



## SPECIAL ARTICLE

## Perspective on stroke in Mexico



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According to the World Health Organization's world health report 2004, cerebral-vascular disease – stroke – is the third leading cause of premature death in both genders.<sup>1</sup> Its greatest impact is represented as the leading cause of disability in adults and the second leading cause of dementia.

Over 15 million cases of stroke occur every year worldwide, one case every 6 s. The impact of the disease is greater in developing countries (2 out of 3 cases). In 2005, 87% of the 5.7 deaths by cerebral-vascular disease were in lower or middle socio-economic-level countries.<sup>2</sup> This means that by the year 2020, over 52 million deaths will be caused by strokes in developing countries.<sup>3</sup>

In Mexico, according to the National Institute of Statistics and Geography (INEGI, by its Spanish acronym), strokes were the sixth leading cause of death in 2012, just after heart diseases, diabetes mellitus, malign tumors, accidents and liver diseases.<sup>4</sup> The fact that it registered as number 6 may seem like in Mexico, death by cerebral-vascular disease is less frequent. However, it is possible that when it occurs in diabetic patients it becomes sub-registered. This can be explained in different ways. Approximately 30% of patients who suffer a stroke have comorbidities with other diseases of cardiovascular risk, such as diabetes, heart diseases, hypertension and other modifiable risk factors, which are registered as the main cause of death in the certificates

in our country. Another explanation is the lack of a universal term that encompasses the whole spectrum of the disease. For example, in the US the word "stroke" includes ischemic vascular disease and hemorrhagic vascular disease, and it is clearly separated from heart disease. In Spain a single term is used: "ictus". This allows them to have global numbers of the disease. In Brazil, it is known as the second leading cause of death. On the other hand, in Mexico, like in many other countries in Latin America, there is no clear distinction between the diseases involving the cardiovascular system. The General population and healthcare personnel use many "similar" terms to refer to cerebral-vascular disease, or stroke, like embolism, apoplexy, brain attack, cerebral infarct, cerebral hemorrhage and cerebral-vascular accident; it is, in many cases, even generalized as "infarct", without specifying whether it was the heart or the brain. This causes a fragmentation in the registry of the disease, thus its incorrect representation in official health records.

Cerebral-vascular disease is more frequent in adults and its frequency increases significantly after the age of 60; however, it may occur at any age. The reason for this is the variety of etiologies, ranging from genetic causes, metabolic origin, hematological causes, cardio-embolic origin, atherosclerosis and even some caused by direct trauma like arterial dissection; thus, age does not represent a restriction to suffering from a cerebral-vascular disease. For example, children with sickle cell anemia may suffer a cerebral infarction during the first years of their lives; a teenager may suffer a carotid artery trauma during a car accident, causing a carotid dissection resulting in cerebral infarction by occlusion of the neck vessels. A young adult with cardiovascular risk factors may suffer a cerebral infarction

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secondary to a heart paroxysmal arrhythmia caused by a thyroid disorder, or even by a defect in the electric conduction to the myocardium; lastly, the elderly may suffer a cerebral infarct caused by an extra atherosclerotic or intracranial plaque which progressively occludes an artery that irrigates the brain. Therefore, it is a disease which affects all ages, with multiple etiologies, and one that should be contemplated by the Health Sector as catastrophic and a priority.

The average age of onset of cerebral-vascular disease is 65 years of age, and the prevalence and incidence of the disease will hopelessly increase with the demographic change. In 2004, the base of the population pyramid is narrower than in 1990 due to the fact that the proportion of children and young people had been significantly reduced, with an increase from 6.2 to 9.7% in the participation of the elderly. By 2050, this is expected to increase to 21.5%.<sup>5</sup> The increase in the survival rate of the population has caused most deaths to occur at an advanced age. For example, in Mexico, out of the 602,000 deaths registered in 2012, 61.9% corresponded to people over 60 years of age and older, the higher percentage of mortality reported by the INEGI in 2012 was a result of chronic degenerative diseases, among which a few stand out: diabetes mellitus (16.9%), ischemic heart diseases (16.5%) and cerebral-vascular diseases (7%).<sup>4</sup>

Most of the healthcare information registered in the country is based on hospital reports and death certificates. There are few epidemiological studies based on communal studies designed to determine the prevalence and incidence of cerebral-vascular disease in Mexico.<sup>6</sup>

Information on cerebral-vascular disease incidence in Mexico results from a door-to-door study called BASID (The Brain Attack Surveillance in Durango),<sup>7</sup> where the accumulated incidence was 232.3 per 100,000 inhabitants (IC 95% 27.8–436.9), with a mean sample of 51.5 years of age and 16% subjects over 65 years of age.

