The incidence of stroke and transient ischaemic attacks is falling: a report from the Belgian sentinel stations

Frank Buntinx, Dirk Devroey and Viviane Van Casteren

SUMMARY

Background: Increasing as well as decreasing trends in stroke incidence have been described.

Aim: To examine time trends associated with the incidence of stroke and transient ischaemic attacks (TIAs) within an ongoing registration network.

Design of study: Analysis of data from a network of sentinel practices.

Setting: Sentinel practice population (approximately 1.4% of the total Belgian population).

Method: Attack incidence rates of both stroke and TIA were studied at four one-year registration periods between 1984 and 1999.

Results: The number of events identified as stroke was 1097 (513 in males and 584 in females). The percentage of first-ever stroke was 69%, 64%, and 70% in 1989, 1998, and 1999 respectively. The number of events identified as TIA was 382 (165 in males and 217 in females). The percentage of first-ever TIA was 65%, 69%, and 75% in 1989, 1998, and 1999 respectively. Yearly age-standardised attack rates of stroke significantly decreased during the registration period, from 2.86 per 1000 in 1984, to 1.62 per 1000 in 1999 ($\chi^2$ for trend, $P = 0.04$) in males and from 2.97 per 1000 to 1.96 per 1000 ($P = 0.007$), for females. The decrease was restricted to subjects aged over 60 years. For TIA, a significant decrease ($P = 0.014$) was identified in females, but not in males ($P = 0.61$). Crude attack rates of stroke also significantly decreased, with an overall decrease between 1984 and 1999 of 37% in males and 26% in females. No such trend was found for TIA ($P = 0.63$ for males and $P = 0.35$ for females).

Conclusion: Both crude and age-standardised attack rates of stroke show a clear and significant decrease between 1984 and 1999. For TIA, a weaker trend was identified.

Keywords: cerebrovascular accident; incidence; morbidity.

Introduction

All over the world, stroke is a disease with a high impact on patients. In Europe, one-year case-fatality rates are around 35% and stroke is ranked between first and fourth among the nations’ main causes of death.

Most survivors are confronted with the need for long and difficult rehabilitation periods, have significant functional deficits, and an increased risk of institutionalisation. National incidence rates in European population surveys range between one and 5 per 1000 inhabitants and are almost twice as high in eastern Europe compared with western Europe. Time trends in incidence rates of stroke and transient ischaemic attack (TIA) have rarely been studied. Both decreases and increases have been identified. In some cases, different trends were identified according to sex or age. Decreasing age-specific incidences have been described in association with constant crude incidences as a result of increasing mean age. Even less information is available with respect to trends in TIA incidence.

Against this background we studied the age and sex-specific incidence, as well as the crude incidence, of both stroke and TIA at four one-year registration periods between 1984 and 1999 in an ongoing general practice-based network of sentinel practices in Belgium.

Method

Definition of stroke

In agreement with the WHO definition, stroke was defined as a sudden onset of clinical signs of focal (or global) disturbance of cerebral function, which lasts more than 24 hours. Cases were excluded if they were related to a non-vascular cause, e.g. trauma, malignancy or intoxication. Similar cases that recovered within 24 hours were coded as TIAs.

According to these definitions the study is based on clinical diagnoses, which have nevertheless been shown to be reliable, although less so for TIA.

Study population

The recordings for this study were made by the Belgian network of general practitioners (GPs). This network has been functioning since 1979 with similar methods and serves as a reliable source on the surveillance of morbidity in Belgium. Such a surveillance system has already been tested and proved effective and is currently applied in a number of countries. It has been adequately proven that the Belgian sentinel general practices form an important source of data over a wide range of both infectious and non-
During the registration period, 1097 events were classified (253 107 person years in males and 265 344 in females). The total number of person years studied exceeded 500 000.

Results

Analysis

Attack incidence rates were calculated per 1000 person years, specific for sex and for ten-year age categories. Age groups of patients aged up to 50 years and patients aged over 89 years were grouped. Crude attack rates for the study population were stratified for sex.

Sex-specific and age-stratified attack rates were calculated by direct standardisation, using the 1999 study population as reference. For all rates, 95% confidence intervals (95% CI) were calculated. The presence of a linear trend over years was tested using $\chi^2$ test for trend in the case of non-standardised measures, and by linear regression analysis in the case of standardised measures. Crude and standardised attack rates were calculated with their 95% CIs using CIA software, and SPSS v10 was used for regression analysis.

