

Mat Soc Med. 2012 Dec 24(4): 232-237

Received: 11 September 2012

Accepted: 25 October 2012

Conflict of interest: none declared.

© AVICENA 2012

DOI: 10.5455/msm.2012.24.232-237

Correlation of Barometer Pressure and Incidence of Cerebrovascular Insult

Enes Slatina¹, Miralem Music², Nermina Babic³, Amna Pleho –Kapic², Senad Dervisevic⁴, Mirhan Salibasic⁵, Ekrema Mujaric⁴

Public Institution of Emergency Medical Institute (EMI) Sarajevo, Bosnia and Herzegovina¹

Institute of Pathological Physiology, Faculty of medicine, University of Sarajevo, Bosnia and Herzegovina²

Institute of Physiology, Faculty of medicine, University of Sarajevo, Bosnia and Herzegovina³

Cantonal hospital Zenica, Zenica, Bosnia and Herzegovina⁴

Clinical Center University of Sarajevo⁵

Corresponding author: Enes Slatina, MD. Public Institution of Emergency Medical Institute, Sarajevo, Bosnia and Herzegovina.

ORIGINAL PAPER

ABSTRACT

Introduction: The intention of this work is to research whether the link between the barometer pressure and the cerebrovascular insult (CVI) exists. The stroke is the first cause of non-traumatic disability and third illness by mortality in the majority of available relevant literature. **Goals:** Goal of the study was to research all the cases of the patients who suffered from the acute stroke in the Canton of Sarajevo and those who were treated in the pre-hospital phase by Emergency Medical Institute staff and their working diagnosis was established as CVI ac. **Material and methods:** The criteria in the research were established for inclusion and exclusion of cases. The days with and without CVI cases were compared with the meteorological data obtained from the Hydro-meteorological Institute of Federation of Bosnia and Herzegovina. Since the approval was requested and obtained from the Hydro-meteorological Institute, all the meteorological data could be compared. The meteorological data comprise the barometer pressure measuring every day at 7 h, 14 h and 21 h. **Results and discussion:** In the retrospective study, there will be followed, during three years (2004, 2005 and 2006), the cases of the patients who suffered from the stroke, and, the emergency medical care was offered to them by the side of the Emergency Medical Institute of Canton of Sarajevo staff. All the cases in the Canton of Sarajevo were followed regardless of the place of incidence: whether the help was offered in Institute's outpatient departments, patient's flat or at public place. Due to the extensiveness of data (in the analysis comprising three years, there was the total of 1930 cases), the test of normal distribution was used. Since it was about the pre-hospital research, the acute stroke was looked at generally without division by types. The certain diagnostics by types can only be established in the hospital. **Conclusion:** The results in the research indicate that the extreme values of barometer pressure, regardless of their being increased ones or decreased ones, influence the increase of CVI incidence, while by comparing the average values in the days with CVI and without CVI, they did not have any influence on the CVI incidence.

Key words: emergency medical care, barometer pressure, CVI.

1. INTRODUCTION

The stroke represents a huge problem in the world, since it is the third illness by mortality and the third illness by non-traumatic disability. About 30% of persons, after having suffered from the stroke, die, while only 30% get recovered and 40% become the invalids with various degree of disability, which represents a huge social-economic problem for the society and economy of that country. The stroke is not the illness of the individual, but the complete family must get involved in the patient's recovery and rehabilitation. The consequence of CVI can be the complete paralysis of one side of the body to the partial one. The speech can also be paralyzed or impaired. There are also present the

psychological disturbances (sudden change of mood) and mental disturbances with gaps in memory. Their power of judgment can be reduced or changed.

The CVI is characterized by sudden neurological dysfunction which is the consequence of insufficient blood supply of the cerebral tissue. The strokes can be divided in two groups depending on the etiology as follows: ischemic (83%) and hemorrhagic (17%). The hemorrhagic stroke is: "The intracranial bleeding which is the third most frequent cause of the stroke, with total share of 17% (10% is the intracerebral bleeding, while subarachnoid bleeding is represented with 7%). Although the etiology is various, the most frequently, there are represented the subgroups – primary

or hypertensive bleeding, ruptured saccular aneurysm or vascular malformation and bleeding related to diseases of homeostasis and consequences of use of anticoagulation medicaments" (1). „The ischemic stroke (ISH) is the result of thrombosis or embolism in cerebral blood vessels" (2). There are several triage scales for pre-hospital establishment of CVI and such as: Los Angeles Pre-Hospital Scale (LAPSS) and Cincinnati Scale.

