How to Avoid or Control Neurological Disorders

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Abstract

Introduction: The world population is ageing and while people are living longer the incidence of neurological degeneration is increasing rapidly.

Objective: There is a critical need to understand the impact of neurological degeneration on society presently and particularly the future impacts. By determining what can be done to ameliorate the symptoms, we may be able to establish better self-management tools to minimize the effects of ageing diseases. Neurological disorders have associated cognitive declines and significant effects on elderly people going about their normal daily living. Medicine and science must also determine and understand if there is an interpersonal relationship between traumatic brain injury and neurodegeneration.

Methods: A review of neurodegenerative diseases including dementia, Parkinson’s disease and Alzheimer’s disease to establish the current incidence and projected patient populations with the associated socioeconomic costs to global communities. Establish if there are pathological commonalities between traumatic brain injury and neurocognitive decline in ageing diseases.

Search Strategy: Medline and Google Scholar searches in addition to the use of personal archives and reference lists from relevant papers in many countries. Evidence Sources: Primary source was empirical papers published in English language journals. Secondary source: Published abstracts of scientific meetings or English abstracts of non-English journal publications that provide useful information.

Results: Neurological disorders are increasingly rapidly throughout the world and particularly in emerging economies. Less developed nations constitute 52% of the total number of dementia cases worldwide with 46% of these cases in Asia. Females are more susceptible accounting for 59% of the total dementia population. Unfortunately, 70% of the medical costs in 2010 occurred in Western Europe and North America, so medical care and costs are not provided equal to the disease prevalence. Alzheimer’s disease occurs in 70% of dementia patients so the disorders are inseparable. Similarly, 40% of Parkinson’s patients develop dementia as do 44% of mild or moderate traumatic brain injured persons. They all share similarities in pathology with amyloid plaques and neurofibrillary tangles. Avoidance of neurological disorders with ageing is almost impossible depending on how long you live, but there are strategies for minimizing and controlling the effects.

Keywords: Neurological Degeneration; Amyloid Plaques; Neurofibrillary Tangles; Dementia; Alzheimer’s; Parkinson’s disease; medical costs

Introduction

Neurological disorders are increasing significantly throughout the global community. One hundred percent avoidance or control of neurodegeneration is impossible, so the available research indicating how to avoid or control neurological disorders contained in this article should be used only as a guide.

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The neurological disorders in this review will be limited to degenerative neurological disorders covering dementia, Parkinson’s disease and Alzheimer’s diseases. Traumatic brain injury (mTBI) is included as it should be regarded as a neurological disorder by virtue of its pathology.

### Economic Impacts

The economic impact of dementia effects the welfare systems but even more so the involved families. In modern western societies we have seen a disengagement from the traditional family structure due to increasing working demands on the family finance providers and an overall "time poorness" affecting all family members. A dementia patient often requires 24/7 care, and the typical modern family member cannot provide this level of care. In 2009 the total worldwide societal cost of dementia, based on a dementia population of 34.4 million demented persons, was estimated at $422 billion, including $142 billion for informal care (34%). Wimoab., et al. [1] In this study, the worldwide occurrence of dementia in 2000 and during the period 1950 - 2050 was estimated. The calculations were based on worldwide demographics of the elderly and age-specific prevalence and incidence values of dementia, estimated from a meta-analysis. In a sensitivity analysis, different prevalence sources were used. The worldwide number of persons with dementia in 2000 was estimated at 25 million persons. Almost half of the demented persons (46%) lived in Asia, 30% in Europe, and 12% in North America. Fifty-two percent lived in less developed regions. [6.1% of the population 65 years of age and older suffered from dementia or 0.5% of the worldwide population, and 59% were female. The forecast indicated a considerable increase in the number of demented elderly persons from 25 million in the year 2000 to 63 million in 2030 (41 million in less developed regions) and to 114 million in 2050 (84 million in less developed regions). In conclusion, the majority of demented elders live in less developed regions and this proportion will increase considerably in the future. The worldwide cost of dementia had increased by 34% between 2005 and 2009 [1].

