom svjetlošću i sa zatvorenim očima u tri navrata u razdoblju od 1 minute svaki. Pri izloženosti bijelom svjetlu, kao i u mraku, srednje vrijednosti SBSK u ACP na strani sa značajnom stenozom ili okluzijom ACI u skupini bolesnika nisu se značaj-

ulation/dark) was not statistically significant. The MBFV findings recorded in this study have indicated that visual evoked response of the PCA remains similar on the stenosed and nonstenosed side of the ICA in case of more pronounced metabolic requirements of the region, suggesting a cerebral posterior circulation mechanism that very successfully compensates for the anterior circulation insufficiency in severe carotid disease. The MBFV of the ICA remained similar regardless of carotid stenosis, suggesting an independent cerebral vascular reserve capacity of the posterior circulation.

jno razlikovale u odnosu na istostranu ACI u skupini zdravih ispitanika. Srednje vrijednosti SBSK u ACP na zdravoj strani u skupini bolesnika također se nisu značajno razlikovale u odnosu na istostranu ACI u skupini zdravih ispitanika kako pri izloženosti bijelom svjetlu tako ni u mraku. Također nije utvrđena ni statistički značajna razlika između razlika srednjih vrijednosti SBSK u ACP pri izloženosti bijelom svjetlu i srednjih vrijednosti SBSK u ACP u mraku između bolesne strane u skupini bolesnika i iste strane u skupini zdravih ispitanika, kao ni između zdrave strane u skupini bolesnika i iste strane u skupini zdravih ispitanika. S obzirom na nepostojanje značajne razlike u SBSK u ACP pri izloženosti bijelom svjetlu i u mraku između skupine bolesnih i zdravih ispitanika, kao niti između bolesne i zdrave strane u skupini bolesnih ispitanika u ovom istraživanju, dobiveni rezultati upućuju na iznimno dobru kompenziranost moždane cirkulacije kod bolesnika sa značajnom stenozom ili okluzijom ACI putem stražnje cirkulacije. Zbog karotidne okluzivne bolesti i samim tim karotidne insuficijencije dolazi do posljedičnog slabljenja hemodinamike u ACM te oštećenja vazoreaktivnosti u ACM koje snažno korelira sa stupnjem stenozе, ali ne i u ACP. Rezultati ovoga istraživanja pokazuju jako dobru kompenzaciju hemodinamike skretanjem krvi iz vertebrobasilarnog sustava u karotidni preko ACP i ACoP, te se BSK održavaju na zadovoljavajućoj razini.

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#### EVALUATION OF NEUROVASCULAR COUPLING BY FUNCTIONAL TRANSCRANIAL DOPPLER AND TECHNETIUM-99M-HMPAO SINGLE PHOTON EMISSION COMPUTED TOMOGRAPHY

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Functional transcranial Doppler (fTCD) is a practical method with high temporal resolution for assessment of blood flow velocity (BFV) changes coupled to brain activity and in patients with impaired vasoreactivity. Technetium-99m-hexamethylpropylenamine oxime single photon emission computed tomography (<sup>99m</sup>Tc-HMPAO-SPECT) provides reliable information about regional cerebral blood flow (rCBF) distribution during activation studies and pathologic blood flow patterns in patients with carotid stenosis and vertebrobasilar insufficiency. We investigated the validity of fTCD with <sup>99m</sup>Tc-HMPAO-SPECT in

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#### FUNKCIJSKI TRANSKRANIJSKI DOPPLER I TEHNECIJ-99M-HMPAO JEDNOFOTONSKA EMISIJSKA KOMPJUTORIZIRANA TOMOGRAFIJA U PROCJENI NEUROVASKULARNOG SPARIVANJA

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Funkcijski transkranijjski Doppler (fTCD) je praktična metoda visoke temporalne rezolucije za procjenu promjena brzina strujanja krvi (BSK) u moždanim arterijama tijekom izvođenja funkcijskih testova te za procjenu vazomotorne reaktivnosti u neuroloških bolesnika s karotidnom stenozom i vertebrobasilarnom insuficijencijom. Tehnecij-99m-heksametilpropilenamin-oksim jednofotonska emisijska kompjutorizirana tomografija (<sup>99m</sup>Tc-HMPAO-SPECT) je pouzdana metoda za prikaz regionalnog moždanog krvotoka tijekom kortikalne aktivacije te u cerebrovaskularnim bolestima za otkrivanje poremećenog moždanog protoka. Cilj rada bio je ispitati vrijednost fTCD

evaluation of neurovascular coupling (NC) during brain activation task. Ten healthy right-handed volunteers (6 women and 4 men; mean age  $\pm$  SD 28.1 $\pm$ 5.34 years) underwent fTCD and SPECT testing during computer game, which contained visuospatial and visumotor elements. Relative BFV changes were measured simultaneously in both middle cerebral arteries (MCAs) during baseline and activation tasks. We calculated the percentage increase in BFV (BFVI%) compared with baseline. Measurement of rCBF in parietal regions was performed by regions of interest (ROI) analysis. The percentage increase in cerebral perfusion was calculated as percentage changes of baseline values. Playing game induced mean BFVI% in the left and right MCAs (mean  $\pm$  SD): 7.74 $\pm$ 2.47% and 10.79 $\pm$ 2.46%, respectively. Relative perfusion increases in the right parietal region were as follows (mean  $\pm$  SD): 0.956 $\pm$ 0.016 *vs* 0.985 $\pm$ 0.019 count/second, rest *vs* stimulation, respectively, in all patients. The percentage increase in cerebral perfusion during activation in the right parietal region *vs* left parietal region was (mean  $\pm$  SD): 4.584 $\pm$ 2.041% *vs* 3.474 $\pm$ 2.310%.  $^{99m}\text{Tc}$ -HMPAO-SPECT and fTCD might detect measurement of rCBF and BFV changes during activation task. Functional TCD showed moderate BFVI% in both MCAs.  $^{99m}\text{Tc}$ -HMPAO-SPECT showed slight rCBF percentage increase in parietal lobes, reflecting the neuronal activity level. Both techniques might be helpful in the evaluation of neurovascular coupling and used in neurologic patients following stroke. Neuroactivation studies are gaining ever more importance in the routine clinical management of stroke leading to better understanding of the process of cerebral plasticity.

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#### BRAINSTEM AUDITORY EVOKED RESPONSE AND TRANSCRANIAL DOPPLER SONOGRAPHY IN PATIENTS WITH RECENT WHIPLASH INJURY

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The aim of the study was to determine whether there are any evident changes of brain function detectable by

u ispitivanju neurovaskularnog sparivanja u odnosu na  $^{99m}\text{Tc}$ -HMPAO-SPECT tijekom neuronske aktivacije. U ispitivanje je bilo uključeno 10 zdravih ispitanika-dešnjačica (6 žena i 4 muškarca; 28,1 $\pm$ 5,34 godine). Snimanje moždanog krvotoka provodilo se je u bazalnim uvjetima i tijekom aktivacije, dok su ispitanici su igrali kompjutorsku igru s vizualno prostornim i vizualno motornim elementima, pomoću metoda fTCD i  $^{99m}\text{Tc}$ -HMPAO-SPECT. Relativne promjene BSK mjerene su istodobno u objema srednjim moždanim arterijama (ACM). Metodom fTCD mjerili smo relativni porast BSK (BSK%) za vrijeme izvođenja zadatka u odnosu na bazalne uvjete. Promjene u regionalnom moždanom krvotoku parijetalnih regija određivane su semikvantitativno, metodom HMPAO-SPECT, pomoću analize regija od interesa (ROI). Relativni porast moždane perfuzije određen je u postotku u odnosu na bazalne vrijednosti. Izvođenje kompjutorske igre izazvalo je srednji porast BSK u lijevoj i desnoj ACM (7,74 $\pm$ 2,47% i 10,79 $\pm$ 2,46%). Relativni porast moždane perfuzije zabilježen je u objema parijetalnim regijama s tendencijom porasta perfuzije u desnoj parijetalnoj regiji tijekom aktivacije u odnosu na lijevu (4,584 $\pm$ 2,041% i 3,374 $\pm$ 2,310%). Mjerenje promjena regionalnog moždanog krvotoka tijekom funkcijske aktivacije moguće je utvrditi primjenom obiju metoda. Funkcijski TCD pokazao je umjeren porast BSK u obje ACM tijekom izvođenja aktivacijskog zadatka.  $^{99m}\text{Tc}$ -HMPAO-SPECT pokazao je blagi porast regionalnog moždanog krvotoka u parijetalnim regijama tijekom kortikalne aktivacije. Obje metode mogu se primijeniti u procjeni aktivacije neuronskih skupina i neurovaskularnog sparivanja te u praćenju funkcionalnog oporavka bolesnika oboljelih od moždanog udara. Neuroaktivacijske studije dobivaju sve veće značenje u dijagnostici cerebrovaskularnih bolesti i razumijevanju plastičnosti mozga.

