Incidence of Stroke and Transient Ischemic Attack in Croatia: A Population Based Study

Dragutin Kadojić1, Vida Demarin2, Marinko Dikanović3, Ivo Lušić4, Lidija Tuškan-Mohar5, Zlatko Trkanjec2, Ivan Mihaljević6, Mira Kadojić7, Milan Bitunjac3 and Željko Vranješ8

1 »J. J. Strossmayer« University, University Hospital Centre Osijek, Department of Neurology, Osijek, Croatia
2 University of Zagreb, »Sestre milosrdnica« University Hospital, Department of Neurology, Zagreb, Croatia
3 »Dr. Josip Benčević« General Hospital, Department of Neurology, Slavonski Brod, Croatia
4 University of Split, University Hospital Centre Split, Department of Neurology, Split, Croatia
5 University of Rijeka, University Hospital Centre Rijeka, Department of Neurology, Rijeka, Croatia
6 »J. J. Strossmayer« University, University Hospital Centre Osijek, Clinical Institute of Nuclear Medicine and Radiation Protection, Osijek, Croatia
7 »J. J. Strossmayer« University, University Hospital Centre Osijek, Department of Physical Medicine and Rehabilitation, Osijek, Croatia
8 »J. J. Strossmayer« University, University Hospital Centre Osijek, Department of Otorhinolaryngology and Cervicofacial Surgery, Osijek, Croatia

A B S T R A C T

The aim of this population based neuroepidemiological study was to establish the real incidence rates of acute cerebrovascular disease (CVD): stroke and transient ischemic attack (TIA) in the Republic of Croatia. Multicentric study included 89 501 persons of all ages in four regional centres in Croatia: Zagreb, Osijek + Slavonski Brod, Rijeka and Split. The following incidence rates of stroke, expressed at population of 100 000, have been established: Zagreb 290.52, Osijek + Slavonski Brod 302.14, Rijeka 219.65, Split 195.82. Incidence rate of stroke for the Republic of Croatia is 251.39. The following incidence rates of TIA, expressed at population of 100 000, have been established: Zagreb 87.15, Osijek + Slavonski Brod 156.53, Rijeka 90.11, Split 59.10. Incidence rate of TIA for the Republic of Croatia is 100.55. In the continental part of Croatia (Zagreb, Osijek + Slavonski Brod) incidence rate of stroke is higher by 45%, while incidence rate of TIA is higher by 82% than in the coastal part of Croatia, probably due to different lifestyle and environmental factors. The study has shown relatively high incidence rates of acute CVD (stroke and TIA) in the Republic of Croatia, which proves that CVD are a great public health problem.

Key words: cerebrovascular disorders, stroke, transient ischemic attack, incidence, Croatia

Introduction

In modern developed countries stroke is the third most common cause of death, after cardiovascular diseases and malignoma. In the Republic of Croatia stroke has been the leading cause of death and invalidity for many years. Thus data analysis on prevalence, incidence and mortality from stroke, as well as the analysis of long-term outcome of this disease, are of great medical and public health significance. The last population indicators on incidence of stroke in the Republic of Croatia were published in the 1980s (Klein-Pudar, Poljaković et al.)3,5. As neuroepidemiological data on stroke in our country are outdated and incomplete, new epidemiological studies are necessary. The aim of this study was to establish the real incidence rates of acute cerebrovascular disease (CVD): stroke and transient ischemic attack (TIA) and find out whether there are significant regional differences in the incidence of these diseases in the Republic of Croatia.