The total estimated worldwide costs of dementia were US$604 billion in 2010. About 70% of the costs occurred in western Europe and North America. In such high-income regions, costs of informal care and the direct costs of social care contribute similar proportions of total costs. In low and middle-income countries, informal care accounts for the majority of total costs as direct social care costs are negligible [2]. From these forecasts it is apparent that the true number of dementia sufferers is speculation, but population ageing seems most likely to play the greatest role in the prevalence and incidence of dementia worldwide [3].

Approximately 50 million people live with dementia, with the estimated global cost of care in 2019 being US$818 billion. As age is the predominant risk factor and demographics are rapidly changing, this figure may rise to 132 million people by 2050 [4]. The cost of caring for this number of dementia patients will then overtake the cost of medical spending in many health areas for governments.

Alzheimer’s disease: Alzheimer’s disease is often referred to as “senile dementia”. Alzheimer’s disease is the most common form of dementia and affects approximately 70% of all people with dementia. Alzheimer’s disease damages the brain, resulting in impaired memory, thinking and behaviour. The biggest risk factor for having Alzheimer’s disease is increasing age, with three in ten people over 85 having dementia. Sporadic Alzheimer’s disease can affect anyone of any age.

Familial Alzheimer’s disease is a very rare genetic condition with onset at an age of less than 65 years. The search for biomarkers in Alzheimer disease (AD) is predicated by the assumption that biomarkers will be identified before significant symptoms appear. The main biomarkers are amyloid plaques and neurofibrillary tangles which are identified on post-mortem. These pathologic changes may accumulate over time before any clinical symptoms occur.

Complicating this diagnosis are other co-morbidities that occur as we age [5]. "In 2006, the worldwide prevalence of Alzheimer’s disease was 26.6 million. By 2050, the prevalence will quadruple, by which time 1 in 85 persons worldwide will be living with the disease."
We estimate about 43% of prevalent cases need a high level of care, equivalent to that of a nursing home” [6].

"An additional challenge is that, while it is widely assumed that plaques and tangles are causally related to the cognitive symptoms in Alzheimer's disease, observations from multiple studies suggest that associations between plaques, tangles, and cognition are not particularly strong, and do not suffice to reliably predict the clinical outcome at an individual level" [7]. When considering Tau and amyloid proteins our current thinking regarding brain plasticity and engrams may not be correct. Considering the brain’s ‘circuitry’ enjoining neurons and glial cells may better explain the brain’s operational paradigm. We should add to this knowledge base with accurate measurements of the fluid dynamics occurring within the cranium. There are now measurement device combinations such as transcranial Doppler and bio-impedance which show differences in the volumes of intracranial blood and cerebrospinal fluid (CSF) during ageing and with Parkinson’s disease [8-10]. Current computerized tomography and magnetic resonance imagery scans do not accurately show brain damage due to spatial inaccuracies, and may be damaging our brains due to radiation exposure. We require better non-invasive methods of measuring brain dysfunctions.

**Figure 1:** ILCa-Additional intracranial fluid capacity, Delta V-Delta V (volume) - the CSF volume derived from the maximum impedance wave peak in the diastolic cardiac phase, S.CSFm-Calculated systolic cerebrospinal fluid volume, Angle-Angle of the ascending systolic combined Doppler/Impedance wave form, Delta T-Time between the peak of the bio-impedance and Doppler waves in the same cardiac cycle, D.CSFm-Calculated diastolic cerebrospinal fluid volume, Frequency-Impedance frequency, Time-Data capture duration.

**Figure 2:** ILCa-Additional intracranial fluid capacity, Delta V-Delta V (volume) the CSF volume derived from the maximum impedance wave peak in the diastolic cardiac phase, S.CSFm-Calculated systolic cerebrospinal fluid volume, Angle-Angle of the ascending systolic combined Doppler/Impedance wave form, Delta T-Time between the peak of the bio-impedance and Doppler waves in the same cardiac cycle, D.CSFm-Calculated diastolic cerebrospinal fluid volume, Frequency-Impedance frequency, Time-Data capture duration.

