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Anatomical and Pathological Review of Alzheimer's, Huntington's, and Pick's Disease: A Public Study on the Awareness of Neurological Disorders

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Abstract:- Neurodegenerative diseases (NDDs) include Alzheimer's disease, Parkinson's disease, Amyotrophic Lateral Sclerosis (ALS), Huntington's Disease, and Pick's disease. These conditions are characterized by a progressive decline in the structure and function of the nervous system. The objective of this paper is to provide a brief overview of these diseases, outline the anatomical changes they cause in the brain, and evaluate the level of public awareness about their prevalence and impact. Neuroimaging studies show that Alzheimer's disease initially leads to the degeneration of neuronal connections in brain regions associated with memory, such as the entorhinal cortex and hippocampus. ALS is characterized by the degradation of motor neurons in the spinal cord and brainstem, leading to muscle weakness and atrophy. In contrast, Parkinson's disease involves the decay of dopaminergic neurons in the substantia nigra, resulting in motor control impairments. Brain structure changes are linked to the accumulation of abnormal protein aggregates such as amyloid beta in Alzheimer's disease and alpha-synuclein in Parkinson's disease, interfering with cellular functions and causing neuronal death. Besides addressing brain structure, this paper presents results from a survey assessing public awareness of neurodegenerative diseases. The findings suggest that while the public is well-informed about Alzheimer's and Parkinson's disease, there is still a significant knowledge gap regarding less common conditions like ALS and Huntington's disease. The significance of implementing thorough educational approaches to increase public knowledge is highlighted by these results. This study seeks to narrow the divide between scientific knowledge and public awareness of neurodegenerative diseases by combining anatomical understanding with public perceptions.

Keywords:- *Neurodegenerative Diseases, Tauopathy, Anatomical Changes, Awareness, Integrating Anatomical Insights with Public Perceptions.*

I. INTRODUCTION

Neurodegenerative diseases are conditions characterized by progressive degradation of the nervous system's structure and function. These diseases which include Alzheimer's disease, Parkinson's disease, amyotrophic lateral sclerosis (ALS), and Huntington's disease are among the top causes of disability and mortality around the world, particularly among the elderly. The occurrence of these illnesses is predicted to increase significantly as the global population ages, presenting formidable obstacles for healthcare systems and society at large.

Each neurodegenerative illness has a unique effect on the brain, resulting in different morphological and functional deficits. The most prevalent type of dementia, Alzheimer's disease, is characterized by the build-up of amyloid-beta plaques and neurofibrillary tangles, which mainly impact the hippocampal and cortical regions, leading to cognitive decline and memory loss. Parkinson's disease is defined by the loss of dopaminergic neurons in the substantia nigra, which results in bradykinesia, stiffness, and tremors as well as other motor symptoms. Progressive muscular weakness and atrophy is the result of ALS, which is caused by the loss of motor neurons in the brainstem and spinal cord. Understanding these anatomical changes is crucial for developing targeted therapies and improving diagnostic accuracy.

Despite the growing prevalence of neurodegenerative illnesses, the public's awareness and understanding of these conditions is limited. Misconceptions and a lack of precise information regarding certain diseases' causes, symptoms, and development frequently shape public impressions. Raising public awareness is essential to advancing early diagnosis, and improving patient outcomes. This study aims to address these challenges by exploring the anatomical changes induced by neurodegenerative diseases and assessing the current level of public awareness. This research seeks to bridge the gap between scientific understanding and societal awareness through a comprehensive analysis of neuroimaging studies and a survey of public perceptions, ultimately contributing to more effective communication strategies and policy development

A. Alzheimer's Disease

- *Pathophysiology*

There is now a lot of evidence that beta-amyloid plays a major role in the apolipoprotein E gene and Alzheimer's disease. Alzheimer's disease is associated with many changes, including loss of synapses, death of neurons, and a decrease

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in specific neurotransmitters and proteins in neurons (called neurofibrillary tangles) and in the hubs between neurons (known as junctions)[40].

➢ *Amyloid-beta in Alzheimer's Disease*

Aβ, which is the primary component of plaques, originates from the amyloid precursor protein (app) and transforms into a diverse set of peptides with different lengths (ranging from 38 to 48 amino acids) and slightly distinct properties[40]. Studies on proteolytic processing have revealed that aβ is a common byproduct of APP metabolism and is produced in substantial amounts within neurons, as well as in other cells throughout a person's lifetime. Despite this, the exact function of app in neurons is still unknown, although it may be linked to synaptic plasticity[40].

➢ *Neurofibrillary Tangles*

These tangles are composed primarily of hyperphosphorylated tau protein, which normally stabilizes microtubules within neurons. However, in Alzheimer's disease, tau becomes abnormally phosphorylated, leading it to dissociate from microtubules and aggregate into paired helical filaments (PHFs). These PHFs then twist together to form NFTs. The formation of NFTs disrupts the normal functioning of neurons by impairing the microtubule system, which is essential for intracellular transport. This disruption can lead to synaptic dysfunction and eventually neuronal death. Additionally, NFTs are thought to interfere with axoplasmic flow, the process responsible for transporting essential molecules along axons, further contributing to neuronal dysfunction.

B. Review of Brain Anatomy in Alzheimer's Disease

➢ *Atrophy of Cortex and Hippocampus*

Atrophy of the cortex, particularly in regions responsible for memory, language, and reasoning is observed. The hippocampus, whose crucial function is to hold our short-term memories and transfer them to long-term storage in our brains, is one of the first areas to suffer significant volume loss. This atrophy can easily be spotted on MRI scans, especially in the medial temporal lobes. The cortical atrophy in AD leads to thinning of the gyri (the ridges of the brain) and widening of the sulci (the grooves), which are indicative of neuron and synapse loss.

Table 1 Descriptive Data for 52 Autopsy-Confirmed AD Cases and Control [1,41]

	Control			Definite AD		
Parameter	**M**	**F**	**All**	**M**	**F**	**All**
n	13	6	19	13	20	33
Age (y)	68 (4)	80 (3)	71 (3)	75 (3)	82 (1)	80 (2)*
Edu	17 (1)	16 (2)	17 (1)	16 (2)	16 (2)	16 (1)
MMSE	28 (1)	28 (1)	28 (1)	10 (2)*	4 (2)*	7 (1)*
Lag Time	20 (6)	32 (3)	22 (5)	45 (10)	50 (10)	48 (7)
PMD	17 (2)	14 (3)	16 (2)	11 (2)	12 (2)	12 (1)
Brn wgt	1368 (49)	1140 (3)	1325 (44)	1212 (40)*	1078 (32)	1128 (27)*
V_{ctx}	517 (21)	423 (10)	491 (17)	415 (23)*	352 (16)*	377 (14)*
V_{brn}	964 (44)	816 (36)	924 (35)	774 (36)*	681 (29)*	718 (24)*
V_{sub}	447 (24)	392 (32)	433 (19)	358 (18)*	329 (15)*	344 (12)*

V_{ctx} = total cortical volume(cc); V_{brn} = total forebrain volume(cc); V_{sub} = total subcortical volume (cc); Brn wgt = unfixed brain weight (g); PMD = postmortem delay (h); MMSE = Mini-Mental State Examination; EDU = education (years); LAG time = months between last MMSE and death [1].
'∗' Indicates significant difference compared to control mean ($p < 0.01$) [1];

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From the above table it can be inferred that the average age at death of the 33 AD cases was 9 years greater [$F(1, 50) = 6.9$; $p < 0.01$] than that for 19 controls, while the mean brain weight of the AD cases was 15% less than that for controls [$F(1, 42) = 11.6$; $p < 0.001$)]. Compared to controls mean total volumes for AD cases were reduced on average by 23% in the cortex [$F(1, 50) = 21.9$; $p < 0.00001$], 22% in the forebrain ($F(1, 50) = 21.8$; $p < 0.00001$), and 21% in subcortical brain regions ($F(1, 50) = 16.0$; $p < 0.0002$) [1,41].

➢ *Occurrence of Neurofibrillary Tangles*

As the disease progresses, NFTs first appear in the entorhinal cortex, which is an area of the brain allocortex, and hippocampus, areas crucial for memory formation, and then spread to other regions such as the neocortex.