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#### SLUŠNI EVOCIRANI ODGOVOR MOŽDANOG DEBLA I TRANSKRANIJSKI DOPLER U BOLESNIKA S NEDAVNOM TRZAJNOM OZLJEDOM

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Cilj ovoga ispitivanja je bio utvrditi postoje li očite promjene u funkciji mozga koje se mogu otkriti pomoću

means of brainstem auditory evoked response (BAER) and transcranial Doppler sonography (TCD) in patients with recent whiplash injury. The measurements were performed in 30 patients with recent (less than 30 days) whiplash injury treated as outpatients Departments of Neurosurgery and of Neurology, Sestre milosrdnice University Hospital, and compared the findings with those of age-matched normal controls. Patients were diagnosed as suffering from a whiplash injury according to the mechanism of injury, all of them reporting primarily the symptoms connected with impairment of the vertebrobasilar circulation (vertigo, nausea, tinnitus, etc.). The brainstem evoked potentials were recorded using a Medelec sensor and analyzed using Apple Macintosh computer equipment. Recordings were made immediately upon admission. Recordings were taken from mastoid electrode with a reference linked to Cz. Latencies and amplitudes of waves I, II, III, IV and V were measured. Blood flow velocities were measured by means of TCD in ACC, ACM, ACA, ACP, AV and AB. Test results were analyzed using the one-way analysis of variance and  $\chi^2$ -test. The results showed the values of latencies of waves I-V in the group of patients with whiplash injuries to differ significantly from those in the group of normal controls, i.e. the latencies of waves I and III and IPL I-III and I-V were significantly slower in the group of patients with whiplash injuries. The amplitude of wave I was significantly smaller in the same group. No significant differences could be determined for the absolute values of blood flow velocities, but we found significantly more asymmetries in the group of patients with whiplash injuries. The results of both tests showed significant correlation with the clinical condition of the subjects and with each other. We believe that these results demonstrated that neural transmission along auditory pathways frequently shows a certain degree of dysfunction following a whiplash injury, especially in the early phases of stimulus transmission, mediated by cochlear nuclei and *n. statoacusticus*. The possible underlying pathology may be impairment of the blood supply, which does not even have to be obvious. Functional neurodiagnostics can help determine the functional impairment as well as to evaluate the effects of therapy administered.

slušnog evociranog odgovora moždanog debla (BAER) i transkranijске doplerske sonografije (TCD) u bolesnika s nedavnom trzajnom ozljedom. Mjerenja su provedena u 30 bolesnika s novijom (manje od 30 dana) trzajnom ozljedom liječenih ambulantno na Klinici za neurokirurgiju i Klinici za neurologiju, KB "Sestre milosrdnice", a nalazi su uspoređeni s onima dobivenim u kontrolnoj skupini zdravih osoba podjednake dobi. U bolesnika je trzajna ozljeda dijagnosticirana prema mehanizmu ozljede, a svi su ponajprije opisivali simptome povezane s poremećajem vertebrobasilarne cirkulacije (vrtočlavica, mučnina, tinitus itd.). Zapis evociranih potencijala moždanog debla bilježeni su pomoću senzora Medelec i analizirani pomoću računalne opreme Apple Macintosh. Zapisi su napravljeni odmah nakon prijma i to iz mastoidne elektrode uz referentnu elektrodu povezanu s Cz. Mjerene su latencije i amplitude valova I., II., III., IV. i V. Brzine protoka krvi mjerene su pomoću TCD u ACC, ACM, ACA, ACP, AV i AB. Rezultate pretraga analizirali smo uz primjenu jednosmjernе analize varijance i  $\chi^2$ -testa. Naši rezultati su pokazali da se vrijednosti latencija valova I-V u skupini bolesnika s trzajnom ozljedom značajno razlikuju od onih u skupini zdravih kontrolnih osoba, tj. latencije valova I. i III. te IPL I.-III. i I-V. bile su značajno niže u skupini bolesnika s trzajnom ozljedom. Amplituda vala I. bila je značajno manja u toj skupini. Nije bilo značajnih razlika u apsolutnim vrijednostima brzine protoka krvi, ali smo našli značajno više asimetrija u skupini bolesnika s trzajnom ozljedom. Rezultati obiju pretraga pokazali su značajnu korelaciju s kliničkim stanjem dotičnih osoba, kao i međusobno. Vjerujemo kako ovi rezultati pokazuju da neuralni prijenos u slušnim putovima često očituje stanovit stupanj disfunkcije nakon trzajne ozljede, poglavito u ranim fazama prijenosa podražaja posredovanih kohlearnim jezgrama i putem *n. statoacusticus*. Moguća osnovna patologija može biti poremećaj opskrbe krvlju, koja ne mora uvijek biti očita. Funkcijska neurodijagnostika može pomoći u utvrđivanju funkcijskog poremećaja, kao i u procjenjivanju učinaka primijenjene terapije.



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### 3D ULTRASOUND OF THE CIRCLE OF WILLIS AND VERTEBROBASILAR SYSTEM

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Little imaging possibilities are offered in exploration of the intracranial blood vessels. Often there are intracranial vascular events, like stenosis or occlusion, detected as causes of stroke occurrence. Our aim was to determine the potential use of three-dimensional transcranial color coded sonography (3D TCCS) for more detailed image acquisition of the intracranial blood vessels. In this study we included 10 volunteers: the circle of Willis and vertebrobasilar circulation were evaluated in 5 subjects each. Sector probes of 2.5 MHz were used for TCCS in all subjects and probes with fixed transducers was applied over 10 seconds using power Doppler sonography in free-handed three-dimensional technique. One subject was excluded due to inadequate bone window. In 2/5 patients both sides of the Willis circle were visualized and complete 3D reconstruction was performed. In another 2/5 patients only ipsilateral side of the Willis circle blood vessels was possible. In evaluation of the vertebrobasilar system 3D reconstruction was possible in all subjects allowing for detection of the point of origin of the basilar artery in 4/5 subjects. It is possible to use 3D TCCS as an additional exploration technique for intracranial blood vessel evaluation. However, it is necessary to apply conventional TCCS as well to get information on intracranial hemodynamics.