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Parkinson's disease (PD): Parkinson’s disease numbers more than doubled worldwide over 26 years, from 2.5 million patients (95% uncertainty interval 2.0 - 3.0) in 1990 to 6.1 million patients (5.0 - 7.3) in 2016. This increase may be partly due to the ageing of the population but also to a longer disease duration [11]. Dementia occurs in approximately 30% of Parkinson’s patients, and its incidence has increased by 4 to 6 times over the general age-appropriate population. The main risks are ageing, the severity of motor impairment, and an already compromised cognitive level. Clinical features include the slow but progressive course of cognitive impairments in relation to attention, executive and visuospatial functions and memory [12]. There are often physical impairments such as difficulty walking and unsteady balance.

Traumatic brain injury (TBI): It is now appreciated that Traumatic Brain Injury is part of the neurological degeneration family. “Traumatic brain injury (TBI) constitutes a major global health and socio-economic problem with neurobehavioral sequelae contributing to long-term disabling sequelae. It causes brain swelling, axonal injury and hypoxia, disrupts blood brain barrier function and increases inflammatory responses, oxidative stress, neurodegeneration and leads to cognitive impairment. Epidemiological studies show that 30% of patients, who die of TBI, have Aβ plaques which are pathological features of Alzheimer’s disease (AD). Although many patients survive the initial insult, TBI initiates a chronic neurological disease process” [13].

According to the US Centers for Disease Control and Prevention 2.87 million Americans experienced TBI in 2014, with the rates highest for people age 75 or older. Children aged 4 and younger, and adults age 65 and older were most likely to suffer serious brain injuries after a fall.

“Traumatic brain injury (TBI) has devastating acute effects and in many cases seems to initiate long-term neurodegeneration. Indeed, an epidemiological association between TBI and the development of Alzheimer’s disease (AD) later in life has been demonstrated, and it has been shown that amyloid-β (Aβ) plaques - one of the hallmarks of AD - may be found in patients within hours following TBI” [14]. Rapid Aβ plaque formation may result from the accumulation of amyloid precursor protein in damaged axons and a disturbed balance between Aβ genesis and catabolism following TBI [14]. Removal of metabolic waste products by cerebrospinal fluid (CSF) is critical to removing waste products from the brain tissue and has also been reported as being of great importance in ageing diseases such as Dementia and Alzheimer’s also contact sport players e.g. 110 of 111 NFL players suffered Chronic Traumatic Encephalography (CTE) on post-mortem. 44% of these players suffered Dementia [15].

Life expectancy is going backwards. In both the United States and the rest of the Western world.

This isn’t a blip caused by war or epidemics. This is a downwards trend since 2015. Our quality of a healthy life is changing. Chronic disease is on the up and up, rising since 2001 by 11% to over half the world’s population according to the World Health organisation. That’s > 50% of the world’s people. That means you’re more than likely to become ill sooner in your life than previously.

Previously the increase in chronic disease was blamed on the ageing population but perhaps we should question this. The real question is where does neurodegeneration start and why?

In considering our genetic heritage it becomes clear that we need “to understand the microbial components of the human genetic and metabolic landscape and how they contribute to normal physiology and predisposition to disease” [16].

Controlling our neurological Destiny: We can alter our genetic predisposition by changing our lifestyle and following logical steps to aid our autoimmune system. This can be accomplished in a number of ways and to varying degrees.

Avoiding Neurodegeneration: Lifestyle

Firstly, changing our lifestyle is required:
1. Not smoking – cigarettes, pipes, cigars. This includes vaping.

2. Limiting our alcohol consumption. This usually means a maximum 1 - 2 standard drinks per day.

3. Drinking enough water. The average person requires 2 - 3 litres of water per day for sufficient hydration.

4. Exercising every day. Exercise at a reasonable level challenges the cardiovascular system sufficiently to release friendly amino acids and neurotransmitters such as dopamine, and serotonin. Exercise upregulates our breathing pattern providing more oxygen to our brain tissue. Yoga should be included as an exercise recommendation as it also includes stretching.

