Introduction

Overview

About 85% of persons with epilepsy inhabit the developing world. Recent studies in developed and developing countries have shown that up to 70% of newly diagnosed children and adults with epilepsy can be successfully treated with antiepileptic drugs. In these regions, more than 60% of people with epilepsy may not receive the treatment they need. This wide treatment gap in these regions needs to be narrowed to decrease morbidity and mortality due to epilepsy.

A difficult dilemma

Of the 35 to 40 million people with epilepsy who live in developing countries, around 60% to 85% receive no treatment at all (Kale 2002; World Health Organization et al 2005). As a consequence, they experience morbidity related to seizures and the psychosocial consequences of stigma and discrimination. Regrettably, most of these people—many of whom are children—could have their seizures completely controlled and could return to a normal life by taking a single daily dose of a drug that costs less than (£1.50; €2.20) each year (Kwan and Brodie 2004). Conducting clinical trials in resource-restricted countries is difficult, contributing to wide treatment gaps, which result from lack of resources and trained personnel, and knowledge gaps in these countries (Perucca 2007).

Historical note

The earliest detailed account of epilepsy is in the British Museum in London. It is part of a Babylonian text on medicine, Sakikku, written over 3000 years ago. The Babylonians provided descriptions of many of the seizure types (miqtu), including what are now called “tonic-clonic seizures,” “absences,” “drop attacks,” “simple and complex partial seizures,” “gelastic seizures,” and “focal motor (Jacksonian) seizures.” The supernatural view has dominated thinking about epilepsy since then and even now remains a deeply rooted negative social influence in many parts of the world.

The supernatural basis was challenged by the school of Hippocrates in the fifth century BC Greece, which first suggested that the brain was the seat of this disorder; however, this concept was later replaced by supernatural causes in much of the world (World Health Organization et al 2005). By the seventeenth and eighteenth centuries, the Hippocratic concept of epilepsy as a brain disorder began to resurface. During these 2 centuries, epilepsy was one of several key areas of interest. Effort was made to separate “nervous disorders” from “mental disorders,” which led to the beginnings of modern neurology in the nineteenth century. Many treatises during this era covered convulsive diseases and also included hysteria, tetanus, tremors, rigors, and other paroxysmal movement disorders. The latter were gradually separated from epilepsy in the nineteenth century.

The understanding of the basis of epilepsy among poorly educated people in the developing world varies widely, and the supernatural and mental illness concepts remain the understanding for many. Nevertheless, modern treatment is sometimes available. In recent decades, there have been several new drugs, many of which have become available in developing countries.

Magnitude of the burden

It is estimated that 80% of people with epilepsy live in developing countries (World Health Organization 1999; 2000),
and the incidence of epilepsy in low-income countries may be as high as 190 per 100,000 people (Placencia et al 1994). Epilepsy accounts for 1% of the global burden of disease. There are few epilepsy incidence studies in developing countries, none of which are prospective; however, the results show rates from 49.3 to 190 per 100,000 (Jallon 2002). Higher incidence rates in developing countries are thought to be attributable to parasitosis (particularly neurocysticercosis, but also falciparum malaria, schistosomiasis, and paragonimiasis), HIV-AIDS, trauma, perinatal morbidity, and consanguinity. The higher incidence is difficult to interpret because of methodological issues, particularly the lack of age adjustment, which is important because epilepsy has a bimodal peak with age. The prevalence of active epilepsy in developing countries has been found to be fairly uniform at 4 to 10 per 1000 in a large number of studies, but higher prevalence has been reported in sub-Saharan Africa and Central and South America; this is possibly due to methodological differences, consanguinity, or environmental factors, which are particularly different in rural areas (International League Against Epilepsy 1997; Preux and Druet-Cabanac 2005). Ascertainment may also be confounded by the ability to group and classify epilepsy in these regions.

**Etiological factors**

The results of studies on the causes of epilepsy have implications for decision-making about the development of locally relevant strategies for prevention and management, education of primary healthcare workers and community physicians, and further research. Perinatal causes have been reported among the most important etiologies of epilepsy in all income categories except high-income countries (World Health Organization et al 2005). The top 4 most frequently reported etiologies of epilepsy (trauma, central nervous system infections, perinatal risk factors, and cerebrovascular disorders) are preventable (Uttam et al 2013). Multidisciplinary efforts focusing on the risk factors, such as reduction of head trauma incidence through enforcement of traffic regulations; immunization against relevant communicable diseases; and public health measures to reduce exposure to parasites can help to substantially decrease incidences of epilepsy.

