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Understanding Alzheimer's Disease

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Alzheimer's disease (AD) is an illness that has perhaps been around as long as mankind itself. Today, it is one of the diseases clinically diagnosed as a form of dementia – which is, in turn, classified as a neurodegenerative disease. AD is the onset of a progressively degenerative form of memory loss, and the disease is most commonly diagnosed in those over the age of 65. However, it is estimated that only one in four people currently suffering from AD are, or will ever be, clinically diagnosed. The World Alzheimer Report of 2016 calculates that over 47 million people globally are suffering from AD or a dementia-related disease leading to memory loss. Therefore, it is important to understand the disease, its symptoms, and what you can do to give your loved ones with AD the care they require.

The roots of AD exist within the nature of human biological evolution. Hence, evidence of AD can be found in written records going back to the civilizations of antiquity. An ancient Egyptian by the name of Ptahhotep, writing in hieroglyphs 2500 years Before Common Era, described an illness of the mind which causes an older person to become increasingly "childish" over time. The Odyssey, a Greek epic, mentions the mental decline of King Laertes of Ithaca, who forgot that he was a leader, and started living in a hut. The most cited historical record documenting our ancestors' experience with this disease's chilling nature comes from the Roman poet Juvenal, who wrote: "Diseases of all kind dance around...but worse than any loss in the body is the failing mind which forgets...and cannot recognize the face of the old friend who dined with him last night, nor those of the children whom he has begotten and brought up."

In 1907, within the German region of Bavaria, Dr. Alois Alzheimer carried out research at Munich University on senile patients committed to mental institutions. He wanted to determine if there was more to this disease than chance of sufferings of those who reach old age. Dr. Alzheimer noted significant differences in chemistry after studying the brain of a deceased woman who had developed early dementia at the age of 51. He linked this form of forgetfulness to specific brain pathology with its own symptoms that separated it from other old age and brain-related disorders. It was not until 1910 that his work got international attention and entered the medical lexicon as AD.

AD can affect the elderly population at a phase in their life when they are physically vulnerable, and need to be extremely mindful of their daily habits to continue staying healthy. Memory loss among the elderly compounds their problems in more ways than the immediate effects of failing to stick to a diet and failing to remember the proper dosage of their medication. Those with AD, who have a sense of cognition before the final stages of the disease, tend to suffer from depression because they cannot remember entire portions of their life. The disease also puts immense strain on social bonds; the elderly often rely on to lead a fulfilling life. Caring for a person with AD can have high physical, emotional, and financial costs. It is hard for the loved ones of an affected individual to helplessly watch a person they know intimately fade into an infantile state of mind.

Unfortunately, the disease is not going away anytime soon. The 2016 World Alzheimer Report determines that AD will grow significantly to affect over 130 million people by 2050. Surprisingly, rising AD numbers is a side effect of significant advances made over the past century in healthcare. Advances in medicine have allowed a higher percentage of the global population to reach old age through increased life expectancy. In this respect, according to the World Health Organization (WHO), the average global life expectancy grew from approximately 48 years in 1960 to 71 years in 2015. For developed countries, the average life expectancy is even higher. A person born today in a developed country can expect to have an average lifespan of 81 years as per WHO data.

Due to this disparity in average lifespan between developed countries and the rest of the world, the former have recognized AD as a problem earlier than other countries did. Developed countries have invested in raising awareness of age related diseases like

AD for decades. They have also devoted significant resources to study other forms of dementia and neurodegenerative diseases, as the population over 65 gains a larger demographic share.

However, in the Arab world, AD is still a poorly understood disease among the general population. It has yet to become a priority for the healthcare system, which is geared towards addressing other challenges such as diabetes, obesity, and heart diseases. We now know that those with type 2 diabetes are four to five times more likely to develop AD, or other common neurodegenerative diseases such as Parkinson's disease. Obviously, the lifestyle of a person will have a significant role in the development of neurodegenerative diseases later. Blood sugar, cholesterol levels, and hypertension are all identified as critical factors in the development of AD. This association with lifestyle factors is stronger than genetics in causing people to develop this disease. Studies are being conducted to accurately determine the environmental and lifestyle factors that might contribute to developing AD, and specifically for at-risk groups. Research has also shown that AD is five percent more likely to affect those above 65 years, and 25 percent more likely to occur in those over 85 years.

In the region, families deal with a loved one suffering from AD in isolation. This is often because they have little or no awareness of the disease, are unfamiliar with the advantages of getting it clinically diagnosed, or simply believe their loved one is suffering from bad memory as a result of old age instead of AD. Those families that do have their loved one diagnosed with AD find it shameful to seek professional assistance, or are unaware of what to do next.

Hamad Bin Khalifa University (HBKU) identified neurological disorders as a serious potential future threat to the Arab world and tasked its Qatar Biomedical Research Institute (QBRI) with pursuing strategic research in this area. As the current working population starts to age over the next 20 to 30 years, AD and other age-related neurodegenerative diseases are bound to see an increase in this region. QBRI is currently working with other stakeholders in Qatar to identify the scale of the problem facing this region through sustained demographic research of those currently with dementia. Only then can work begin to identify genetic and biological markers unique to the Arab population that can help early diagnosis. The goal is to accelerate the global quest to find faster and effective diagnoses, better treatments, and, eventually, a permanent cure for AD and other neurodegenerative diseases.