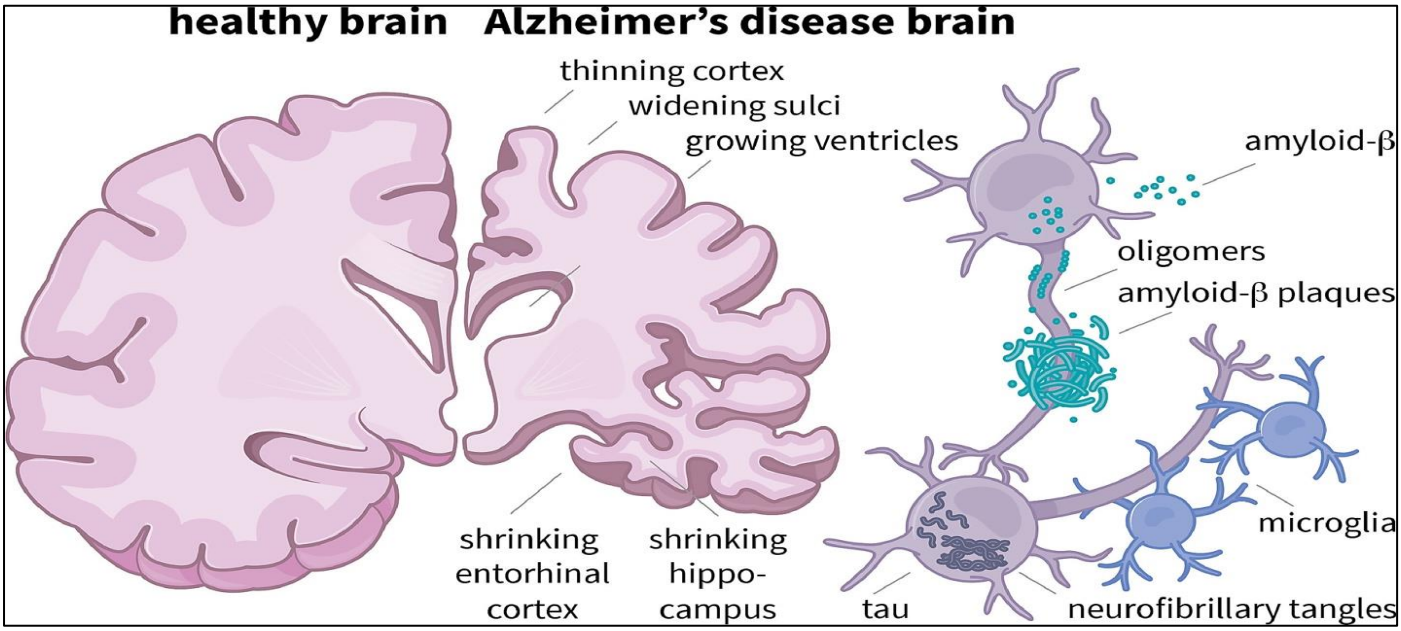

Fig 1 Showcases the Outlined Anatomical Features Mentioned beforehand alongside a Basic Infographic Concerned with the Formation of Neurofibrillary Tangles

C. Pick's Disease

➢ *Pathological and Anatomical Features*

- *Gross Findings.*

A decrease in brain weight down to 750 to 900 grams is common, while this type of shrinkage is uncommon in Alzheimer's disease[2,46]. The key feature is localized or specific cerebral shrinkage that affects the front part of the temporal and frontal lobes, the orbital frontal lobe, and the inner part of the temporal lobes. The affected cortex is dense and yellow-brown, with a finely granular appearance on the surface of the affected brain convolutions. This noticeable convolutional shrinkage is known as "knife-edge" shrinkage[46]. The spared areas include the back part of the advanced temporal gyrus and the gyri in front and behind the central sulcus. Shrinkage of the parietal lobes is usually minimal[2,46]. The parietal lobes generally experience mild atrophy. This atrophy can be uneven, with the dominant hemisphere (typically the left side) being more impacted[46]. Upon slicing, the cortical ribbon appears thinner than usual, and the gray-white boundary is indistinct[46]. The gray matter of the cortex may seem dense due to gliosis. The subcortical white matter is diminished, shriveled, gray, and typically smooth. The ventricles, especially the frontal and temporal horns of the lateral ventricles, are enlarged[46]. The corpus striatum, globus pallidus, and substantia nigra may exhibit degeneration in some cases [2,46]. Severe shrinkage of the caudate nucleus can be indicative of Huntington's disease. However, it is important to note that striatopallidonigral degeneration is less common in classical Pick's disease compared to lobar atrophy without Pick bodies or FTD [3, 2,46]. The caudate is more affected than the putamen in cases of degenerated corpus striatum, a distribution pattern that differs from the degeneration of basal ganglia in Huntington's disease and multiple system atrophy. Cases with longer periods commonly exhibit striatopallidonigral degeneration. Despite minimal basal ganglia pathology in many cases, clinical extrapyramidal symptoms are only rarely reported in Pick's disease [2,46].

- *Microscopic Findings*

✓ *Neocortex.* The neocortex displays severe pathology in certain areas, featuring a near-complete loss of large pyramidal neurons, parenchymal collapse, dense gliosis, and widespread spongiosis[46]. The upper cortex houses the neuropil, while the middle and lower cortical layers contain swollen chromatolytic neurons, also known as "swollen chromatolytic neurons"[4] or "Pick cells."[5]. In the most severely affected regions, there may be a lack of these swollen neurons. Argyrophilic amphophilic inclusions of round to irregular shapes are present in small neurons in the upper cortex, demonstrating strong argyrophilia when stained with silver (e.g., Bodian, Bielschowsky, or Gallyas stains). Inflated neurons may

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also exhibit weak and inconsistent argyrophilia. Pick bodies are topographically distributed in various cortical gyri, with the highest concentration found in the inferior parietal, inferior temporal, cingulate, insular, fusiform, and lingular gyri. They are less frequently observed in the occipital gyri, anterior frontal, and temporal lobes[6]. Occasionally, a few neurofibrillary tangles may be present alongside these lesions, but the distribution of Pick bodies differs from that of neurofibrillary tangles[7,46].

- ✓ *Neuritic pathology.* Neuritic degeneration is not widespread and is not easily observed in Pick's disease [9], but the use of immunocytochemical techniques has uncovered neuritic changes in Pick's disease [10,46]. These changes, although they may resemble the threads and grains of argyrophilic grain dementia, are not as numerous and can be found in areas other than the temporal lobe.

- ✓ *Hippocampus.* The hippocampal region and the amygdala typically exhibit the most severe pathology in Pick's disease, characterized by an abundance of Pick bodies. The distribution of Pick bodies is similar to that of Hirano bodies and granulovacuolar bodies found in Alzheimer's disease. The dentate fascia is particularly susceptible to Pick bodies, which present as round inclusions displacing the nucleus. These inclusions are larger in the pyramidal neurons. Apart from Pick bodies, pyramidal neurons in Ammon's horn are also vulnerable to granulovacuolar degeneration and Hirano bodies [8,46].

D. Huntington's Disease

- ➢ *Pathophysiology*

The full understanding of selective neuronal dysfunction in Huntington's disease caused by polyglutamine aggregation is still incomplete. However, certain crucial processes have been identified. Initially, proteins break down, and clumps form during the early stages of the process. Mutant huntingtin is more prone to proteolysis than the wild-type protein, and its truncation speeds up aggregation[11-16]. The polyglutamine segment in the mutant protein only occupies a small portion of its length[17], and a shorter protein could reduce steric hindrance. Evidence indicates that aggregates of truncated huntingtin are harmful and likely to migrate to the nucleus[16-18]. It is believed that the continuous production of mutant huntingtin and the formation of aggregates overwhelm the cell's ability to degrade them, either through proteasomes or autophagic vacuolization [19,20,21], resulting in an increased burden of unmanageable aggregated proteins. Aggregates also disrupt normal proteins by incorporating some of them into their structure, including those that typically interact with wild-type huntingtin [20,21,22,43], suggesting that truncated and aggregated mutant huntingtin may retain active binding sites. Through these and potentially other mechanisms, mutant huntingtin affects various nuclear and cytoplasmic proteins that govern transcription[23,20,21,43], apoptosis [20,21,24,43], mitochondrial functions[20,21,25,43], tumor suppression [26], vesicular and neurotransmitter release [27,28,29], and axonal transport[30]. Through the numerous described mechanisms, mutant huntingtin may not only exhibit a toxic gain of function but also exert a dominant negative effect by interfering with the typical function of wild-type huntingtin [31,32,33]. One potential aspect of Huntington's disease pathogenesis may involve interactions between cells. Mutant huntingtin can potentially harm a neuron by disrupting the function of neighboring neurons or glial cells that provide crucial support to that neuron. For example, in a transgenic mouse model of Huntington's disease, the interference of mutant huntingtin with the axonal transport and vesicular release of brain-derived neurotrophic factor in corticostriatal neurons appears to contribute to the inherent dysfunction of striatal neurons[31,34,35].

E. Review of Brain Anatomy in Huntington's Disease

- ➢ *Expansion of Frontal Horns of Lateral Ventricles (Ventriculomegaly)*

The lateral ventricles become noticeably enlarged as the surrounding brain tissue shrinks. This enlargement is one of the most consistent findings in neuroimaging (CT and MRI) of Huntington's patients and is used as a biomarker for disease progression[44].

- ➢ *Atrophy of the Striatum*

The severe shrinkage of the striatum, including the caudate nucleus and putamen, is a significant change observed in Huntington's disease[44]. The caudate nucleus, a paired C-shaped subcortical structure near the thalamus, plays a crucial role in various higher neurological functions. Similarly, the putamen, which is part of the brain's lentiform nucleus, is involved in speech articulation, reward, cognitive functioning, and addiction[45]. In Huntington's disease, the caudate nucleus and putamen experience noticeable shrinkage, which can be detected using neuroimaging as a substantial reduction in their volume. This atrophy is linked to the severity of motor symptoms such as chorea (involuntary, jerky movements) and rigidity. The loss of medium spiny neurons, which are especially susceptible in HD, disrupts the basal ganglia's circuitry, impairing motor control and causing the characteristic movement disorders of Huntington's disease.

