Incidence of Transient Ischemic Attacks and Minor Ischemic Strokes in Segovia, Spain

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Background and Purpose The aim of this study was to determine the incidence of transient ischemic attacks (TIAs) and minor ischemic strokes (MISs) in Segovia, Spain.

Methods A 2-year prospective community-based register of TIAs and MISs was established in Segovia from February 16, 1992, to February 15, 1994. Every patient underwent a complete clinical evaluation and cranial CT scan. Sex- and age-specific incidence rates with 95% confidence intervals (CIs) were calculated for all ages.

Results The total series included 235 patients; 103 suffered TIAs and 132 suffered MISs. Mean age was 70.8 years (range, 29 to 96 years); 92 were women and 143 were men. The crude annual incidence was 0.80/1000 (95% CI, 0.70 to 0.90): 0.35/1000 (95% CI, 0.28 to 0.42) for TIAs and 0.45/1000 (95% CI, 0.37 to 0.53) for MISs. The incidence of TIAs and MISs increased with age. Approximately 78% of TIAs and MISs were in the carotid distribution, 19% were vertebrobasilar, and 3% were considered of uncertain vascular distribution. Cranial CT scan was performed in all patients. CT showed cerebral infarcts in 30.1% (31/103; 95% CI, 21% to 39%) of TIAs and 70% (92/132; 95% CI, 62% to 78%) of MISs ($P<.00001$).

Conclusions Our study is the first community-based register that provides sex- and age-specific rates for MISs and in which a CT scan was obtained in all patients. The incidence of TIAs in Segovia is comparable to that in other previous similar studies. (*Stroke*. **1996;27:667-671.**)

Key Words • cerebral ischemia, transient • epidemiology • incidence

Community-based studies have provided reliable data on the incidence of TIAs in several countries.[1-4] It has been suggested that the distinction between TIAs and MISs is arbitrary.[5] If amaurosis fugax is excluded, both groups have similar risk factors and prognosis.[6] Surprisingly, there has been only one community-based study that analyzed TIAs and MISs at the same time.[7] Since most trials of secondary prevention have included both groups, it seems necessary to obtain more information from community-based studies.

Our study was planned to measure the incidence of TIAs and MISs in a rural area in Spain with the use of a community-based register. This is part of a larger community-based project on the incidence, risk factors, pathogenesis, and prognosis of TIAs and MISs taking place currently in Segovia.

Subjects and Methods

Our study was performed in the province of Segovia, located in the center of Spain, 100 km north of Madrid. This province is a rural area of 6992 km^2, with a population of 146 716 (1991 census). Ninety-eight percent of the population is covered by the National Health Service. Primary health care is provided by 190 general practitioners distributed in 14 health centers. Specialized referral is provided by a General Hospital located in the city of Segovia, where our Neurology Unit is the only one in the province. There is a 24-hour neurologist on call attending the General Hospital, including the Emergency Department. There was no private neurological practice in the province during the study period.

Patients were introduced into the study in two main ways: (1) General practitioners were asked to notify the Neurology Unit as soon as possible of all patients with a suspected TIA or nondisabling stroke. There was a direct telephone line to the Neurology Clinic available for all general practitioners at their health centers. Patients could also be referred immediately and directly to the Neurology Clinic without a previous appointment. (2) All patients with suspected cerebrovascular disease attending the Emergency Department of our hospital were referred directly to the Neurology Unit, admitted to the hospital, or evaluated in the Emergency Department by the neurologist on call. All patients were assessed by the same neurologist (A.P.S.), although initially the first evaluation might have been performed by other neurologists of the same unit.

During the study period we consulted the Pediatric Unit if any child with cerebrovascular disease had been diagnosed by them. Medical attention at nursing homes is provided by the National Health Service through general practitioners who agreed to notify the Neurology Unit of all patients with a suspected TIA or nondisabling stroke.