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### 3D ULTRASOUND IN EVALUATION OF THE VERTEBROBASILAR JUNCTION HEMODYNAMICS

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In our previous studies we have shown that three-dimensional ultrasound (3D US) reconstruction of images from transcranial color-coded sonography (TCCS) and power Doppler imaging is very useful in evaluation of the

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### 3D ULTRAZVUK WILLISOVA KRUGA I VERTEBROBAZILARNOG SUSTAVA

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Nije poznato mnogo načina za prikaz intrakranijskih krvnih žila. Često su promjene na intrakranijskim krvnim žilama poput stenoze ili okluzije uzrokom nastanka moždanog udara. Naš cilj je bio utvrditi je li moguće rabiti trodimenzijski transkranijjski bojom kodirani ultrazvuk (3D TCCS) za točniji prikaz intrakranijskih krvnih žila. U istraživanje je bilo uključeno 10 dobrovoljaca: 5 radi pregleda Willisova kruga, a 5 radi pregleda krvnih žila vertebrobazilarnog sustava. Za ispitivanje se je rabila sektorska sonda od 2,5 MHz za tehniku konvencionalnog TCCS te nakon toga ista sonda s pričvršćenim odašiljačem tijekom 10 sekundi uz pomoć power Dopplera, a primijenjena je tehnika "slobodnom rukom". Jedan bolesnik je isključen zbog nedostatnog koštanog prozora. U 2/5 ispitanika uspješno su se prikazale obje strane Willisova kruga te se je uspješno izvršila trodimenzijska rekonstrukcija. U dodatnih 2/5 ispitanika uspješno se je prikazati samo ispilateralna strana Willisova kruga. U procjeni krvnih žila vertebrobazilarnog sustava 3D rekonstrukcija je bila moguća u svih ispitanika, a u 4/5 uspješno se je prikazalo i polazište bazilarne arterije. Moguće je rabiti 3D TCCS kao dodatnu tehniku vizualizacije intrakranijskih krvnih žila. Ipak, treba primijeniti i konvencionalni TCCS kako bi se dobio uvid u hemodinamske značajke ispitivanih žila.

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### 3D ULTRAZVUČNI PRIKAZ CIRKULACIJE VERTEBROBAZILARNE SPOJNICE

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U našim prethodnim radovima pokazali smo da je trodimenzijski ultrazvučni (3D UZV) prikaz dobiven matematičkom rekonstrukcijom iz bojom kodiranog transkranijjskog doplera (TCCD) vrlo koristan u prikazu verte-

vertebrobasilar (VB) system. In most individuals the origin of basilar artery (BA) cannot be visualized due to unfavorable angle of the vertebral arteries (VA) junction or unfavorable angle of insonation. In such cases 3D US enables mathematical reconstruction of the VB junction. The aim of this study was to calculate the angle of VB junction by means of 3D US and to apply it in vector analysis of the VB junction hemodynamics. We tried to display 3D images of the intracranial parts of the VA and BA. Interactive 3D imaging software was integrated into an ultrasound platform (Aloka Prosound 5500). Data acquisition was performed using a 2.5 MHz sector transducer, freehanded in a fixed length of time (10 seconds), allowing for power Doppler (PD) sonography. The images were postprocessed (TomTec imaging system). The technique was applied in 25 patients in order to visualize all three vessels at the time, and to calculate the angle between each pair of vessels according to the direction of blood vessels. Hemodynamic parameters such as mean blood velocity (MBFV), pulsatility index (PI) and resistance index (RI) were measured in all three vessels. Vector analysis was applied for each hemodynamic parameter. We took real time measured MBFV, PI and RI values for VA and the angle value between VA and BA. We tried to find correlation between real time measured MBFV, PI and RI in BA, and mathematically calculated values for BA. In TCCS the angle between VA could be obtained in 19/25 patients. In 6 patients the angle between the VA and BA origin could not be adequately visualized, but mathematical reconstruction according to the direction of blood vessels was possible. 3D US enabled calculation of the angle between VA and BA.

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#### COMPARISON OF ARTERIAL STIFFNESS: M MODE vs THREE-DIMENSIONAL ULTRASOUND

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A decrease in common carotid artery (CCA) elasticity is a strong predictor for atherosclerosis and stroke. So far, no studies have been conducted on CCA vessel wall to compare two-dimensional and three-dimensional ultrasound. Our aim was to assess whether the use of three-dimensional ultrasound is comparable to two-dimensional ultrasound. We evaluated 10 volunteers with no appar-

brobazilarne (VB) spojnice. U najvećem broju slučajeva prikaz polazišta bazilarne arterije (BA) je otežan zbog kuta pod kojim se vertebralne arterije (VA) spajaju te samim time nepovoljnog kuta insonacije. U takvim slučajevima 3D prikaz nam omogućuje matematičku rekonstrukciju VB spojnice. Cilj ovoga rada bio je primijeniti 3D UZV u vektorskoj analizi hemodinamike VB spojnice. Za 3D prikaz VB spojnice uporabljen je kompjutorski program koji je ugrađen na UZV uređaj Aloka Prosound 5500. Snimanje je bilo provedeno osnaženim doplerom (PD) sa sektorskom sondom od 2,5 MHz vođenom rukom u fiksnom vremenu od 10 sekundi. Slike su naknadno obrađivane pomoću sustava TomTec za 3D rekonstrukciju. Istraživanje je provedeno u 25 ispitanika. Pokušali smo prikazati sve tri žile VB spojnice istodobno te prema smjeru žila odrediti kut između pojedinog para žila. Mjereni su i hemodinamski parametri za svaku žilu: srednja brzina strujanja krvi (SBSK), indeks pulzatilnosti (PI) i indeks otpora (RI). Vektorska naliza primijenjena je za svaki od tih parametara te su dobiveni rezultati uspoređeni s onima stvarno izmjerenim. Prikaz kuta VB spojnice pomoću TCCD bio je moguć u 19 ispitanika. U 6 ispitanika polazište bazilarne arterije nije se moglo primjereno prikazati, no matematičkom rekonstrukcijom iz dobivenih podataka je rekonstruirano polazište te su izračunati kutovi za svaki par žila.

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#### USPOREDBA KRUTOSTI ARTERIJSKE STIJENKE: M PRIKAZ PREMA TRODIMENZIJSKOM ULTRAZVUČNOM PRIKAZU

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Smanjenje elastičnosti u zajedničkoj karotidnoj arteriji (ACC) značajan je predskazatelj za nastanak ateroskleroze i moždanog udara. Dosad nije bilo istraživanja koja bi usporedila dvodimenzijski prikaz i trodimenzijski prikaz na ACC u ovakvoj analizi. Cilj istraživanja bio je procijeniti je li moguće upotrijebiti trodimenzijski ultrazvuk u ovakvoj

ent risk factors for stroke other than smoking. CCA elasticity was determined on a two-dimensional Aloka 5500 Prosound ultrasound platform using high resolution B-mode and M-mode. Initial calculation of two parameters, luminal strain (LS) and midwall strain (MS), was done by dividing the difference between systolic and diastolic diameters with diastolic diameter, the latter considering the CCA intima-media thickness. Afterwards, three-dimensional analysis was performed using a TomTec imaging system software. Kolmogorov-Smirnov one sample test using exponential distribution was used on data analysis. The mean intima-media thickness using two-dimensional B-mode was  $0.53 \pm 0.13$ , using two-dimensional M-mode  $0.52 \pm 0.16$  and using three-dimensional ultrasound  $0.61 \pm 0.14$  ( $p < 0.05$ ). LS on using two-dimensional M-mode was  $11.4 \pm 5.72$  and using three-dimensional ultrasound  $10.6 \pm 3.55$  ( $p < 0.05$ ). MS using two-dimensional M-mode was  $7.66 \pm 2.61$  ( $p < 0.05$ ) and using three-dimensional ultrasound  $9.01 \pm 4.84$  ( $p < 0.05$ ). It is possible to use three-dimensional ultrasound in evaluation of CCA early atherosclerosis.