In Latin America, the variation of cerebral-vascular disease prevalence is wide. In Mexico, estimations suggest 6.7 per 1000 inhabitants in urban areas and 6.5 per 1000 in rural areas.<sup>8</sup> In the BASID study, cerebral-vascular disease prevalence was 7.7 per 1000 in all patients and 18.2 per 1000 in those 60 years old or older.<sup>7</sup>

Cerebral-vascular disease mortality rate has increased in Mexico, while the mortality rate has decreased in developed countries, like in the US, where it went from being the third leading cause of death to number 4.<sup>9</sup> This was thanks to the education awareness of the population, early detection of risk factors, and the implementation of specialty hospital services, called Stroke Units. In Mexico, in the year 2000, 435,386 deaths by cerebral-vascular disease were registered, with an annual mortality rate of 25.21/100,000, while in the year 2008, 538,288 deaths were registered with an annual mortality rate of 28.3/100,000.<sup>10</sup> In 2007, cerebral-vascular disease was the fourth cause of death in people 65 years of age and older,<sup>11</sup> and in 2012, it is the third leading cause of death after diabetes and heart diseases.<sup>4</sup>

Global CVD mortality rates reported in some hospital records in the country range from 19.6% at 30 days up to 29% at one year. Cerebral hemorrhage reported a higher mortality rate than cerebral infarction.<sup>6</sup>

The most commonly associated risk factors of cerebral-vascular disease in our country are high blood pressure (65–70%), diabetes mellitus (35–39%), obesity (50%),

frequent consumption of alcohol (16%), smoking (16–24%) and dyslipidemia (11%).<sup>7,12</sup>

Cerebral-vascular disease (CVD) includes ischemic and hemorrhagic CVD and cerebral venous thrombosis (CVT). At the same time, ischemic CVD includes transient ischemic attack (TIA) and cerebral infarction (CI); Hemorrhagic CVD includes different forms of intracranial hemorrhage (ICH), such as cerebral hemorrhage (CH) and subarachnoid hemorrhage (SAH), excluding those hemorrhages of traumatic etiology. The most common form of cerebral-vascular disease is ischemic, especially cerebral infarction (≈60–80%).<sup>13</sup>

The most frequent ischemic CVD etiology in Mexico cannot be precisely known, due to the fact that a uniform protocol of attention to the disease, including a diagnostic approach, does not exist among hospitals in this country. This is unfortunate because the secondary prevention treatment, which helps to avoid a recurrence, depends on the prompt etiological definition of the cerebral infarct. For example, in the PREMIER study, the etiological mechanism registered to cerebral infarct was: 8% by large artery atherosclerosis, 20% by lacunar infarction or by small vessel disease, 20% by cardioembolism, without specifying whether or not it was atrial fibrillation, 5% by diverse causes and 41% by an undefined etiology.<sup>13</sup> It is evident that the etiology of cerebral infarction is defined as the necessary laboratory and clinical studies are conducted. In the 2012 report of the neurovascular unit of the University Hospital of Monterrey, 39% were caused by large artery atherosclerosis, 17% by lacunar infarction or by small vessel disease, 13% by cardioembolism, 0.5% by arterial dissection and 24% by undetermined causes.<sup>14</sup> These differences are due to the fact that the hospital has created a systematic form for the clinical and laboratory studies, such as MRIs (86%), echocardiograms (60%) and ultrasound studies of the arteries of the neck (75%), during the patient's stay in the acute stage of the stroke, while in the PREMIER study (the first multicenter study in Mexico) an MRI was performed on 24%, an echocardiogram on 15% and a carotid ultrasound study on 20% of the patients registered with a stroke. Despite the high percentage of cases without an etiological definition, the rate of recurrence of cerebral ischemia was 8% annually,<sup>12</sup> and 50% occurred in the first month after the initial event.

