

ANALYSIS OF THE KEY ISSUES IN THE ORGANIZATION OF EMERGENCY CARE FOR STROKE AND HEART ATTACK PATIENTS IN BJELOVAR-BILOGORA COUNTY

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SUMMARY – Emergency care for patients with acute ischemic stroke and acute myocardial infarction according to the principles of evidence-based medicine is a challenge for the healthcare system, as it requires a multidisciplinary approach and good cooperation of all the subjects involved. The time elapsed from symptom onset to patient admission to the hospital, and the period from admission to the hospital to the beginning of therapy play an essential role in the thrombolytic treatment of stroke. For the patient, effective functioning of the system can mean the difference between preserved functional independence and disability. In recent years in Bjelovar-Bilogora County, there has been some development in emergency care of patients with acute heart attack by applying thrombolytic therapy and organizing transfer of indicated cases to the nearest clinical department for invasive cardiologic therapy. In case of acute ischemic stroke, thrombolysis has so far remained the only method of causal treatment. Results of a retrospective study conducted in 2010 in Bjelovar General Hospital on 169 patients with the established time of ischemic stroke symptom onset showed that only 39.64% of patients reached the hospital for treatment within the target time window. The results indicated the need for continuous efforts in preventing cardiovascular and cerebrovascular disease, as well as for education of citizens and healthcare professionals in recognizing the early symptoms of stroke and understanding them as an emergency condition. The present situation calls for permanent education of health workers in first line contact, an increase in the number of neurologists and cardiologists, as well as the introduction of stroke units on the model of coronary units, with constant presence of specialists. The radiology and laboratory services need adjustment to enable performing diagnostic procedures within the given time limit. At the national level, a network of stroke units should be organized, which would eliminate distance to county hospitals as a limiting factor in effective treatment.

Key words: *Stroke – diagnosis; Stroke – therapy; Myocardial infarction – diagnosis; Myocardial infarction – therapy; Thrombolytic therapy; Emergency health services – organization and administration; Emergencies*

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Introduction

For a long time, the treatment of acute ischemic stroke consisted of supporting vital functions and nonspecific care, whereas a new era began in 1995, when clinical studies¹⁻⁴ proved that early intravenous administration of the recombinant tissue plasminogen activator (rt-PA), which meets strict criteria of the so-called thrombolysis protocol, can improve clinical outcome. The method has clear indications and contraindications⁵ and a limited time "window" of three hours for intravenous administration and six hours for intra-arterial administration⁶. Acute coronary syndrome also represents one of the most severe and life-threatening forms of cardiovascular disease. It is manifested through several clinical forms that require different strategies of treatment procedures based on the estimated urgency of interventional treatment. The greatest challenge is acute ST segment elevation myocardial infarction (STEMI), in which it is necessary to establish reperfusion of the occluded coronary artery as soon as possible either by using fibrinolytics or through interventional treatment. Ischemic stroke and acute myocardial infarction represent emergency conditions whose adverse outcome can be prevented or alleviated through good organization of all the services involved.

Basic epidemiological data

Cerebrovascular disease and ischemic heart disease are among the most common and most important causes of mortality in developed countries, including Croatia. According to 2008 data, stroke ranks second among the ten leading causes of death in the Republic of Croatia (Croatia) with a share of 15.49% (8,076), while ischemic heart disease ranks first with a share of 19.37% (10,101)⁷. Circulatory system disease ranks as the first cause of death in Bjelovar-Bilogora County (County) with a rate of 779.96/100,000, which is higher than the national rate (591.22/100,000). The rates for men in the County (640.00/100,000) and in Croatia (533.83/100,000) are lower than the respective rates for women (911.09/100,000 and 644.48/100,000)⁸.