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#### THROMBOTIC DIATHESIS AND MUTATION IN THE GENE FOR PROTHROMBIN (G20210A) – CASE REPORT

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The causes of thrombotic diathesis (thrombophilia) can be either acquired or inherited. There are a range of well-known inherited causes of diathesis, such as resistance to activated protein C due to mutation in the gene for factor V (FV Leiden), deficiency of antithrombin, protein C and protein S, mutations in the gene for prothrombin (G20210A), and infrequent dysfibrinogenemia. A 48-year-old man was hospitalized for acute weakness of the left extremities, followed by lowered sensory power on the left side of the body and central paresis of the left facial nerve. He had been receiving therapy moderate arterial hypertension for the last 15 years, and smoked 25-30 cigarettes a day. Five days after hospitalization, the neurologic deficit progressed to hemiplegia. Since computed tomography of the brain did not show any pathomorphologic substrate

analizi. U istraživanje je bilo uključeno 10 ispitanika koji nisu imali značajne čimbenike rizika za moždani udar osim pušenja. Elastičnost ACC mjerila se je ultrazvučnim uređajem Aloka 5500 Prosound uz uporabu B prikaza visoke rezolucije i M prikaza na dvodimenzijski način. Mjerenja su uključivala dva parametra: luminalni napor (LN) i napor stijenke (NS) u koji su uključene razlike promjera arterijske stijenke u sistoličnom i dijastoličnom dijelu srčanog ciklusa podijeljene s dijastoličkim promjerom, a NS je pritom uključivao i debljinu intimalnog dijela prednje i stražnje stijenke. Posljednji se je za usporedbu rabio trodimenzijski prikaz uz pomoć sustav "TomTec imaging system" programske potore. Odgovarajuće statističke metode upotrijebljene su za usporedbu među skupinama. Prosječna debljina stijenke u ACC upotrebom dvodimenzijskog ultrazvuka na B prikazu bila je  $0,53 \pm 0,13$  mm, na M prikazu  $0,52 \pm 0,16$  mm te trodimenzijskim prikazom  $0,61 \pm 0,14$  mm ( $p < 0,05$ ). LN uz pomoć M prikaza iznosio je  $11,4 \pm 5,72\%$ , a uz uporabu trodimenzijskog ultrazvuka  $10,6 \pm 3,55\%$  ( $p < 0,05$ ). NS uz pomoć M prikaza iznosio je  $7,66 \pm 2,61\%$  ( $p < 0,05$ ), a uz uporabu trodimenzijskog ultrazvuka  $9,01 \pm 4,84\%$  ( $p < 0,05$ ). Ovo istraživanje je pokazalo kako je moguće upotrijebiti trodimenzijski ultrazvuk u procjeni rane ateroskleroze na ACC.

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#### HIPERKOAGULABILNOST I MUTACIJA GENA ZA PROTROMBIN (G20210A) – PRIKAZ SLUČAJA

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Uzroci hiperkoagulabilnosti (trombofilije) mogu biti stečeni i nasljedni. Postoji niz poznatih nasljednih uzroka hiperkoagulabilnosti, poput rezistencije na aktivirani protein C uzrokovane mutacijom u genu za Faktor V (F V Leiden), nedostatka antitrombina, proteina C i proteina S, mutacije u genu za protrombin (G20210A), te rijetke disfibrinogenemije. Muškarac star 48 godina hospitaliziran je zbog akutno nastale slabosti lijevih udova praćene sniženim osjetom na lijevoj strani tijela te središnjom parezom lijevog ličnog živca. Posljednjih 15 godina liječi se zbog umjerene arterijske hipertenzije, puši 25-30 cigareta na dan. Petoga dana nakon hospitalizacije neurološki deficit napredovao je do hemiplegije. Kompjutoriziranom tomografijom mozga nije utvrđen patomorfološki supstrat sukladan nastalom neurološkom ispadu, pa je napravljena magnetna rezonancija mozga kojom se je u području

compatible with the newly developed neurologic disorder, magnetic resonance of the brain was also done to show hyperintensity of the blurred signal in T2 time in the cranial part of the pons on the left, and hypointensity of the signal in T1 time. Upon application of the paramagnetic contrast medium the mentioned change appeared blotchy along the edges. The described findings corresponded to subacute ischemic stroke, 18×12 mm in diameter. Duplex echosonography of the carotid and vertebral arteries revealed fibroid thickening of the walls of the common and internal carotid arteries bilaterally, with uneven inner contours and slightly increased vascular resistance, but without signs of reduction of the inner lumen.

Neurologic deficit was only partly reduced during rehabilitation. A year and a half after the stroke, the same patient experienced another disorder, intermittent claudication. Since the examination indicated obliterating atherosclerosis of terminal aorta and both iliac arteries (Leriche's syndrome), aorto-bifemoral bypass was placed (intervascular prosthesis, 18x9mm), and thromboendarterectomy was done on both sides of the common and deep femoral arteries. Two and a half years after the first stroke, echosonography revealed progressive changes in the carotids, i.e. reduction of lumen of the inner carotid arteries bilaterally (40% on the right and 30% on the left). Additional laboratory testing was done to reveal the presence of heterozygosity for G20210A. The onset of thrombotic diathesis in younger people requires additional diagnostic examination, including genetic testing for possible inherited factors.

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#### PIAL SYNANGIOSIS IN MOYAMOYA SYNDROME

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Moyamoya syndrome (MMS) is a chronic occlusive cerebrovascular disorder of unknown etiology, characterized by progressive stenosis of the supraclinoid segment of carotid arteries and proliferative collateral circulation. The children with MMS may sustain recurrent episodes of transient ischemic attacks (TIA), seizures, headache and recurrent strokes. Most surgical techniques attempt to establish collateral circulation in the ischemic region of the brain. The aim of this report is to present clinical char-

kranijskog dijela ponsa s desne strane prikazao hiperintenzitet signala mrljasta oblika u T2 vremenu, te hipointenzitet signala u T1 vremenu. Nakon injiciranja paramagnetskog kontrastnog sredstva promjena se rubno mrljasto imbibira. Opisani nalaz odgovara subakutnom ishemijskom infarktu promjera 18x12 mm. Dupleks ehosonografijom karotidnih i vertebralnih arterija utvrde se obostrana fibrozna zadebljanja stijenka zajedničkih i unutarnjih karotidnih arterija uz neravne unutarnje konture te blaže povišene vaskularne otpore, no bez znakova suženja unutarnjeg lumena.

Neurološki deficit je tijekom rehabilitacije tek dijelom regresirao. Godinu i pol nakon možanog udara bolesnik javlja intermitentne klaudikacije. Obradom je utvrđena obliterirajuća ateroskleroza terminalne aorte i obiju ilijačnih arterija (Lericheov sindrom), postavljena je aorto-bifemoralna premosnica (proteza Intervascular 18x9 mm), kao i obostrana tromboendarterektomija zajedničkih i dubokih bedrenih arterija. Dvije i pol godine nakon moždanog udara ehosonografski je utvrđena progresija promjena na karotidnim arterijama u smislu obostranog suženja lumena unutarnjih karotidnih arterija (40% desno, te 30% lijevo). Izvršena je dopunska laboratorijska obrada. Analizom je utvrđena prisutnost heterozigotnosti za G20210A. Pojava trombotske dijateze u mlađih ljudi zahtijeva dopunsku dijagnostičku obradu, što uključuje i gensko testiranje na moguće nasljedne čimbenike.

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#### PIALNA SINANGIOZA U SINDROMU MOYAMOYA

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Sindrom moyamoya (MMS) je kronični okluzivni cerebrovaskularni poremećaj nepoznate etiologije. Obilježen je progresivnom stenozom supraklinoidnog dijela karotidnih arterija i stvaranjem obilne kolateralne cirkulacije. Djeca s MMS mogu imati ponavljane epizode prolaznih ishemijskih napadaja (TIA), konvulzije, glavobolju i recidivirajuće infarkte. Većina kirurških tehnika pokušava uspostaviti kolateralnu cirkulaciju u ishemičnom dijelu mozga. Cilj ovoga prikaza je pokazati klinička obilježja, rezultate neuroradi-



acteristics, results of neuroradiologic studies, transcranial duplex Doppler (TCDD), and neurosurgical treatment in two children with MMS. Patient 1, a 7-year-old boy, had relapsing TIAs. He had no neurologic events. TCDD showed hypoperfusion in the area of anterior and middle cerebral arteries, more pronounced on the left, with abundant collateral circulation through the posterior cerebral artery. MRI revealed a previous stroke in the left hemisphere, whereas MRA confirmed hypoperfusion in the anterior, and hyperperfusion in the posterior part of the circle of Willis. DSA indicated stenosis of the anterior and middle cerebral artery with abundant collateral circulation characteristic of MMS. Patient 2, a 4-year-old girl, had recurrent headaches and vertigo without neurologic events. TCDD showed absence of signal in the anterior and middle cerebral arteries, with proliferating vascularization in the right posterior cerebral artery. MRI revealed multiple periventricular ischemic lesions bilaterally, primarily frontally and temporally, whereas MRA showed a network of irregular, partially dilated blood vessels, distally of the bifurcation of both internal carotid arteries, corresponding to MMS. Both patients were operated on. A modification of encephalo-duro-arterio-synangiosis, a neurosurgical technique in which arachnoidea was wide open, and adventitia of the "donor" superficial temporal artery was directly attached to the pia, i.e. "pial synangiosis", was performed. Patient 1 experienced no TIA or new ischemic insults on MRI during the 2.5-year follow up. Patient 2, operated on 9 months ago, also shows a favorable postoperative course.

