

Incidence and case fatality rates of first-ever stroke – comparison of data from two prospective population-based studies conducted in Warsaw

Zapadalność i wskaźniki śmiertelności dla pierwszego w życiu udaru mózgu – porównanie dwóch warszawskich badań populacyjnych

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Neurologia i Neurochirurgia Polska 2011; 45, 3: 207–212

Abstract

Background and purpose: According to official statistics, the stroke mortality rate has remained high in Eastern European countries for a few decades. It has been shown that also in Poland stroke mortality failed to decline in the period 1984 to 1992. Since that time, stroke management in our country has changed, especially in the cities, where stroke units have been developed. The aim of the present study was to compare incidence and case fatality rates, estimated on the basis of two prospective population-based studies performed in Warsaw in 1991/1992 and 2005.

Material and methods: Incidence rates and case fatality rates for the first-ever-in-a-lifetime stroke have been estimated on the basis of two population-based studies: the Warsaw Stroke Registry (population 182 649) conducted in 1991 and 1992, and the European Register of Stroke (population 120 186) – registration in 2005. In both studies data were standardized to the European population by the direct methods.

Results: Contrary to the incidence rates, which did not change significantly between 1991/1992 and 2005, 30-day and 1-year case fatality rates decreased significantly from 43% to 14.9% and from 59.7% to 33.1%, respectively.

Streszczenie

Wstęp i cel pracy: Zgodnie z oficjalnymi statystykami, w Europie Wschodniej od kilku dziesięcioleci wskaźniki umieralności i śmiertelności z powodu udaru mózgu są bardzo wysokie. We wcześniejszych badaniach epidemiologicznych prowadzonych w Polsce w latach 1984–1992 nie stwierdzono spadku umieralności z powodu udaru. Od tamtego czasu istotnie zmieniła się jednak opieka nad chorymi na udar mózgu, szczególnie w miastach, gdzie stworzone zostały oddziały udarowe. Celem tej pracy jest porównanie wskaźników zapadalności i śmiertelności z powodu udaru mózgu na podstawie dwóch badań populacyjnych prowadzonych w Warszawie w latach 1991/1992 i 2005 r.

Materiał i metody: Na podstawie dwóch badań populacyjnych: Warszawskiego Rejestru Udarów (liczebność populacji – 182 649), prowadzonego w latach 1991/1992, i badania populacyjnego prowadzonego w ramach projektu European Registers of Stroke (liczebność populacji – 120 186) w roku 2005, porównywano wskaźniki zapadalności i śmiertelności z powodu pierwszego w życiu udaru mózgu. W obu badaniach wskaźniki standaryzowano do populacji europejskiej metodą bezpośrednią.

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Received: 5.11.2010; accepted: 26.02.2011

Conclusions: Comparison of data from two population-based prospective stroke registries showed that stroke case fatality and mortality significantly decreased. This may be associated with the better management of patients in the acute phase of stroke and implementation of secondary prevention strategies for stroke.

Key words: stroke, epidemiology, incidence, case fatality.

Wyniki: Wskaźniki zapadalności nie zmieniły się istotnie pomiędzy latami 1991–1992 a 2005 r., natomiast wskaźniki śmiertelności 30-dniowej i rocznej zmiennie zmniejszyły się odpowiednio z 43% do 14,9% i z 59,7% do 33,1%.

Wnioski: Porównanie danych z dwóch populacyjnych rejestrów pierwszego w życiu udaru mózgu pokazało wyraźne zmniejszenie wskaźników śmiertelności. Może to wynikać z poprawy opieki nad pacjentami z udarem mózgu w fazie ostrej, jak również z wdrażania zasad profilaktyki wtórnej udaru mózgu.

Słowa kluczowe: udar mózgu, epidemiologia, zapadalność, śmiertelność.