In patients with Huntington's disease, a relationship exists between cortical and subcortical brain volumes[46]. The brains of seven patients diagnosed with Huntington's disease and with a positive family history, along with 12 controls, were obtained posthumously with the consent of relatives. Detailed clinical assessments and genotype confirmation were available for all study subjects with Huntington's disease. Brain volume analysis on serial 3-mm coronal slices was conducted. All patients with Huntington's disease showed significant brain shrinkage due to reductions in both cortical and subcortical grey matter[46]. The cortical atrophy was relatively consistent, though the structures of the medial temporal lobe were unaffected. Caudate nucleus and putamen were notably reduced in all cases, and this atrophy was associated with the severity of cortical atrophy, suggesting a linked disease process. The rate of cortical atrophy, but not subcortical atrophy, was correlated with CAG repeat numbers. Loss of frontal white matter was linked

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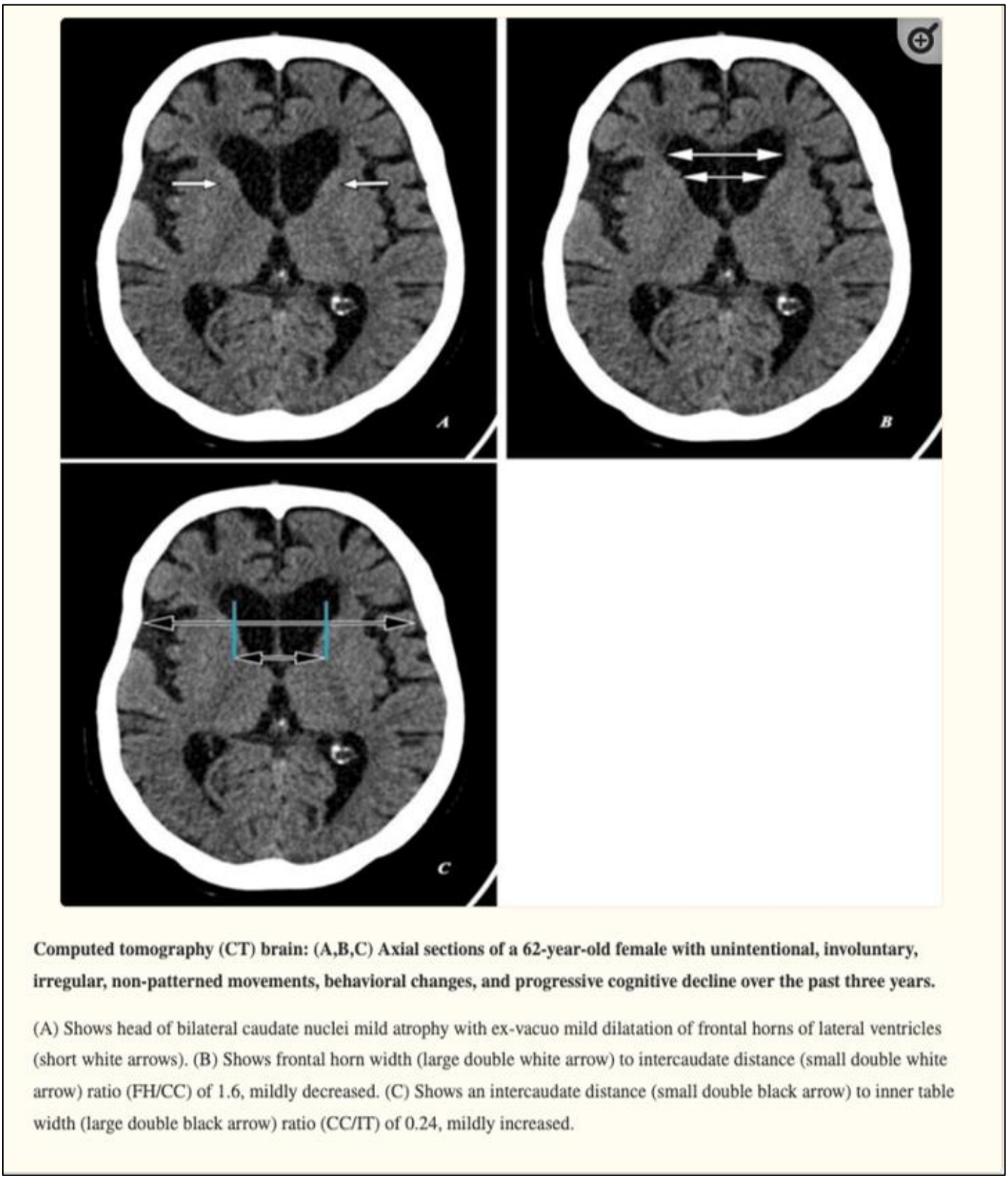
to both cortical and striatal atrophy. The age of onset of chorea was associated with the degree of subcortical atrophy, while the duration of chorea was inversely correlated with white matter atrophy[46]. These findings indicate a more widespread and global disease process in patients with Huntington's disease.

The above-mentioned changes can be observed in the figures given below(36)



Computed tomography (CT) brain: (A,B,C) Axial sections of a 62-year-old female with unintentional, involuntary, irregular, non-patterned movements, behavioral changes, and progressive cognitive decline over the past three years.

(A) Shows head of bilateral caudate nuclei mild atrophy with ex-vacuo mild dilatation of frontal horns of lateral ventricles (short white arrows). (B) Shows frontal horn width (large double white arrow) to intercaudate distance (small double white arrow) ratio (FH/CC) of 1.6, mildly decreased. (C) Shows an intercaudate distance (small double black arrow) to inner table width (large double black arrow) ratio (CC/IT) of 0.24, mildly increased.

Fig 2 CT Scans showing Changes in Anatomical Layout of the Brain

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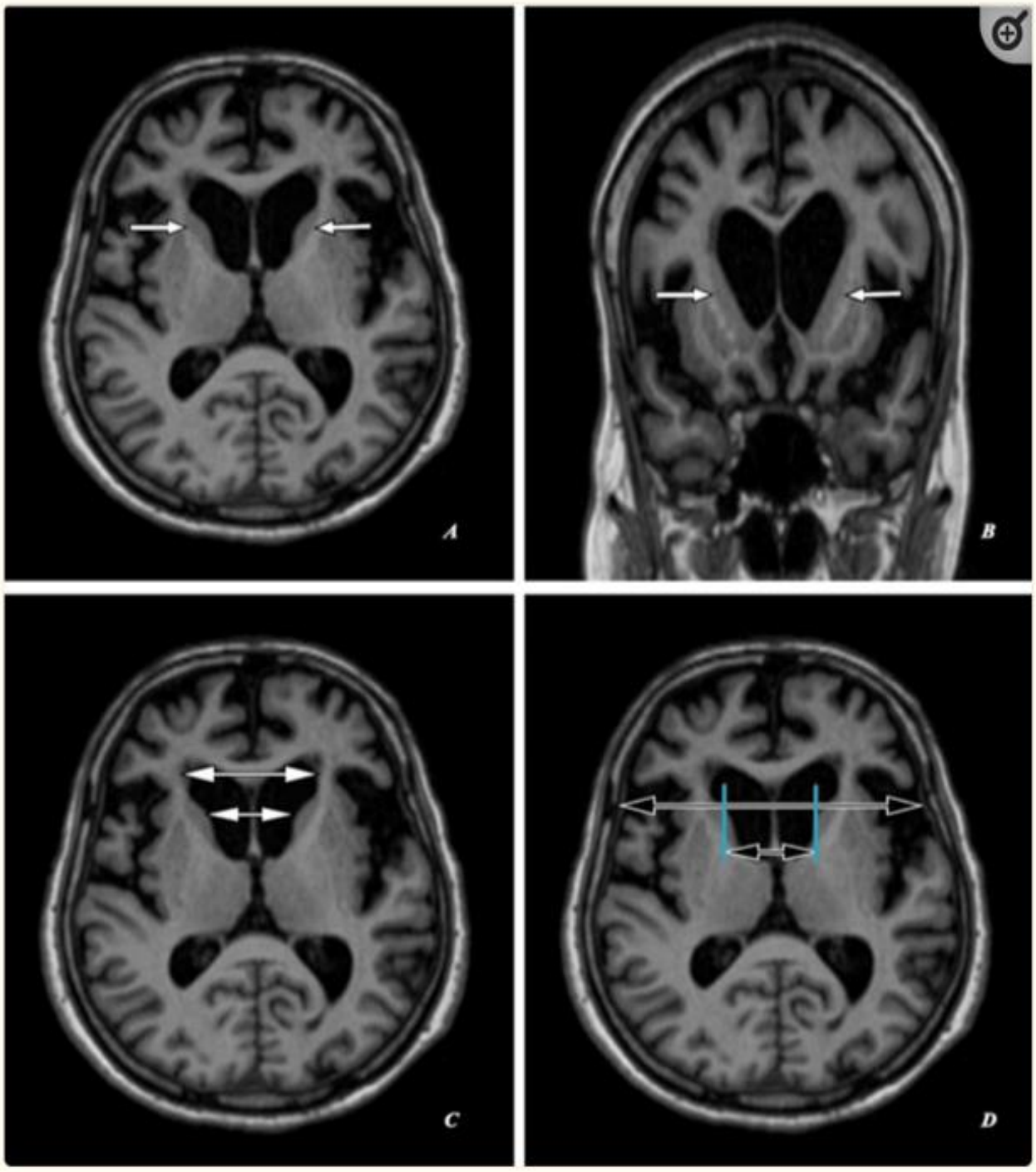

Magnetic resonance imaging (MRI) brain (T1-weighted): (A,C,D) Axial sections and (B) coronal section of the same patient.