Patients and Methods

Four study centres were formed. Two of them were located in the continental part of Croatia (Osijek + Slavonski Brod with surrounding areas and Zagreb with surrounding areas), and another two in the coastal part of...
Croatia (Rijeka and Split with their surrounding areas). These centres represent the overall Croatian population well, both geographically and population-related (five largest cities in Croatia). 89,501 examinees were followed for a year (January 1st – December 31st 2005) by their general practitioners who filled-in a default questionnaire for every new case of stroke and TIA. There were 17,210 examinees from the central part of Croatia (Zagreb), 27,471 examinees from the Eastern part of the country (Osijek + Slavonski Brod), 17,755 examinees from the Northern part of Croatian coast (Rijeka) and 27,065 examinees from central coastal part of the country (Split). Geographic distribution of the research centres is shown in Figure 1.

Unfortunately, it was not possible to include the complete population of Croatia, since national stroke registry was not established. Most of the patients with symptoms of stroke and TIA in Croatia are urgently sent to hospitals. Diagnosis is made by a neurologist. This practice was also used in this study. In cases when the affected patients were not sent to a neurologist, diagnosis was made by a family medicine doctor who consulted a neurologist included into this study. The research protocol had several stages. In the beginning, plan of the research was made, diseases were precisely defined and aims were set, population and parameters to be investigated were defined, and questionnaires for investigation were designed. In the next phase, fields of investigation were defined, contacts with general practitioners were made and investigation teams were formed. After that, investigation teams were educated and criteria were standardized. Following the above preparatory actions, we started to collect data and stored them on computer hard disks. In the end we performed statistical analysis. In this research, internationally accepted methodology was applied. Internationally suggested criteria for »ideal« stroke incidence study were followed including: standard diagnostic criteria, complete case ascertainment, prospective design, and representative population. All pathological types of stroke were included (CI, PICH, SAH).

The main investigation leader and team leaders in certain regional centers were in continuous contact with general practitioners included in this research. All data were checked by experienced neurologists and then recorded into database. A descriptive statistical analysis has been performed. Incidence rates have been calculated at 100,000 population and the results have been shown in adequate tables.

**Results**

During one year period (January 1st – December 31st 2005) cases of acute CVD were recorded as follows: 50 cases of stroke and 15 cases of TIA in Zagreb; 83 cases of stroke and 43 cases of TIA in Osijek + Slavonski Brod; 39 cases of stroke and 16 cases of TIA in Rijeka; 53 cases of stroke and 6 cases of TIA in Split (Table 1).

According to data collected on all strokes and TIs during the investigated period we calculated incidence rates, expressed at the population of 100,000, as follows: Zagreb 290.52, Osijek + Slavonski Brod 302.14, Rijeka 219.65, Split 195.82. Incidence rate of stroke for the Republic of Croatia is 251.39. The following incidence rates of TIA, expressed at the population of 100,000, have been
established: Zagreb 87.15, Osijek + Slavonski Brod 156.53, Rijeka 90.11, Split 22.16. Incidence rate of TIA for the Republic of Croatia is 100.55 (Table 2).

In the continental part of Croatia (Zagreb, Osijek + Slavonski Brod) incidence rate of stroke is 296.33, while incidence rate of TIA is 121.84. In the coastal part of Croatia (Rijeka, Split) incidence rate of stroke is 205.87, while incidence rate of TIA is 71.40 (Table 3).

In the continental part of Croatia incidence rate of stroke is 45% higher and incidence rate of TIA is 82% higher than in the coastal part of Croatia.

**Discussion and Conclusion**

Neuroepidemiological studies meet many methodological problems. Community based investigations depend on specific knowledge and readiness of the participants. In spite of the fact that most reliable data on incidence and mortality are those of patients treated in hospitals, even they are not always precise if complete diagnostics and autopsy were not performed. Data obtained from general practitioners and coroners are even less precise. Some cases of stroke are not presented by classic signs of motoric paralysis, speech disorders etc. which causes diagnostic problems. It is even more difficult to diagnose the cause of death in persons who died at home or outside hospitals, due to differentiation of cardiovascular, cerebrovascular or other causes of death. Apoplectic syndrome can appear as a result of other causes like uncompensated brain tumors or other acute incidences of central nervous system. In developed countries, epidemiological indicators are well established and well known, while in other regions such data are insufficient. For these reasons no major population studies of stroke epidemiology have been performed in the Republic of Croatia for many years. We