The definitions of TIA and MIS were those used in the OCSP.[6] TIA was defined as an acute loss of ocular or focal cerebral function lasting less than 24 hours that was presumed to be due to ischemic vascular disease. Stroke was defined as the rapid onset of clinical signs of a focal or global disturbance of cerebral function, lasting more than 24 hours or until death, with no apparent nonvascular cause.[8] A stroke was considered nondisabling if the patient was functionally independent. Every patient with a nondisabling stroke was followed up at 1 month. The stroke was considered minor if the score on the modified Rankin scale[9] was 1 at the first evaluation or if the score was 0 or 1 at the 1-month follow-up (ie, no symptoms or minor symptoms that did not interfere with their normal lifestyle). The neurological condition of the patient had to be stable for at least 24 hours to estimate the score on the Rankin scale. No patient with a nondisabling stroke died before the 1-month follow-up. A cranial CT scan was performed in all patients as soon as possible after the event. Patients who had already suffered a previous stroke were excluded. Only incident (new)

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Selected Abbreviations and Acronyms

CI = confidence interval
MIS(s) = minor ischemic stroke(s)
OCSP = Oxfordshire Community Stroke Project
PCSS = Perth Community Stroke Study
SEPIVAC = Studio Epidemiologico sull'Incidenza delle Vasculopatie Acute Cerebrali
TIA(s) = transient ischemic attack(s)

cases were included. We used the OCSP's definition of incident case: the first TIA or MIS occurring during the time of the study that led to consultation with a physician. We excluded patients who suffered a TIA or MIS during the time of the study but who had had a previously diagnosed TIA before the study period. If a patient had already suffered a TIA before the study period but had not consulted a physician, the case was also considered an incident one. We excluded patients who had a TIA but suffered a stroke before being referred to the Neurology Unit.

Criteria for the diagnosis of left carotid distribution were transient monocular blindness affecting the left eye, dysphasia, weakness or clumsiness of the right extremities and/or face, and numbness or paresthesias involving the right limbs and/or face. Criteria for the diagnosis of right carotid distribution were transient monocular blindness affecting the right eye, weakness or clumsiness of the left extremities and/or face, and numbness or paresthesias involving the left limbs and/or face. Criteria for the diagnosis of vertebrobasilar distribution were weakness or numbness involving both sides of the body, loss of vision in one or both homonymous fields, loss of balance, vertigo, diplopia, dysarthria, and dysphagia. Vertigo, dysphagia, dysarthria, and diplopia were not considered if they occurred in isolation.

Cranial CT scans were performed without contrast agents in a 256×256 matrix with 1-cm cuts (CX Tomoscan, Phillips). CT scans from all patients finally diagnosed as TIAs or MISs were reviewed by a neurologist (J.D.) without knowledge of the clinical presentation, although he knew that all patients had either a TIA or MIS. If a CT scan was obtained within 24 hours, it was repeated later for the review. A cerebral infarct was defined as a well-defined hypodense lesion considered to be ischemic. Another neurologist (A.P.S.) assessed the relevance of the CT findings identified by the blinded observer. An infarct was considered "asymptomatic" if clinical symptoms did not correspond to the site of the lesion.

The study population comprised the population of Segovia according to the 1991 census. We included all patients registered in the study from February 16, 1992, to February 15, 1994 (2 years). Incidence rates were calculated per 1000 inhabitants. We calculated 95% CIs of incidence rates with a CI analysis package.[10] Incidence rates were age adjusted to the European standard population by the direct method.[11] Continuous variables were compared by Student's unpaired t test, and discrete variables were compared by Yates' corrected χ^2 test. The statistical analysis was performed with SPSS, version 5.0.[12] All probabilities are two-tailed values.

Results

During the study period, 325 patients were evaluated because of suspected TIAs or MISs. We included 235 as incident cases: 103 TIAs and 132 MISs. The diagnoses of the 90 patients not included as incident cases were the following: (1) Misdiagnosed TIAs included brain tumors (2 patients), transient global amnesia (4 patients), epilepsy (4 patients), isolated vertigo (10 patients), syncope (14 patients), and miscellaneous (30 patients). Eight patients suffered a TIA during the study period but were excluded because they had previously consulted a physician because of a TIA occurring before the study period. (2) Misdiagnosed MISs included motoneuron disease (1 patient), radial palsy (4 patients), intracerebral hemorrhage (4 patients), and isolated diplopia (5 patients). Four patients were excluded because they suffered a TIA before the study period and had been evaluated by a physician.