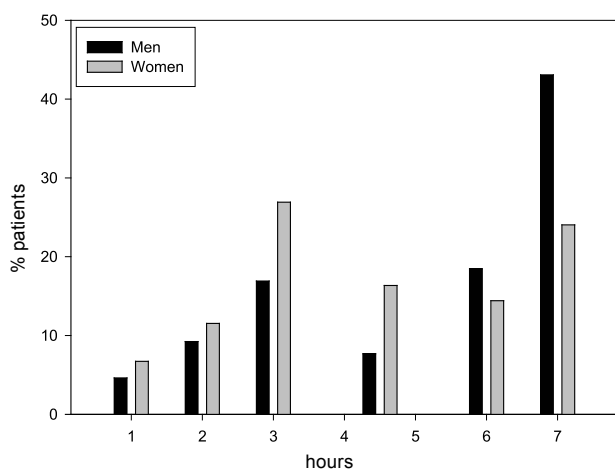
Subjects and Methods

For the purpose of planning the introduction of a new therapeutic method at Department of Neurology,

Bjelovar General Hospital, we looked into medical documentation retrospectively, analyzing the time elapsed from symptom onset to hospital admission for the patients suffering from acute ischemic stroke, as well as the percentage of people that would be eligible for intravenous or intra-arterial thrombolysis according to the time criterion. The study included 169 patients according to the time of hospital admission, provided we could determine the exact time of symptom and/or disease onset on the basis of medical documentation, history or heterohistory data, and in whom computed tomography (CT) could verify ischemia in different parts of the brain during treatment. Medical histories of 104 (61.54%) women and 65 (38.46%) men were analyzed. The time of symptom onset was defined as the moment when the neurologic deficit was first noticed by the patient or a close person. The time of hospital admission was the time elapsed from symptom onset to admission to emergency neurology clinic. In all patients included in our study, ischemic stroke was confirmed by CT. The patients whose symptoms were noticed in the morning upon waking up, or those whose symptoms regressed within an hour (transient ischemic attack) were excluded from the study.

Results

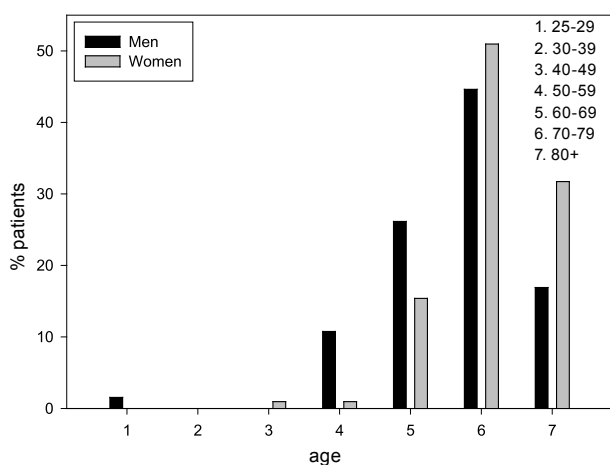
The results showed that 67 (39.64%) patients arrived for treatment within three hours of symptom onset, 47 (70.15%) women and 20 (29.85%) men, accounting for 45.19% of all study women and 30.77% of all study men. When compared to the total number of female patients, 6.73% of women arrived within one hour of symptom onset, 11.54% arrived between one and two hours later, while 26.92% arrived within two to three hours; as many as 4.62% of men arrived within the time window of one hour, 9.23% arrived one to two hours after symptom onset, while 16.92% of men arrived two to three hours after symptom onset; 13.02% of patients were admitted between 3 and 4.5 hours after symptom onset. As many as 77.27% of the patients were women, accounting for 16.35% of the total number of female patients; the rest of 22.73% were men, accounting for 7.69% of the total number of patients; 15.98% of patients arrived within 4.5-6 hours of symptom onset, 55.55% of them women and 44.45% men; 31.36% of patients arrived later than 24



Hours	1	2	3	4.5	6	24
M	4.62	9.23	16.92	7.69	18.46	43.08
W	6.73	11.54	26.92	16.35	14.42	24.04

Fig. 1 and Table 1. Time elapsed from symptom onset to admission to hospital – men and women.

hours after symptom onset, 47.17% of them female and 52.83% male (Fig. 1 and Table 1). As many as 98.08% of female patients and 87.69% of male patients were older than 60. Patients aged between 50 and 59 accounted for 10.77% of male patients and



Age (yrs)	25-29	30-39	40-49	50-59	60-69	70-79	80+
M	1.54	0	0	10.77	26.15	44.62	16.92
W	0	0	0.96	0.96	15.39	50.96	31.73

Fig. 2 and Table 2. Patients according to age – men and women.