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#### GALEN'S VEIN ANEURYSM IN INFANCY – CASE REPORT

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We report on a 3-year-old boy who was admitted to our Hospital at the age of five months because of macrocrania and ultrasonographic signs of communicating hydrocephalus. Brain ultrasonography also revealed an anechoic oval formation below the third ventricle, filled with color on transfontanellar color duplex Doppler (TCDD), which corresponded to vascular malformation. Brain computed tomography showed a hypodense oval structure between occipital horns, 20x11 mm in size. Brain magnetic reso-

loških pretraga, transkranijuskog dupleks doplera (TCDD) i neurokirurško liječenje u dvoje djece s MMS. Bolesnik 1, dječak u dobi od 7 godina, imao je recidivirajuće TIA. Nije imao neuroloških ispada. TCDD je pokazao hipoperfuziju u području prednje i srednje moždane arterije, izrazitije lijevo s bogatom kolateralnom cirkulacijom kroz stražnju moždanu arteriju. MRI je pokazala stari inzulat u lijevoj hemisferi, dok je MRA potvrdila hipoperfuziju u prednjem, a hiperperfuziju u stražnjem dijelu Willisova kruga. DSA je pokazala stenozu prednje i srednje moždane arterije s bogatom kolateralnom cirkulacijom tipičnom za MMS. Bolesnica 2, djevojčica u dobi od 4 godine, imala je recidivirajuće glavobolje i vrtoglavicu bez neuroloških ispada. TCDD je pokazao izostanak signala u prednjim i srednjim moždanim arterijama, uz bogatu vaskularizaciju u desnoj stražnjoj moždanoj arteriji. MRI je pokazala višestruke obostrane periventrikulske ishemijske lezije primarno frontalno i temporalno, a MRA mrežu nepravilnih, djelomice proširenih krvnih žila distalno od bifurkacije objiju unutarnjih karotidnih arterija, što bi odgovaralo MMS. Oboje bolesnika je operirano. Učinjena je modifikacija encefalo-duro-arterio-sinangioza, neurokirurška tehnika u kojoj je arachnoidea široko otvorena, a adventicija gornje temporalne arterije "davateljice" izravno je pripojena na piu, tj. "pialna sinangioza". Bolesnik 1 nije tijekom 2,5-godišnjeg praćenja imao TIA niti novih ishemijskih inzulata na MRI. Bolesnica 2, koja je operirana prije 9 mjeseci, također ima povoljan poslijeoperacijski tijek.

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#### ANEURIZMA GALENOVE VENE U DJETINJSTVU – PRIKAZ BOLESNIKA

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Prikazujemo 3-godišnjeg dječaka koji je primljen u našu kliniku u dobi 5 mjeseci zbog makrokranije, usporenog psihomotornog razvoja i ultrazvučnog nalaza komunicirajućeg hidrocefalusa. UZV glave pokazao je i anehogenu ovalnu formaciju ispod III. komore, koja se je na transkranijском obojenom Doppleru (TCDD) ispunila bojom, što bi odgovaralo vaskularnoj malformaciji. CT mozga je zabilježio hipodenznu ovalnu strukturu između okcipi-

nance imaging indicated an aneurysm of Galen's vein. The boy had neurologic signs of dystonia with normal funduscopy and EEG studies. Digital subtraction angiography confirmed aneurysmatic dilatation Galen's vein with drainage into the region of mediosagittal sinus. Aneurysm of Galen's vein is a special type of arteriovenous malformation resulting from abnormal communication between one or several cerebral arteries and Galen's vein. The most common clinical manifestation in infants is macrocrania due to progressive hydrocephalus, which is the result of increased venous pressure or compression of the Sylvian aqueduct. The treatment implies flow reduction through the fistula, which is best performed by intracranial radiologic techniques. At the age of nine months the boy underwent successful operative occlusion of the aneurysm feeding artery. Control TCDD showed normal cerebral circulation and head circumference showed no tendency of rapid growth as before the operation.

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#### EPI STATUS AS THE FIRST MANIFESTATION OF AV MALFORMATION

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A 45-year-old female was hospitalized after she had fallen at home, in her bathroom, blowing her head against the tub, sustained contusion hematoma frontally to the right, and lost consciousness. She was alone at home. She had no serious illness in her personal history and was not taking any medication. She was a smoker, 20 cigarettes daily for years. Family history normal. Organic-neurologic findings on admission: cardiac compensation, contusion area frontotemporally on the right. During examination, an episode of the loss of consciousness of grand mal type. Comatose postictally. Brain CT pointed to contusion of the frontal lobe on the right. After 12-h latency, involuntary jerks of the left extremities and left side of the face occurred, leading to secondary generalization after a few minutes. The patient developed epi status in spite of therapy administered, therefore she was intubated and anesthetized with Nesdonal. After 2 days, the patient was extubated, the seizures did not occur anymore, however, she was confused and disoriented. Control brain CT suggested AV malformation (AVM) frontally to the right. Brain MRI and MRA also indicated AVM. Tegretol was intro-

talnih rogova lateralnih komora, veličine 20x11 mm, što je prema nalazu MR mozga upućivalo na aneurizmu Galenove vene. Digitalna subtrakcijska angiografija (DSA) potvrdila je da se radi o aneurizmatškoj dilataciji Galenove vene s drenažom u mediosagitalni sinus. Aneurizma Galenove vene je arteriovenska malformacija koja je posljedica nenormalne komunikacije između jedne ili više moždanih arterija i Galenove vene. Najčešća klinička pojavnost u dojenačkoj dobi je makrokranija koja je posljedica progresivnog hidrocefalusa. Hidrocefalus je rezultat porasta venskog tlaka ili kompresije Sylviusova akvedukta s opstrukcijom protoka likvora. Intrakranijskim radiološkim tehnikama postiže se smanjenje protoka kroz fistulu. U dobi od 9 mjeseci dječaku je uspješno učinjena operacijska okluzija arterije hranilice aneurizme. Kontrolni TCDD je pokazao uredan moždani protok. Rast glave nije više bio ubrzan kao prije operacije, a psihomotorni razvoj dječaka odgovara kronološkoj dobi.

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#### EPI STATUS KAO PRVA MANIFESTACIJA AV MALFORMACIJE

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Bolesnica stara 45 godina primljena je na bolničko liječenje nakon što je iz nejasnog razloga pala kod kuće u kupaonici, udarila glavom o rub kade, zadobila kontuzijski hematom desno frontalno i izgubila svijest. Događaju nitko nije pribivao. Dotad nije teže bolovala i nije uzimala nikakve lijekove. Godinama puši oko 20 cigareta na dan. Obiteljska anamneza uredna. Iz organsko-neurološkog nalaza kod dolaska: kardijalno kompenzirana, kontuzijski areal desno frontotemporalno. Za vrijeme pregleda ima napadaj gubitka svijesti tipa grand mal. Postiktalno komatozna. Učinjen je CT mozga koji upućuje na kontuziju frontalnog režnja desno. Nakon latencije od 12 h nastupaju nevoljni trzaji lijevih ekstremiteta i lijeve strane lica, da bi nakon trajanja od nekoliko minuta došlo do sekundarne generalizacije. Usprkos primijenjenoj terapiji bolesnica ulazi u epi status zbog čega je intubirana i uvedena u anesteziju Nesdonalom. Nakon 2 dana bolesnica se ekstubira, napadaji se više ne javljaju, ali je smetena i dezorijentirana. Kontrolni CT mozga pokazuje da bi se moglo raditi o AVM desno frontalno. Preporučeni MR mozga i MR an-

duced in therapy, however, it was discontinued after 4 days because of elevated liver function tests. The patient's general condition improved, no new epi seizures occurred, and she was referred for additional neurosurgical treatment.

