SAŽETAK

Uvod: Moždani udar označava naglo nastali, fokalni nekonvulzivni neurološki poremećaj, do kojeg dolazi usled vaskularnog oštećenja.

Cilj: Cilj studije bilo je praćenje svih pacijenata koji su se u određenom vremenskom periodu javili službi Urgentnog centra, usled nastanka nekog neurološkog deficita.

Materijali i metode: U periodu od mesec dana, pratili smo 123 pacijenta koji su priljubi na Četiri koristi remanje sa nekim neurološkim deficitom, a ureden je natančno univerzitet od vaskularnog oštećenja. Svi pregledi su rađeni na 16-slajsnom aparatu – GE BrightSpeed, USA. Nakon inicijalne nativne dijagnosticke, u zavisnosti od nalaza, pregled se ili prekinuo, ili se administriralo kontrastno sredstvo i rađen je postkontrastni pregled ili CT angiografija.

Rezultati: Najveći broj pacijenata sa vaskularnim neurološkim deficitom je bio životnom dobu između 50 i 59 godina, dok je najmanji broj pacijenata registrovan u grupi osoba životnog doba ispod 40 godina. Najveći broj pacijenata ženskog pola bio je izražen od 50 do 59 godina, dok je najveći broj pacijenata muškog pola bio starosti od 40 do 49 godina. Od 94 pacijenta koji su razvili moždani udar, 78 (83%) pacijentima je imalo ishemijski moždani udar, dok je 16 (17%) pacijentima imalo hemoragijski moždani udar. Ne postoji statistički značajna razlika u javljanju supratentioralne hemoragije i subarahnoidalne hemoragije među polovima. Lokalizacija ishemijskog infarkta mozga nalazila se u zoni vaskularizacije prednje supratentioralne hemoragije i subarahnoidalne hemoragije među polovima. Responsible authors: Kristina Davidović

Zaključak: Nativni CT pregled je zlatni standard za trijažu pacijenata sa akutnim moždanim udarom. Preučen CT skeniranja u proceni pacijenata sa akutnim moždanim udarom se praktičnost, preciznost, brzina i dostupnost CT uredaja. Takođe, CT skeniranje ima i prognoštu vrednost koja je potrebna za prihvat uživanje i respiracijsku terapiju.

Ključne reči: komputerizovane tomografije, ishemijski moždani udar, hemoragijski moždani udar

ABSTRACT

Introduction: A stroke is a sudden, focal nonconvulsive neurological dysfunction which occurs due to vascular damage.

Aim: The aim of the study was monitoring all patients who reported to the Emergency Center due to some neurological deficit, within a particular period of time.

Materials and methods: For a period of one month, we monitored 123 patients who were admitted to the Department of Emergency Diagnostics with some form of neurological deficit and who underwent a native computed tomography (CT) scan and/or angiographic examination of the endocranium. All examinations were performed with the GE BrightSpeed 16 Slice CT scanner (USA). After initial native CT diagnostics, depending on the finding, the examination was either stopped, or the contrast dye was administered and postcontrast examination was performed or CT angiography was carried out.

Results: Most of the patients with vascular neurological deficit were between 50 and 59 years old, while a smaller number of patients was registered in the age group of persons younger than 40 years. Most of the female patients were in the 50 – 59 age group, while most of the male patients were between 40 and 49 years old. Of the 94 patients who developed stroke, 78 (83%) patients had ischemic stroke, while 16 (17%) patients suffered hemorrhagic stroke. There is no statistically significant difference in the occurrence of intracerebral hemorrhage and subarachnoid hemorrhage between the sexes. The localization of ischemic brain infarction was in the vascular territory of the anterior cerebral artery (ACA) – 3.2% of cases, the middle cerebral artery (MCA) – 38.9% of cases, the internal carotid artery (ICA) – 8.4% of the patients, the basilar artery (BA) – in 13.7% of the cases, the posterior cerebral artery (PCA) – in 7.4% of the patients, the vertebral artery (VA) – 9.5% of the cases, and the supratentorial watershed areas of arterial irritation – in 11.7% of the patients.

Conclusion: Native CT examination is the golden standard for the triage of patients with acute stroke. The advantages of using a CT scan in the assessment of patients with acute stroke are that it is practical, precise, quick and available. CT imaging has prognostic value as well, as it can predict the response to the administered thrombolytic therapy.