0.96% of female patients. Among male patients that arrived for treatment within the time window of three hours, 5.0% were aged 50-59, 20.0% were aged 60-69, 50.0% were aged 70-79, and 25.0% were older than 80. Among female patients that arrived for treatment within three hours, 2.13% were aged 40-49, 14.89% were aged 60-69, 48.94% were aged 70-79, and 34.04% were older than 80 (Fig. 2 and Table 2). Out of the total number of subjects of both sexes, as many as 8.88% continued treatment in some of the specialized hospitals for medical rehabilitation, 73.37% were released from hospital care, while 17.75% regrettably passed away.

Discussion

Ischemic stroke and myocardial infarction can occur at any age, but are most frequent in the ages above 65, which was also confirmed by the results of our study. In the study sample, 98.08% of female patients and 87.69% of male patients were older than 60. Considering that the studied diseases have well-known risk factors (modifiable and nonmodifiable) against which, in most cases, preventive action can be successfully taken, part of the responsibility for the high rates of morbidity and mortality from circulatory system disease in the County lies in the insufficient measures of primary prevention, and is partly due to the patients' own risky behavior. This behavior is a result of low-level health education in both rural and urban population, which manifests itself in daily practice, and was demonstrated by the results of a survey carried out on the occasion of the Arterial Hypertension Day in the Town of Bjelovar⁹. Another compelling detail is the fact that the average income *per* household member in the County is among the lowest in Croatia, which, together with an increase in unemployment, is a significant limiting factor in practicing healthy habits dependent on financial funds.

The results of our study showed that a total of 39.64% of patients, 70.15% of them women and 29.85% of men, arrived at the hospital within the time period in which they could receive thrombolysis treatment. This does not mean that all admitted patients met the thrombolysis protocol criteria or that this treatment could be implemented in all these patients. Indications and contraindications are determined on the basis of clinical and radiologic (CT and/or MRI)

evaluation, as well as laboratory tests, so it is essential to cut down the time necessary for carrying them out by defining priorities and organizing the hospital in an efficient way. The results of more recent studies with alteplase represent an optimistic announcement of the possibility to extend the time window for intravenous administration from 3 to 4.5 hours after symptom onset^{10,11}. Compared to the studies carried out in Croatia several years ago¹²⁻¹⁵, our study recorded an increased percentage of patients who arrived on time. Still high, the percentage of patients admitted to the hospital 24 hours or later after symptom onset is attributed to their advanced age, greater distance between their places of living and the hospital, insufficient knowledge of the disease symptoms, and the fact that thrombolytic stroke therapy was unavailable in our hospital in 2009.

Prevention of unwanted outcomes

Continuous implementation of preventive measures at all levels of healthcare is essential for decreasing the morbidity and mortality rates of ischemic stroke. Unfortunately, insufficient effort and financial funds are invested in them. The role of printed media, radio and television is also quite relevant. Regrettably, we cannot influence unmodifiable risk factors, so it is important to recognize and direct preventive actions towards those lifestyle aspects that we can change (modifiable risk factors). The primary purpose of any treatment is to affect the quality of life improvement for the patient, and timely implementation of treatment can substantially affect the clinical outcome and the quality of life of patients and their families. In the course of care, the role of primary healthcare is essential, through emergency medical services or family doctor. Out-hospital emergency care falls significantly behind the same category of services in the developed countries in terms of education, available equipment and personnel. At the hospital service level, there is an evident lack of a smooth-running fast-track treatment protocol for stroke patients. The possibilities of good interconnection within the health system of the County can be seen in the instance of the organization of care of patients suffering from acute STEMI, shown in Figure 3. The decision on the method of treatment of acute myocardial infarction is based on clear electrocardiographic criteria, where thrombolytic therapy

is of a relatively low risk, and any errors can only cause minor negative effects. The decision on the method of treatment of ischemic stroke is based on clinical and radiologic evaluation, where thrombolytic treatment is at a comparatively high risk, and the possible errors or complications can be fatal. Laboratory and radiology units need to be organized to shorten the time period from patient admission to obtain medical records relevant for making treatment decisions and starting the treatment within the given time window.

Since the establishment of stroke units with multidisciplinary teams consisting of a neurologist specialized in the treatment of cerebrovascular diseases, specifically educated nurses, physical therapists and other experts, significant progress has been achieved in the treatment, the frequency of complications has been reduced, and the mortality and disability rates decreased^{17,18}. With good assessment by experienced clinicians and observation of the thrombolysis protocol, attempts have been made to avoid errors and bring complications to a minimum.