Introduction

Stroke mortality rates vary considerably by country [1,2]. According to official statistics, Poland has one of the highest stroke mortality rates in Europe, which seems to result mainly from high case fatality rates. Population-based studies conducted in the 1980s and 1990s showed that Poland had an incidence of stroke similar to that of other countries but a very high mortality rate and a very high 30-day case fatality rate for first-ever-in-a-lifetime stroke (FEL), exceeding 30% [3,4]. A World Health Organization (WHO) report based on information from death certificates showed that the stroke mortality rate in Poland increased between 1970 and 1985 [5]. In addition, stroke mortality failed to decline between 1984 and 1992 because neither the case fatality rate nor the stroke incidence rate decreased [4,6]. In recent decades, mortality due to cardiovascular disease has declined in many countries [7–10]; this trend has been observed in Poland as well [11–13].

The aim of this study was to compare the incidence, 30-day, and 1-year case fatality rates for FEL based on prospective population-based stroke registries conducted in Warsaw in 1991/1992 [3,14] and 2005.

Material and methods

Two 2-year, prospective, population-based stroke registries were conducted in Warsaw. The first, the Warsaw Stroke Registry (WSR), aimed to register FEL among permanent residents of the Ursynów and Mokotów districts in Warsaw from January 1, 1991 to December 31, 1992 (population as of 1991: 182 649; 85 791 males and 96 858 females) [3,4,14]. The second study, conducted as part of the European Register of Stroke Project (EROS), registered FELs among permanent

residents of the Ursynów District in Warsaw between January 1, 2005 and December 31, 2005 (population: 120 186; 56 816 males and 63 370 females). The source population was estimated from a constantly updated official population register which was based on an available census from 2002 [15]. The two populations were similar with respect to socio-economic parameters and risk factor profiles (see *Results* section).

Cases were ascertained similarly in both studies: case subjects were ascertained by screening all hospitals that admitted acute stroke patients from the studied population. Patients not admitted to hospitals were identified by regular screening of all primary care facilities (e.g., general practitioners and outpatient clinics) and nursing homes in the study area and by checking death certificates; specially trained fieldworkers or neurologists from the study group performed these activities. Moreover, before the project was started, all hospital physicians, general practitioners, nursing institutions, and health authorities in the study area were contacted, informed of the study, and asked to report suspected cases of stroke to the study centre: the Institute of Psychiatry and Neurology. The data for both studies were collected by standardized questionnaire. All study participants were Caucasian.

Stroke was defined according to WHO criteria as a rapid onset of clinical signs of focal or global disturbance of cerebral function lasting more than 24 hours or leading to death, with no apparent nonvascular cause [1]. Stroke was classified as cerebral infarction or primary intracerebral haemorrhage based on computed tomography (CT)/magnetic resonance imaging scans, examination of cerebrospinal fluid, or necropsy. Cases without confirmation of stroke subtype were classified as undefined. In some cases, CT scan was repeated 7 days after stroke. Patients with subarachnoid haemor-

Table 1. Profile of populations in the Warsaw Stroke Registry (WSR) (1991/1992) and European Register of Stroke Project (EROS) study (2005)

Age, years	WSR, 1991/1992		EROS, 2005	
	Number	% of total population (95% CI)	Number	% of total population (95% CI)
<35	82 520	45.2 (45.0-45.4)	54 876	45.7 (45.4-45.9)
35-44	31 856	17.4 (17.3-17.6)	12 072	10.0 (9.9-10.2)
45-54	22 235	12.2 (12.0-12.3)	29 901	24.9 (24.6-25.1)
55-64	23 257	12.7 (12.6-12.9)	14 431	12.0 (11.8-12.2)
65-74	13 301	7.3 (7.2-7.4)	5724	4.8 (4.6-4.9)
75-79	4375	2.4 (2.3-2.5)	1628	1.4 (1.3-1.4)
≥ 80	5105	2.8 (2.7-2.9)	1554	1.3 (1.2-1.4)
Total	182 649	100.0	120 186	100.0

CI – confidence interval

rhage (SAH) were excluded from the analysis because they were not included in the WSR.

