

Improvement of survival in Polish stroke patients is related to reduced stroke severity and better control of risk factors: the Krakow Stroke Database

Marta Swarowska, Jacek Burkot, Aleksandra Janowska, Aleksandra Klimkowicz-Mrowiec, Joanna Pera, Agnieszka Slowik, Tomasz Dziezic

Department of Neurology, Jagiellonian University Medical College, Krakow, Poland

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Corresponding author:

Tomasz Dziezic MD
Department of Neurology
Jagiellonian University
Medical College
3 Botaniczna St
31-503 Krakow, Poland
Phone: +48 12 424 86 00
E-mail: dziedzic@cm-uj.krakow.pl

Abstract

Introduction: In the last decade, the stroke mortality rate in Poland significantly decreased. We hypothesised that stroke severity, the major determinant of outcome, is lowered in Polish stroke patients.

Material and methods: We compared the stroke severity in two cohorts of first-ever ischaemic stroke patients admitted within 24 h after stroke onset to the Department of Neurology, Jagiellonian University, Krakow in the years 1994–2000 and 2008–2012. To assess stroke severity we used the National Institute of Health Stroke Scale (NIHSS). We defined mild stroke as an NIHSS score ≤ 4 .

Results: We included 816 patients hospitalised in the years 1994–2000 and 569 patients hospitalised in the years 2008–2012. NIHSS score on admission was higher in the former (mean: 12.0 ± 7.0 vs. 8.0 ± 6.0 , $p < 0.01$), and the frequency of mild stroke was higher in the latter (12.7% vs. 41.8%, $p < 0.01$). Although the frequency of hypertension (67.3% vs. 81.2%, $p < 0.01$), diabetes mellitus (20.8% vs. 26.4%, $p = 0.02$) and atrial fibrillation (20.7% vs. 26.2%, $p = 0.02$) was higher in patients hospitalised in the years 2008–2012, the systolic and diastolic blood pressure values and the frequency of fasting hyperglycaemia were lower in this cohort. This cohort also less frequently suffered from hypercholesterolaemia (25.4% vs. 16.3%, $p < 0.01$).

Conclusions: Reduced stroke severity is associated with better recognition and control of risk factors and explains the improvement of survival in Polish stroke patients.

Key words: ischaemic stroke, stroke severity, risk factors, hypertension, hypercholesterolaemia.

Introduction

Epidemiological and hospital-based studies conducted in the 1990s showed a higher mortality rate in Polish stroke patients compared to patients from the USA or western European countries [1–3]. In the Warsaw Stroke Registry, 30-day and 1-year case fatality rates in the years 1991–1992 were 43% and 59.7%, respectively. This excessive stroke mortality was attributed, at least partially, to more severe stroke and higher frequency of cardiovascular diseases (hypertension, atrial fibrillation, diabetes, coronary heart disease, heart failure) in the Polish population [4].

In the last two decades the death rate from coronary heart disease in Poland halved [5–8]. This reduction was attributed to favourable changes in cardiovascular risk factors (~54% fall) and modern treatments (~37% fall) [8]. In the last decade a significant decrease in mortality rates was observed in Polish stroke patients [9, 10]. According to the European Register of Stroke Project, 30-day case fatality in the Warsaw population in the year 2005 was 14.9% and 1-year case fatality was 33.1%.

We hypothesised that reduced stroke mortality in Polish patients could be related to decreased stroke severity, which is the major determinant of outcome in stroke patients.

Material and methods

Using our stroke database, we compared the baseline characteristics of the cohort of patients hospitalised in the Department of Neurology, Jagiellonian University, Krakow in the years 1994–2000 and the cohort of patients hospitalised in the years 2008–2012. Consecutive patients with first-ever ischaemic stroke admitted to our stroke unit within 24 h after stroke onset were eligible for the study. The cohort of patients hospitalised in the years 1994–2000 included 816 persons and the cohort of patients hospitalised in the years 2008–2012 included 569 persons.