Results

The total number of person years studied exceeded 500 000 (253 107 person years in males and 265 344 in females). During the registration period, 1097 events were classified as stroke (513 in males and 584 in females). The percentage of first-ever strokes was 69%, 64%, and 70% in the years 1989, 1998, and 1999 respectively. For 1984 this percentage is no longer retrievable.

As TIA was not registered during the first year of registration, the study population for TIA consists of 197 226 person years in males and 205 944 in females, during which 382 events were classified as TIA (165 in males and 217 in females). The percentage of first-ever TIA was 65%, 69%, and 75% in 1989, 1998, and 1999 respectively. For a total of 11 cases (over all four registrations) the age of the patient was missing. These patients were assigned to the median age group of the year’s cases.

Careful examination of the ten-year age groups reveals that the group aged between 60 and 69 years follows the trend of the younger age group for stroke and the trend of the older age group for TIA (Table 1).

Age-standardised attack rates of stroke significantly decreased during the registration period, from 2.86 per 1000 in 1984, to 1.62 per 1000 in 1999 ($\chi^2$ for trend, $P = 0.04$) in males and from 2.97 per 1000 to 1.96 per 1000 ($P = 0.007$) for females (Figure 1). For TIA, a significant decrease ($P = 0.014$) was identified in females. However, this could not be found in males ($P = 0.61$).

Differences in the evolution of the incidence of stroke attacks occur according to age (Table 2). Above the age of 70 years, stroke incidence is progressively and significantly decreasing in both males and females. For TIA the same trend was present, although it is not statistically significant in our study. However, in the under-70 years age group, no such trend could be found. TIA incidence in females even had a (non-significant) tendency to increase.

Discussion

Age-standardised attack rates of stroke show a clear and significant average decrease between the years 1984 and 1999. The decrease was found in both males and females, but seems to be restricted to subjects aged over 60 years. In males the overall decrease in crude rates is one-third, in females one-quarter. This corresponds to a yearly decrease of 2.5% and 1.7% respectively. Elsewhere, decreases as well as increases have been reported for stroke incidence.4,9 In some other countries, such as Sweden and New Zealand, no changes in stroke incidence were observed.20,21

For TIA, on the other hand, the trend to decrease is much smaller and non-significant. This may either result from an absence of such a trend or from the shorter time period that was studied (1989 to 1999), with three registration periods instead of four.

The co-occurrence of an important decrease over time of stroke incidence and only a limited decrease in TIA incidence suggests the influence of secondary prevention measures, maybe in addition to an effect of measures of primary prevention and lifestyle changes.

Analysis of trends in stroke attack incidence rates can provide data on the mechanisms responsible for stroke and the possible influence of changes in prevention and diagnostic features. In several countries, registrations in hospitals and in well-defined populations have been set up. In Belgium, the cases of stroke attacks in a network of sentinel general practices are distributed evenly over the territory by means of a cluster analysis based on epidemiological criteria.14-15 The yearly sentinel population was estimated to be slightly over 1.4% of the total Belgian population.

Case ascertainment

The registration covered the years 1984, 1989, 1998, and 1999 respectively. The choice of these periods was made for pragmatic reasons only. Results covering each of the first three registration periods have been published previously.6,18,19 GPs in the sentinel network registered all cases that occurred in well-defined populations have been set up. In Belgium, GPs in the sentinel network registered all cases that could be confirmed or denied the initial diagnosis and to provide additional or more detailed information.

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What does this paper add?

Both crude and age-standardised attack rates of stroke decreased between 1984 and 1999. For TIA the picture is less clear. This combination suggests an effect of secondary prevention measures, maybe in association with an effect of primary prevention measures and lifestyle changes.

What do we know?

Both increasing and decreasing time trends in incidence rates of stroke have been reported. Information on TIA trends is scarce.

Infectious diseases. The network of sentinel general practices consists of physicians who, with respect to age and sex, are representative of GPs in Belgium. The general practices are distributed evenly over the territory by means of a cluster analysis based on epidemiological criteria. The yearly sentinel population was estimated to be slightly over 1.4% of the total Belgian population.