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### **SYMPTOMATIC EPILEPSY – CLINICAL PRESENTATION OF MULTIPLE CEREBRAL ANGIOMAS: CASE REPORT**

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A 49-year-old female was hospitalized for “tightening” in her right eye she felt three days before, followed by ptosis of the right eyelid and right-sided midriasis, lasting for a few minutes. Later, she felt the same discomforts but of shorter duration. Her medical history revealed she had experienced her first absence seizure at age 17, since when she has been suffering seizures of catamenial nature, and occasionally also of grand mal type. After the first seizure, she started taking antiepileptic therapy regularly. Ten years ago she underwent first CT and MR of the brain, when multiple bilateral hemangiomas were described. On admission, the patient was of a normal neurologic status. Laboratory tests pointed to mild anemia, GGT was 39 (35), serum methylphenobarbital 12 (15-40), and carbamazepine 4.5 (4-10). Ultrasound of the abdomen revealed a diffuse lesion of the liver parenchyma and cholelithiasis, whereas extracranial color Doppler showed a fibrous plaque in the left common carotid, reducing lumen by 30%-40%. The patient was examined by an internist and an ENT specialist. The internist described hypochromic anemia and leukopenia, probably due to AET, just like the liver lesion. As ENT examination revealed no hemangiomas on the mucosa, the internist concluded that it was not a case of Rendu-Osler-Weber disease. Brain MR showed pontine cavern, cortical AV malformation of the right frontal lobe, subcortical AV malformation of the left occipital lobe, and multiple white matter cavernomas bilaterally, whereas MR angiography showed no pathologic changes of the brain. MR finding did not differ significantly from those obtained 10 years before. Neurosurgical treatment (classic operation) was not indicated, and the patient was proposed a gamma-knife procedure, however, she refused it for now. The patient was discharged with recommendation to continue taking AET.

giografija također upućuju na AVM. U terapiju je uveden Tegretol, ali se nakon 4 dana ukida zbog porasta vrijednosti jetrenih testova. Opće stanje bolesnice se poboljšava, nema novih epi ataka i upućuje se na daljnje neurokirurško liječenje.

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### **SIMPTOMATSKA EPILEPSIJA – KLINIČKA PREZENTACIJA VIŠESTRUKIH CEREBRALNIH ANGIOMA: PRIKAZ SLUČAJA**

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Bolesnica stara 49 godina primljena je na bolničku obradu, jer je tri dana prije prijma osjetila “stezanje” u desnom oku, javila se ptoza desnog kapka i desnostrana midriaza. Smetnje su trajale nekoliko minuta. Slične tegobe je osjetila i prethodnih dana, ali kraćeg trajanja. In anamneze se doznaje da je prvi absans imala u dobi od 17 godina i da je otada imala napadaje katamenijalne naravi, a povremeno i napadaje tipa grand mal. Nakon prvog napadaja počela je redovito uzimati antiepileptičnu terapiju (AET). Prije 10 godina učinjen je prvi CT i MR mozga te su opisani višestruki obostrani hemangiomi. Prije dolaska imala je uredan neurološki nalaz. Laboratorijske pretrage ukazuju na blagu anemiju, GGT je 39 (35), serumski metilfenobarbital 12 (15-40), a karbamazepin 4,5 (4-10). Ultrazvuk abdomena pokazuje difuznu leziju jetrenog parenhima i kolelitijazu, a ekstrakranijski obojeni dopler fibrozni plak u lijevoj zajedničkoj karotidi, koji smanjuje lumen za 30%-40%. Bolesnicu pregledava internist i otorinolaringolog. Internist opisuje hipokromnu anemiju i leukopeniju koja je vjerojatno posljedica AET, kao i jetrena lezija. Kako pregled otorinolaringologa nije otkrio hemangiome na sluznicama, internist zaključuje kako nije riječ o Rendu-Osler-Weberovoj bolesti. MR mozga pokazuju pontini kavernom, kortikalnu AV malformaciju desnog frontalnog režnja, subkortikalnu AV malformaciju lijevog okcipitalnog režnja, te obostrane višestruke kavernome bijele tvari, dok MR angiografija ne pokazuje patološke promjene krvnih žila mozga. MR nalaz ne razlikuje se značajno u usporedbi sa snimkama od prije 10 godina. Neurokirurško liječenje (klasična operacija) nije bilo indicirano, ali je predložen zahvat gama-nožem koji je bolesnica zasad odbila. Otpuštena je s preporukom da i dalje uzima AET.

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### ROLE OF D-DIMER IN STROKE

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The plaques formed in fast flow arteries are mostly composed of platelets and contain small amounts of fibrin. These so-called white thrombi can easily detach from the arterial wall and embolize any distal segment, thus causing transient or permanent ischemia. This pathophysiological process is also responsible for cerebral ischemia which in turn is the culprit for a high proportion of strokes. Analysis of specific fibrinopeptides, the products of fibrin breakdown, such as D-dimer, is used in the diagnostic algorithm for pulmonary embolism and deep vein thrombosis as an example of peripheral embolization of blood vessels. According to literature data, the role of D-dimer in the early diagnosis of stroke has been investigated. The aim of our study was to determine the role of D-dimer in a group of patients treated at our hospital. A positive test for D-dimer points to the presence of the plasma detached, insoluble, cross-linked fibrin. There are two types of tests for D-dimer: latex agglutination and ELISA. We used ELISA. We observed correlation between D-dimer increase and neurologic deficit progression as evaluated by the Scandinavian Stroke Scale (SSS) in order to evaluate the possible role of D-dimer as a surrogate marker of stroke progression (severity). There were 30 patients consecutively hospitalized at Department of Neurology in Varaždin with clinical symptoms of stroke. D-dimer and SSS were determined on admission and after 24-hour hospital stay. Change in D-dimer values was found to correlate with the neurologic deficit progression in the study group. Also, correlation between stroke extent as evaluated from axial spiral tomograms of the brain, and the study parameters will be illustrated.

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### ULOGA D-DIMERA U MOŽDANOM UDARU

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Ugrušci koji se stvaraju u arterijama s brzim protokom sastavljeni su uglavnom od trombocita i sadrže male količine fibrina. Ovi tzv. bijeli trombi mogu se lako odvojiti od arterijske stijenke i embolizirati bilo koji distalni dio izazivajući tako privremenu ili trajnu ishemiju. Taj je patofiziološki proces odgovoran i za cerebralnu ishemiju koja je odgovorna za velik broj moždanih udara. U algoritmu dijagnostike plućne embolije i duboke venske tromboze kao primjera periferne embolizacije krvnih žila primjenjuje se analiza specifičnih fibrinopeptida, proizvoda razgradnje fibrina, kao što je D-dimer. Prema podacima iz literature istražuje se uloga D-dimera u ranoj dijagnostici moždanog udara. Cilj našega rada bio je utvrditi ulogu D-dimera u promatranoj skupini bolesnika našega odjela. Pozitivna pretraga na D-dimer označava prisutnost od plazmina odcijepljenog, netopljivog, križno povezanog fibrina. Postoje dvije vrste pretrage na D-dimer: lateks aglutinacija i ELISA. Mi smo rabili test ELISA. Praćena je korelacija između porasta D-Dimera i progresije neurološkog deficita mjenom ocjenkom ljestvicom SSS (Scandinavian Stroke Scale) u cilju evaluacije D-dimera kao surrogatnog biljega progresije (težine) moždanog udara. Ukupno je bilo 30 bolesnika susljedno primljenih na Neurološki odjel OBV s kliničkim simptomima moždanog udara. D-Dimeri i SSS su određeni kod prijma i nakon 24 sata boravka na odjelu. Uočena je korelacija promjene vrijednosti D-Dimera i progresije neurološkog deficita u promatranoj skupini. Prikazujemo i slikovnu korelaciju opsega moždanog udara prema snimkama aksijalne spiralne tomografije mozga i promatranih parametara.