“The biometeorology is the part of the meteorology which deals with the influence of weather on people, animals and plants. The human being, like all the living beings on the Earth, from the birth, is surrounded by the ocean which is called atmosphere (and hydrosphere) and is used to the changes which take place in that milieu. The atmosphere and the human being are two dynamic systems in uninterrupted mutual interaction. We all feel the weather changes, but a healthy human being has also corresponding mechanisms for adaptation to them. But, with age and illness, the mechanisms of adaptation to these changes (compensation mechanisms) become weaker, first of all it is the immune system of organism, so that the difficulties appear more and more and they are called by one name which is indicated as meteoropathy" (3).

As the selected climate parameter, we chose barometer or atmospheric pressure since: „The barometer pressure is one of the basic indicators of dynamics of atmospheric processes. It is defined by the intensity of force by which the air with unit average from the upper limit of atmosphere has effect on the unit of horizontal surface of 1 cm², which is presented in hectopascals (hPa). Considering that the altitude between meteorological stations at Bjelave and in Butmir is low – 137 m, thus the considerations can be conducted only for the MS (Meteorological Station) Bjelave, considering that the values for the area of Butmir can be obtained by establishing the vertical barometer gradient" (4).

The place of research is Sarajevo, the capital of BiH, which is located at the Balkan peninsula in South-Eastern Europe (Northern latitude: 43° and 52', and 18° and 25' eastern from Greenwich). The climate is moderate continental.

“The Sarajevo valley is located in inter-mountain (inside-mountain depression) amongst the massifs of Bjelašnica and Igman on South-West and low-mountain and medium mountain area on the North-East. The average altitude is about 500 m. The lowest elevation is on the North in the area of Reljevo, while somewhat higher elevations are in creek-like wider parts of Željeznica, Kasindolska, Tilava, Miljacka and Zujevina. The most western point of the valley lies under 18° 16' E (settlement of Blažuj), whilst the most eastern point has the value of 18° 27' (Sarajevo settlement of Bentbaša).

The most northern point lies under 43° 53' N (in the settlement of Reljevo), while the most southern point is in the entry of rocky basin of Željeznica into the field (southern from Vojkovići) and has the value of 43° 47' N. The valley has the surface of about 31,7 km² with the center in the area of Ilidža and Plandište. It is located in the spring area of Bosna in which Zujevina with Rakovica flow, as well as Željeznica with Kasindolka, Dobrinja with Tilava and Miljacka. The average value of air pressure at MS «Bjelave» is 942,7 hPa with the fluctuation degree from 939,8 hPa to 944,9hPa (4).

2. GOAL OF THE STUDY

The goals of this research are as follows: To establish the importance of barometer pressure for CVI incidence; To establish the trend of occurrence of CVI in the considered period and to correlate the findings with the trend of barometer pressure changes; To correlate the established CVI incidence in relation to gender, age and chosen climate parameter. In our three-year research, we would like that the results contribute to the improvement of our bio-forecast as well as reduced CVI incidence in various groups of patients.

3. SUBJECTS AND METHODS

This work represents the retrospective research. The subjects are the patients of Emergency Medical Institute Sarajevo, who, in the period from 2004 to 2006 had the working diagnosis of CVI. For establishing the working diagnosis, there were used the criteria and instructions of Cincinnati Pre-Hospital Scale as well as the criteria for inclusion. The information on patients who had the working diagnosis of CVI and who were included in this study will be analyzed in relation to age, gender, time of establishing diagnosis (hour, month, season and year) and according to basic meteorological parameters. The basic meteorological data for days, months and years of researched period were submitted by the Federation Meteorological Institute, Canton of Sarajevo (Decision number: 04-33-2-197/06). The card with relevant data was formed for each subject.