(A,B) Shows head of bilateral caudate nuclei mild atrophy with ex-vacuo mild dilatation of frontal horns of lateral ventricles (short white arrows). (C) Shows frontal horn width (large double white arrow) to intercaudate distance (small double white arrow) ratio (FH/CC) of 1.6, mildly decreased. (D) Shows an intercaudate distance (small double black arrow) to inner table width (large double black arrow) ratio (CC/IT) of 0.24, mildly increased.

Fig 3 MRI Scans showing Changes in Anatomical Layout of the Brain

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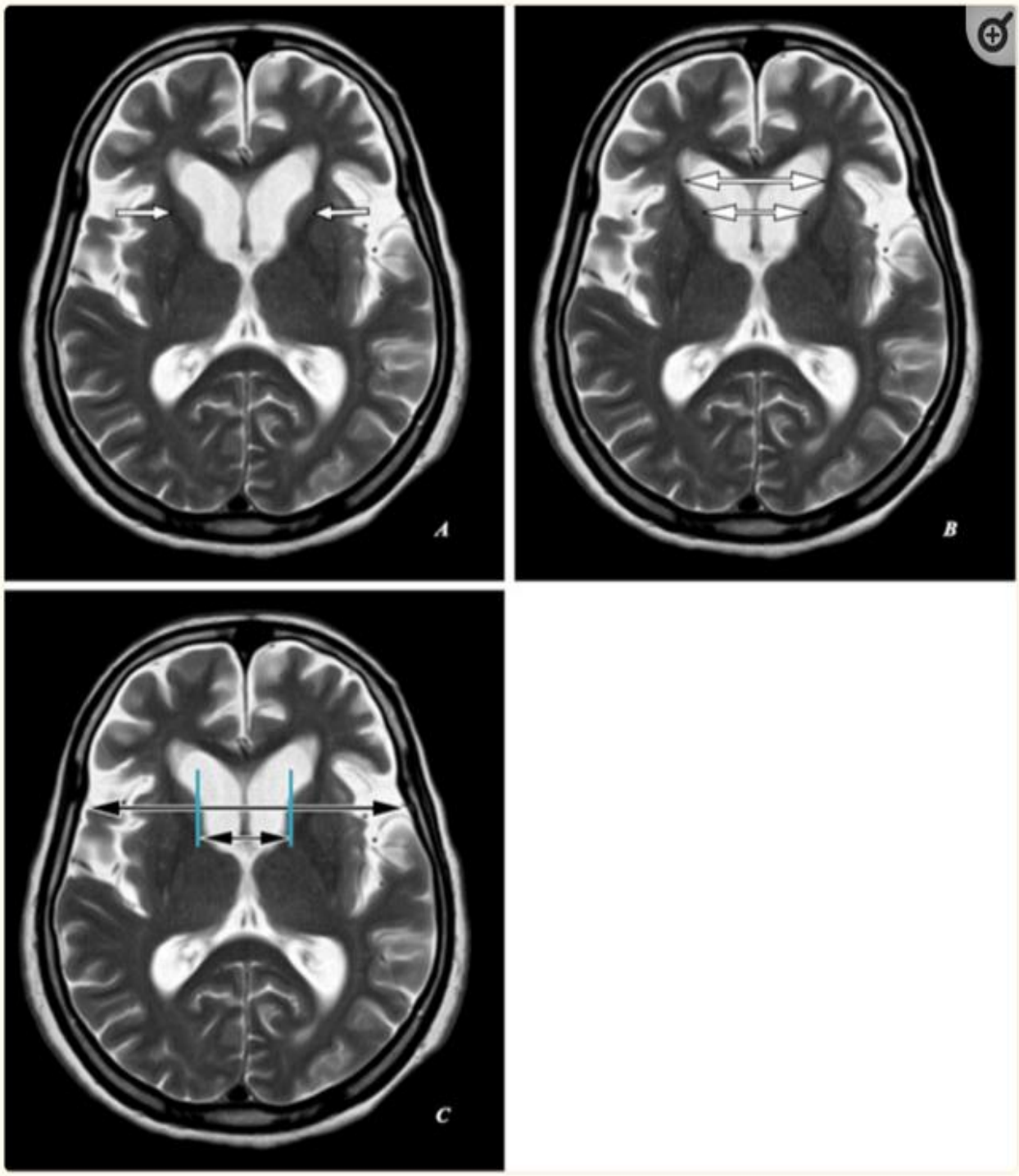

Magnetic resonance imaging (MRI) brain (T2-weighted): (A,B,C) Axial sections of the same patient.

(A) Shows head of bilateral caudate nuclei mild atrophy with ex-vacuo mild dilatation of frontal horns of lateral ventricles (short white arrows). (B) Shows frontal horn width (large double white arrow) to intercaudate distance (small double white arrow) ratio (FH/CC) of 1.6, mildly decreased. (C) Shows an intercaudate distance (small double black arrow) to inner table width (large double black arrow) ratio (CC/IT) of 0.24, mildly increased.

Fig 4 MRI Scans showing Changes in Anatomical Layout of the Brain

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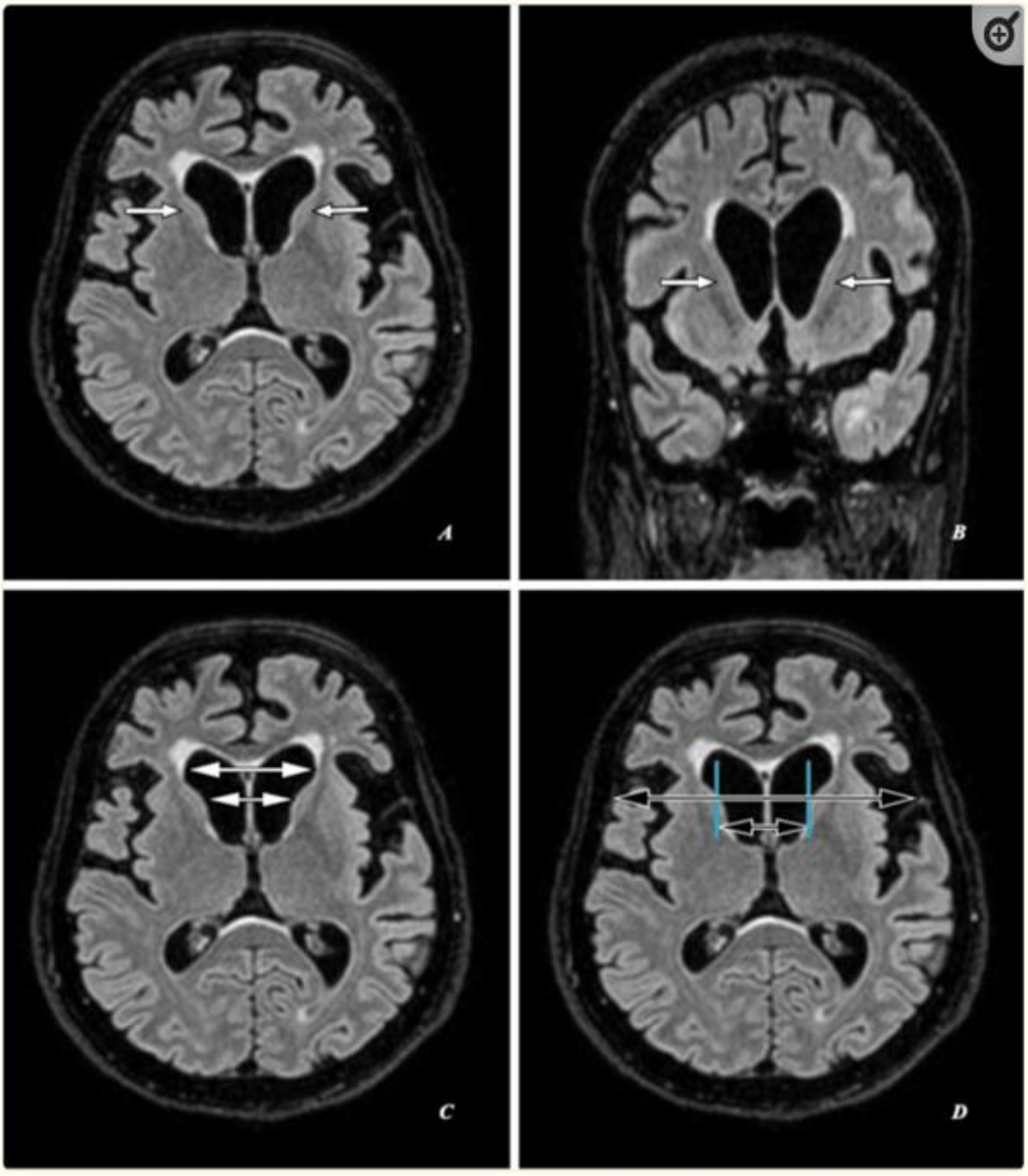

Magnetic resonance imaging (MRI) brain (fluid attenuation inversion recovery/FLAIR): (A,C,D) Axial sections and (B) coronal section of the same patient.