5. Making sure that we get 8 hours sleep per night. This involves the Glymphatic System: CSF has been shown to be critical to the brain's glymphatic system, which plays an important role in flushing metabolic toxins or waste from the cellular interstitial fluid (ISF) of the brain tissues [17]. The CSF flushing of wastes from brain tissue is significantly increased during sleep. This effect results from the opening of extracellular channels, which are controlled by the contraction of the brain's glial cells. This allows for a rapid influx of CSF into the brain tissue [18]. Sleep may play a restorative function in maintaining brain health by the removal of potentially neurotoxic waste products e.g. beta amyloid from the central nervous system. These findings also indicate that CSF may play a large role during sleep in clearing the metabolic waste that is produced by the activity of the awake brain [19]. As humans we spend nearly one-third of our lives sleeping. Lack of sleep has been demonstrated to impair brain function [20].

6. Ensure that you maintain a health gut flora. Probiotics are now readily available but make sure that you use a strong dose. When we consider our gut/brain connection humans have 86 billion neurons in our brains but also 500 million neurons in our gut. These gut neurons are postulated to affect our auto-immune system and can trigger an erroneous autoregulation within the host with a neurodegenerative effect such as Multiple Sclerosis [21]. There may be effects generally on our neural health in the long term.

7. Limit the use of antibiotics to when absolutely necessary. The overuse of antibiotics, particularly penicillin, affects our MicroBiome. This affects our intestinal bacteria levels and efficiency. Losing our Antimicrobial resistance results in the gradual loss of effective drugs to treat life-threatening infections, which leads to an estimated additional 700,000 deaths each year. There are already antibiotics in the food chain from intensive farming practices [22].

8. Limiting our exposure to chemicals and sugars/refined foods. These substances impair our blood-brain-barrier (BBB) permeability, and that allows neurotoxins such as aluminum to reach the central nervous system [23-25].

9. Added challenges to our neurology may be in the viral epidemics sweeping the world such as the coronavirus, SARS-CoV-2 or COVID-19. These viruses change over time and are not always confined to the respiratory tract. They invade the central nervous system and may cause neurological diseases. This was observed in Wuhan China recently and in America.

10. Create a positive mindset and use and challenge your brain with high level cognitive challenges. Filling out the crossword puzzle is not sufficiently challenging. You should begin study courses that provide higher level learning. Having positive thoughts and a healthy interaction socially benefits our hormone production from the pituitary gland. The pituitary gland is inexorably influenced by our neurological system as it consists of part nervous tissue and part gland formation. “The pivotal role of the hypothalamo-hypophysial link is the integration of the neural and endocrine systems to produce a coordinated response to environmental stimuli” [26].

11. Much of the eventual neurodegenerative changes in our brain is cumulative damage. The greatest proportion of brain injuries
(mTBI) represent cumulative damage to our brain circuitry. Concussion is not always the ‘one big hit’ (TBI). Similarly, diminished engram activity is the result of underuse of our developed cognitive skills. Engaging in advanced learning courses challenges our brains and maintains a high activity level.

12. Meditation and mindfulness have been shown to diminish stress and maintain a healthy immune system with neurological benefits [27].

In order to benefit from this healthy lifestyle a person can practice many of these beneficial lifestyle activities on a daily basis. These may be enhanced by intermittent fasting. A Fasting practice using the 16 abstinence /8 hour eating program works well for many people.

Conclusion

We may not be considering the whole picture with neurological degeneration and ageing. Once considered to be only related to the elderly population, what we previously considered ‘old age’ neurological disorders such as Parkinson’s disease and dementia are also being diagnosed across many younger age groups. The number of neurological disorders across the world is increasing at an alarming rate and our health systems cannot hope to support the ageing tsunami. We can hope for pharmaceutical advancements to assist with the symptoms and earlier diagnostic capabilities. However, the human bio-mechanism is designed to survive and is influenced by our lifestyle choices. We should be mindful of surviving with our neurology systems intact as we live longer. This is very much under our control in the degree we maintain our neurological connectivity by embracing better self-help strategies.

Bibliography


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