The select climate parameter which is analyzed in the work is: barometer pressure. The measuring was performed at 7 h, 14 h and 21 h every day of research and there was determined minimal, maximal and average barometer pressure from 2004. to the end of 2006. The statistical data processing was done in the program Microsoft EXCEL and Microsoft ACCESS. The results obtained in the research are statistically processed and for all the researched parameters, the tables are made and the pictures (graphs) are given with comment for easy reference of individual factors and their mutual relations. In the work, there is used the normal distribution test for testing hypotheses whether or not the influence of barometer pressure on CVI incidence exists. For every noticed phenomenon, the arithmetical average, standard mistake and variance of change as well as parameter of normal distribution conformity were determined. Also statistical methods of data analysis and synthesis, method of obviousness, generalization method, comparative method and compilation method are used. As significant value, there is taken $p < 0.05$. The degree of mutual relation of CVI and barometer pressure is determined by the indicator – coefficient of correlation.

4. RESULTS

The research results are grouped according to the analysis of certain parameters which were considered. During three-year research (2004, 2005 and 2006), there were registered, in the working protocols, 1930 patients who had acute stroke or stroke relapse. The EMI Sarajevo staff offered emergency medical care to the patients. Out of 1930 patients, the male persons are 924 (48.88%), while female persons are 1006 (51.12%). The data analysis is carried out for each year individually, as well as all three years together.

Period 2005.		Men			Women			Total		Weekly average		
From	To	No.	%for men	%for total	No.	%for women	%for total	No.	%	T(°C)	Bar	V.%
01.03.	06.03.	5	2,81	1,32	3	1,49	0,79	8	3,96	-7,63	936,25	57,88
07.03.	13.03.	4	2,25	1,05	6	2,97	1,58	10	4,95	-2,70	941,20	66,30
14.03.	20.03.	8	4,49	2,11	7	3,47	1,84	15	7,43	5,13	951,33	62,40
21.03.	27.03.	12	6,74	3,16	7	3,47	1,84	19	9,41	7,74	945,32	67,63
28.03.	31.03.	4	2,25	1,05	2	0,99	0,53	6	2,97	9,00	940,17	70,83
01.04.	03.04.	3	1,69	0,79	5	2,48	1,32	8	3,96	5,50	952,50	47,25
04.04.	10.04.	6	3,37	1,58	3	1,49	0,79	9	4,46	11,67	940,67	50,22
11.04.	17.04.	10	5,62	2,63	12	5,94	3,16	22	10,89	8,27	936,50	74,77
18.04.	24.04.	5	2,81	1,32	8	3,96	2,11	13	6,44	8,46	938,46	53,62
25.04.	30.04.	1	0,56	0,26	2	0,99	0,53	3	1,49	14,00	940,00	46,00

Table 1. Selected days in characteristic months

In the research for each year, two months are taken with the highest number of strokes and the average values of selected climate parameter are compared with the parameter values when there were no strokes. Aiming at preciseness, two weeks from each of the given months with the highest number of strokes with average values of climate parameters are set aside and they were tested to zero hypothesis. There are also correlated the changes of the given climate parameters on the day of CVI and the day before that. The age of patients is in the range from 24 to 99 years of age. The incidence of patients, who had stroke, by years of research, is: (2004) 151/100 000, (2005) 147 / 100 000, (2006) 162/100 000 inhabitants in the Canton of Sarajevo. The total age average of patients by years of age and gender in three-year period is: men – 69,31, women – 72,53 and together – 70,92 years of age. (table 1, 2).

The frequency of stroke by gender in the year 2005, from total number of observed patients with CVI (616), 51,46% was female persons, while 48,54% was male persons. Also the analyses in other years of research as well as collectively show similar results.

During the research, the statistical analysis was carried out in order to establish whether the correlation exists between CVI and barometer pressure. It was established that between the values of barometer pressure in the days with CVI and days without CVI, there is no statistical correlation. The analysis was carried out for every year of research individually, as well as for all three years together.