(A,B) Shows head of bilateral caudate nuclei mild atrophy with ex-vacuo mild dilatation of frontal horns of lateral ventricles (short white arrows). (C) Shows frontal horn width (large double white arrow) to intercaudate distance (small double white arrow) ratio (FH/CC) of 1.6, mildly decreased. (D) Shows an intercaudate distance (small double black arrow) to inner table width (large double black arrow) ratio (CC/IT) of 0.24, mildly increased.

Fig 5 MRI Scans showing Changes in Anatomical Layout of the Brain

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F. The Challenge of Diagnosing Huntington's Disease in Living Patients

➢ *Overlapping Symptoms with Other Disorders*

Huntington's disease (HD) has many clinical similarities to other neurodegenerative and mental illnesses, complicating diagnosis. For example, the motor symptoms of HD, notably chorea (involuntary dance-like movements), might be similar to those of Parkinson's disease and other movement disorders such as Sydenham's chorea or tardive dyskinesia. Parkinson's disease (PD) patients have tremors, bradykinesia (slowed movements), and rigidity, which might be confused with the hypokinetic-rigid type of HD that develops as the disease advances. Furthermore, HD's psychiatric symptoms, such as depression, anxiety, and irritability, share significant overlap with major depressive disorder and bipolar disorder [37,38,39]. These overlapping symptoms frequently result in misdiagnosis, particularly in the early stages of HD, when motor symptoms may be minimal.

For example, a patient who presents with sadness and modest motor symptoms may be treated for depression or anxiety without the underlying neurodegenerative disease being detected. Furthermore, cognitive decline in HD, which includes memory issues, decreased judgment, and difficulty with executive tasks, is a hallmark of Alzheimer's disease (AD). In the early stages, patients may be misdiagnosed with early-onset AD or another type of dementia, especially if there is no family history of HD[37,38,39]. Therefore, diagnosing HD demands comprehensive clinical evaluation, including neuroimaging and genetic testing.

➢ *Late Onset of Symptoms*

Huntington's disease is genetically determined, but symptoms normally do not develop until mid-adulthood, between the ages of 30 to 50. This late beginning makes detecting the disease difficult because the early symptoms are frequently mild and can easily be mistaken for natural aging or other common adult-onset disorders. For example, moderate cognitive changes such as forgetfulness, irritability, or difficulty concentrating may be misdiagnosed as age-related cognitive decline or early indicators of other neurodegenerative illnesses, such as mild cognitive impairment (MCI), which can precede Alzheimer's. Furthermore, late-onset HD might be confused with other adult-onset neurodegenerative disorders, such as frontotemporal dementia (FTD), which exhibits behavioral abnormalities, personality transformations, and executive dysfunctionIn certain situations, people with late-onset HD may develop symptoms similar to progressive supranuclear palsy (PSP) or multiple system atrophy (MSA), both of which are characterized by movement abnormalities such as bradykinesia, rigidity, and postural instability[37,39] These overlapping symptoms might cause a delay in the right diagnosis of HD, especially in patients who have no documented family history of the disease or who have atypical symptoms.

The problem is exacerbated by the likelihood of juvenile-onset HD, which starts before the age of 20 and has a distinct clinical presentation, generally marked by Parkinsonian symptoms such as rigidity and bradykinesia rather than the traditional chorea. The diversity in symptom onset and presentation makes it difficult to identify HD early, resulting in delayed diagnosis and therapy.

➢ *Variable Symptom Presentation*

The clinical appearance of Huntington's disease varies greatly between individuals and within the same individual over time. This diversity can make diagnosing HD more difficult. For example, some individuals may experience psychological symptoms first, such as depression, irritability, and obsessive-compulsive behaviors, before any motor symptoms develop[37,39]. These psychiatric manifestations are frequently misdiagnosed as main mental diseases, such as major depressive disorder, generalized anxiety disorder, or obsessive-compulsive disorder, rather than being identified as part of a neurodegenerative process. Other patients may initially present with cognitive symptoms, including difficulty with planning, organizing, and multitasking, which might be misinterpreted as other forms of dementia, such as Alzheimer's disease or vascular dementia. The diversity in symptom presentation can also lead to a misdiagnosis of neurodegenerative disorders affecting the frontal lobes, such as frontotemporal dementia (FTD), which is characterized by behavioral and executive impairment. In certain situations, the motor symptoms of HD are modest or atypical, leading to misdiagnosis as multiple system atrophy (MSA), progressive supranuclear palsy (PSP), or even Parkinson's disease[47], especially when bradykinesia and rigidity are the primary motor symptoms[37,39]. Due to the diversity in clinical presentation, doctors must include HD in a broad differential diagnosis, especially when evaluating patients with psychiatric, cognitive, and motor symptoms. A detailed family history neuroimaging and genetic testing are critical to the right diagnosis.

II. METHODOLOGY

➢ *Research Type*

The general public's awareness of neurodegenerative disorders was assessed in this study through the use of a quantitative research approach. The aim was to evaluate understanding of the causes, preventive measures, and prevalence of conditions like Alzheimer's disease, Parkinson's disease, and amyotrophic lateral sclerosis (ALS). The selection of the quantitative method enabled statistical analysis of the gathered data, facilitating the identification of trends and patterns in public awareness.

➢ *Data Collection*

Data was collected using a structured online survey distributed through various digital platforms, including social media, email lists, and online forums. The survey was designed using a well-known survey tool 'SurveyPlanet' and was accessible to a diverse demographic across different regions. The survey consisted of multiple-choice questions and a few open-ended questions to capture both the generality and specificity of the respondent's knowledge. The survey link was shared widely to ensure a representative sample of the general population.

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➢ *Data Analysis*

The data collected were transferred to a statistical software program (Excel) for analysis. An analysis was performed to understand the levels of awareness and comprehension among the survey participants. Furthermore, inferential statistical analyses were carried out to explore the links between demographic factors (like age, education level, and geographical location) and awareness of neurodegenerative diseases. Furthermore, open-ended responses underwent thematic analysis to uncover recurring themes and insights.

➢ *Tools and Materials*

The primary tool used for data collection was an online survey platform, chosen for its ease of use, broad accessibility, and ability to handle large datasets. For data analysis, statistical software (such as SPSS and R) was utilized to conduct both descriptive and inferential studies. Thematic analysis of qualitative data was performed manually or using qualitative analysis software (such as NVivo).

➢ *Mitigation of Research Biases*

Several steps were taken to mitigate potential research biases:

- **Sampling Bias:** Efforts were made to distribute the survey to a diverse audience, ensuring that different age groups, educational backgrounds, and geographical locations were represented.
- **Response Bias:** The survey was designed to be anonymous to reduce social desirability bias, where respondents might feel compelled to answer questions in a manner they perceive as socially acceptable rather than truthful.
- **Question Design Bias:** Care was taken to phrase questions neutrally and clearly, avoiding leading questions that might influence responses. Pilot testing of the survey was conducted with a small group to identify and correct any ambiguous or biased wording.

➢ *Justification of Methods*

An online survey was selected for its efficiency in reaching a broad and diverse population at a relatively low cost. Given the topic's broad relevance, an online platform allowed for a more extensive and varied sample, which is crucial for understanding general public awareness. The quantitative approach enabled objective measurement and statistical analysis of public awareness levels, providing clear insights into the current state of knowledge about neurodegenerative diseases. The chosen methods align with the study's aim to produce reliable and generalizable findings that inform future awareness campaigns and educational initiatives.

III. FINDINGS

➢ *Awareness of Types of Neurodegenerative Diseases*

Based on the survey findings, it is evident that there is a significant lack of public awareness regarding conditions such as Huntington's and Pick's disease. Nevertheless, previous global initiatives and campaigns have effectively increased awareness of Alzheimer's disease, Parkinson's disease, and Multiple Sclerosis, as indicated in Figure 6.