**Medical services**

Epilepsy specialists provide care to people with epilepsy in 88.6% of high-income countries, but they are present in only 55.6% of low-income countries and are available without charge to the patient in about 67% of these low-income countries (World Health Organization et al 2005). CT scan is available in 70.5% of low-income countries. MRI is much more useful in the evaluation of epilepsy, but is available in only 29.6% of low-income countries. Similarly, long-term video-EEG monitoring is available in 21.7% of low-income countries, as compared to 77.1% of high-income countries (World Health Organization et al 2005). Neuropsychological services are less available, with availability in 37% of low-income countries and available free of charge in about one third of these countries.

The median number of professionals per 100,000 population who are members of an organization of epilepsy specialists is 0.17 in southeast Asia and Africa, 0.31 in the Western Pacific, 0.33 in the Eastern Mediterranean, and 0.35 in the Americas, compared with 2.15 in Europe (International League Against Epilepsy 2009). Professional organizations of epilepsy specialists do not exist in 64.6% of low-income countries, compared with 22.9% of high-income countries (Newton and Garcia 2012). Also, the median number of professionals per 100,000 population who are members of an organization of epilepsy specialists varies across different income groups of countries, with 0.19 in low-income countries, compared to 1.83 in high-income countries (World Health Organization 2005).

**Treatment gap**

A consensus definition of the “treatment gap” was adopted by international experts gathered together by the International League Against Epilepsy (ILAE): “The difference between the number of people with active epilepsy and the number whose seizures are being appropriately treated in a given population at a given point in time, expressed as a percentage” (Meinardi et al 2001). The random effects mean of the treatment gap prevalence for all of the studies has been reported as 56% (95% CI for true prevalence 31.1% to 100%). When stratified by continent, the random effects mean of the treatment gap prevalence was 55.4% for Latin America (95% CI 39% to 78.6%), 64% for Asia (95% CI 24.3% to 100%), and 49% for Africa (95% CI 14% to 100%) (Mbuba et al 2008). Lack of access has been identified as a major barrier to adequate treatment in both high-income and low-income countries. The attributed causes with the highest medians have been related to the health systems: inadequately skilled personnel, lack of available drugs, and excessive cost of treatment. Improved training of the health workers providing first level of contact in case detection, initiation of treatment with antiepileptic drugs, follow-up, and monitoring for compliance and adverse effects might be the most cost-effective ways to decrease the treatment gaps in the majority of countries. Both cultural and
structural factors affect the treatment gap (Tripathi et al 2006). Cultural values affect people's health-seeking strategies. If people believe epilepsy is caused by something that is not natural or medical, then treatment through Western medicine may not be sought (Meinardi et al 2001). In many developing countries, epilepsy is perceived as a manifestation of supernatural forces (Watts 1992; Reis 1994; Tripathi et al 2006). In such situations, the family and the patient first consult the traditional healers and follow their recommendations, and this treatment may be followed for a long period of time (Shorvon and Farmer 1988; Reis 1994; Tripathi et al 2006). The mean duration before seeking modern medical care can be several years, and reports have identified this period as lasting 6 to 14 years (Reis 1994; Tripathi et al 2006; 2010). This has been shown to depend on the area of residence (urban or rural), impact of cultural beliefs, and financial means.

**Antiepileptic drug usage**

There is wide disparity in the availability of treatment modalities in different parts of the world. The reasons for these inequalities are multifactorial. They may include both “hardware” factors (eg, availability of technologies and a reliable drug supply) and “software” factors (eg, availability of expertise and access to health care), which are often dictated by economic constraints (World Health Organization et al 2005). Phenobarbital carries the lowest cost among the antiepileptic drugs and can be reliably supplied to rural areas. Phenytoin, carbamazepine and valproic acid can also be accessed in most countries. In low-income countries, inclusion of first-line antiepileptic drugs in the lists of essential drugs varies (Haroon et al 2012). Phenobarbital is included in 96%, carbamazepine in 82.6%, phenytoin in 68.2%, and valproic acid in 62.5% of the countries. The median cost in international dollars for the first-line antiepileptic drugs is variable across World Health Organization regions. The cost of carbamazepine and valproic acid in Europe and the Western Pacific is almost half that of other regions. The cost of phenobarbital is 2.7 times higher in southeast Asia than in Europe (World Health Organization et al 2005). Even so, the use of newer antiepileptic drugs is increasing even in resource-limited settings.