All patients underwent head computed tomography (CT) scan within 24 h after stroke onset. We assessed stroke severity using the Scandinavian Stroke Scale (SSS) [11] for patients hospitalised in the years 1994–2000 and the National Institute of Health Stroke Scale (NIHSS) [12] for patients hospitalised in the years 2008–2012. Nowadays

NIHSS is routinely used in clinical practice; however, for long time this scale was used mainly in the United States, whereas European countries tended to use the SSS. To facilitate the comparisons between groups, we converted SSS scores to NIHSS scores using a published mathematical equation [13]. A previous study demonstrated that total scores for SSS and NIHSS may be interconverted with good precision [13]. We defined mild stroke as an NIHSS score ≤ 4 . This threshold has been commonly used in previous studies on thrombolysis in stroke patients [14].

Arterial hypertension was diagnosed when its presence was documented in medical records or when at least 2 readings of blood pressure were ≥ 140 mm Hg (systolic) or ≥ 90 mm Hg (diastolic) after the acute phase of stroke. Diabetes mellitus was diagnosed if its presence was documented in medical records or the patient was taking insulin or oral hypoglycaemic agents. Hypercholesterolaemia was defined as a fasting total cholesterol level > 6.1 mmol/l. Fasting hyperglycaemia was defined as a serum glucose level > 6.1 mmol/l. The glomerular filtration rate (GFR) was estimated from the Modification of Diet in Renal Disease equation.

The study protocol was approved by the Bioethics Committee of Jagiellonian University (120/B/2012).

Statistical analysis

The χ^2 test was used to compare proportions and the Mann-Whitney test to compare continuous variables between groups. The calculations were performed using the program Statistica for Windows (version 10, StatSoft, Poland).

Table I. Characteristics of two stroke patient cohorts

Parameter	Cohort 1994–2000 (N = 816)	Cohort 2008–2012 (N = 569)	P-value
Age, mean \pm SD	69.6 \pm 12.6	70.4 \pm 13.4	0.23
Female, n (%)	431 (52.8)	296 (52.0)	0.77
Hypertension, n (%)	549 (67.3)	462 (81.2)	< 0.01
Diabetes mellitus, n (%)	170 (20.8)	150 (26.4)	0.02
Previous myocardial infarction, n (%)	104 (12.7)	80 (14.1)	0.48
Atrial fibrillation, n (%)	169 (20.7)	149 (26.2)	0.02
Hypercholesterolaemia, n (%)	207 (25.4)	93 (16.3)	< 0.01
TIA prior to stroke, n (%)	68 (8.3)	30 (5.3)	0.03
NIHSS score on admission, mean \pm SD	12.0 \pm 7.0	8.0 \pm 6.0	< 0.01
Mild stroke, n (%)	104 (12.7)	238 (41.8)	< 0.01
30-day case fatality, n (%)	134 (16.4)	30 (5.3)	< 0.01
Systolic blood pressure on admission, mean \pm SD	161 \pm 29	151 \pm 26	< 0.01
Diastolic blood pressure on admission, mean \pm SD	94 \pm 16	87 \pm 14	< 0.01
Fasting hyperglycaemia, n (%)	333 (40.8)	180 (31.6)	< 0.01
GFR < 60 ml/min per 1.73 m ² , n (%)	300 (36.7)	115 (20.2)	< 0.01

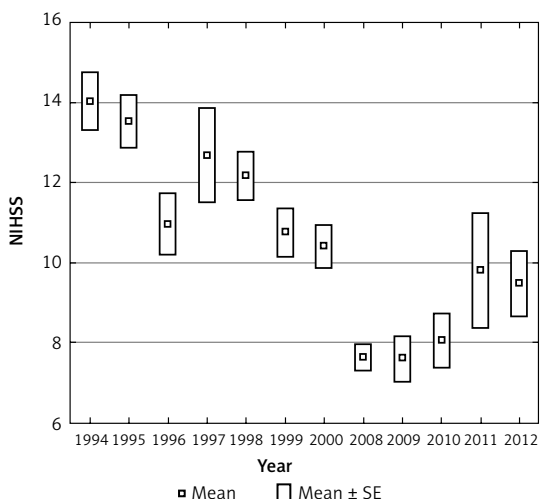


Figure 1. NIHSS scores in patients hospitalised in years 1994–2000 and 2008–2012

Results

The characteristics of both cohorts are shown in Table I.