One of the examples of tabular survey of zero hypothesis testing by years for selected days in two months with the most of strokes in 2005. and analyzed climate parameters with average values of climate parameters without stroke in three-year research. The characteristic months with the highest number of CVIs are March and April, 2005. It is established that with the significance of $p < 0,05$, the average values of barometer pressure did not have any influence on CVI incidence.

Highest number of strokes in the year 2004 occurred in January, then February and the least number of strokes occurred in November. By gender, the men had the highest number of strokes in January (33 or 10,75%), while the women had the highest number strokes in February (37 or 11,28%).

The highest number of CVIs occur in the decade 70-79 (258 / 41,8%), then 60-69 (151 / 24,51%) for 2005. Sepa-

rately, until decade 60-69, the men are more represented and later women. The results are similar also in the other years of research.

The highest percentage of number of CVIs in one day with lower average pressure of 934 mbar then 927, 920, 923 mbar. The highest average of number of CVIs in 2005 per one day with much lowered average pressure of 922 and 927mbar.

Years of age	Men	%	Women	%	Total	%
30 to 39	0	0	1	0,16	1	0,16
40 to 49	7	1,13	5	0,81	12	1,94
50 to 59	45	7,30	29	4,70	74	12,01
60 to 69	84	13,63	67	10,87	151	24,51
70 to 79	120	19,48	138	22,40	258	41,88
80 to 89	40	7,79	70	11,36	110	17,85
90 to 99	3	0,48	7	1,13	10	1,62

Table 2. Number of strokes by gender and years of age in 2005

The highest average of number of CVIs in 2006 per one day with extremely high average pressure of 961 and then very low pressure of 924 mbar.

We also researched number of strokes by months in year (2004.-2006.). The largest number of strokes was in January (181 or 9,38%), then in April (177 or 9,17%) while the least number was in November (126 or 6,53%) in the period from 2004-2006. By gender, the men have the highest number of strokes in March and in April – 89 or 9,63/4,61% each, while the women have the highest number of strokes in January – 101 or 10,04/5,23%.

We analyzed average number of CVIs per one day with same average atmospheric pressure in three-year period (2004-2006). The stroke per one day is the most frequent at much lowered atmospheric pressure of 927 mbar and 922 mbar as well as at very high pressure of 960 mbar.

For 41 occurrences of different number of strokes which are sorted by classes in the table, the correlation coefficient is $r = 0,85$, which represents significant degree of correlation between CVI and average pressure in the day.

For 21 occurrences of different numbers of strokes sorted by classes in the table, the correlation coefficient is $r = 0,35$, which represents a mild correlation between CVI and change of barometer pressure in the day.

No. of occurrences of strokes		Average pressure in day p (bar) at 7,00; 14,00 ;21,00							
No. of strokes	x1÷x2	920-926	926-932	932-938	938-944	944-950	950-956	956-962	962-968
y1÷y2	Ysr \ Xsr	923	929	935	941	947	953	959	965
0-20	10	5	6	0	0	0	1	5	1
20-40	30	0	0	3	0	0	3	0	0
40-60	50	0	0	2	0	0	0	0	0
60-80	70	0	0	1	0	0	2	0	0
80-100	90	0	0	0	3	1	0	0	0
100-120	110	0	0	0	3	2	0	0	0
120-140	130	0	0	0	0	3	0	0	0
140-160	150	0	0	0	0	0	0	0	0

Table 3. Correlation of number of strokes and average pressure in the day

No. of occurrences of strokes		Average change p(bar) from 7,00 to 14,00						
No. of strokes	x1÷x2	-4-3	-3-2	-2-1	-1-0	0-1	1-2	2-3
y1÷y2	Ysr \ Xsr	-3,5	-2,5	-1,5	-0,5	0,5	1,5	2,5
0-20	10	1	0	1	0	0	1	2
20-40	30	0	0	0	0	0	2	0
40-60	50	0	0	1	0	1	0	0
60-80	70	0	0	0	0	0	0	0
80-100	90	0	0	1	1	1	0	0
100-120	110	0	0	1	2	0	0	0
120-140	130	0	0	2	1	1	0	0
140-160	150	0	0	1	0	1	0	0

Table 4. Correlation of strokes and change of pressure in the day.