TABLE 1. Age- and Sex-Specific Incidence Rates (×1000) for Incident TIAs and MISs in Segovia, Spain

Age, y	Cases/Population at Risk	Annual Incidence	95% CI
Men			
<15	0/23 652	0.00	...
15-44	5/62 480	0.08	0.00-0.15
45-54	6/14 980	0.40	0.08-0.72
55-64	35/19 106	1.83	1.23-2.44
65-74	49/15 044	3.26	2.35-4.17
75-84	40/9304	4.30	2.97-5.63
≥85	8/2112	3.79	1.65-7.51
Total	143/146 678	0.98	0.82-1.13
Women			
<15	0/21 992	0.00	...
15-44	1/55 998	0.02	0.00-0.05
45-54	4/14 398	0.28	0.00-0.55
55-64	10/20 752	0.48	0.18-0.78
65-74	35/17 604	2.05	1.37-2.73
75-84	34/12 176	2.79	1.86-3.73
≥85	8/3834	2.09	0.92-4.09
Total	92/146 754	0.63	0.50-0.76
Men and women			
<15	0/45 644	0.00	...
15-44	6/118 478	0.05	0.01-0.09
45-54	10/29 378	0.34	0.13-0.55
55-64	45/39 858	1.13	0.80-1.46
65-74	84/32 648	2.57	2.02-3.12
75-84	74/21 480	3.45	2.66-4.23
≥85	16/5946	2.69	1.37-4.01
Total	235/293 432	0.80	0.70-0.90

The mean age of the 235 incident cases was 70.8 years (range, 29 to 96 years); 92 were women and 143 were men. The mean age of patients with TIAs (71.8 years) and MISs (70.1 years) did not differ significantly (P=.231). Women were older than men (73.3 and 69.3 years, respectively; 95% CI, 1.2 to 6.9 years).

Age- and sex-specific incidence rates for TIAs and MISs are shown in Tables 1 through 3. The crude annual incidence was 0.80/1000 (95% CI, 0.70 to 0.90): 0.35/1000 (95% CI, 0.28 to 0.42) for TIAs and 0.45/1000 (95% CI, 0.37 to 0.53) for MISs. The rates adjusted to the European standard population were 0.50/1000 (95% CI, 0.35 to 0.66): 0.21/1000 (95% CI, 0.12 to 0.30) for TIAs and 0.28/1000 (95% CI, 0.17 to 0.39) for MISs. The incidence of TIAs and MISs rose with increasing age, although there was a tendency to decrease in people older than 85 years (Figs 1 and 2).

The median interval from the onset of the event to assessment by the study neurologist was 24 hours. A cranial CT scan was performed in all patients. Cranial CT scan was obtained within 2 weeks in 82% of MISs and 52% of TIAs. CT showed cerebral infarcts in 30.1% (31/103; 95% CI, 21% to 39%) of TIAs and 70% (92/132; 95% CI, 62% to 78%) of MISs (P<.00001). Asymptomatic infarcts were observed in 9% of TIAs (9/103) and MISs (12/132).

TABLE 2. Age- and Sex-Specific Incidence Rates (×1000) for Incident TIAs in Segovia, Spain

Age, y	Cases/Population at Risk	Annual Incidence	95% CI
Men			
<15	0/23 652	0.00	...
15-54	4/77 460	0.05	0.001-0.10
55-64	14/19 106	0.73	0.35-1.12
65-74	19/15 044	1.26	0.70-1.83
75-84	19/9304	2.04	1.12-2.96
≥85	5/2112	2.37	0.79-5.55
Total	61/146 678	0.42	0.31-0.52
Women			
<15	0/21 992	0.00	...
15-54	1/70 396	0.01	0.00-0.04
55-64	5/20 752	0.24	0.03-0.45
65-74	16/17 604	0.91	0.46-1.35
75-84	17/12 176	1.40	0.73-2.06
≥85	3/3834	0.78	0.18-2.26
Total	42/146 754	0.29	0.20-0.37
Men and women			
<15	0/45 644	0.00	...
15-54	5/147 856	0.03	0.00-0.06
55-64	19/39 858	0.48	0.26-0.69
65-74	35/32 648	1.07	0.72-1.43
75-84	36/21 480	1.68	1.13-2.22
≥85	8/5946	1.35	0.41-2.28
Total	103/293 432	0.35	0.28-0.42

The possibility of a preceding TIA was assessed in all patients with an established stroke who were admitted to the hospital. In 2 patients, a stroke and a preceding TIA during the period of study had not been communicated to the Neurology Unit. Six patients in our study were recruited from nursing homes. No child with ischemic cerebrovascular disease was attended by the Pediatric Unit during the study period.

