Impact of Brain Stroke on the U.S.

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Abstract

In the United States, brain stroke is among the leading causes of mortality and disability. Although, researchers have been able to unveil the complex pathophysiological mechanisms that lead to sequelae, there has not been a drastic change on the therapeutic and surgical treatments for brain stroke. Therefore, it has become increasingly important to devise other strategies for assisting patients and their caregivers on the acute phase, long-term phase and sequelae after stroke. Historically, brain stroke is a disease that can affect patients, as well as, primary caregivers on various aspects of their lives. These impacts plus gender, age, and social disparities give rise to a complex acute and long-term treatments that have a financial impact on society. As a consequence of these, there have been different strategies that have been implemented on federal, local and state level with the objective to decrease the incidence of brain stroke. Moreover, new advances in technology have allowed the implementation of strategies, such as, Telestroke with the purpose of decreasing the impact and incidence of brain stroke in the United States. Yet, there is still need to assess the efficacy of these strategies on the incidence of stroke. At the end, due to the complexity of this disease, only prevention has proven to be the most promising strategy for decreasing the impact of brain stroke.

Keywords: brain stroke, brain ischemia, cerebrovascular disease, Telestroke, telemedicine

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In the United States, every 40 seconds, a person has a brain stroke and, every 4 minutes, a person dies from it (Benjamin et al., 2017). Brain stroke is among the leading causes of death and long-term disability in the U.S. (Benjamin et al., 2017). Even globally, brain stroke has been found to be the main cause disability and affecting financially low and middle-income countries (Feigin et al., 2014). In the U.S., Benjamin et al. (2017) have anticipated that, between 2012 and 2030, the total direct medical stroke-related costs will increase. As a result, it has become increasingly important to understand brain stroke and high-risk population.

There are a number of risk factors that contribute to the presentation of a stroke in a patient (Prabhakaran, Ruff, & Bernstein, 2015). The sequelae that follow an ischemic event in the brain are complex with an onset in the first minutes or months after the ischemic event (An et al., 2014). These sequelae can leave the patient with a long-term disability (Park, 2017). As a result, more than half of the surviving stroke patients require support after a stroke (Benjamin et al., 2017). Therefore, the complexity of assistance linked to the sequelae affect the quality of life, finance, and health of the patient, as well as, caregivers.

It has become increasingly important to identify the characteristics of the population with higher risk of suffering a brain stroke. At the moment, the population with highest incidence of stroke mortality are reported to have age, gender and geographical disparities in the U.S. (Feigin et al., 2014). As a result, there has been ongoing efforts at local, state, and federal level to decrease the incidence of stroke and recurrent episodes on the population with higher incidence of stroke. This is a review on the consequences of the incidence and prevalence of stroke and the impact on the population of the U.S., as well as, the impact of the long-term sequelae and recurrence of stroke on patients and caregivers.

**Literature Review**

Brain stroke is caused by the interruption of blood flow to the brain by blockage (blood clot) or low perfusion(hemorrhage) (Mattson & Arumugam, 2018). Low perfusion to brain cells, rather than depletion of glucose and hypoxia, trigger an ischemic cascade (An et al., 2014) with a rapid onset (≈6 seconds) that results in a central area of irreversible damaged cells called ischemic core and an area of salvageable brain cells called the penumbra (Amantea et al., 2018). The signs presented during an ischemic event are focal neurologic deficits (Yew & Cheng, 2015) dependent on the affected brain area (Mattson & Arumugam, 2018) and will lead the physician toward the diagnosis of brain stroke (Centers of Disease Control and Prevention, 2018).

Most therapies have a small time window (Advani, Naess, & Kurz, 2017) and are directed toward the salvage of neurons in the penumbra (Prabhakaran et al., 2015). Since most of the ischemic events are caused by blockage by a clot or embolus, thrombolytics are considered the main standard for treatment of acute ischemic stroke (Chamorro, 2018). There are also surgical options for patients with severe stenosis and hemorrhage (Morris et al., 2017). For some years, there has been clinical trials that have researched the use of neuroprotective agents but none has yet proved effective (Chamorro, 2018).

Most of stroke survivors present recurrent stroke events (Benjamin et al., 2017), therefore, treatment with antiplatelet agents are considered as first-line agents in the prevention of recurrent stroke unless there is a contraindication (Bhaskar et al., 2018). Additionally, it has been found effective to include palliative care for the patient and support for caregivers (Braun et al., 2016).