5. DISCUSSION

During three-year retrospective research which was conducted in the EMI Sarajevo in the period of 2004, 2005 and 2006, it was about the homogeneous group of patients in relation to gender, age and years of research. The analysis was conducted for each year individually and collectively. The total number of persons which suffered from the acute stroke (CVI) and who are registered in the working protocols is 1930. It represents very large number of samples for research and that is why the normal distribution test was used. As climate parameters, the values of barometer pressure are analyzed. The research results are tested statistically in relation to zero-hypothesis by comparing the average meteorological data on the days with CVI and days without CVI. The statistical analysis of barometer pressure and CVI frequency was done in relation to all the samples, as well as for every year of research separately. There are established two months in the considered period which had the highest incidence of CVI. Within these two months, there are established four weeks with the highest incidence of CVI. For each of these periods, there is established the importance of selected climate parameter in the incidence of CVI. The CVIs were diagnosed from adolescent age to late seniority, the most frequently between 70 and 79 years of age in all three years of research (2004.-40,31%, 2005.-41,88%, 2006.-42,26%), then 60-69 also in all three years of research: 2004.-27,24%, 2005.-24,51% and 2006.- 21,35%. The youngest patient was 24 years old, while the oldest was 99 years old. The average age of patients in all three years of research is 70,92 years, and, separately by gender, for men – 69,31 and for women – 72,53 years. The Emergency Medical Institute Sarajevo staff offered the emergency

medical care to the patients. All the cases which met the criteria for inclusion were considered in the research. The analysis was carried out retrospectively and the CINCINNATI pre-hospital scale (Kothari and associates 1999.) was used. The CINCINNATI scale effectively identifies the patients for rough neurological evaluation with acute stroke and it researches 3 main physical findings out of which one changed finding is highly suspectable regarding acute stroke: 1. Facial distortion (facial asymmetry), 2. Direction of raised and extended arms (raising arms), 3. Capability to speak (changed – impaired speech).

- A large number of authors in different geographical parts of the world have researched the influence of weather changes on human health and occurrence of CVI: Nowadays, there is the general conclusion that there is the relation between the climate factors and human health, but the scientists have not yet agreed precisely about the mechanism of the way in which those weather-climate factors influence the human health. Some of them think that only the extreme variations of climate factors influence the human health, some others think that the seasonal variations lead to increased mortality, while there are also those who blame the air-pollution ozone wholes, global warming of the planet of Earth, air ionization, thinking that they influence directly or indirectly the frequency of falling sick and dying.

The positive meteorological conditions in which the human being feels well are the combination of several climatic parameters along with optimal air temperatures of 21 °C (17-23 °C) and humidity of 50% (50-65%) and barometer pressure which is on average, for the area of Sarajevo, 943 mbar, while at the sea level, it is 1013 mbar.

Oberg and associates (2000.), University of N. Carolina,

USA, in the research conducted on 72779 patients in the period of 10 years (1986.-1995.), there is established clear evidence of occurrence of ischemic stroke caused by the weather. The highest incidence is in the middle of May. There is no link between the CVI and season. The area and race of patient do not have any influence.

Nyquist and associates (2001.) at Mayo Clinic, Minnesota, USA, during 30-year research (1960.-1989.) conducted on 155 patients with SAH and 15-year period (1974-1989) research conducted on 137 patients with ICH, it was established that the SAH and ICH incidence in the day is the most frequently between 8 a.m. and 4 p.m. The SAH incidence showed that there are the variations caused by the weather with significant increase during December, January and February. Regarding ICH, it appeared that there are no statistically significant variations caused by the weather.

In our research, there was not established either any statistical difference by months in year which would be significant for the CVI incidence for every year of research, but it was established that the highest number of cases was in January, April and August in the three-year period (2004.-2006.).