Bjelovar General Hospital primarily provides care for the population of the County, which, according to the last census from 2001, has 133,084 inhabitants¹⁹. Residents of peripheral settlements of the surrounding counties who live at a greater distance from their own county centers often seek health care in Bjelovar Hospital, which is closer to them. The distance of the place of residence to the closest county hos-

Distance in km	Settlement/Village
31-40	Šumečani 40.8
41-50	Sibenik 44.4 Podgarić 48.8
51-60	Lončarica 50.6 Duhovi 55.2 M. Vukovje 52.5
61-70	Kip 61.1 Sirač 63.3 Sređani 66.4
71-80	Jesenaš 72.5 Gov. Polje 74.4 St. Krivaja 74.6

Table 3. Peripheral villages/settlements in Bjelovar-Bilogora County at a distance from the County Hospital greater than 30 km²⁰

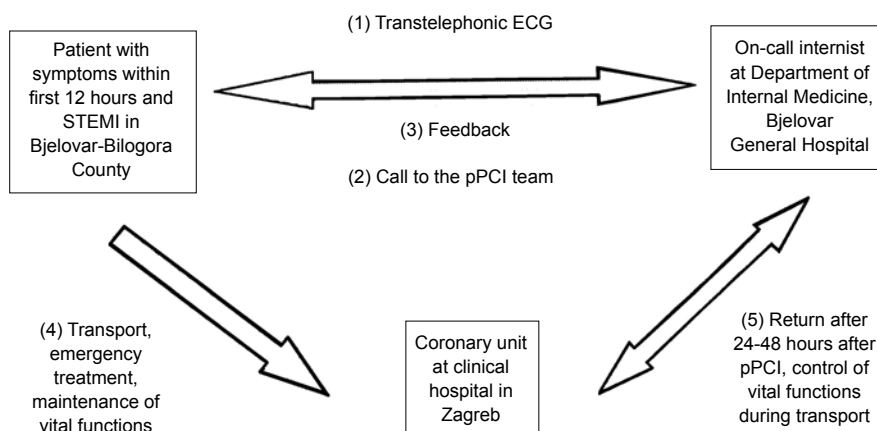


Fig. 3. Procedure manual of current care for patients with ST segment elevation myocardial infarction (STEMI) in Bjelovar-Bilogora County¹⁶ (with permission).

pital should be taken into consideration when planning the national network of stroke units and trying to reduce the time elapsed from the onset of ischemic stroke symptoms to admission to a specialized medical institution. Peripheral settlements in the County, which are more than 30 km from the County center, are shown in Table 3. For the residents of these settlements/villages (as well as similar villages in other counties), the possibility of emergency admission and treatment in other closer medical institutions should be considered, where possible. In the areas where it is not possible, air transport and telemedicine are the potential options, following the example of other developed countries.

If necessary, after acute treatment and rehabilitation depending on the level of remaining disability, stationary medical rehabilitation continues either in one of the rehabilitation centers, in the community, or through permanent care and assistance provided by the others^{21,22}. The remaining neurologic deficiencies (motor, sensory, or cognitive), as a form of unwanted outcomes, are partially a result of the disease, but can also be partly attributed to the quality level of the organization of continued early physical or occupational treatment in specialized centers²³. This study has indicated that the possibility of direct transfer from acute hospital to rehabilitation center is ensured for only 8.88% of people treated for acute ischemic stroke. Whether this percentage is adequate or too

low should be indicated by studies that would include data on the functional status of subjects, measured by standardized questionnaires, as well as the percentage of subjects that really required rehabilitation due to the remaining neurologic deficiencies.

Conclusion

The emergency treatment of acute myocardial infarction and acute ischemic stroke patients according to the principles of evidence-based medicine is a challenge for the healthcare system, as it requires a multidisciplinary approach and good cooperation of all subjects involved. Efficient functioning of the system could mean the difference between preserved functional independence and disability. The results of our study, which was carried out in 169 subjects, show that in total a little more than one-third of patients arrived for treatment within the critical time window in which, according to the exclusive criterion of time, they could receive thrombolysis treatment. This does not mean that all the subjects met the criteria for the thrombolysis protocol. It partly refers to patient characteristics, history data and results of the conducted tests, which would constitute contraindications, and partly to the internal organization of the healthcare system and the (im)possibility of reaching the recommended time standards for patient transport, conducting and interpretation