TABLE 3. Age- and Sex-Specific Incidence Rates (×1000) for Incident MISs in Segovia, Spain

Age, y	Cases/Population at Risk	Annual Incidence	95% CI
Men			
<15	0/23 652	0.00	...
15-54	7/77 460	0.09	0.002-0.16
55-64	21/19 106	1.10	0.63-1.57
65-74	30/15 044	1.99	1.28-2.71
75-84	21/9304	2.26	1.29-3.22
≥85	3/2112	1.42	0.31-4.09
Total	82/146 678	0.56	0.44-0.68
Women			
<15	0/21 992	0.00	...
15-54	4/70 396	0.06	0.00-0.11
55-64	5/20 752	0.24	0.03-0.45
65-74	19/17 604	1.08	0.59-1.56
75-84	17/12 176	1.40	0.73-2.06
≥85	5/3834	1.30	0.43-2.99
Total	50/146 754	0.34	0.25-0.44
Men and women			
<15	0/45 644	0.00	...
15-54	11/147 856	0.07	0.03-0.12
55-64	26/39 858	0.65	0.40-0.90
65-74	49/32 648	1.50	1.08-1.92
75-84	38/21 480	1.77	1.11-2.33
≥85	8/5946	1.35	0.41-2.28
Total	132/293 432	0.45	0.37-0.53

FIG 1. Age- and sex-specific incidence (per 1000 population) of TIAs and MISs in Segovia, Spain.

One hundred eighty-three patients (78%) had TIAs or MISs in the carotid distribution. Only 1 of them presented with isolated amaurosis fugax; 45 patients (19%) suffered vertebrobasilar distribution TIAs or MISs, and 7 patients (3%) had TIAs or MISs of uncertain vascular distribution. We considered the possibility that amaurosis fugax cases could have been referred directly to the Ophthalmology Department; after a screening of their medical records and personal consultation, we determined that no case of amaurosis fugax had been referred to them during the study period.

Discussion

It is difficult to know the true incidence of TIAs (and also minor strokes) because patients, particularly the elderly, do not always seek medical attention. The only door-to-door survey of TIAs conducted thus far in Spain found that 29% of patients had not reported their symptoms to their family physicians.[13] A similar study conducted in Italy[14] showed similar figures: 37% of patients with definite TIAs had not reported their symptoms to their family physicians. One of the main problems of door-to-door surveys on TIA incidence is that the studied populations are small and the estimates of incidence for different age bands are imprecise, with wide 95% CIs.

Three prospective community-based studies of TIA incidence have been published thus far that provide age-specific rates for all ages with 95% CIs: the OCSP[2] and the SEPIVAC[4] in Europe and the PCSS[15] in Australia. Our study is the first community-based register that obtained CT scans in all patients. CT scans were per-

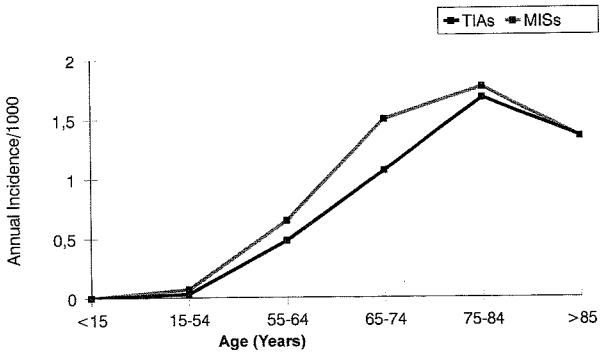

FIG 2. Age-specific incidence (per 1000 population) of TIAs and MISs in Segovia, Spain.

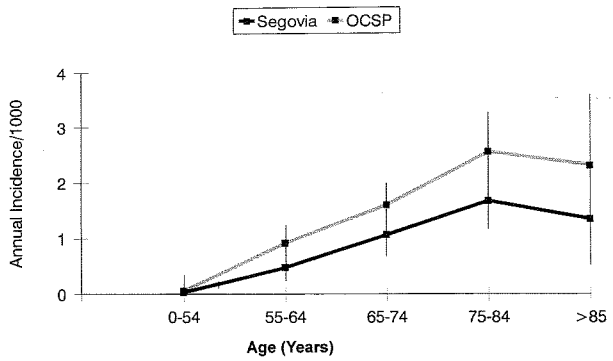

FIG 3. Comparison of age-specific incidence of TIAs in Segovia and the OCSP. Vertical lines represent 95% CIs. Note that 95% CIs overlap in all age groups.

formed in 72% of TIA patients in the OCSP[16] and in only 62% in the SEPIVAC.[4] The percentage of patients with TIAs who had a CT scan was not mentioned in the PCSS.[15] Structural intracranial lesions such as tumors or vascular malformations may be missed if CT scanning is not performed.[17] In our study, CT scan revealed a brain tumor in 2 patients previously diagnosed with TIA by the study neurologist. A cerebral infarct was found in 30% of TIAs and 70% of MISs. The incidence of infarction in TIAs was very similar to the results obtained in the OCSP (27%)[16] despite technical differences in the scanners.