The functional incapacity after an ictus for cerebral vascular event is a consequence of the extent of the cerebral damage. For example, in the evolution of a stroke, if the treatment is begun as early as possible and is able to reestablish cerebral circulation before the first 3 h of the evolution, functional and neurological recuperation will be very satisfactory. In Mexico's registers, between 24 and 59% of patients are left with moderate to severe functional dependency at 30 days of follow-up. The greater degree of functional damage is felt by patients in rural areas, as opposed to urban,<sup>8,15</sup> possibly due to incomplete medical attention and the lesser exposure of new treatments in rural areas.

Another reason why the health priority that CVD represents is underestimated is a lack of complete analysis of the costs. In Mexico, the hospital costs are less than those reported by other countries like the United States, Spain or Brazil. However, the true cause seems to be the greater mortality rate and the lack of diagnostic approach studies made in our hospitals, causing the lack of definition of the

etiology, thus the administration of a medication which is less-effective in avoiding recurrence. On the other hand, the indirect cost of a patient with neurological sequelae and functional dependence is enormous, especially if we consider long-term care, rehabilitation, the loss of productive capacity and the impact on the family economy.

The first step in the chain of events that lets us treat a patient with a cerebral-vascular event opportunely is the recognition of the alarm symptoms and the necessity of moving the patient to a hospital center immediately.<sup>2</sup> The Mexican population does not know the alarm signs of a cerebral-vascular event. For example, in Mexico City it was found that 37% of the population recognized an alarm symptom such as weakness in an arm or leg, deviation of the mouth or difficulty speaking, but only 2.1% could name 3 or more clinical manifestations. This evidences the necessity of making massive education campaigns with the information that would permit the population to identify the manifestations of a cerebral-vascular event and permit the urgent transportation to a hospital.<sup>16,17</sup>

Current treatment has changed the panorama of CVD, especially cerebral infarcts. Since 1995, it has been known that the treatment called thrombolysis allows patients who immediately go to a hospital to receive an intravenous medication which recanalize the occluded artery and which can sometimes achieve a complete recovery in the neurological functions of the patient. The time in which this medication can be applied is only 4-and-a-half hours from the onset of symptoms. Nevertheless, its use has changed the way we see ischemic CVD and opened the hope of medical recuperation for the patient. Because of this, it is a priority to announce to the public that they must get to a hospital quickly if they notice signs of ischemic stroke, and ask the doctors and authorities to prepare to offer this alternative treatment in national hospitals.

There have been some efforts made to improve the public's knowledge of, and the hospitals' attention to, this disease in Mexico. National and international scientific meetings have been organized, generating collaboration initiatives between national societies like the Mexican Neurological Academy and the Mexican Association of Cerebral-Vascular Disease, and other international associations like the Iberoamerican Society of Cerebrovascular Disease, the American Academy of Neurology and the World Federation of Neurology. In 2010 the first Neurovascular Units were inaugurated in Mexico, although, to this day, the only one that has survived the passage of time has been the one at the University Hospital of the city of Monterrey, thanks to the aid of the local authorities. On October 29th, "World Cerebral-Vascular Disease Day" in 2012, the state of Nuevo Leon won first place in the World Stroke Campaign of the World Stroke Organization with the Campaign of Education and Diffusion against Cerebral Attacks, made with the aid of the Secretary of Health. Other states of Mexico have added to the effort of working toward this proposal, highlighting the states of Querétaro, Sinaloa, Jalisco, Chiapas and the Federal District, with education programs and training for medical personnel and paramedics on pre-hospitalization attention. In the framework of the Annual Meeting of the Mexican Neurological Academy in November of 2013, the Merida Declaration was made, where a commitment was signed between medical societies to work together

with the states of Mexico to improve the means of education, prevention and medical and paramedical attention, as well as the rehabilitation services of cerebral-vascular disease. However, in spite of all these efforts, the impact on the recovery of the patient with a cerebral-vascular event has been minimal. We believe that the only way to change and improve the prognosis of patients with a cerebral-vascular event or Stroke is to guarantee their management with national health coverage. We must develop a strategic plan for universal coverage of CVD through educational programs, organization of pre-hospitalization attention, and growth of the medical infrastructure with the support of authorities and the Government, which will allow us to access the treatments which have been scientifically demonstrated to change the functional prognosis of the patient.

## Conflict of interest

The authors have no conflicts of interest to declare.

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