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practices were recorded. Our registration method, as well as the number of participating GPs, remained stable over the complete period of the registration. This should assure us that changing trends are probably not attributed to changes of data recording procedures.

Changes in diagnostic opportunities or diagnostic behaviour by clinicians have a tendency to influence incidence rates of diseases. It has been suggested that the increase in the 1980s coincided with the introduction of computed tomography (CT), which has given physicians the ability to detect less severe strokes. All incidence rates before the introduction of CT would therefore be underestimates.29 After this period it is imagined that improved diagnostic and therapeutic abilities in hospitals resulted in a higher referral rate for patients who had had a stroke or TIA. However, as stroke and TIA are essentially clinical diagnoses, there is no reason to assume that this will substantially affect overall attack rates, which was confirmed by our results. The increasing use of CT since 1985 and magnetic resonance imaging since 1990 has apparently not influenced the incidence of stroke attacks in Belgium.

Comparing our data with other countries’ is difficult. Adjustment for age and sex is often done in different ways in different countries. As crude incidences differ considerably in age and sex categories, only standardised incidences can be compared. The different environment of the registration (general population, hospital or GP) and age group limitations in some studies also need to be considered.

<table>
<thead>
<tr>
<th>Stroke</th>
<th>Males</th>
<th>Crude</th>
<th>Population</th>
<th>Incidence (95% CI)</th>
<th>Standardised</th>
<th>Population</th>
<th>Incidence (95% CI)</th>
<th>Standardised</th>
<th>Population</th>
<th>Incidence (95% CI)</th>
<th>Standardised</th>
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<td></td>
<td>55 881</td>
<td>2.86 (2.4–3.3)</td>
<td>2.58 (2.2–3.0)</td>
<td>62 228</td>
<td>2.27 (1.9–2.7)</td>
<td>2.06 (1.7–2.4)</td>
<td>67 652</td>
<td>1.96 (1.6–2.3)</td>
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<td>67 346</td>
<td>1.62 (1.3–2.0)</td>
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<td>67 346</td>
<td>1.62 (1.3–2.0)</td>
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<td>70 515</td>
<td>1.96 (1.7–2.3)</td>
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<td>Females</td>
<td>Crude</td>
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<td>2.97 (2.5–3.4)</td>
<td>2.64 (2.3–3.1)</td>
<td>64 957</td>
<td>2.68 (2.3–3.1)</td>
<td>2.40 (2.3–3.1)</td>
<td>70 472</td>
<td>1.90 (1.6–2.2)</td>
<td>1.89 (1.6–2.2)</td>
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<td>Standardised</td>
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<td>2.64 (2.3–3.1)</td>
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<td>1.96 (1.7–2.3)</td>
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<tr>
<td>TIA</td>
<td>Males</td>
<td>Crude</td>
<td>62 228</td>
<td>0.96 (0.7–1.2)</td>
<td>0.87 (0.7–1.0)</td>
<td>67 652</td>
<td>0.96 (0.7–1.2)</td>
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Table 1. Crude and age-standardised incidence of stroke and transient ischaemic attacks (TIAs) (n = number of cases).
Table 2. Age-specific incidence rates of cerebrovascular accident (CVA) (stroke) and transient ischaemic attacks.

