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Short Communication

Acute stroke treatment during COVID-19 pandemic "lockdown" period – Croatian experience

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Abstract

Background and purpose: *Inevitable lockdown scenario during the first wave of COVID-19 pandemic led to different approaches of medical care system worldwide. During this period, health care services faced the problem of time, place and human resources management. However, in spite of redirecting health forces to fight this new and unknown virus in all countries, the need of routine treatment of all the other emergencies according to the guidelines remained present. The aim of our study was to analyse the acute stroke care in Croatia during first wave of Covid pandemic.*

Materials and methods: *In order to achieve the rate of stroke patients admitted to hospital care in dedicated hospital stroke units and centers, we have gathered the data from four Croatian University Hospitals. We analyzed the number of hospitalized stroke patients from 1th of February to 1th of May 2020 and the proportions of patients treated with recanalization therapy.*

Results: *Our results showed a slight decrease of number of all neurological patients who arrived to the Emergency Unit. In 2019 recanalization therapy was given to 158 patients (19%) vs 177 (26%) in 2020. Thrombolysis alone was given to 72 (9%) of patients in 2019 and to 68 (10%) of patients in 2020, while thrombectomy (with or without thrombolysis) has been performed to 86 (10%) vs 109 (16%) patients in 2019 and 2020 respectively.*

Conclusion: *In conclusion, we did not notice less severe stroke patients or lower level of stroke care in University Hospitals.*

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INTRODUCTION

COVID-19 pandemic spread to the Croatian territory on 25th of February 2020, with the first COVID-19 positive patient being confirmed. Within the next three weeks the number of positive patients in Croatia rose to one hundred, then in the following 2 days it escalated to 200, and in one month the number finally reached 500 positive cases (*1*). Croatian Ministry of Health announced the epidemic of COVID-19 infection on the Croatian territory on 11th of March (*1*). This was the same date when World pandemic was announced by WHO as well. Until the 1th of May there were 2,085 confirmed COVID-19 positive patients, from this number 1,421 were cured and 75 patients died (*1*). Finally, since 11th of May, Croatia gradually released most of the restrictions which were active during 3 months of pandemic (*1*). According to the analysis of Oxford University, Croatia was among countries

with most severe restriction methods (*1*, *2*), resulting in considerable positive effect on epidemiologic data as well as low mortality rate. At that time Health system was prepared to accept hundreds of COVID-19 patients with severe infection, including respiratory failure symptoms, which luckily never happened. However, this reorganization had its price in the lack of appropriate healthcare for a lot of chronic patients, leaving only severe emergency patients to be taken care of. Moreover, medical care was sometimes late, due either to late arrival of patients in the Emergency Unit or to the time of postponing the invasive treatment while waiting for COVID-19 PCR test results. In such a setting, the appropriate and timely medical care for stroke patients remains questionable.

The aim of this paper was to analyze the rate of admitted stroke patients to established Stroke Units and Centers in Croatia and the proportion of patients treated with recanalization therapy for acute stroke during three-month lockdown period, and to compare it with the rate of the same period last year, as well as during the strongest pandemic quarantine period.

MATERIAL AND METHODS

In order to achieve the rate of stroke patients admitted to hospital care in dedicated hospital stroke units and centers, we have gathered the data from four of five Croatian University Hospitals (University Hospital Rijeka, Sestre milosrdnice, Split and Zagreb), which cover 2/3 of Croatian population, namely about 3 million of inhabitants. We analyzed the number of hospitalized stroke patients from 1th of February to 1th of May 2020 and separately from 12th of March to 23th of April 2020 (40 days of the strongest lockdown period) and the rate of patients treated with recanalization (thrombolysis alone and/or thrombectomy) therapy. We compared those numbers with the numbers of the same period last year.

RESULTS

Our results for the three months period (February 1 to May 1, 2020) showed a slight decrease of the number of all neurological patients who arrived to the Emergency Unit (about 70% of patients comparing with the same period in 2019). Considering only acute stroke patients who were admitted to the hospitals, the difference was present, but not significant (799 admitted patients in 2019 *vs* 670 (84%) in 2020.). However, in all hospitals there was a clear trend of not admitting patients with a mild case of stroke and of postponing complete diagnostic work-up for those patients until the end of the epidemic. The largest difference in the number of admitted stroke patients between the years 2019 and 2020 was noted in University Hospital Rijeka, where there was approximately 30% patients with acute stroke admitted to the hospital less than in 2020. However, considering recanalization therapy, we did not notice significant difference either in every single hospital nor on the national level. In 2019 some kind of recanalization therapy was given to 158 patients (19%) vs 177 (26%) in 2020. Thrombolysis alone was given to 72 (9%) of patients in 2019 and to 68 (10%) of patients in 2020, while thrombectomy (with or without thrombolysis) has been performed to 86 (10%) vs 109 (16%) patients in 2019 and 2020, respectively. It is worthwhile mentioning that University Hospital Rijeka did not perform thrombectomy before 1st June 2019, meaning that this kind of recanalization therapy was not available in Rijeka during the period in 2019 analyzed. All the data for the three-month period are presented in Table 1.