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**TABLE 1**

<table>
<thead>
<tr>
<th>Centers</th>
<th>No of patients</th>
<th>No of stroke cases</th>
<th>No of TIA cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osijek + Slavonski Brod</td>
<td>27,471</td>
<td>83</td>
<td>43</td>
</tr>
<tr>
<td>Zagreb</td>
<td>17,210</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>Rijeka</td>
<td>17,755</td>
<td>39</td>
<td>16</td>
</tr>
<tr>
<td>Split</td>
<td>27,065</td>
<td>53</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>89,501</td>
<td>225</td>
<td>90</td>
</tr>
</tbody>
</table>

TIA – transient ischemic attack

**TABLE 2**

<table>
<thead>
<tr>
<th>Center</th>
<th>Stroke Incidence rate / 100 000 citizens</th>
<th>TIA Incidence rate / 100 000 citizens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osijek + Slavonski Brod</td>
<td>302.14</td>
<td>156.53</td>
</tr>
<tr>
<td>Zagreb</td>
<td>290.52</td>
<td>87.15</td>
</tr>
<tr>
<td>Rijeka</td>
<td>219.65</td>
<td>90.11</td>
</tr>
<tr>
<td>Split</td>
<td>195.82</td>
<td>59.10</td>
</tr>
<tr>
<td>Average</td>
<td>251.39</td>
<td>100.55</td>
</tr>
</tbody>
</table>

TIA – transient ischemic attack

**TABLE 3**

<table>
<thead>
<tr>
<th>Center</th>
<th>Stroke No of cases</th>
<th>Incidence rate / 100 000 citizens</th>
<th>TIA No of cases</th>
<th>Incidence rate / 100 000 citizens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continental region (Zagreb, Osijek + Slavonski Brod)</td>
<td>133</td>
<td>297.66</td>
<td>58</td>
<td>129.80</td>
</tr>
<tr>
<td>Coastal region (Rijeka, Split)</td>
<td>92</td>
<td>205.26</td>
<td>32</td>
<td>71.40</td>
</tr>
</tbody>
</table>

TIA – transient ischemic attack
mostly use data of the National Bureau of Statistics on the deceased from this disease in everyday work. The last population study of stroke incidence was performed in 1984 in Zagreb on a small sample of 1,000 inhabitants (Poljaković et al.). The incidence rate of stroke was 2.4‰, and of TIA about 3‰. According to data obtained by this amount, i.e. food with high amount of unsaturated fatty acids and antioxidants. It is well known that such type of nutrition decreases the risk for coronary heart disease and atherosclerosis. Some other factors in life habits and environmental factors are also important. Similar observations and differences between continental and coastal regions in relation to mortality from stroke in the Republic of Croatia have been published.

The study showed a relatively high rate of acute CVD (stroke and TIA) incidence in the investigated areas and confirmed CVD as one of the leading medical and public health issues in Croatia. Significantly higher incidence rates of acute CVD in the continental part of Croatia prove that the lifestyle and environmental factors influence the incidence of acute CVD.

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D. Kadojić

»J. J. Strossmayer« University, University Hospital Centre Osijek, Department of Neurology, J. Huttlera 4, 31000 Osijek, Croatia

e-mail: kadojic.dragutin@kbo.hr

INCIDENCIJA MOŽDANOG UDARA I TRANZITORNE ISHEMIJSKE ATAKE U HRVATSKOJ: POPULARIJSKA STUDIJA

SAŽETAK

Cilj ove populacijske neuroepidemiološke studije bio je utvrditi stvarne stope incidencije akutne cerebrovaskularne bolesti (CVB): moždanog udara (MU) i tranzitorne ishemijske atake (TIA) na području Republike Hrvatske (RH).