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<td>Males aged &lt;70 years</td>
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<tr>
<td>CVA</td>
<td>0.42</td>
<td>0.80 (0.55–1.04)</td>
<td>0.87 (0.63–1.11)</td>
<td>0.91 (0.67–1.14)</td>
<td>0.57 (0.38–0.76)</td>
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<tr>
<td>TIA</td>
<td>0.85</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>0.30 (0.16–0.44)</td>
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<tr>
<td>Females aged &lt;70 years</td>
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<tr>
<td>CVA</td>
<td>0.16</td>
<td>0.60 (0.39–0.81)</td>
<td>0.46 (0.28–0.63)</td>
<td>0.51 (0.33–0.69)</td>
<td>0.34 (0.20–0.49)</td>
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<tr>
<td>TIA</td>
<td>0.42</td>
<td>–</td>
<td>–</td>
<td>0.18 (0.07–0.28)</td>
<td>0.20 (0.09–0.31)</td>
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<tr>
<td>Males aged ≥70 years</td>
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<tr>
<td>CVA</td>
<td>&lt;0.0001</td>
<td>23.60 (19.1–28.1)</td>
<td>17.2 (13.4–21.0)</td>
<td>13.1 (10.2–16.1)</td>
<td>12.8 (9.9–15.7)</td>
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<tr>
<td>TIA</td>
<td>0.22</td>
<td>–</td>
<td>–</td>
<td>8.15 (5.5–10.8)</td>
<td>7.26 (5.1–9.5)</td>
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<tr>
<td>Females aged ≥70 years</td>
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<tr>
<td>CVA</td>
<td>&lt;0.0001</td>
<td>16.9 (13.9–19.8)</td>
<td>16.6 (13.8–19.4)</td>
<td>10.8 (8.7–12.9)</td>
<td>12.3 (10.1–14.5)</td>
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<tr>
<td>TIA</td>
<td>0.05</td>
<td>–</td>
<td>–</td>
<td>8.3 (6.3–10.3)</td>
<td>6.5 (4.8–8.1)</td>
</tr>
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</table>

Basically, risk factors for stroke and TIA are the same. Age and sex are the most important but are not modifiable. Modifiable risk factors are: hypertension, atrial fibrillation, smoking, diabetes, alcohol misuse, and hyperlipidaemia. The decreased incidence in stroke attacks in Belgium could partially be explained by a decrease in the proportion of smokers in the population, by improved treatment of hypertension, and by the abundant use of statins to lower lipid levels, especially after a previous cardiovascular event. 

Epidemiological studies have shown a clear and linear relationship between the diastolic blood pressure and the incidence of primary stroke. The relative risk reduction by improved diastolic blood pressure control is less extreme in old age than in middle age. Epidemiological studies in the United States, Japan, Germany, and Finland have shown declining incidence rates for stroke between the 1950s and the 1970s in all age and sex groups for TIA which coincided with the introduction of effective antihypertensive drugs. However, while the control of hypertension continued to improve during the 1970s and 1980s, the rates stabilised in the 1970s and increased again from the second half of the 1980s onwards, especially in the older age groups. Although serum cholesterol is a strong risk factor for coronary artery disease, its predictive power for stroke is weak and controversial. Lipid-lowering drugs can only reduce the incidence of stroke after myocardial infarction.

As well as the risk factor reduction, the use of aspirin as secondary prevention after TIA should be considered. For 1000 patients treated for three years and compared with controls, around 20 recurrent strokes were prevented by the use of low doses of aspirin. Additional unpublished data from our study indicate that in 1999 four out of the five patients with TIA were prescribed aspirin on a long-term basis. Although this cannot be considered sufficient proof, we assume that the decrease over time in stroke attack rates in this study may largely result from the use of aspirin after a previous CVA or TIA. This is possibly associated with continuously improving antihypertensive therapy and the increased treatment.