During the 40-day of strict quarantine period (12 March – 23 April 2020) we did not observe any significant difference in analyzed data either. The number of admitted stroke patients remained almost the same (382 *vs* 334) compared to 2019 (87%). The percentage of patients who received some kind of recanalization therapy was 18% in 2019 *vs* 23% in 2020 (10% *vs* 9% of patients received only thrombolysis and 8% *vs* 14% of patients who had thrombectomy with or without thrombolysis). Those data are presented in Table 2.

During this period, we did not confirm any COVID-19 positive patients who developed acute stroke as a complication or comorbidity during COVID infection.

Table 1. *The number of patients (N) admitted and treated in four University Hospitals in Croatia from 1st February till 1st May 2019 and 2020**

	2019			2020		
Hospital	N	Thrombolysis	MT	N	Thrombolysis	MT
UHC Split	206	21	29	209	9	14
UHC Rijeka	162	3	na	110	12	16
UHC SM	133	7	35	122	11	40
UHC Zagreb	298	41	22	229	36	39

* UHC – University Hospital Center, Thrombolysis – patient who were thrombolysed, MT – patients who had thrombectomy alone or in combination with thrombolysis

Table 2. *The number of patients (N) admitted and treated in four University Hospitals in Croatia from 12th March till 23rd April 2019 and 2020*.*

	2019			2020		
Hospital	N	Thrombolysis	MT	N	Thrombolysis	MT
UHC Split	111	11	11	111	3	7
UHC Rijeka	63	2	na	45	5	5
UHC SM	59	5	19	50	5	15
UHC Zagreb	149	18	9	128	19	19

**Legend: UHC – University Hospital Center, Thrombolysis – patient who were thrombolysed, MT – patients who had thrombectomy alone or in combination with thrombolysis*

DISCUSSION

In this paper we present the data from four out of five University Hospitals in Croatia during COVID-19 lockdown period in 2020. These hospitals serve as tertiary centers for about 3 million Croatian inhabitants, which represents 70% of Croatian population. We, therefore, consider our data to be a representative model for stroke care in Croatia during the period analyzed. A limiting factor in our analysis however is a simple fact that the number of acute stroke patients in the whole country in a 3-months period is at least twice larger than reported in this paper (*3*). We still miss data from most regional hospitals who admit stroke patients in Croatia as well, which, especially during these pandemic times did not refer the patients to tertiary centers in the usual manner. We also miss the data from one University Hospital covering the eastern part of the country. In spite of this limitations, the results interestingly showed no statistical significance in the main aspects of stroke care in Croatia between the lockdown period and the same period in 2019. We did notice a clear trend of less stroke patient arrivals to the Emergency Unit but we also noticed a decrease of 30% of neurological patients in Emergency Units of tertiary hospitals overall. Patients with a mild stroke were less likely admitted to hospitals or considered for thrombolytic therapy. Complete diagnostic work-up was also often postponed. However, the numbers of admitted patients to Stroke Units or/and Stroke Centers did not differ statistically between 2019 and 2020. Furthermore, there was no difference in the percentage of patients who received adequate recanalization therapy in the same period. Our results showed a trend of better stroke care in 2020 due to a higher proportion of patients who received recanalization therapy (26% vs 19% of all admitted patients in 2019). This larger proportion of patients receiving thrombectomy in the COVID-19 pandemic time might also be the result of starting this procedure in the University Hospital Rijeka. In any case, patients with more severe strokes during this period were treated according to guidelines (*4*, *5*, *6*). The remaining question is whether the patients with a mild stroke who would otherwise be candidates for thrombolytic therapy received proper care. The result of a high percentage of patients who received recanalization therapy has to be interpreted also in the light of tertiary center hospitals, considering the fact that not all patients arrived to the tertiary center in time for recanalization therapy. Therefore, this high proportion of recanalized patients does not represent the national level of recanalization therapy given.

Finally, in contrary to the experience of some other countries (6), we did not notice lower number of stroke patients or a lower level of stroke care in University Hospitals. Our results show no difference in acute stroke care between the same periods in 2019 and 2020, as described in other European countries (7). The reasons for this are most probably very strict restriction measures during COVID-19 pandemic with respectable epidemiologic results (1). At that time, only 0.05% of Croatian population was actually infected and patients were admitted to special COVID centers, leaving enough intensive beds for other patients during all this period. Neurological intensive beds and beds in Stroke Units were, therefore, not compromised. Furthermore, we discussed and issued our guidelines for acute stroke care in COVID-19 pandemic only one month after the announcement of World pandemic which led to unique approach in all stroke units and centers in Croatia. In spite of the fact that some studies implied that COVID-19 pandemic was associated with a significant decrease in acute stroke admission (*8*), Altersberger in his study included 20 stroke centers and the results showed that most of the patients had mild to severe strokes, and that all of them received acute reperfusion therapy (*9*). Unlike other studies, in his study stroke severity on admission was not significantly higher during lockdown compared with the reference period in 2019. He concluded that in high volume dedicated centers the solid stability of key stroke care service was stable also during the lockdown period (*9*), which is actually in concordance with our results. As several papers report a connection between the severity of the lockdown measures and a decrease of hospital admissions, including stroke patients (*10*), we could summarize that our results correspond to strict lockdown measures, which resulted in

lower admission rate but maintained adequate acute care for severe stroke patients.