Key words: computed tomography, ischemic stroke, hemorrhagic stroke

Author for correspondence:
Kristina Davidović
Center for Radiology and Magnetic Resonance Imaging, University Clinical Center of Serbia
2 Pasterova Street, 11000 Belgrade, Serbia
E-mail: dr.kristina.davidovic@gmail.com

Corresponding author:
Kristina Davidović
Center for Radiology and Magnetic Resonance Imaging, University Clinical Center of Serbia
2 Pasterova Street, 11000 Belgrade, Serbia
E-mail: dr.kristina.davidovic@gmail.com

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UVOD

Acute stroke is the second most common cause of death in the world and the first most common cause of disability in developed countries. It is estimated that one person suffers stroke every 45 seconds, while there is one death related to acute stroke every three minutes, in the world. The incidence of stroke in developed countries is 100 – 150 cases per 100,000 population, per year. In Serbia, however, it is significantly higher and is estimated at 300 cases per 100,000 population, per year. Only around a half of the surviving patients remain independent after stroke, while 30% are incapable of living without assistance. A significant number of patients, around 20%, suffer a repeated stroke [1].

A stroke is a sudden, focal nonconvulsive neurological dysfunction which occurs due to vascular damage. The basic characteristic of stroke is sudden onset of neurological symptoms. However, neuro-visualization techniques (CT – computed tomography; MRI – magnetic resonance imaging) can also reveal so called “silent brain infarcts”, which develop without clear clinical manifestation.

Stroke is classified according to the pathology which is at the core of the focal brain damage. Therefore, we recognize two types of stroke – ischemic and hemorrhagic stroke [2]. The occurrence of a headache, vomiting, epileptic seizures, or coma, indicate, with a higher degree of certainty, that the cause of stroke is hemorrhage, however, the only reliable method of definitively determining the type of stroke is scanning the head with a CT scanner.

The contemporary concept of stroke as an emergency, requires a fast, focused, and precise diagnosis, on which not only the type of therapeutic approach is dependent, but also the prognosis of the illness. The recommended method and the method of choice in emergency neurological states is the native CT scan, which enables the exclusion of other, nonvascular causes of neurological deficit and the selection of patients eligible for different emergency therapeutic procedures (e.g., administering thrombolytic and other reperfusion therapy options, performing emergency endovascular procedures) [3].

The aim of the study was monitoring all patients who reported to the Emergency Center due to some neurological deficit, within a particular period of time. Based on the obtained results, we can draw conclusions on the advantages and disadvantages of early multidetector computed tomography (MDCT) examination within the diagnostics of acute stroke.

MATERIJALI I METODE

During the period between December 1, 2017 and January 1, 2018, we monitored 123 patients who were admitted to the Department of Emergency Diagnostics of the
nativni CT i/ili angiografski pregled endokranijuma. Svi pregledi su rađeni na 16-slajsnom CT aparatu – GE, Brightspeed, USA. Nakon inicijalne nativne CT dijagnostike, u zavisnosti od nalaza, pregled se ili prekidao, ili se administriralo kontrastno sredstvo i rađen je postkontrastni pregled, ili je rađena CT angiografija.

Rezultati su obrađeni metodama deskriptivne (srednja vrednost, medijana, modus) i analitičke (X² test) statistike.

REZULTATI

U periodu od 1.10.2017. do 1.2.2018. godine, u Urgentnom centru Univerzitetskog kliničkog centra Srbije je primljeno 123 pacijenta sa nekim neurološkim deficitom. Od ukupno 123 pacijenata, 20 pacijenata je na nativnoj CT dijagnostiki imalo nevaskularnu patologiju. Kao što se vidi na Slici 1, ženski pol je bio dominantan, u odnosu 1,5:1 (Slika 1).

The results were processed with methods of descriptive (mean, median, mode) and analytical (X² test) statistics.

RESULTS

During the period between December 1, 2017 and January 1, 2018, 123 patients were admitted to the Department of Emergency Diagnostics of the University Clinical Center of Serbia with some form of neurological deficit and who underwent a native computed tomography (CT) scan and/or angiographic examination of the endocranium. All examinations were performed with the GE BrightSpeed 16 Slice CT scanner (USA). After initial native CT diagnostics, depending on the finding, the examination was either stopped, or the contrast dye was administered and postcontrast examination was performed or CT angiography was carried out.