Crude incidence rates for FEL were calculated for the whole population, by age group, and according to sex, and expressed per 100 000 population. Stroke mortality was calculated as 30-day fatality (%) and one-year mortality rates expressed per 100 000 population. Age-specific rates were calculated for seven age groups in ten-year intervals, starting from 0-35 years up to 74 years. The oldest groups were analysed according to age 75 to 79 years and greater than or equal to 80 years. Total incidence rates and mortality rates were age-adjusted to the standard European population [16] because there were significant differences in age distribution between the two analysed populations (Table 1). Confidence intervals (CI) for the incidence rate estimates were calculated using the Poisson distribution. Statistical analyses were performed using CIA software.

The study was approved by the Ethics Committee of the Institute of Psychiatry and Neurology (22/2004).

Results

Between January 1, 2005 and December 31, 2005, 127 residents of the Ursynow District were registered with FEL. The majority of these patients were admitted to the Institute of Psychiatry and Neurology; a few were admitted to other hospitals (up to 5%). Overall, in 2005, 97% of FEL patients were hospitalized, the majority in stroke units, and 3% were treated in outpatient clinics. In 1991/1992, the proportion of patients hospitalized was 78%; 15% were treated in outpatient clinics.

The diagnosis of stroke was confirmed by CT in 98% in 2005. Based on the neuroimaging, ischaemic stroke was diagnosed in 90.3%, intracerebral haemorrhage in 8%, and about 2% were unclassified. The age of the patients ranged from 34 to 93 years (mean $\pm$ SD: 69.5 $\pm$ 13.1 years) in 2005 and 18 to 97 years in 1991/1992 (mean $\pm$ SD: 69.0 $\pm$ 13.9 years). The proportions of men and women in the two studies were similar: in 2005, 51.2% and in 1991/1992, 51.5% of patients were female.

In 2005, the prevalence of hypertension was 75.8% and atrial fibrillation was present in 25%. The prevalence of diabetes was 10.7%. More than 30% of stroke patients were current smokers. In general, the risk factor profiles for patients in the 1991/1992 study were similar: atrial fibrillation was diagnosed in 22.8% of patients and diabetes in about 15%. Although the proportion of patients with hypertension in 1991/1992 was lower (57%) than in 2005, the percentage of patients with undiagnosed and untreated hypertension before stroke was higher (33% vs 10% for 1991/1992 and 2005 respectively).

Data for incidence, case fatality rate, and mortality rate for 1991/1992 were published previously [3,4,6,14]. Stroke incidence in 2005 was estimated on the basis of patient registers established as part of the European Registers of Stroke [15]. The crude annual incidence of FEL was 105.7 per 100 000 (confidence interval [CI], 86-112); 109.1/100 000 for men and 102.5/100 000 for women). After standardization to the European population by a direct method [16], the incidence rates for FEL were 139.6 per 100 000 for men (CI, 124-173), 120.4 per 100 000 for women (CI, 105-150), and 128.9 per 100 000 for the general population. Age-specific inci-

Table 2. Annual age- and sex-specific incidence rates per 100 000 for first-ever-in-a-lifetime stroke in Warsaw, Poland (1991/1992 and 2005)

Age, years	1991/1992				2005			
	Men		Women		Men		Women	
	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)
<35	9	11 (4-18)	2	2 (0-6)	11	0	0	4 (0-11)
35-44	14	44 (21-68)	9	28 (10-46)	23	0	0	0
45-54	17	88 (46-130)	18	72 (38-105)	35	85 (35-135)	11	47 (14-80)
55-64	69	324 (247-400)	34	135 (90-180)	103	309 (180-438)	22	123 (43-204)
65-74	61	534 (400-667)	49	323 (233-413)	110	253 (102-520)	7	440 (235-752)
75-79	19	648 (390-1010)	45	774 (549-999)	64	1273 (584-2400)	9	977 (448-1850)
≥80	34	1260 (874-1760)	82	1092 (857-1330)	116	2530 (1310-4380)	12	2410 (1580-3510)
Total	223	130 (113-147)	239	124 (108-139)	462	109 (82-136)	62	103 (78-127)
Standardized*	134 (111-157)		91 (72-110)		111 (90-132)	140 (132-147)	120 (114-127)	129 (122-136)