of tests. In this sense, more comprehensive studies are necessary, which would take into consideration all the requirements prescribed by the thrombolysis protocol, as well as the comparable functional status of the patient, measured by a standardized questionnaire. Compared to similar studies carried out in Croatia several years ago, a higher percentage of patients admitted on time was recorded. The results indicate the need of continuous efforts in preventing cardiovascular and cerebrovascular disease as well as the need of education of citizens in recognizing the early symptoms of stroke and understanding them as an emergency condition. It is necessary to permanently educate health workers in the first line of contact and to increase the number of neurologists and cardiologists, to organize stroke units on the model of coronary units with constant presence of specialists, as well as to adjust the diagnostics in radiology and laboratory services to the established time window. At the national level, it is necessary to standardize prehospital protocols and organize stroke unit network, which will prevent the distance to the county hospital from being a limiting factor for efficient treatment. These results may be useful for medical facilities in the Bjelovar-Bilogora County and the County Health Council in defining health priorities, initiating preventive activities, as well as planning improvements in the organization of healthcare service within the County.

References

1. The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. *N Engl J Med* 1995;333:1581-7.
2. HACKE W, KASTE M, FIESCHI C, *et al.* Intravenous thrombolysis with recombinant tissue plasminogen activator for acute hemispheric stroke: The European Cooperative Acute Stroke Study (ECASS). *JAMA* 1995;274:1017-25.
3. HACKE W, KASTE M, FIESCHI C, *et al.* Randomised double-blind placebo-controlled trial of thrombolytic therapy with intravenous alteplase in acute ischaemic stroke (ECASS II). *Lancet* 1998;352:1245-51.
4. KWIATOKOWSKI TG, LIBMAN R, FRANKEL M, *et al.* The NINDS rtPA stroke study: sustained benefit at one year. *Stroke* 1998;28:288.
5. DEMARIN V, LOVRENČIĆ HUZJAN A, TRKANJEC Z, VUKOVIĆ V, VARGEK SOLTER V, ŠERIĆ V, *et al.* Recommendations for stroke management – 2006 update. *Acta Clin Croat* 2006;45:219-85.
6. ADAMS HP Jr, del ZOPPO G, ALBERTS MJ, BHATT DL, BRASS L, FURLAN A, *et al.* Guidelines for the early management of adults with ischemic stroke: a guideline from the American Heart Association/American Stroke Association Stroke Council, Clinical Cardiology Council, Cardiovascular Radiology and Intervention Council, and the Atherosclerotic Peripheral Vascular Disease and Quality of Care Outcomes in Research Interdisciplinary Working Groups. *Stroke* 2007;38:1655-711.
7. www.hzjz.hr/publikacije/hzs_ljetopis/Ljetopis_Yearbook_HR_2008.pdf. (in Croatian)
8. CERONJA I. Vodeći uzroci smrtnosti u BBŽ. www.hcjz 2010;6:22. (in Croatian)
9. KLOBUČIĆ M. Uzroci visokog kardiovaskularnog mortaliteta i morbiditeta u Bjelovarsko-bilogorskoj županiji i kako ga smanjiti. www.hcjz 2010;6:22.
10. HACKE W, KASTE M, *et al.* Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke (ECASS III). *N Engl J Med* 2008;359:1317-29.
11. WAHLGREN N, AHMAD N, DÁVALOS A, *et al.* Thrombolysis with alteplase for acute ischaemic stroke in Safe Implementation of Thrombolysis in Stroke-Monitoring Study (SITS-MOST): an observational study. *Lancet* 2007;369:275-82.
12. VULETIĆ V, DIKANOVIĆ M, LEŽAIĆ Ž, ŠAPINA L, KADOJIĆ D. Are we ready for intravenous thrombolysis in acute stroke treatment in our region? *Acta Clin Croat* 2011;50:463-8.
13. ŠKLEBAR D, VRABEC MATKOVIĆ D, PREKŠAVEC M, GRŽINČIĆ T. Vrijeme od nastanka simptoma akutnog ishemijskog moždanog udara do prijema u bolnicu – čimbenik rizika na koji se može utjecati. www.hcjz 2010;6:22. (in Croatian)
14. ŠKLEBAR D, MARČEC R, SABOLEK K, VRABEC MATKOVIĆ D. Analiza hitnosti prijema oboljelih od ishemijskog moždanog udara – primjer Bjelovarsko bilogorske i Medimurske županije. *Lijec Vjesn* 2008;Suppl 6:42. (in Croatian)
15. BILIĆ I, FILIPOVIĆ GRČIĆ P, LUŠIĆ I. Time to hospital admission in patients with acute stroke – observational study in Split-Dalmatia County, Croatia. *Acta Clin Croat* 2007;46:21-5.
16. IVANUŠA M. Primjena algoritama u dijagnostici i liječenju akutnog infarkta miokarda. www.plivamed.net/. (in Croatian)
17. SCHWAMM LH, PANCIOLI A, ACKER JE, *et al.* Recommendations for the establishment of stroke systems of care: recommendations from the American Stroke Association's Task Force on the Development of Stroke Systems. *Circulation* 2005;111:1078-91.
18. STERZI R, CANDELISE L, GATTINONI M, BERSANO A, MICIELI G. Stroke-unit care for patients with acute stroke. *Lancet* 2007;369(9569):1255.