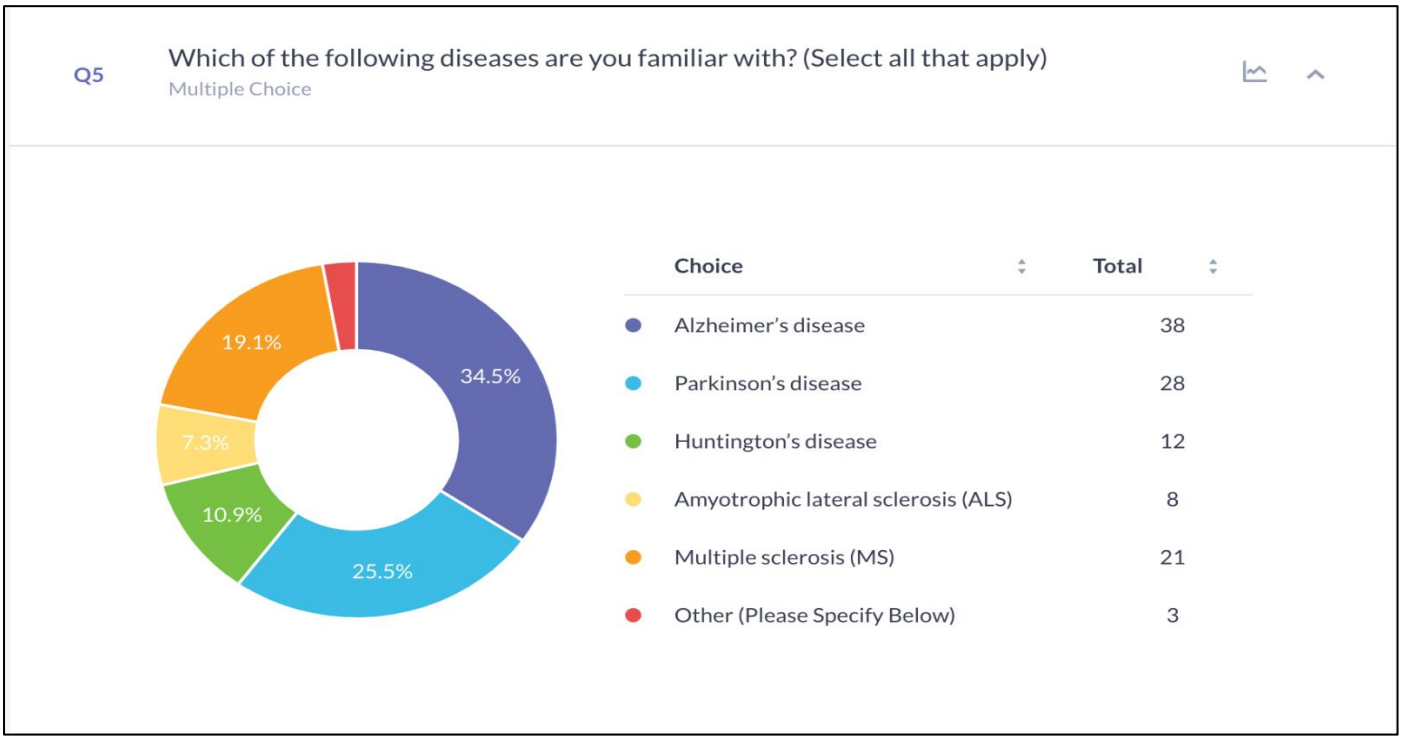

Fig 6 Shows the obvious disparity in awareness of more common diseases like Alzheimer's and Parkinson's disease and less common but not less fatal diseases like Huntington's disease and Amyotrophic Lateral Sclerosis (ALS)

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➢ *Awareness of Causes of Neurodegenerative Diseases*

Figure 7 indicates that the majority of respondents from the survey do not consider infections as a likely factor for neurodegenerative diseases. Table 2 demonstrates the widely accepted notion that being exposed to common viral pathogens raises the likelihood of developing Alzheimer's disease and other neurodegenerative conditions. This implies that a significant portion of the population that has encountered viral pathogens is uninformed about their heightened vulnerability to neurodegenerative diseases.

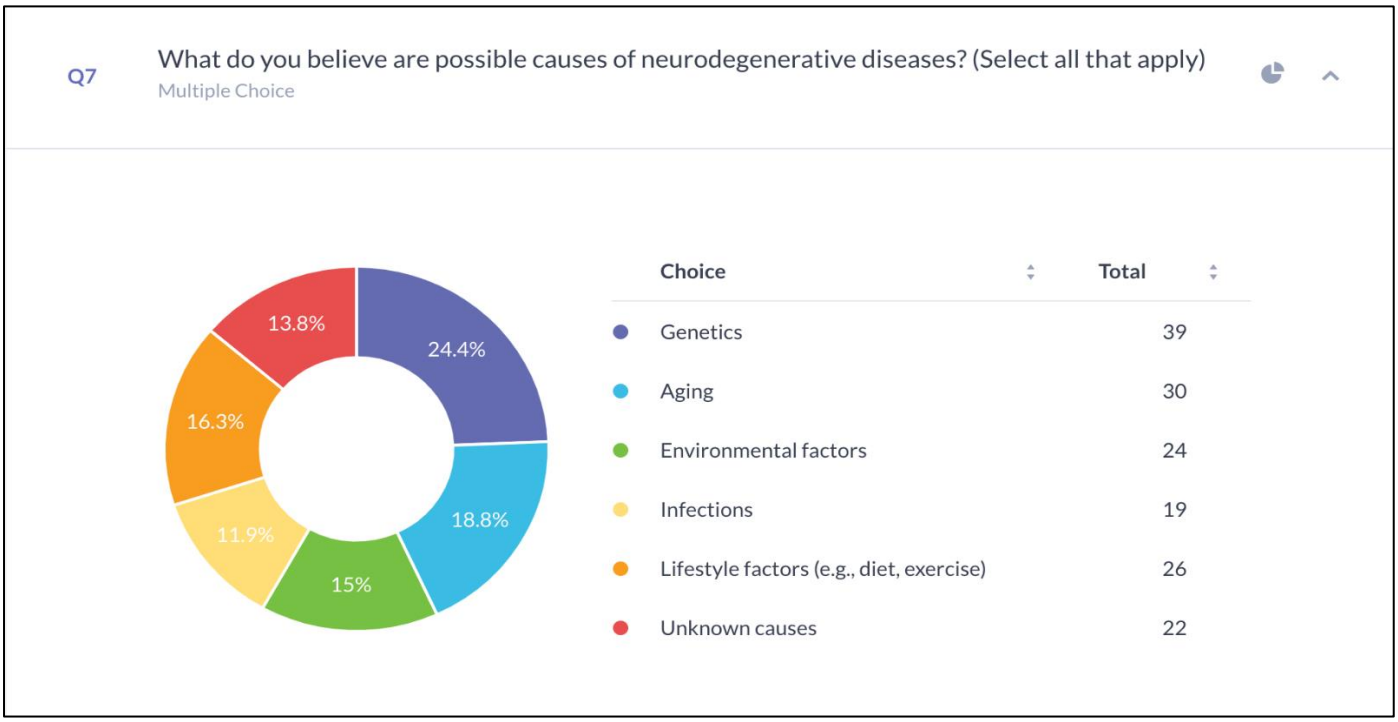

Fig 7 Show cases the drastically lesser amount of people who consider infections to be possible contributors to the development of neurodegenerative diseases

Table 2 Viral Infections Linked to Neurodegenerative Diseases [49]

Disease	Infection
Alzheimer's disease	Influenza and pneumonia Intestinal infections Meningitis Viral encephalitis
Amyotrophic lateral sclerosis	Human papilloma virus
Generalized dementia	Influenza and pneumonia Viral encephalitis
Multiple sclerosis	Epstein-Barr virus Herpes simplex virus Varicella zoster virus
Parkinson's disease	Hepatitis C virus Influenza and pneumonia
Vascular dementia	Influenza and pneumonia Varicella zoster virus

➢ *Awareness of Symptoms of Neurodegenerative Diseases*

High Recognition of Core Symptoms: Most respondents accurately identified memory loss and difficulty moving or walking as key symptoms of neurodegenerative diseases. This would likely be because these symptoms are strongly associated with well-known conditions such as Alzheimer's and Parkinson's disease, indicating once again that, public awareness campaigns and media coverage have been effective in conveying this information, *refer to figure 8.*

Moderate Awareness of Peripheral Symptoms: A significant portion of respondents also recognized changes in mood or behavior as symptoms, indicating that many people are aware of the broader cognitive and emotional impacts of neurodegenerative diseases, beyond crude physical symptoms.