*Age standardized to the European population by the direct method [15,16]
CI – confidence interval

dence rates for both sexes increased sharply with age. In 2005 the rates for people older than 75 years of age were higher than in 1991/1992 (Table 2).

Age-specific 30-day case fatality rates were lower in 2005 than in 1991/1992 (Fig. 1). In total, 30-day case fatality rates decreased from 43% in 1991/1992 to 14.9% in 2005.

The crude annual mortality rate of FEL in 2005 was 34.9 and in 1991/1992, 75.5. Age-specific one-year mortality rates were lower in 2005 than in 1991/1992 (Table 3).

Discussion

The present study demonstrated a significant decline in stroke case fatality rate between 1991/1992 and 2005/2006. Thirty-day case fatality rates decreased from 43% in 1991/1992 to 12.9% in 2005/2006, and one-year case fatality rates decreased from 59.7% to 24.0%. According to official statistics, stroke case fatality and mortality rates in Poland were unchanged over the past few decades, whereas the average annual stroke mortality rate has declined by up to 7% in many countries since 1970 [5,17]. A prospective population-based study conducted in Warsaw in 1991/1992 revealed one of the highest 1-year stroke mortality rates in Europe (106/100 000 in men and 78/100 000 in women) [4,6]. These findings were confirmed by the Pol-MONICA study [18,19].

Both the present study and the WSR were prospective population-based studies with a high case ascertainment. Our results regarding incidence are similar to estimates made in other epidemiological studies from

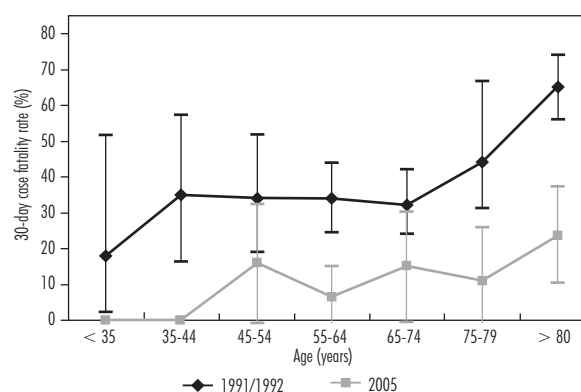


Fig. 1. Age-specific 30-day case fatality rate (%) for first-ever-in-a-lifetime stroke in Warsaw. Data are from two population-based studies conducted in 1991/1992 and 2005. Error bars indicate the 95% confidence intervals

Poland and Western Europe [2,3,14,20]. The most up-to-date population-based study in Poland, which was performed in Krakow, showed slightly higher incidence rates for stroke than those reported here; however, 21% of those cases were recurrent strokes and 8% were SAH [21]. In our study, SAH account for about 6.7% of all FELs. Similar to our results, 30-day and 1-year case fatality rates for all strokes in Krakow were lower than those previously reported (in WSR 43% at 30 days and 59.7% at 1 year), and reached 17.8% and 39.7%, respectively [21].