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### NEUROLOGIC DEFICIT IN PATIENTS WITH EARLY AND LATE SYMPTOMATIC MANIFESTATIONS DURING AND AFTER STROKE

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According to Framingham study, stroke entails a variety of sequels. They belong to a clinical category with various motor disorders, communication abnormalities, disorders of vision, sensibility, urine incontinence, different types of early and late epileptic manifestations, and a category known as the quality of life with disability degree, i.e. able or unable to perform daily activities such as eating, clothing, bathing, walking, making bed, personal hygiene, etc., graded as dependent/independent, partially dependent, completely dependent and psychologically dependent. The aim of the study was to assess the correlation between neurologic deficit and the occurrence of early and late epileptic seizures during and after stroke, as well as to determine the level of difference significance between each neurologic finding, and early and late epileptic seizures. The study included 160 patients with symptomatic early and late epileptic seizures during and after different types and subtypes of stroke. All patients were treated at Neurology Department, Sarajevo Clinical Center, from January 1, 1989 till December 31, 1998. Clinical and statistical processing was done by use of a specifically designed questionnaire with four groups of items: basic data, risk factors, stroke, and epileptic seizures. A total of 7001 patients with different types and subtypes of stroke were treated during the 10-year period, 104 of them, with late epileptic manifestations and 56 with early epileptic manifestations. Considering neurologic deficit, differences in the number of findings according to neurologic deficit were highly significant. Left and right hemiparesis and left hemiplegia were most common, whereas visual and sensibility abnormalities, and meningeal syndrome were most infrequently recorded. Testing of differences between late and early epileptic seizures compared to neurologic findings yielded a low level of significance for left hemiparesis ( $\chi^2=88.5$ ;  $p<0.01$ ) and high significance for left hemiplegia in the group with early seizures ( $\chi^2=8.128$ ;  $p<0.01$ ); the difference was not significant for right paresis, however, the difference between patients with early and those with late seizures was significant for right hemiplegia. It is concluded that the most common signs in patients with

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### NEUROLOŠKI DEFICIT KOD BOLESNIKA SA SIMPTOMATSKIM RANIM I KASNIM EPILEPTIČNIM MANIFESTACIJAMA U TOKU I POSLIJE MOŽDANOG UDARA

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Prema Framinghamskoj studiji sekvele nakon moždanog udara su različite. Svrstavaju se u kategoriju kliničkih sa različitim motornim ispadima, smetnjama komunikacije, poremećajima vida, senzibiliteta, inkontinencijom alvi i urinae, različitim tipovima ranih i kasnih epileptičkih manifestacija i kategoriju sa oznakom kvaliteta života uz stupanj onesposobljenosti, odnosno osposobljenosti sa oznakom sposoban/nesposoban za obavljanje osobne higijene, pri ishrani, pri oblačenju, kupanju, hodanju, spremanju kreveta uz oznake ovisan/neovisan, djelimično ovisan, potpuno ovisan i psihički ovisan. Cilj rada bio je utvrditi korelaciju između neurološkog deficita sa pojavom ranih i kasnih epileptičkih napada u toku i nakon moždanog udara, kao i odrediti razinu značajnosti razlike između pojedinih neuroloških nalaza, ranih i kasnih epileptičkih napada. Materijal za naš rad je 160 bolesnika sa simptomatskim ranim i kasnim epileptičkim napadima u toku i poslije različitih tipova i podtipova moždanog udara. Svi bolesnici su liječeni na Neurološkoj klinici KCU u Sarajevu od 1. 1. 1989. do 31. 12. 1998. Za kliničku i statističku obradu upotrebljen je specijalno dizajniran upitnik sa četiri grupe pitanja: osnovni podaci, čimbenici rizika, moždani udar i epileptički napadi. U promatranom desetogodišnjem razdoblju liječen je ukupno 7001 bolesnik sa različitim tipovima i podtipovima moždanog udara. Kasne epileptičke manifestacije imalo je 104 bolesnika, 56 bolesnika je imalo rane epileptičke manifestacije. U odnosu na neurološki deficit možemo reći da su razlike u broju nalaza u zavisnosti od neurološkog deficita visoko značajne: najčešće su lijeva i desna hemipareza te lijeva hemiplegija. Najmanje su se javljali ispadi u vidnom polju, ispadi senzibiliteta i meningealni sindrom. Testiranje razlike između kasnih i ranih epileptičkih napada spram neurološkog nalaza: za lijevu hemiparezu nađena je niža razina značajnosti ( $\chi^2=88,5$ ;  $p<0,01$ ), za lijevu hemiplegiju utvrđena je visoka značajnost za grupu bolesnika sa ranim napadima ( $\chi^2=8,128$ ;  $p<0,01$ ), za desnu hemiparezu razlika nije značajna, dok je razlika između bolesnika sa ranim i kasnim napadima za desnu hemiplegiju značajna. Možemo zaključiti da su na-

symptomatic epileptic seizures are left and right hemiparesis and left hemiplegia. Early epileptic seizures significantly correlate with plegia of one or the other side of the body, more commonly with the left side. Parietotemporal region ("insult hemisphere") can be identified as a predictor of symptomatic early and late epileptic seizures during and after stroke.

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#### THROMBOEMBOLIC INCIDENTS IN THE POSTPARTAL PERIOD

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A female born in 1983, until then a healthy puerpera, was hospitalized after two epileptic attacks for the first time in her life. Brain CT showed a subcortical focal lesion parietally to the right with surrounding edema. Upon stabilization of the patient's condition under the diagnosis of stroke, she was transferred to our Department for further management. Generally healthy, she had given birth to a healthy male newborn 14 days before. She denied abuse; from family history, her father and brother suffered from epilepsy. Organic-neurologic status on admission: conscious, normal verbal contact, pale, adynamic, cardiopulmonary compensation, no focal neurologic events. Two ischemic lesions parietooccipitally on the right and frontally on the left were verified on brain MR, with normal MR angiography. On the second day of hospital stay, the patient became febrile, dyspneic, tachypneic, complaining of chest pain, physical activity intolerance; upon consultation with an internist, additional studies were performed to raise suspicion of pulmonary embolism, which was subsequently verified by scintigraphy; also, left leg phlebothrombosis was found as the cause of embolism. Further examinations and treatment were performed at Department of Medicine, where she was administered heparin and warfarin, AT III, anemia was corrected, along with other therapy as needed. The patient's clinical condition improved, there were no new episodes of consciousness disturbance. The examinations performed did not indicate autoimmune disease, so it was concluded that multiple thromboembolic incidents (ischemic stroke, lower leg venous thrombosis, pulmonary embolism) must have been a complication of the early postpartal period.

jčešći neurološki znaci kod bolesnika sa simptomatskim epileptičkim napadima lijeva i desna hemipareza i lijeva hemiplegija. Rani epileptički napadi značajno koreliraju sa plegijom jedne ili druge strane tijela, češće sa lijevom. Parijetotemporalna regija "inzult hemisfere" može se identificirati kao prediktor ranih i kasnih epileptičkih simptomatickih napada u toku i poslije moždanog udara.