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Scarce Recognition of Less Obvious Symptoms: While the public is well informed about the more commonly discussed aspects of these diseases, there is less understanding (Relative) of those symptoms that are less prominently featured in public discourse such as vision problems and seizures, *refer to figure 8.*

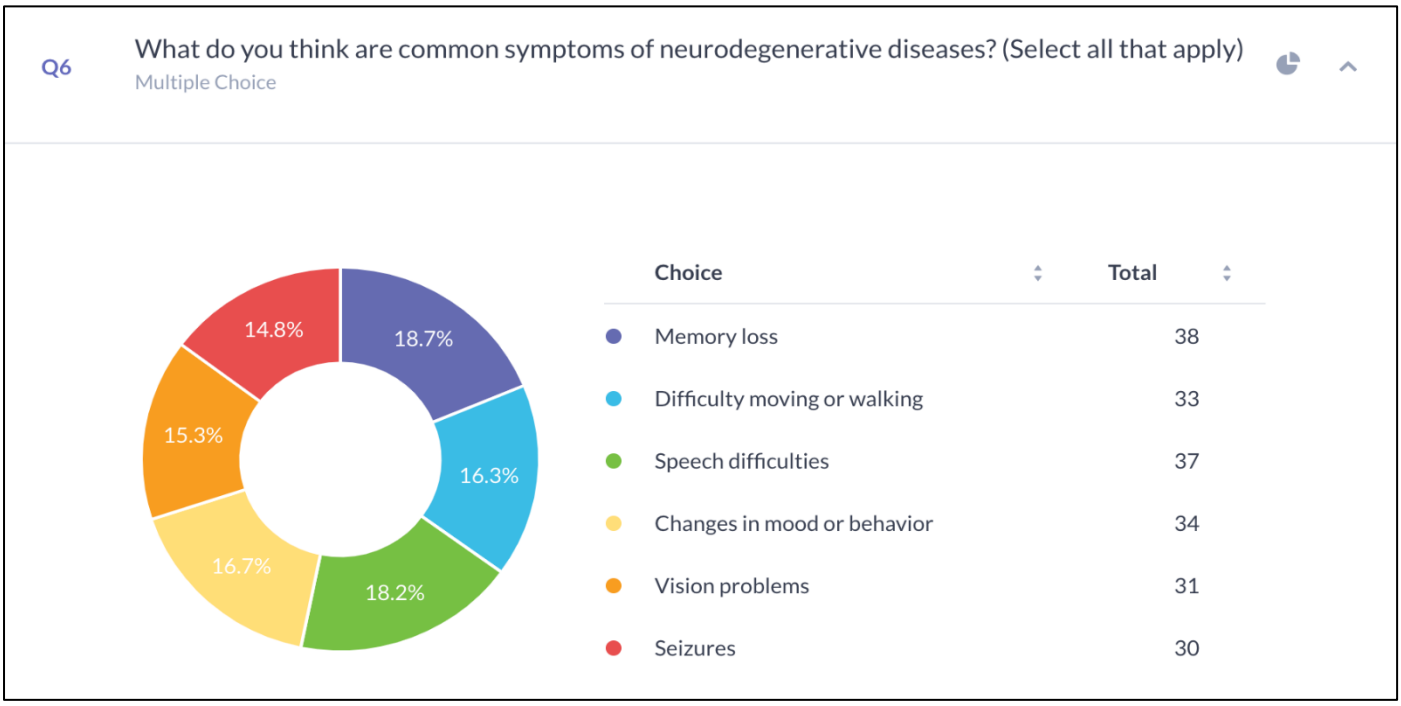

Fig 8 Show cases the disparity in responses depending on how prominently specific symptoms are talked about in media

The need for comprehensive educational reform in a way that accommodates and accounts for these gaps in the understanding of neurodegenerative diseases is necessary.

➢ *Awareness of the most affected brain Functions due to Neurodegenerative Diseases*

- *Memory and Thinking are Seen as the Most Affected –*

The highest percentage (24.7%, corresponding to 37 total votes) of respondents selected "Memory and Thinking", *refer to Figure 9*, as the brain functions most impacted by neurodegenerative diseases. This suggests that the public associates these diseases primarily with cognitive decline, which is consistent with widely recognized conditions such as Alzheimer's disease, where memory loss is a hallmark symptom. It indicates a strong awareness of the cognitive implications of these diseases.

- *Movement and Coordination are also Widely Recognized*

With 22% of respondents (33 total votes), the second most selected option was "Movement and Coordination." This reflects an awareness of conditions like Parkinson's disease, where motor function is significantly impaired. The public seems to have a good understanding of the motor-related symptoms often seen in neurodegenerative disorders, *refer to Figure 9.*

- *Moderate Awareness of Other Affected Functions*

Responses show a relatively balanced awareness across other brain functions, with "Language and Communication" (20%, 30 votes) and "Emotions and Behavior" (20.7%, 31 votes) receiving moderate attention. This indicates that while people recognize cognitive and motor impairments, they also understand that neurodegenerative diseases can affect a person's emotional regulation, behavior, and ability to communicate, *refer to Figure 9.*

- *Lower Awareness of Sensory Impairment*

The least selected option, "Vision and Sensory Perception" (12.7%, 19 votes), suggests that fewer respondents associate neurodegenerative diseases with sensory impairments. This could indicate a gap in public awareness, as some diseases (e.g., multiple sclerosis) can indeed affect sensory perception, but these symptoms may not be as well known to the general public, *refer to Figure 9.*

- *Overall Awareness Reflects Commonly Known Symptoms*

The data overall shows that the public is most familiar with the more noticeable or widely discussed symptoms, such as cognitive decline and motor impairment. However, there seems to be less recognition of the more nuanced effects, such as sensory and emotional disturbances. Public education efforts could benefit from highlighting lesser-known aspects of neurodegenerative diseases to provide a more comprehensive understanding.

In conclusion, the survey responses reflect a reasonable level of awareness of the major brain functions affected by neurodegenerative diseases. However, some functions, particularly sensory perception, may be underappreciated in public discourse. This insight can help in shaping educational initiatives to address gaps in awareness.

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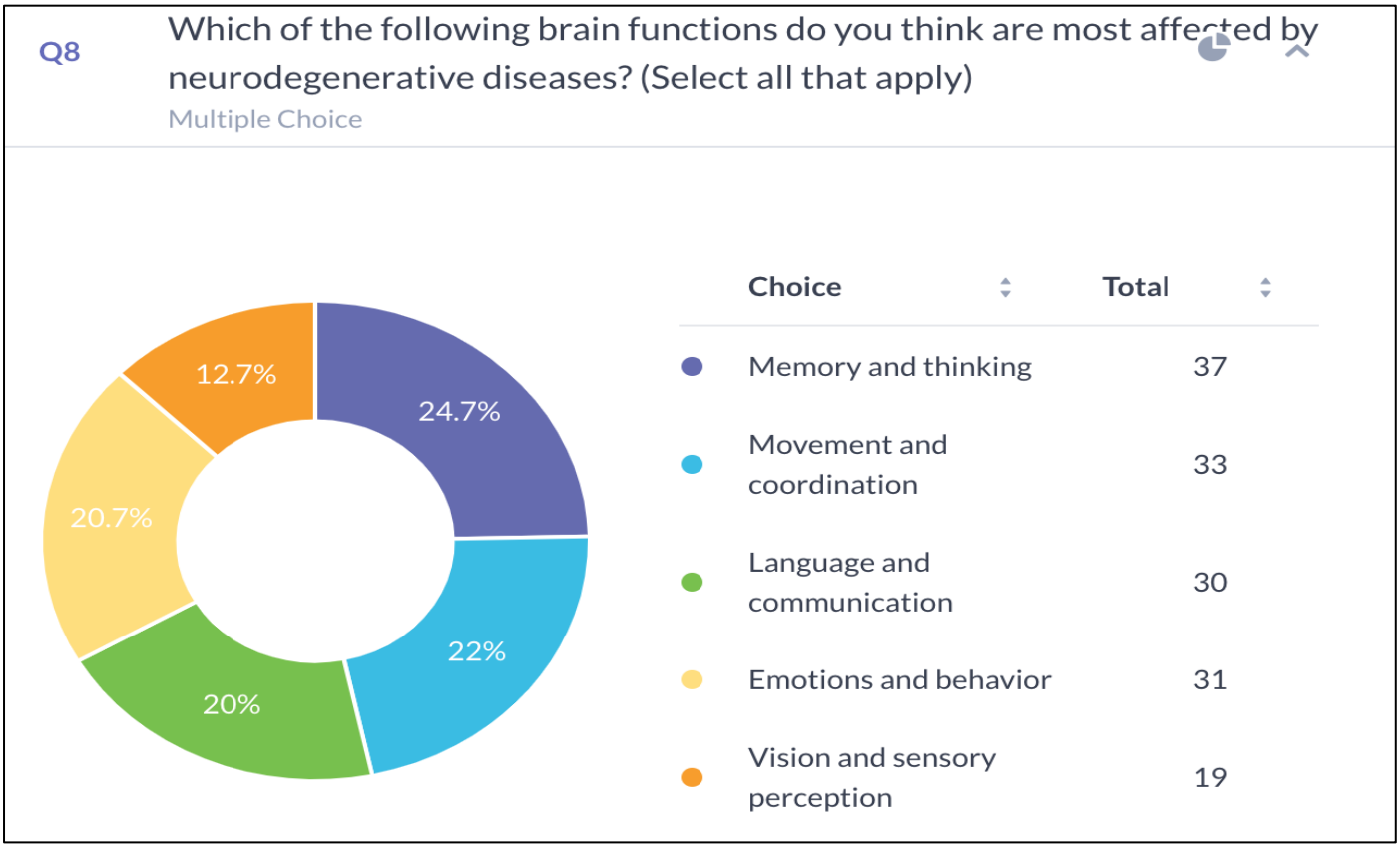