The patients hospitalised in the years 1994–2000 had a significantly higher NIHSS score on admission than those hospitalised in the years 2008–2012. The proportion of mild stroke was lower in the former. NIHSS scores are shown in Figure 1.

The distribution of risk factors and cardiovascular diseases was different between groups. The patients hospitalised in the years 2008–2012 more often had diagnosed hypertension, diabetes mellitus and atrial fibrillation than the patients hospitalised in the years 1994–2000. Those hospitalised in the years 1994–2000 more often suffered from hypercholesterolaemia and transient ischaemic attack (TIA) prior to stroke.

Both systolic and diastolic blood pressure values were higher on admission in the patients hospitalised in the years 1994–2000 than in those hospitalised in the years 1998–2012. The former more frequently had GFR below 60 ml/min per 1.73 m² and more often had fasting hyperglycaemia.

Finally, 30-day case fatality was lower in the patients hospitalised in the years 2008–2012.

Discussion

We found decreased stroke severity reflected by a lower NIHSS score in the patients hospitalised in the years 2008–2012 compared with those hospitalised in the years 1994–2000. Stroke severity is the most important predictor of outcome. Thus, reduction in stroke severity could explain, at least partially, the lower case fatality observed by us in Polish stroke patients.

Paradoxically, the frequency of major risk factors (hypertension, diabetes mellitus, atrial fibrillation) was higher in the cohort hospitalised in the

years 2008–2012. The exception was hypercholesterolaemia, which was less frequent in this cohort. Also the frequency of TIAs before stroke was lower in this group of patients. Higher frequency of major risk factors in the cohort hospitalised in the years 2008–2012 could be explained by better recognition and treatment of cardiovascular diseases in Poland in recent years [8]. We observed significantly lower values of both blood pressure on admission and fasting glucose in the patients hospitalised in the years 2008–2012. Although blood pressure and glucose level measured in acute stroke depend partially on stroke severity, their lower values also reflect better control of hypertension and hyperglycaemia before stroke. Furthermore, higher values of glomerular filtration rate (GRF), the recognised marker of subclinical organ damage in hypertension, in the patients hospitalised in the years 2008–2012 suggest better control of blood pressure in this group of patients.

Lower frequency of hypercholesterolaemia in patients hospitalised in the years 2008–2012 could be related to changes in dietary habits and/or more common use of statins. A reduction of total cholesterol was observed in the last decades in the Polish population and was attributed to increased consumption of oils rich in α -linolenic acid [5–8].

Our study has several limitations. First, it was a single centre study, and our results do not necessarily reflect the epidemiological situation in the whole Polish population. Second, the conversion of SSS scores to NIHSS scores is not perfect, although a previous study showed satisfactory precision of this method [13]. Third, our study is not able to demonstrate causality between risk factors and stroke severity. Finally, we cannot verify the hypothesis that reduced stroke severity in our stroke patients may be related to more common use of statins and ACE inhibitors, drugs that could exert a neuroprotective effect [15–18]. Our database did not contain information about medications taken before stroke.

In conclusion, we observed a decrease of stroke severity among Polish patients hospitalised in recent years. The reduction in stroke severity was associated with better recognition and control of risk factors, which highlights the significance of primary prevention. However, it should be emphasised that the optimal blood pressure and cholesterol levels to optimise stroke prevention remain largely unknown [19, 20].

Conflict of interest

The authors declare no conflict of interest.

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