Crude incidence rates cannot be compared directly because of the different age structure of the populations. The annual rates for the OCSP and SEPIVAC adjusted to the European standard population were 0.36 (95% CI, 0.24 to 0.48) and 0.42 (95% CI, 0.33 to 0.54), respectively, and the rate for TIAs in Segovia adjusted to the European standard population was 0.21 (95% CI, 0.12 to 0.30). In Figs 3 and 4, we compare the age-specific incidence of the three mentioned European studies—OCSP, SEPIVAC, and ours—after adjusting the incidence rates to the same age bands. Incidence rates for TIAs in Segovia seem to be lower, although CIs overlap through all age bands. This lower incidence is observed in all age groups, and this cannot be explained on the basis of underrepresentation of the elderly since the mean age of the patients with TIAs in our study was 71.8 years compared with 69.4 years in the OCSP[2] and SEPIVAC.[4] It is surprising that only one patient presented with amaurosis fugax in our study. A possible explanation could be that patients and physicians in Segovia have a low awareness of the significance of transient monocular blindness. The low incidence rate of amaurosis fugax (1%) could partly explain the overall lower incidence of TIAs in Segovia since amaurosis fugax represented 17% of the patients in the OCSP[2] and 5.3% in the SEPIVAC.[4]

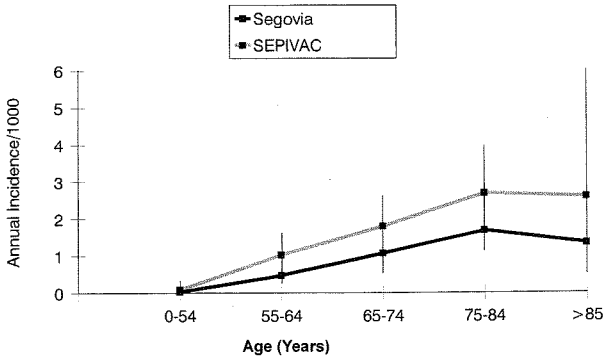

FIG 4. Comparison of age-specific incidence of TIAs in Segovia and Umbria, Italy (SEPIVAC). Vertical lines represent 95% CIs. Note that 95% CIs overlap in all age groups.

MISs and TIAs are the subject of most trials of secondary prevention.[18-21] It is necessary to have reliable incidence data for both groups when planning trials of secondary prevention or estimating the cost of evaluation and treatment. However, MISs thus far have received less attention in epidemiological studies. Only the OCSP group has published results for both groups,[6] although they provided age- and sex-specific incidence rates for TIAs but not for MISs. Our study is the first community-based register that provides incidence rates for TIAs and MISs in all age groups.

In our study there was a neurologist on call at all times, and this fact could explain the short delay between the ischemic attack and our assessment of the patient (median, 24 hours). It is reasonable to think that the diagnosis of a TIA is more accurate as the delay becomes shorter. The interobserver reliability of the diagnosis of TIA is poor.[22,23] In our study the final diagnosis of TIA was made by the same neurologist (A.P.S.) to avoid this problem.

When minor strokes are evaluated, it is important to take into account the time the CT scan is performed because minor hemorrhages can resolve within 2 weeks.[24] CT scans were obtained within 2 weeks in 82% of our patients with suspected minor ischemic strokes, and the possibility that we included some primary intracerebral hemorrhages seems rather unlikely.

The overall incidence was slightly greater in men than in women (Fig 1). Women were older than men (73.3 and 69.3 years, respectively). Women were also older in the Italian study.[4] The mean age for both sexes in the OCSP is not available for comparison.

Patients older than 70 years represented more than 50% of all TIAs and MISs in our series. Elderly patients constitute the most important group for secondary prevention. The incidence of TIAs in Segovia is comparable to that in other previous similar studies. The incidence of MISs is slightly greater than that of TIAs.

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