References
original papers

References


Acknowledgements

This study would not have been possible without the continuous efforts of the sentinel GPs: Dr Jean-Francois Adant, Dr Eric Alardeau, Dr Veronique Albert, Dr Guy Armand, Dr Dirk Avonts, Dr Baxier, Dr Pascale Bastin, Dr Nicole Bayers, Dr Fabienne Balbast, Dr Sonja Berael, Dr Q Blonda, Dr Pierre Boudolf, Dr Dominique-Jean Boulliez, Dr Monique Boulat, Dr Jozeff Boulonne, Dr Bruynseels, Dr Pierre Buchin, Dr M. Buttiens, Dr Patrick Buytaert, Dr Nadine Carette, Dr J-M Caroyry, Dr P Cassiman, Dr Francois Chapeaux, Dr J Charles, Dr M Chiang, Dr Christine Beyrens, Dr Pierre Claerhout, Dr Geert Cauwets, Dr Henri Clinquart, Dr Jose Coppine, Dr Corneli Koen, Dr Myriam Cramm, Dr Charles Cuypers, Dr Marc Daans, Dr Agnes De Graef, Dr Eric De Graef, Dr T De Lannoy, Dr J De Loof, Dr Dirk De Pauw, Dr Hilde De Ridder, Dr W De Scheppe, Dr Frans De Smedt, Dr Jos De Smedt, Dr Maurice Debarre, Dr Marie Debruy, Dr Frank Declercq, Dr Inge Decock, Dr Ludovic Deferm, Dr Steven Delcour, Dr Jean Delespaul, Dr E Delvaux, Dr Nadine Deraux-Carette, Dr Christian Deruyck, Dr Marc Dethier, Dr Jean-Jacques Detheux, Dr J Devies, Dr Francis Dills, Dr Jy-De Jan, Dominicus, Dr Jean-Luc Dubuisson, Dr Johan Dupont, Dr Yves Durez, Dr Catherine Durieux, Dr Luc Eraly, Dr Rudy Faelens, Dr Dominique Filee, Dr Robert Floir, Dr Fabien Fondu, Dr Francois Amnick, Dr Philippe Fremy, Dr Chris Geens, Dr Wale Geeraert, Dr Willy Gelchof, Dr Bertine Gemen, Dr Francoise Gerard, Dr Isabelle Geuveder, Dr Bernard Geuse, Dr Philippe Gilbert, Dr Jean-Marc Gille, Dr Jules Goffin, Dr Patrick Govaert, Dr Yves Gueuning Dr Françoise Hanon, Dr L Hardy, Dr Kristien Hendrickx, Dr Jean Henrotin, Dr Ivo Herbots, Dr Jean-Pierre Hoengenaert, Dr Raymond Hovinne, Dr Pierre Huart, Dr Patrick Jadoulle, Dr Raouf Joos, Dr Michel Kaesemans, Dr C La Haye, Dr Hilde Lagasse, Dr Jan Laeken, Dr Pierre Larue, Dr Renate Lauwers, Dr V Lebrun, Dr L Leconte, Dr Antoine Ledent, Dr Alain Ledoux, Dr Leonard Roger, Dr Philip Libaut, Dr Rik Lietaer, Dr Godelieve Lindemans, Dr Linden Baudouin, Dr Martine Luwel, Dr E Luyten, Dr Michel Magieu, Dr C Maimiaux, Dr Pierre Maillat, Dr Jacques Marin, Dr Jean Marysael, Dr Christian Massart, Dr Jan Mathyja, Dr A-C Mehu-Wegria, Dr J-JMesdag, Dr Francois Michaelis, Dr Jean-Philippe Monette, Dr Guido Nicolai, Dr P Noppe, Dr D Notte, Dr P Nuytemans, Dr P Nys, Dr Jean Permentier, Dr Karine Pelicaen, Dr Yolanda Pill, Dr Wim Raes, Dr Martine Renard, Dr Marc Rijckaert, Dr Frank Robijn, Dr Jean Rosillon, Dr Francois Ossion, Dr Marc Royackers, Dr Jules Saerens, Dr Schillens, Dr Hubert Schoofs, Dr Karl Segers, Dr Jan Sette, Dr Ghislain Spitaels, Dr Thierry Storme, Dr Peter Strobbe, Dr Jozef Thys, Dr Marcel Toyne, Dr Jan Van Assche, Dr C Van Cauwenberge, Dr Francois Van Der Meersch, Dr Van Doren, Dr Jean-Luc Van Duysse, Dr A Van Erum, Dr Anne Van Hoof, Dr Christine Van Hoof, Dr Yvan Van Maaele, Dr T Van Mullern, Dr Van Riet, Dr P Van Royen, Dr Philippe Van Vlaenderen, Dr Anne-Marie Vanderborght, Dr Daniel Vandeweghe, Dr Christina Vanhercke, Dr Freddy Vantomme, Dr Karolien Vantomme, Dr Thierry Vanwersch, Dr Jacques Vedin, Dr Karleen Vercruyssse, Dr F Verduycyt, Dr Cecile Verheugen, Dr Koen Verhofstadt, Dr M Vervenne, Dr Werner Vliegels, Dr Ch Vrijens, Dr Luc Vuytsyteke, Dr Marc Vynkt, Dr Sylviane Wargny, Dr Johan Wens, Dr Gerlinde Wijnen, Dr Spiros Xanthos, Dr Els Yperman Els. We are also grateful to Marina Devis for logistic assistance and to Jan Heyman for his helpful comments to a previous version of the manuscript.

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British Journal of General Practice, October 2002 817