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University Clinical Center of Serbia with some form of neurological deficit and who underwent a native computed tomography (CT) scan and/or angiographic examination of the endocranium. All examinations were performed with the GE BrightSpeed 16 Slice CT scanner (USA). After initial native CT diagnostics, depending on the finding, the examination was either stopped, or the contrast dye was administered and postcontrast examination was performed or CT angiography was carried out.
In the remaining 9%, the deficit in question was transient ischemic attack (TIA) (Figure 4).

Of the 94 patients who suffered stroke, 78 (83%) patients sustained ischemic stroke, while 16 (17%) patients had hemorrhagic stroke (Figure 5).

Of the 16 patients with hemorrhagic stroke, there were 10 (62.5%) women, while 6 (37.5%) patients were men. Intracerebral hemorrhage (ICH) was found in 7 (43.75%) patients, of whom 3 were women, while 4 were men. A total of 9 (56.25%) patients suffered subarachnoid hemorrhage (SAH) – 7 women and 2 men (Table 1). There was no statistically significant difference in the occurrence of ICH or SAH between the sexes, $p = 0.152$.

Of all the patients with vascular etiology, thrombolytic therapy was administered in 24 (23.3%) persons, while 79 (76.7%) patients had contraindications for the application of this therapy. The most frequent contraindications were a developed ischemic zone visible on CT (in 25.3% of the cases) and intracerebral hemorrhage visible on CT (in 20.3% of the cases). After intravenous administration of thrombolytic therapy, intracerebral hemorrhage with a consequent lethal outcome developed in 5 (0.2%) patients (Figure 6).

The localization of ischemic brain infarction was in the vascular territory of the anterior cerebral artery (ACA) – 3.2% of the cases, the middle cerebral artery (MCA) – in 38.9% of the cases, the internal carotid artery
The importance of multidetector computed tomography in acute stroke detection, monitoring and selection of therapy

Lokalizacija ishemijskog infarkta mozga nalazila se u zoni vaskularizacije prednje moždane arterije (engl. anterior cerebral artery – ACA) – u 3,2% slučajeva, srednje moždane arterije – u 38,9% slučajeva, unutrašnje karotidne arterije – (engl. internal carotid artery – ICA) kod 8,4% pacijenata, bazilarne arterije (engl. basilar artery – BA) – u 13,7% slučajeva, zadnje moždane arterije (engl. posterior cerebral artery – PCA) – kod 7,4% pacijenata, vertebralne arterije (engl. vertebral artery – VA) – u 9,5% slučajeva, i u watershed supratentorialnim zonama arterijske irrigacije – kod 11,7% pacijenata (Slika 7).

**DISCUSSION**

Of the 123 patients with some form of neurological deficit who were included in the study, 103 patients had a deficit of a vascular origin. Of those 103 patients, 61% were female. Appelros et al. showed the opposite results in their study [1,2,3]. The greatest number of fe-
DISKUSIJA
Od 123 pacijenta sa neurološkim deficitom koji su bili obuhvaćeni istraživanjem, njih 103 je imalo deficit vaskularne geneze. Od ta 103 pacijenta, 61% su bile osobe ženskog pola. Apelros i saradnici su u svom istraživanju pokazali suprotno [1,2,3]. Najveći broj pacijenata ženskog pola bio je uzrasta od 50 do 59 godina, iza kojih su bili pacijenti u sedmoj i osmoj deceniji života, dok su pacijentkinje mlađe od pedeset godina oboljevale u znatno nižem procentu. Ovo se može objasniti činjenicom da su žene u menopauzu pod većim rizikom od dobijanja kardiovaskularnih oboljenja [4]. Pored toga, deset godina nakon menopauze, rizik od moždanog udara se udvostručuje kod žena. Pad nivoa endogenog estrogena za oko 60% dovodi do viša androgenih hormona, što može da dovede do povećanih faktora rizika za nastanak kardiovaskularnih oboljenja. S druge strane, najveći broj pacijenata muškog pola je bio od 40 do 49 godina, što može ukazati na faktore rizika koji su povezani sa načinom života. To su pušenje, prekomerno konzumiranje alkohola, zloupotreba droga, fizička neaktivnost i gojaznost, nezdrava ishrana i stres [5]. Takođe, hipertenzija, povišeni holesterol, šećerna bolest i srčana bolest i srčanost dovode do moždanog udara.