In our research the women are more represented in the total – 1006 or 52,12%, and the men – 924 or 47,87% as well as in all three years individually, but there is no significant statistical importance regarding the gender for the CVI incidence. The strokes are more frequent amongst the persons over 65 years of age, they are present in 76,17% (1470) and they are present the most in the decade from 70 to 90 years of age – 801 or 41,50%. There are 648 or 44,09% of men who are over 65 years of age and 822 or 55,91% of women. In the previous researches of Bokonjić R. (8.), the most of cases were in the decade from 60-69, which indicates that the life is prolonged for one decade considering all the consequences of CVI and its frequency, as well as the fact that the medicine had progressed in its development, diagnostics, treatment and technique. During 24 h, the most of cases occurred during the period from 8 a.m. to 2 p.m., especially in the morning between 9 a.m. and 10 a.m. and also from 8 a.m. to 9 a.m., which also corresponds to the majority of results from the literature which available for us.

Shenouda and associates (2005.) in their research in England (in two regions: Devon and Cornwall), in the population-based retrospective study in the period from 1992.-1996., 514 – 64% are women and 284 – 36% are men, they revealed a significant statistical link between the aneurismal SAH and increased barometer pressure but no link was established with temperature and air humidity. 61 years of age is the average age of patients. (46% of patients are over 65 years of age). The average age for the women is 63 and for the men – 57.

Houck and associates (2005.) researched the link between the barometer pressure and occurrence of acute myocardial infarction and stroke. The changes of barometer pressure indicate daily and seasonal variations and could influence the occurrence of vascular problems. The analysis was conducted in the central Texas from 1993.-1996. The climatic data were used from the national center. 1327 patients were comprised with acute infarction and 839 patients with stroke who were identified from the hospital's computer

database. There were analyzed average barometer pressure, greatest change of pressure and scope of pressure changes in 24 hours. The cyclic pressure variations are linked to greater daily variations during the winter months. There were lower daily values of barometer pressure during the summer and greater values during the winter. The link was not found between the barometer pressure and acute stroke, and as possible reason, there is mentioned the fact that the gathered data were related to all types of stroke regardless of cause, while regarding acute myocardial infarction, it was established that the link exists concerning decrease of barometer pressure.

In our research, when testing the zero-hypothesis of climatic parameters influence on the days with and without CVIs, in comparison of average values of monitored barometer pressures during two months with the most of CVIs and four weeks with the most of strokes within these months, the influence of average barometer pressure on the CVI incidence was not established, neither for the entire year. It was established that the highest CVI incidence in our research is on the occasion of extreme values of barometer pressure [960 mbar (pictures 2, 3, 4, 6)]. When testing the zero-hypothesis of conformity of appurtenance to the same set regarding the changes of tested climatic parameters in the day, it was established that in the majority of sets the analyzed changes of barometer pressure influence the CVI incidence.

The research focused on the correlation of barometer pressure in relation to the oscillations in the day in time period with the highest number of CVIs from 7 a.m. to 2 p.m. or changes of average barometer pressure in the day in relation to the previous day. In our research, there are comprised the cases in the day from 7 a.m. – 2 p.m. and the mild correlation $r = 0,35$ is established between the barometer pressure and CVI incidence, and, when all the cases are comprised also the high correlation $r = 0,85$ is present at the average barometer changes during the day (tables 3 and 4), while in the extreme situation (4 to 8 CVIs) in the day, where 54 days in three years are comprised with the average of 5,3 CVIs, the correlation is not present, which indicates that something else had influence during these days.

In the situations when looking for the mutual link amongst temperature, relative humidity and barometer pressure with CVI, it was established that on the days of CVI occurrence at increased temperatures, the barometer pressure is lower and relatively stable with mild oscillations, while the relative humidity is more changeable. On the days when the temperature is low, the barometer pressure is higher, while the barometer pressure and humidity oscillations are greater (12).

6. CONCLUSIONS

Based on the research results of the influence of the given climatic parameter on the CVI incidence, as well as based the results published in the scientific literature which is available for us, we make the following conclusions:

In the research period from 2004. to 2006., the total of 1930 patients with the working diagnosis CVI was registered. While testing the zero-hypothesis in two months with the highest number of CVIs in every research year

as well as with two weeks each with the highest number of CVIs during these two months, the average barometer pressure did not have any statistically important influence on the CVI incidence.