In 2003, Medicare reported that of the patients discharged from hospitals after brain stroke approximately 55% of them required some kind of rehabilitation or skilled nursing facility (Benjamin et al., 2017). Patients after a stroke event often develop problems with communication, socialization, (Towfighi et al., 2017), low health-related quality of life, deteriorating health, symptom distress, and a complex care regimen (Park, 2017). As a result, patients and families are faced with long term challenge and burden (Braun et al., 2016).

Recently, Benjamin et al. (2017) found that the incidence of stroke has reduced significantly between 1990 and 2010; a higher prevalence, recurrence and mortality on females; and, geographical disparity in mortality rates. Historically, stroke mortality has presented higher mortality rates in the Southwest of the U.S. (Jauch et al., 2018) in an area known as the stroke belt (Benjamin et al., 2017). Within this region there is a region known as the buckle region (Benjamin et al., 2017). The belt and the buckle regions have a higher mortality of ≈30% and ≈40%, respectively, from the rest of the nation (Benjamin et al., 2017).

In order to overcome geographical disparities, Levine & Gorman proposed the application of telemedicine technology to evaluate and manage patients on acute phases of stroke events (Rubin & Demaerschalk, 2014). The proposed application is now called Telestroke. (Shafqat et al., 2018). Nowadays, Telestroke is considered to be the mainstream implementation of telemedicine (Rubin & Demaerschalk, 2014) and has evolved into varying types of size and implementations (Amadi-Obi et al., 2014) that allows post stroke evaluation and care (Rubin & Demaerschalk, 2014; Towfighi et al., 2017).

Globally, brain stroke has been found to be the leading cause of long term disability affecting middle-income and low-income countries(Feigin et al., 2014). In the U.S., it has been anticipated that direct medical stroke-related costs may increase from $71.6 billion to $184.1 billion, between 2012 and 2030 (Benjamin et al., 2017). Moreover, average outpatient stroke rehabilitation will also represent an economical burden that can increase by 38% after recurrent strokes (Benjamin et al., 2017). The stroke associated morbidity is still high and the related cost of $34 million dollars per year can be attributed to health care services and lost days at work (Boheme, Esenwa, & Elkind, 2017).

Additionally, there are ongoing efforts and policies that target prevention of stroke at individual, community, and population level in order to either modify a single or a cluster of risk factors (Boheme et al., 2017). The CDC support various public health programs whose objective is to prevent and assist patient and health care providers (Centers for Disease Control and Prevention, 2016). There are other programs and associations not supported by CDC and whose aim is to promote the prevention, assist with early diagnosis, provide guidelines for appropriate care, and palliative care (National Insitute of Neurological Disorders and Stroke, 2018).

**Conclusions and Future Study**

Even though, there have been important advances in the understanding of the underlying mechanisms that affect the brain after an ischemic event, stroke is still among the five principal causes of death and the leading cause of disability in the U.S. (Benjamin et al., 2017). The treatment for brain ischemia has focused mainly on the restoration of normal blood flow. Nonetheless, the time window for treatment with a positive outcome is limited (Advani et al., 2017). There has been ongoing efforts to increase the therapeutic window for brain stroke with the use of neuroprotectants, nevertheless, none has proven effective (Chamorro, 2018).

Paraphrasing Broderick on his (2003) speech, we will not be able decrease the impact of stroke unless we modify the primary risk factors of stroke and allocate resources in the correct manner. With that in mind, it has become increasingly important to raise the awareness between the relationship of cardiovascular disease and uncontrolled hypertension on populations with high risk of brain stroke. The former is mostly related to the limited effective therapeutic options that are available (Bhaskar et al., 2018) for brain stroke and the numerous sequelae (An et al., 2014). Furthermore, it has become important to direct research toward population with higher risk of stroke incidence and create ad hoc strategies directed to the clinical presentation, as well as, treatment (Reed, Halpern, & Starr, 2013).

Federal and state governments have created numerous programs to raise awareness of the importance of the modification of risk factors in order to decrease the incidence of brain stroke (Centers for Disease Control and Prevention, 2016). Nonetheless, there is still need to review the effectivity of those programs on the epidemiology of brain stroke. Moreover, it will be important to assess other policy measures, such as the implementation of the Affordable Care Act in the incidence of brain stroke.

In conclusion, the complexity of the pathophysiology, sequelae, epidemiology, and treatment have caused brain stroke to be one of the diseases that generates a wide variety of life altering events for the patient and caregivers. This wide array of sequelae has an economic impact on individual level that permeate into the community at many levels. Since therapeutic measures have not been effective, prevention has become the most effective way to decrease the incidence stroke. Yet, there is much work needed for understanding populations at high risk and the correct allocation of resources.

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