Akutni ishemijski moždani udar (AIMU) nastaje kao posledica okluzije krvnog suda, bilo trombom ili embolusom. Ovaj udar je značajno češći i dijagnostikuje se u 83% bolesnika, dok se akutni hemoragijski moždani udar, koji po tipu može biti intracerebralna hemorrhagia (ICH) ili subarahnoidal hemorrhagia (SAH), dijagnostikuje u preostalih 17% bolesnika. Prema novijim istraživanjima, ishemijski moždani udar obuhvata trombozu, emboluse, vensku trombozu i sistemsku hipoperfuziju. Najčešći zajednički faktori rizika za ICH i SAH su: hipertenzija, pušenje i zloupotreba alkohola [6].

U ovom istraživanju je bilo 37,5% muškaraca i 62,5% žena sa hemoragijskim udarom, ali nismo pronašli visokostatističku značajnu razliku u javljanju ICH-a i SAH-a među polovima. U drugim istraživanjima se navodi da je polna zastupljenost kod hemoragijskog moždanog udara približna, ali da se verovatno zbog povezanosti javljanja SAH-a i ICH-a sa trudnoćom i puerperijum, ali sa uzimanjem oralnih kontraceptiva, u većini izveštaja pojavljuje veća učestalost ovih entiteta kod osoba ženskog pola [7]. Neki autori opet navode 1,4 – 2,0 puta veće učestalost ovih entiteta kod osoba ženki sa uzimanjem kontraceptiva, u većini izveštaja pojavljuju se trudnoće i puerperije, ali sa uzimanjem oralnih kontraceptiva, u većini izveštaja pojavljuju se veće učestalosti ovih entiteta kod osoba ženskog pola [7]. Neki autori opet navode 1,4 – 2,0 puta veće učestalosti ovih entiteta kod osoba ženskog pola [7].

Dobijeni rezultati ukazuju na to da postoji veća učestalost ishemijskih infarkata u zoni vaskularizacije karotidnog sliva (54,7%) u odnosu na arterije vertebral-bazilarnog sliva (45,3%). Infarkti u regiji vaskularizacije srednje moždane arterije (engl. middle cerebral artery – MCA) su najčešći tip moždanog udara, što je pokazano i u ovom istraživanju. Oni mogu biti površni male patients was in the age group between 50 and 59 years, followed by patients in their sixties and those in their seventies, while the percentage of female patients who were younger than 50 and suffering from some form of neurological deficit was significantly lower. This can be explained by the fact that women in menopause are at a higher risk of developing cardiovascular disease [4]. Also, in women, 10 years after the onset of menopause, the risk of stroke doubles. The decrease in the level of endogenous estrogen by 60% leads to an excess of androgens, which may lead to increased risk factors for the development of cardiovascular diseases. On the other hand, the greatest number of male patients was in the age group 40 – 49 years, which may indicate risk factors related to lifestyle, which include smoking, excess alcohol intake, drug abuse, physical inactivity and obesity, an unhealthy diet, and stress [5]. Also, hypertension, elevated cholesterol levels, diabeties, and cardiac diseases, lead to stroke.

Acute ischemic stroke (AIS) occurs as the result of blood vessel occlusion, either by a thrombus or embolus. This type of stroke is significantly more frequent and is diagnosed in 83% of patients, while acute hemorrhagic stroke, which can have two types – intracerebral hemorrhage (ICH) and subarachnoid hemorrhage (SAH), is diagnosed in the remaining 17% of patients. According to the latest studies, ischemic stroke includes thrombosis, emboli, venous thrombosis, and systemic hypoperfusion. The most frequent shared risk factor for ICH and SAH are hypertension, smoking and alcohol abuse [6].

The present study included 37.5% of men and 62.5% of women with hemorrhagic stroke, but we did not find a highly statistically significant difference in the occurrence of ICH and SAH between the sexes. Other studies state that the distribution by gender in hemorrhagic stroke is similar, however, probably due to the link between the occurrence of SAH and ICH and pregnancy and puerperium, but also with the use of oral contraceptives, most studies report a higher frequency of these entities in female patients [7]. Some authors, however, report between 1.4 and 2.0 times more frequent cerebral hemorrhage in men [6].