Visually, it is possible to establish that statistically important difference does not exist on the occasion of CVI occurrence regarding the gender. Both genders are nearly equally represented during the research and the masculine gender is represented 47,88%, while the women are represented a little more 52,12% during all three years of research.

The years of age have significantly important influence on the occurrence of stroke, so that the highest number of cases was in the decade 70-79 years (41,35%), then 60-69 years (24,30%), which corresponds also to the results in the scientific literature which is available for us where older persons are more exposed to the CVI incidence.

From the point of view of calendar, the strokes are represented in all months, mainly in the winter during January, then in spring in April, while in the summer it is in August, while the least they are represented in autumn in November, but without any statistical significance. The results correspond to the results of the majority of literature which is available for us.

The research results have established that the CVI incidence in total, as well as for each year individually, from 2004. to the end of 2006. increases at extremely low or high values of barometer pressure. The results obtained are significantly different from the majority of results from the scientific literature which available for us.

When examining the correlation of CVI and average pressure in the day for all the cases, there is established significant degree of correlation $r=0,85$ at average barometer pressure in the day. When examining the correlation of CVI and change of barometer pressure in the day (7 a.m. to 2 p.m.) a mild degree of correlation was established: $r=0,35$.

Considering that the research was conducted in relatively small area of BiH – Canton of Sarajevo—with specific geographical area, altitude and local climate, there would be needed further research in other parts of BiH which have their specificities regarding the climate, influence of weather on health and occurrence of strokes, in order that the data be more complete, and thereby our bio-forecast.

REFERENCES

1. Demarin V i sar: Faktori rizika za nastanak moždanog udara. *Medix*. 2001; 7 (37-38); 40-43.
2. Majstorović, Ž: Vrijeme i zdravlje, JP Sliv Save: Vode i Mi. 2006; 51: 74-79.
3. Drešković, N: Klima Sarajeva, Magistarski rad, Sarajevo, 2003. 1-4, 25-29, 151-155.
4. Kothari RU, Pancioli A, Liu T, Brott T, Broderick J.: Cincinnati Prehospital Stroke Scale. *Ann Emerg Med*. 1999; 33: 373-378
5. Oberg AL, Ferguson JA, McIntyre LM, Horner RD. Incidence of stroke and season of the year: evidence of an association, *Am J Epidemiol*. 2000; 152(6): 558-564,
6. Nyquist PA, Brown RD Jr, Owiebers D, Crowsu CT, O'Fallon WM. Circadian and seasonal occurrence of subarachnoidal and intra-cerebral haemorrhage. *Neurology*. 2001; 56(2): 190-193,
7. Shenouda EF, Pobreskin LH. Relation of Aneurismal Subarachnoid Haemorrhage and Climatic Conditions: A Retrospective Population-Based Study. *The Internet Journal of Neurosurgery*. 2005; 2 (2) DOI: 10.5580/1070
8. Houck PD, Lethen JE, Riggs MW, Gantt DS, Dehmer GJ.: Relation of atmospheric pressure changes and the occurrences of acute myocardial infarction and stroke. *Eur J Epidemiol*. 2005; 20(8): 693-698.
9. Buxton N, Liu C, Basic D, Moody P, et al. Relationship of Aneurismal Subarachnoid Haemorrhage to Changes in Atmospheric Pressure: Results of a Prospective Study. *J Neurosurg*. 2001; 95: 391- 392,
10. Inagwa T. Seasonal variation in the incidence of aneurismal subarachnoid haemorrhage in hospital community- based studies. *J Neurosurg*. 2002; 96: 497- 509.
11. Mehanović M, Šehović S. Analiza uzroka prometnih nesreća u javnom gradskom prevozu putnika. *Suvremeni promet Zagreb*. 2011; 3/4: 319-325
12. Slatina E, Bešlagić E, Musić M, Mehanović M. Korelacija promjena temperature zraka i incidence cerebrovaskularnog insulta. *ABC – časopis urgentne medicine*. 2010; 3 (10): 142-155