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Neuroepidemiology

Epidemiology of stroke and transient ischemic attacks: Current knowledge and perspectives

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ABSTRACT

Because of the growing size and aging of the world's population, the global burden of stroke is increasing dramatically. Current epidemiological data indicate that 16.9 million people suffer a stroke each year, which represents a global incidence of 258/100,000/year, with marked differences between high- and low-income countries, and an age-adjusted incidence 1.5 times higher in men than in women. Although primary prevention has contributed to a decrease in stroke incidence in high-income countries, the so-called 'epidemiological transition' has led to an increase in incidence in middle-to-low-income countries as well. In addition, the incidence of ischemic stroke in young adults is on the rise, suggesting a need for specific preventative interventions in that age group. The number of stroke survivors almost doubled between 1990 and 2010, and has now reached 33 million people. According to epidemiological projections, this number will rise to 77 million by 2030. In France, the number of hospitalizations for an acute cerebrovascular event was about 138,000 in 2009, accounting for 3% of the total national health expenditure. Outcomes after stroke are frequently impaired by complications, including motor handicaps, dementia, depression, fatigue, and a high risk of early rehospitalization and institutionalization, with adverse consequences in terms of socioeconomic costs. In addition, there are 5.9 million stroke-related deaths worldwide every year. Finally, although many analytical epidemiological studies have considerably increased our knowledge of risk factors for stroke, the recent INTERSTROKE study provided evidence that 10 risk factors alone accounted for 88% of all strokes. Many of these risk factors are modifiable, which suggests that efforts should be made to promote interventions that aim to reduce the risk of stroke. A new 'mass approach' aiming to reduce the level of stroke risk factors in all people in a region, regardless of any given individual's level of risk, is currently still being developed. This interesting and innovative way to spread stroke awareness is based on the use of an internationally validated mobile-phone application that can calculate the risk of stroke for any given individual, and also contains a section to educate people on stroke warning symptoms and signs.

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1. Introduction

Knowledge about the epidemiology of stroke and transient ischemic attacks (TIAs) has dramatically increased in recent decades. Indeed, epidemiological research in the field of cerebrovascular disease has gained in importance, given the growing global burden of the disease and the need to identify risk factors. Such research has helped in establishing requirements for the implementation of dedicated services, and in guiding and evaluating future preventative priorities. The aim of the present review is to update the current data on the worldwide incidence, recurrence, mortality, prevalence, and prognosis of stroke and TIAs; to focus on the epidemiology of the disease in France; and to discuss risk factors and the latest approaches to improve prevention in future.

2. Incidence of stroke and transient ischemic attacks

2.1. *Methodological considerations*

Evaluating the incidence of stroke and TIAs requires reliable tools to provide the most accurate information. Prospective population-based stroke registries are regarded the best method for conducting incidence studies, and several criteria have been defined to ensure both the quality and exhaustiveness of case ascertainment, and reliable interpretation of the collected data, while allowing international comparisons between studies (Table 1) [1–3].

However, although of high value, such population-based registries are limited by the fact that they are time-consuming and expensive, and they cover relatively small populations, which may not reflect the composition of the entire population of a country, thereby restricting generalization of their findings. In a review of the published data on stroke incidence, only 56 studies from 47 centers were conducted between 1970 and 2008 [4]. Of note, information coming from low- and middle-income countries was particularly scarce. For this reason, a stepwise approach (STEPS Stroke) to the development of stroke registries has been implemented by the World Health Organization (WHO). This stroke surveillance system begins with stroke patients admitted to hospital (step 1) and is completed, whenever possible, by the addition of stroke events identified outside of hospital; such events can be either fatal (step 2) or non-fatal (step 3). Such a program has been shown to be helpful in obtaining reliable epidemiological data on stroke in low-to-middle-income countries [5].

Another point for discussion is the definition of stroke and TIAs to be used in epidemiological research. The classical definition of stroke according to WHO diagnostic criteria is ''rapidly developing clinical signs of focal (at times, global) disturbances of cerebral function, lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin''. In addition, the WHO defines a TIA as an acute focal loss of brain or monocular function, with symptoms lasting < 24 hours. In 2002, a TIA was redefined as a ''brief episode of neurologic dysfunction caused by focal brain or retinal ischemia, with clinical symptoms typically lasting less than 1 h, and without evidence of acute infarction''; this was based on the observation that a large majority of TIAs have a short duration (usually < 1 hour), and are sometimes associated with ischemic lesions on brain imaging [especially diffusion-weighted magnetic resonance imaging (MRI)] [6]. This definition, however, is difficult to apply in epidemiological studies, as the categorization of cerebrovascular events such as TIAs and stroke are considerably influenced by access to diagnostic resources – for example, the proportion of brain MRI performed in patients with transient neurological symptoms and the sensitivity of

Table 1 – Current criteria for performing high-quality stroke-incidence studies.

Use of standard definitions
WHO definition of stroke
Classification into ischemic stroke, intracerebral hemorrhage and subarachnoid hemorrhage, with at least 80% verification of diagnosis by computed tomography or magnetic resonance imaging
Classification of ischemic stroke into subtypes (e.g. large-artery disease, small-artery disease, cardioembolic, other) if possible
First-ever stroke in a lifetime only (for incidence calculations) and recurrent stroke
Standard methods for case ascertainment
Complete population-based case ascertainment based on multiple overlapping sources of information: hospitals (including admissions for acute vascular problems and cerebrovascular imaging studies and/or interventions); outpatient clinics (including regular checking of general practitioners' databases); and death certificates
Prospective study design, ideally with 'hot pursuit' of cases[a]
Large, well-defined, stable population
Follow-up of patients' vital status for at least 1 month
Reliable method for estimating denominators (census data not more than 5 years old)
Standard data presentation of findings for comparisons between studies
Complete calendar-years of data to avoid the influence of seasonal fluctuations, and no more than 5 years of data averaged together
Men and women presented separately
Recommended reporting of age-specific estimates within standard mid-decade age bands (e.g. 45–54 years), including the oldest age group ($\geq$85 years)

Source: references [1–3].

[a] Procedures that allow stroke cases to be pursued as they happen, including daily visits with admitted stroke patients, daily checks of all requests for brain imaging and direct notification of cases by general practitioners.

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