The obtained results indicate a higher frequency of ischemic infarction in the watershed area of the carotid artery vascular territory (54.7%), as compared to the arteries in the watershed area of the vertebrobasilar territory (45.3%). Infarctions in the vascular territory of the middle cerebral artery (MCA) are the most common type of stroke, which has been demonstrated in this study. They may be superficial (involving the cortex and white matter), deep (involving the basal ganglia, internal capsule, and deep white matter), and
Moždani udar je posledica promena na krvnim sudovima mozga, a oko 20% njih je posledica krvarenja u mozgu vima mozga. Oko 80% moždanih udara je posledica bolesnika sa cerebrovaskularnim bolestima, nativni CT angiografijom, trombozom unutrašnje karotidne arterije (ICA), disekcijom ili embolijom.

Svih 24 kandidata za trombolitičku terapiju su imala prisustvo trombotičke mase u velikim arterijama mozga, dok je kod 11 kandidata za trombolitičku terapiju, koji su imali pozitivan znak hiperdenzne arterije na nativnom CT pregledu, na angiografskom pregledu potvrđeno prisustvo tromba, odnosno uočen je defekt u punjenju kontrastnim sredstvom. Glavna klinička uloga CT angiografije u akutnom moždanom udaru je isključivanje trombolitičke terapije kod pacijenata sa embolijskim moždanim udarom, koji nemaju velike okluzije krvnog suda, kao što je to slučaj kod lakanurnog infarkta, tranzitornog ishemijskog ataka (TIA), migranske glavobolje, hipoglikemije. CT angiografija (engl. computed tomography angiography – CTA) je veoma precizna u dijagnostikovanju intrakranijalnih trombova. U studiji, koja je obuhvatila 44 kandidata za trombolizu, koji su u dijagnostičkom algoritmu prošli i CTA i DSA (engl. digital subtraction angiography), CTA je pokazala visoku senzitivnost (98,4%) i specifičnost (98,4%) za detekciju velikih trombova u velikim krvnim sudovima [9]. Takođe, stepen i nivo okluzije su važan faktor u planiranju terapije akutnog moždanog udara. CTA se koristi i za serijalno praćenje pacijenata sa dokazanim okluzijama unutrašnje karotidne arterije (ICA).

ZAKLJUČAK

Moždani udar je posledica promena na krvnim sudovima mozga. Oko 80% moždanih udara je posledica onemogućenog snabđevanja mozga krvlju (ishemijski udar), a oko 20% njih je posledica krvarenja u mozgu (hemoragijski moždani udar). Uprkos novim tehnološkim dostignućima u neuroimaging tehnikama i protokolima za procenu i tretman bolesnika sa cerebrovaskularnim bolestima, nativni CT ostaje zlatni standard za trijažu pacijenata sa akutnim moždanim udarom. Prednosti CTA skeniranja u proceni pacijenata sa akutni moždanim udarom jesu praktičnost, preciznost, brzina i dostupnost CT uređaja. Takođe, CTA skeniranje ima i prognostičku vrednost, jer može predvideti i odgovor na primenjenu trombolitičku terapiju. CT angiografija je precizna za dijagnozu intrakranijalne vaskularne okluzije kod pacijenata sa simptomima moždanog udara u prvih 6 sati. Podaci dobijeni CT angiografskim pregledom su dragoceni, jer omogućavaju brzu dijagnostiku i adekvatnu terapiju u kratkom vremenskom periodu. CTA je brza, jednostavna i tačna dijagnostička metoda, koja daje dovoljno informacija neurologu u vezi sa vaskularnom prohodnošću zahvaćene arterije.

Sukob interesa: Nije prijavljen.
ZNAČAJ MULTIDETEKTORске KOMPUTERIZованE ТОМографиE U ОТКРивAnu, ПРACЦивAnu И ИЗбOrУ ТЕраВy КoД AkuтнoГo МoЗжaнoГo УДАраЛА
THE IMPORTANCE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN ACUTE STROKE DETECTION, MONITORING AND SELECTION OF THERAPY

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