In the Middle East, HBKU's QBRI is working to help raise awareness of dementia and other neurological disorders through print and online media, conferences, and events. QBRI is an internationally recognized institute for leading cutting-edge medical research in the region, and is also a one-of-a-kind research institute in the Arab world, receiving global competitive funding to undertake translational medical research. QBRI has established a dedicated Neurological Disorders Research Center for studying brain-related diseases such as autism, epilepsy, and neurodegenerative diseases. The

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center is undertaking advanced cutting-edge research to tackle these healthcare issues. Recently, the QBRI team has been selected by the Austrian biotechnology company AFFiRiS AG to evaluate select parameters in clinical trials on an innovative immunotherapy-based approach to treating Parkinson's disease that has been developed by the company. Moreover, pioneering diagnostic tools developed for neurodegenerative diseases by QBRI scientists have recently been selected by Lundbeck, a leading global pharmaceutical firm, to underpin their clinical trials in a new upcoming treatment.

So what are neurodegenerative diseases? In simple terms, neurodegenerative diseases are those which directly affect the healthy functioning of neurons.

Neurons are specialized cells that are prevalent within the brain and our nervous system. These cells transmit information throughout the body, and are responsible for our five senses. They allow us to experience life as we know it. Neurons enable us to hear music, see the world around us, smell the air, taste our food, and feel the heat emanating from a fire. Moreover, neurons facilitate our cognitive abilities such as memory and learning.

There are many types of neurodegenerative diseases other than from AD, such as Parkinson's disease, prion disease, motor neuron disease, spinocerebellar ataxia, spinal muscular atrophy, and others. Progressive degeneration and the ultimate death of neurons is a trait which underpins these diseases. It results in improper mental function and subsequent problems with muscle movement in affected individuals over a period of time.

Of this broad spectrum of neurodegenerative diseases, those which primarily impact the proper functioning of neurons in the brain are classified specifically under dementia. They include AD, Parkinson's disease, prion disease, frontotemporal dementia, dementia with Lewy bodies, Huntington's disease, and amyotrophic lateral sclerosis. It is worth noting that 50 percent of all individuals diagnosed with dementia are classified under AD.

However, diagnosing AD is a challenge. This is primarily due to the timeframe over which AD develops in the brain. An individual will have had the disease for 20 to 25 years before it can be clinically diagnosed using current tests and technologies. This means that a person who is clinically diagnosed with AD at 60 years of age would have initially had the disease developing in their brain while they were 35 or 40 years old. During early stages of the disease, detection and diagnosis with current technology are impossible.

To make matters worse, symptoms in early-stage AD are often so benign that they are easily overlooked by affected individuals and casual observers. It is written off as common forgetfulness which develops naturally as memory retention and retrieval slows with age. It can start with simply forgetting which sandwich you had eaten for lunch, and

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eventually remembering it. Over many years, this short-term memory loss progressively becomes more frequent and severe. At this point, it becomes apparent to the individual and those around them that something is wrong and professional assistance is sought.

Typically, diagnosis is achieved through a complex and comprehensive series of tests which go over family and personal medical history, mental status evaluations, mood testing, behavioral observations, and neurological exams. Blood and urine tests are also taken to rule out other illnesses that might be causing AD and dementia-related symptoms. Confirmation from test results and a subsequent positive diagnosis for AD can take several months. In some extreme cases, this process can last up to two years before the disease can be confirmed.

The major problem with diagnosing AD is that there are no convenient identification tools and processes for physicians to use. There is no single clinical test available today that can be analyzed to effectively diagnose a person with AD, as is the case for diseases like diabetes which use simple blood or urine tests. Magnetic resonance imaging (MRI) and positron emission tomography (PET) brain scans are inconclusive in detecting AD at earlier stages, but can be used to identify the disease at an advanced stage.

With the average cost of an MRI and PET brain scan being USD2,600 and USD6,800, respectively, they are prohibitively expensive – even for those residing in developed countries. Prices for these scans are high partly due to the financial cost of employing MRI and PET scanners in medical centers. This is a major reason why these scanners are not in widespread use, or easily accessible, across the Arab world. They also require isotopes used in the scanners to be produced at the same location, which adds a technical dimension to the implementation problem in regional medical centres.

Compounding the diagnosis problem of AD is that its symptoms often overlap with other dementia-related diseases. As a result, AD has an approximately 20 percent chance of being misdiagnosed either way. Therefore, someone having the disease gets told they have something else, or those without it receive a test result which is positive for AD. This leads to delays in treatment, or to patients receiving incorrect treatment.

When it comes to treatment for those with AD in the Arab world, there are almost no treatment centers available that provide quality and specialized care. There are several high-quality dedicated treatment centers available abroad in Europe and North America, but the cost is too high for an average family to afford. Moreover, specialized treatment centers are typically not covered by state funded or private medical insurance.

However, treatments in the form of certain prescription drugs are available and can be administered to those with AD. This form of treatment can briefly mitigate memory loss. But medications available today generally come with too many side effects. Therefore, doctors usually recommend these for temporary use as the side effects outweigh any positive short-term impact.

The good news is that investment in AD research has increasingly started to pay off in recent years. Advanced cutting-edge research carried out by big pharmaceutical companies and independent research institutes is successfully identifying at-risk populations, developing treatments which mitigate symptoms without severe side effects, and are on the cusp of finding a permanent cure for this illness.

It is important to understand that even with remarkable progress being made in AD research and treatments, the disease is still a big financial burden for families and healthcare systems. In 2010, according to The World Alzheimer Report, USD150 billion was spent dealing with AD globally. This number has grown exponentially since, with the 2016 report calculating that USD150 billion was spent in the United States alone for 2015 – with global estimates pinned at USD409 billion.

Sustained research investment will be required for many years to ensure AD does not continue to be a financial burden and to tax families emotionally. Qatar and HBKU, by investing in QBRI and other healthcare facilities within the country, are working to ensure this disease is given priority. Together, we are striving to ensure that new research over the next five years addresses and considers Middle East-specific genetic, environmental, and lifestyle issues when it comes to AD and other neurological disorders ●