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#### TROMBOEMBOLIJSKI INCIDENTI U POSTPARTALNOM RAZDOBLJU

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Bolesnica rođena 1983., dotada zdrava babinjača, hospitalizirana je nakon dvije epi atake prvi puta u životu. CT mozga je pokazao subkortikalnu žarišnu leziju parijetalno desno s okolnim edemom. Nakon stabilizacije stanja pod dijagnozom moždanog udara premještena je na našu Neurološku kliniku radi daljnje obrade. Uglavnom zdrava, prije 14 dana je urednim porodom rodila zdravog dječaka. Negira abuzus, u obitelji otac i brat boluju od epilepsije. Organsko-neurološki status kod prijma: pri svijesti, urednog verbalnog kontakta, blijeda, adinamična, kardiorpulmonarno kompenzirana, bez fokalnih neuroloških ispada.

Magnetska rezonanca mozga verificira dvije ishemijske lezije parijetookcipitalno desno i frontalno lijevo, uz uredan nalaz MR angiografije. Drugoga dana boravka postaje dispneična, tahipneična, febrilna, žali se na bolove u prsima, ne podnosi tjelesnu aktivnost, te se u konzultaciji s internistom učini indicirana obrada kojom se postavi sumnja na plućnu emboliju, što se kasnije potvrđuje scintigrafskim nalazom, a također se nađe flebotromboza vena lijeve potkoljenice kao uzrok embolije. Daljnji tijek obrade i liječenja provode se na Internoj klinici gdje je liječena heparinom i varfarinom, AT III., korigirana anemija, uz ostalu terapiju. Kliničko stanje bolesnice u dobrom poboljšanju, novih ataka kriza svijesti nije bilo. Učinjenom obradom nije otkrivena autoimuna bolest, pa se zaključuje da višestruki tromboembolijski incidenti (ishemijski moždani udar, tromboza vena noge, plućna embolija) predstavljaju komplikaciju u ranom poslijeporođajnom razdoblju.

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### EMBOUZATION OF AV MALFORMATION AFTER HEMORRHAGE

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Upon appointment, a 22-year-old female was transferred to our Department from another institution where intracerebral and intraventricular hemorrhage was diagnosed, with suspicion of AV malformation. According to history data, two days before admission the patient had complained of headache accompanied by nausea and vomiting. She had already experienced similar complaints on several occasions, for which she had been treated at emergency unit, however, she had never undergone diagnostic workup. Organic-neurologic status on admission: no motor deficit or cranial nerve events, stiff neck. Neurologic examination included angiography which revealed deep central vascular malformation with drainage mostly *via* a. choroidea anterior and temporal media branches, then through Galen's vein and sinus rectus. A minor portion of the malformation was also supplied by a. choroidea posterior branches. A neurosurgeon was consulted, who suggested operative therapy or embolization, which was performed on two occasions in Zürich. The first embolization of 80% malformation was performed two months after the incident, and the second procedure with 90% embolization one year later. The patient feels subjectively well and has been free from neurologic events.

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### CORRELATION BETWEEN C-REACTIVE PROTEIN, STROKE SEVERITY AND DISABILITY AFTER ACUTE ISCHEMIC STROKE

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*Background and purpose:* Elevated levels of inflammation markers, notably C-reactive protein (CRP) are predictive of cardiovascular disease. The aim of this study was to examine the relationships between CRP and stroke severity and between CRP and disability after acute ischemic

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### EMBOUZACIJA AV MALFORMACIJE NAKON KRVARENJA

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Bolesnica u dobi od 22 godine premještena je dogovorno na našu kliniku iz matične ustanove gdje joj je dijagnosticirano intracerebralno i intraventricularno krvarenje te postavljena sumnja na AV malformaciju. Prema anamnestičkim podacima bolesnica se dva dana prije prijma žalila na glavobolju praćenu mučninom i povraćanjem. Slične tegobe imala je i ranije u više navrata, zbog čega je liječena u hitnoj medicinskoj pomoći, ali nikada nije učinila dijagnostičku obradu. Organsko-neurološki status kod dolaska: bez motornog deficita i ispada kranijalnih živaca, šija kočena. U okviru neurološke obrade učinjena je angiografija koja je pokazala duboku centralnu žilnu malformaciju uz drenažu pretežno preko a. choroidee anterior, kao i temporalnih grana medie i odvodom preko vene Galeni i sinus rectusa. Manji dio malformacije opskrbljen je i ograncima a. choroidee posterior. Konzultiran je neurokirurg koji je preporučio operacijski zahvat ili embolizaciju koja je učinjena u dva navrata u Zürichu. Dva mjeseca nakon incidenta učinjena je prva embolizacija 80% malformacije, a godinu dana kasnije i druga uz 90% embolizaciju. Nakon provedene terapije bolesnica je subjektivno dobro i bez neuroloških ispada.

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### POVEZANOST C-REAKTIVNOG PROTEINA S TEŽINOM AKUTNOG ISHEMIČNOG MOŽDANOG UDARA TE NJEGOVIM ISHODOM

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Uvod: Povišene razine markera upale, osobito C-reaktivnog proteina (CRP), prediktori su kardiovaskularnih bolesti. *Cilj ispitivanja:* Utvrđivanje povezanosti serumskih koncentracija CRP-a i težine i ishoda akutnog ishemičnog

stroke. *Methods:* CRP was determined within 24 hours after stroke in 130 patients. We examined stroke severity on the National Institute of Health Stroke Scale (NIHSS) and accordingly divided patients into three groups: with mild (NIHSS<8), moderate (NIHSS 8-16) and severe (NIHSS>16) stroke. Disability after stroke was determined on the Barthel index (BI) at the hospital discharge and subsequently patients were divided into three groups: with severe (BI 0-59), moderate (BI 60-84) and mild (BI 85-100) disability. *Results:* 51 patients (39,23%) had mild stroke with median CRP values 11,71 ( $p<0,005$ ), 47 (36,15%) had moderate stroke with median CRP values 24,81 ( $p<0,005$ ) and 32 (24,62%) had severe stroke with median CRP values 42,35. 59 (45,38%) patients had severe disability, their median CRP values were 38,32; 28 (21,54%) had moderate disability with median CRP values 14,48 and 43 patients (33,08) had mild disability with median CRP values 11,12 ( $p<0,005$ ). *Conclusions:* Elevated CRP concentrations are correlated with stroke severity and disability. These findings are consistent with a role of inflammation as one of the important risk factor for atherosclerosis.

moždanog udara. *Bolesnici i metode:* CRP je određivan unutar 24 sata od nastanka moždanog udara u 130 bolesnika. Težina moždanog udara određivana je prema National Institute of Health Stroke Scale (NIHSS) te su bolesnici podijeljeni u tri skupine: s lakšim (NIHSS<8), srednje teškim (NIHSS 8-16) i teškim (NIHSS>16) moždanim udarom. Ishod moždanog udara određivan je kod otpusta bolesnika prema Barthelovoj ljestvici te su bolesnici podijeljeni u tri skupine: s teškim (BI 0-59), srednje teškim (BI 60-84) i lakšim invaliditetom (BI 85-100). *Rezultati:* 51 bolesnik (39,23%) je imao lakši moždani udar s prosječnom vrijednošću CRP 11,71; 47 (36,15%) je imalo srednje teški moždani udar s prosječnim vrijednostima CRP-a 24,81 i 32 (24,62%) je imalo težak moždani udar s prosječnim CRP vrijednostima 42,35 ( $p<0,005$ ). Kod 59 (45,38%) bolesnika je zaostala teška invalidnost, prosječna vrijednosti CRP-a u tih bolesnika je 38,32; 28 bolesnika (21,54%) s umjerenom invalidnošću imalo je prosječnu vrijednost CRP-a 14,48; te 43 bolesnika (33,08%) s lakšom invalidnošću imalo je prosječnu vrijednost CRP-a 11,12 ( $p<0,005$ ). *Zaključci:* Povećane koncentracije CRP su povezane s težinom i ishodom moždanog udara. Ovi nalazi su konzistentni s dosadašnjim spoznajama o upali kao bitnom rizičnom faktoru za razvoj ateroskleroze.



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