19. Državni zavod za statistiku Republike Hrvatske. Statistički ljetopis 2008.
20. http://www.dzs.hr/Hrv/publication/stat_year.htm
20. <http://www.mireo.hr>
21. ŠERIC V. Possibilities for rehabilitation after stroke. *Acta Clin Croat* 2009;48:335-9.
22. SINANOVIĆ O, MRKONJIĆ Z, ZUKIĆ S, VIDOVIĆ M, IMAMOVIĆ K. Poststroke language disorders. *Acta Clin Croat* 2011;50:79-94.
23. ČENGIĆ Lj, VULETIĆ V, KARLIĆ M, DIKANOVIĆ M, DEMARIN V. Motor and cognitive impairment after stroke. *Acta Clin Croat* 2011;50:463-7.

Sažetak

ANALIZA KLJUČNIH PITANJA ORGANIZACIJE HITNOG ZBRINJAVANJA OBOLJELIH OD MOŽDANOG I SRČANOG UDARA U BJELOVARSKO-BILOGORSKOJ ŽUPANIJI

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Hitno zbrinjavanje oboljelih od akutnog infarkta miokarda i akutnog ishemijskog moždanog udara prema načelima medicine temeljene na dokazima izazov je za zdravstveni sustav, zahtijeva multidisciplinarni pristup i dobru suradnju svih uključenih subjekata. U trombolitičkom liječenju moždanog udara ključna je uloga vremena proteklog od nastanka simptoma do dolaska u bolnicu i vremena od dolaska u bolnicu do početka terapije. U posljednjih nekoliko godina na području Bjelovarsko-bilogorske županije postignut je napredak u zbrinjavanju bolesnika s akutnim srčanim udarom primjenom trombolitičke terapije i organizacijom premještaja indiciranih slučajeva u najbližu kliniku radi invazivne kardiološke terapije, a u slučajevima akutnog ishemijskog moždanog udara tromboliza zasad ostaje jedina metoda kauzalnog liječenja. Rezultati retrospektivne studije koju smo proveli 2010. godine u Općoj bolnici Bjelovar na 169 bolesnika s poznatim vremenom nastanka simptoma ishemijskog moždanog udara pokazali su da je samo 39,64% oboljelih stiglo na liječenje u bolnicu u ciljnom vremenskom okviru. Zaključujemo da je i dalje potrebno raditi na obrazovanju stanovništva o čimbenicima rizika, promjeni načina života, te ranom prepoznavanju simptoma bolesti i shvaćanju moždanog i srčanog udara kao hitnog stanja. Neophodna je trajna izobrazba zdravstvenih djelatnika prvog kontakta, povećanje broja specijalista neurologa i kardiologa, organiziranje jedinice za moždani udar po uzoru na koronarne jedinice uza stalno prisutne liječnike specijaliste, te prilagodba radiološke i laboratorijske djelatnosti za provedbu dijagnostike u zadanim vremenskim okvirima. Na nacionalnoj razini potrebna je organizacija mreže jedinica za moždani udar, čime bi prostorna udaljenost od županijske bolnice prestala biti ograničavajući čimbenik u djelotvornom liječenju.

Ključne riječi: Moždani udar – dijagnostika; Moždani udar – terapija; Srčani udar – dijagnostika; Srčani udar – terapija; Trombolitička terapija; Hitna medicinska služba – organizacija i administracija