The last decade has brought significant changes in stroke management in Poland, as well as establishing modern stroke services [22]. Current stroke epidemiology in Warsaw is comparable to that in other European countries. In southern Sweden, the age-standardized incidence rate in 2001/2002 was 144 per 100 000 and the 30-day case fatality rate was 14% [23]. The decline in case fatality rates in the Warsaw population could reflect the improvements in the management of acute stroke and an increased awareness of stroke symptoms on the part of emergency medical personnel. In Warsaw in 2005/2006, 95% of patients with acute stroke were treated in specialized stroke units and 97% were hospitalized, as compared to 87% in 1991/1992. A well-developed network of stroke units allows for early intensive treatment with recombinant tissue-type plasminogen activator (rt-PA) as well as the early implementation of secondary prevention strategies. All hospitalized patients in 2005/2006 were offered early rehabilitation. Moreover, these patients have been routinely followed in the outpatient clinic since their stroke. Secondary prevention measures were implemented in the hospital and maintained in the outpatient setting. Lower case fatality rates can be mainly attributed to better control of cardiovascular risk factors before the occurrence of stroke. It is likely that changes in lifestyle during the last two decades that brought a decline in heart disease mortality in Poland also influenced the stroke case fatality rate. The use of antihypertensive medication before stroke has increased since 1991/1992 and untreated hypertension is diagnosed much more rarely. In addition, a positive trend in smoking habits was observed between 1996 and 2004 in men, in whom the percentage of current smokers decreased from 47.3% to 38% [24,25].

Our results offer an example of the efficacy of a well-developed system for acute stroke service and long-term care for stroke patients. However, it should be stressed that our study encompassed a population of permanent residents of Warsaw districts, which is not representative of the general population of Poland. Results from

Table 3. Annual age- and sex-specific mortality for patients with first-ever-in-a-lifetime stroke in Warsaw, Poland (1991/1992 and 2005)

Age, years	1991/1992						2005					
	Men			Women			Men			Women		
	Rate (95% CI)	N		Rate (95% CI)	N	Total	Rate (95% CI)	N		Rate (95% CI)	N	Total
<35	1 (0-4)	1		1 (0-4)	1	1 (0-3)	0	0		0	0	0
35-44	19 (4-34)	6		9 (0-20)	3	14 (5-23)	0	0		0	0	0
45-54	36 (9-63)	7		20 (2-37)	5	27 (12-42)	15 (6-37)	2		12 (4-28)	2	13 (0-26)
55-64	136 (87-186)	29		71 (38-104)	18	101 (72-130)	56 (1-111)	4		0	0	28 (0-55)
65-74	324 (220-428)	37		171 (106-237)	26	237 (178-295)	72.2 (9-260)	2		169 (55-395)	5	122 (328-213)
75-79	579 (338-926)	17		447 (276-618)	26	491 (345-638)	424 (88-1240)	3		326 (67-949)	3	369 (135-800)
≥ 80	1150 (781-1630)	31		919 (703-1130)	69	979 (788-1170)	844 (23-2150)	4		1570 (920-2510)	17	1350 (839-2060)
Total	75 (62-88)	128		76 (64-89)	148	76 (67-84)	26 (13-40)	15		43 (26-59)	27	35 (24-45)
Standardized*	80 (62-97)			52 (47-56)		63 (59-68)	39 (35-42)			51 (47-56)		48 (44-52)

*Age standardized to the European population by the direct method [15,16]

CI – confidence interval

the Polish National Stroke Prevention and Treatment Registry showed great differences in in-hospital mortality from ischaemic stroke between participating centres, ranging from 8% to 32% [26].

Conclusions

1. Information from a population-based prospective stroke registry in Warsaw (EROS) revealed a stroke incidence rate similar to that in other European countries.
2. The decrease in the stroke case fatality rate detected here is likely the result of better management of acute stroke and the implementation of secondary prevention strategies.
3. Results from Warsaw demonstrate a positive trend in stroke outcome, which has also been observed in other urban areas of Poland.

Acknowledgments

The study was conducted as part of the European Registers of Stroke (EROS) Project and was supported by a scientific grant from the European Union, Fifth Disclosure Framework Contract No. QL4-CT-2002-0191.

Disclosure

The authors report no conflict of interest.

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