**Epilepsy surgery**

Services provided by epilepsy specialists vary also among income groups of countries in relation to provision of surgical therapy. Of the low-income countries, 4% mention provision of surgery as a task of epilepsy specialists compared with 37.9% of high-income countries. Nevertheless, epilepsy surgery may be indicated for people with epilepsy who continue to have frequent seizures despite multiple-drug therapy (Diop et al 1998). Surgery can provide a significant improvement in quality of life for many of the 30% of people with epilepsy who continue to have seizures while taking appropriate medication. However, epilepsy surgery is not available in 87% of low-income countries. Facilities for epilepsy surgery are also absent in 34.3% of high-income countries (World Health Organization et al 2005). Availability of epilepsy surgery requires a knowledgeable team consisting of an epileptologist and neurosurgeon, and technical services, including MRI and video-EEG (Engel 2005; Tripathi and Jain 2007; Asadi-Pooya and Sperling 2008).

Whereas the treatment gap for epilepsy is of considerable concern in the developing world, there is a marked treatment gap with respect to epilepsy surgery even in industrialized countries, where perhaps only 5% of potential surgical candidates are ever referred to an epilepsy surgery center. This is largely attributed to misinformation about the risks and benefits of surgery, particularly with respect to recent advances in diagnostic and surgical approaches that have greatly improved safety and efficacy. Until recently, epilepsy surgery was not available in countries with limited resources, but epilepsy surgery programs are now prominent in Brazil, China, India, and Turkey and are being developed in many other countries with limited resources where it is recognized as a more cost-effective treatment for surgically remediable syndromes than continued pharmacotherapy (Engel 1996; Wieser and Silfvenius 2000). The success of epilepsy surgery depends on the accurate identification of good surgical candidates, and then selecting the best candidates based on the available resources and technologies without jeopardizing safety (Engel et al 2005; Tripathi and Jain 2007; Asadi-Pooya and Sperling 2008).

**Conclusion**

Although the World Health Organization has made significant progress in defining the magnitude of the problem of epilepsy and identifying the likely etiological factors, our understanding of the epidemiology of epilepsy in developing countries is still incomplete. The problem is particularly compounded in areas where patients with epilepsy do not have access to neurologists, or even to physicians, and where diagnostic methods such as CT scans and electroencephalography (EEG) are not available. Other difficulties include the complexity of diagnosis in epilepsy.
The potential etiological factors for epilepsy in low-income countries is different from high-income countries; however, some of the etiological factors in developing countries may be preventable (Anonymous 2012; Tripathi et al 2012). Intracranial infections are of particular importance in this respect because hygiene improvement and vaccination can have major impacts. Epilepsy and other long-term sequelae of intracranial infections can be minimized by early detection and prompt and adequate treatment.

In most low-income countries, out-of-pocket payment by the patient is the major source of healthcare financing, which differs from high-income countries that have healthcare provided at reduced or no charge when patients are unable to pay. This financial burden results in further inequity, with underutilization of whatever services are available in the low-income country and sought by the patient. Every region must make a collective and cohesive effort towards the management of epilepsy, bringing it out of the shadows (Dagar et al 2011). Developing national programs will go a long way in reducing the treatment gap in epilepsy in the poor regions of the world.

References cited


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**References especially recommended by the author or editor for general reading.

ICD and OMIM codes

ICD codes

ICD-9:
Epilepsy and recurrent seizures: 345

ICD-10:
Epilepsy: G40

Other topics to consider

Anticonvulsants
Carbamazepine
Epilepsy
Epilepsy surgery in adults
Epilepsy surgery in children
Ketogenic diet in the treatment of epilepsy
Migraine and epilepsy
Pharmacological treatment of epilepsy in adolescents and adults
Phenytoin
Sleep disorders associated with epilepsy
Valproic acid