In spite of these good results, the question of late outcome for acute stroke patients during COVID-19 pandemic remains open and will be answered only after a longer follow-up period. Long term mortality and morbidity data for patients who suffered an acute stroke in this period are still lacking. Recent papers are still reporting confusing results considering acute stroke and the long-term treatment (*8*, *9*, *10*). We already suspect prolonged door-to-needle, door-to-groin and symptom-to-reperfusion times in some patient cohorts, as well as clear reduction in percentage of patients who were sent to neurorehabilitation facilities. These consequences of COVID-19 pandemic could influence the final functional outcome for our patients in spite of a high percentage of patients receiving recanalization therapy in early stroke care.

REFERENCES:

1. Official website of Croatian Government for timely and exact information about corona virus infection, https://vlada.gov.hr/koronavirus (2020, accessed 23 June 2020)
2. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected. Interim guidance. WHO/2019-nCoV/IPC/v2020.2. 25 Jan 2020. World Health Organization.
3. KRALJ V, BRKIC BILOS I 2013 Morbidity and mortality from cardiovascular diseases. *Cardiologia Croatica* 8(10-11): 373
4. BARACCHINI C, PIERONI A, VIARO F, CIANCI V, CATTELAN AM., TIBERIO I, MUNARI M, CAUSIN 2020FAcute stroke management pathway during Coronavirus-19 pandemic. *Neurol Sci* 41: 1003–5. https://doi.org/10.1007/s10072-020-04375-9
5. LYDEN P 2020 Temporary Emergency Guidance to US Stroke Centers During the COVID-19 Pandemic. On Behalf of the AHA/ASA Stroke Council Leadership. *Stroke* 51: 1910–12. https://doi.org/10.1161/STROKEAHA.120.030023
6. AGGOUR M, WHITE P, KULCSAR Z, FIEHLER J, BROUWER P 2020European Society of Minimally Invasive Neurological Therapy (ESMINT) recommendations for optimal interventional neurovascular management in the COVID-19 era. *J Neurointervent Surg.* 12: 542–4. https://doi.org/10.1136/neurintsurg-2020-016137
7. BERSANO A, KRAEMER M, TOUZE E, WEBER R, ALAMOWITCH S, SIBON I, PANTONI L 2020 Stroke care during the COVID-19 pandemic: experience from three large European countries. *EurJ Neurol* 27(9), 1794–1800. https://doi.org/10.1111/ene.14375
8. D'ANNA L, BROWN M, OISHI S, ELLIS N, BROWN Z, BENTLEY P, DRUMM B, HALSE O, JAMIL S, JENKINS H, MALIK A, KALLADKA D, VENTER M, KWAN J, BANERJEE S 2021aImpact of national lockdown on the hyperacute stroke care and rapid transient ischaemic attack outpatient service in a comprehensive tertiary stroke centre during the COVID-19 pandemic, *Front Neurol* 12:627493. https://doi.org/10.3389/fneur.2021.627493
9. ALTERSBERGER VL, STOLZE LJ, HELDNER MR, HENON H, MARTINEZ-MAJANDER N, HAMETNER C, NORDANSTIG A, ZINI A, NANNONI S, GONÇALVES B, NOLTE CH, BAUMGARTNER P, KASTRUP A, PAPANAGIOTOU P, KÄGI G, LEKER RR, ZEDDE M, PADOVANI A, PEZZINI A, PADJEN V, CEREDA CW, NTAIOS G, BONATI LH, RINKEL LA, FISCHER U, SCHEITZ JF, WEGENER S, TURC G, MICHEL P, GENTILE M, RENTZOS A, RINGLEB PA, CURTZE S, CORDONNIER C, ARNOLD M, NEDERKOORN PJ, ENGELTER ST, GENSICKE H; TRISP Collaborators2021 Maintenance of acute stroke care service during the COVID-19 pandemic lockdown. *Stroke* 52(5): 1693–1701. https://doi.org/10.1161/STROKEAHA.120.032176
10. MARIET AS, GIROUD M, BENZENINE E, COTTENET J, ROUSSOT A, AHO-GLÉLÉ LS, TUBERT-BITTER P, BÉJOT Y, QUANTIN C Hospitalizations for stroke in France during the COVID-19 pandemic before, during, and after the national lockdown. *Stroke* 2021 52(4): 1362–1369. https://doi.org/10.1161/STROKEAHA.120.032312