Fig 9 Show cases the public's awareness when it comes to gauging what functions of the brain are commonly compromised by the onset of neurodegenerative diseases

➢ *Public Opinion on Raising awareness of Neurodegenerative Diseases*

- *Strong Consensus on the Importance of Public Awareness*

Fully 55.8%, or 29 respondents, believe that increasing public awareness about neurodegenerative diseases is "Very Important." The overwhelming response suggests a broad-based recognition of the need for better education and outreach on these diseases. The data indicates that many people understand the importance of public knowledge in fostering early detection, improving patient care, and possibly encouraging greater research support, *refer to Figure 10.*

- *High Support towards Awareness Campaigns*

The second-largest group, 34.6% of respondents (18 people), believe that raising public awareness is "Somewhat Important." While these individuals may not consider it as critically urgent as the first group, they still recognize the value of spreading knowledge on the subject. Combined with the first group, over 90% of respondents think that public awareness is highly important, reinforcing the idea that the general public sees a benefit in more education about neurodegenerative conditions, *refer to Figure 10.*

- *Minimal Resistance to Awareness Building*

Only 5.8% of respondents (3 people) believe raising awareness is "Not Very Important," while an even smaller percentage, 3.8% (2 respondents), believe it is "Not Important at All." This minimal opposition indicates that the overwhelming majority see the need for awareness programs, though a few may not immediately perceive its relevance, *refer to Figure 10.*

- *Implications for Public Health Campaigns*

Results from this survey indicate a very strong foundation for launching or expanding public health campaigns focused on neurodegenerative diseases. The fact that the majority recognizes the importance of such efforts suggests there will likely be public support for initiatives that seek to educate about these conditions. Furthermore, it suggests that awareness-raising campaigns could be successful and have a positive societal impact, leading to better understanding, early diagnosis, and potentially more funding for research.

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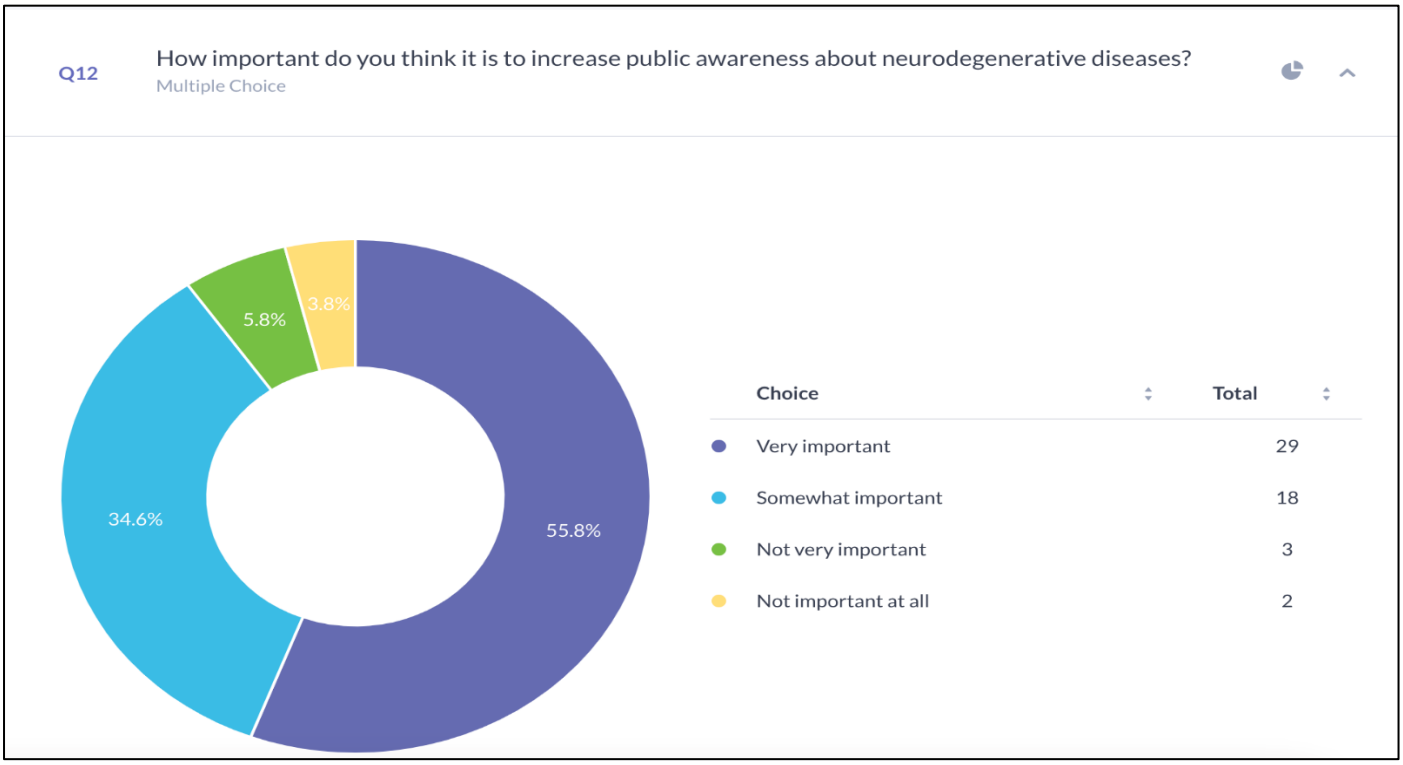

Fig 10 Pie chart highlighting public opinion on whether efforts should be taken in order to increase awareness regarding neurodegenerative diseases

IV. CONCLUSION

The characteristics of Alzheimer's, Huntington's, and Pick's diseases were investigated in this thesis to identify similarities and differences that provide insight into their mechanisms of neurodegeneration. Alzheimer's disease is distinguished by the presence of amyloid plaques and neurofibrillary tangles, primarily affecting memory and cognitive abilities. Huntington's disease results from a genetic mutation that leads to the progressive loss of motor control. In contrast, Pick's disease, associated with abnormal tau protein levels, impacts personality and language abilities. These findings emphasize the complex nature of these diseases and highlight the need for further research, particularly focusing on early detection and personalized interventions.

A survey of the public revealed a moderate to high level of awareness about neurodegenerative diseases, with Alzheimer's and Parkinson's being the most recognized conditions. However, there is still a significant lack of knowledge about lesser-known diseases such as Pick's disease and their effects beyond memory and movement, including sensory perception and behavioral regulation. The vast majority of respondents, over 90%, stressed the importance of increasing public awareness, highlighting the urgent need for comprehensive public health initiatives that educate about all forms of neurodegeneration.

In future public health reforms, there should be a shift towards improving early diagnosis through awareness campaigns that not only educate on common symptoms but also on the diverse manifestations of neurodegenerative diseases. Educational programs in schools and public health initiatives can incorporate comprehensive information about diseases like Huntington's and Pick's, which are often overlooked. Policymakers should also invest in healthcare reforms that broaden access to diagnostic services, neuroimaging, and genetic counseling, all of which are crucial for early intervention. Additionally, the development of digital tools and platforms to disseminate information, promote community support, and increase public awareness could help bridge the knowledge gap. Ultimately, a well-informed public, along with advanced diagnostic and therapeutic interventions, could collaborate to minimize the impact of these neurodegenerative diseases on individuals and society as a whole.

REFERENCES

[1]. Peter R Mouton, Lee J Martin, Michael E Calhoun, Gloria Dal Forno, Donald L Price, Cognitive decline strongly correlates with cortical atrophy in Alzheimer’s dementia, Neurobiology of Aging, Volume 19, Issue 5, 1998.
[2]. Kosaka K, Ikeda K, Kobayashi K, Mehraein P (1991) Striatopallidonigral degeneration in Pick’s disease: a clinicopathological study of 41 cases. J Neurol 238: 151-160
[3]. Hulette CM, Crain BJ (1992) Lobar atrophy without Pick bodies. Clin Neuropathol 11: 151-6
[4]. Clark AW, Manz HJ, White CL III, Lehmann J, Miller D, Coyle JT (1986) Cortical degeneration with swollen chromatolytic neurons: its relationship to Pick’s disease. J Neuropathol Exp Neurol 45: 268-284

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP629

[5]. Williams HW (1935) The peculiar cells of Pick's disease: Their pathogenesis and distribution in disease. Arch Neurol Psychiatry 34: 508-519
[6]. Yoshimura N (1989) Topography of Pick body distribution in Pick's disease: a contribution to understanding the relationship between Pick's and Alzheimer's diseases. Clin Neuropathol 8: 1-6
[7]. Hof PR, Bouras C, Perl DP, Morrison JH (1994) Quantitative Neuropathologic analysis of Pick's disease cases: cortical distribution of Pick bodies and coexistence with Alzheimer's disease. Acta Neuropathol 87: 115-124
[8]. Dickson, D. W. (1998). Pick's disease: a modern approach. Brain pathology, 8(2), 339-354.
[9]. Davis DG, Wang HZ, Markesbery WR (1992) Image analysis of neuropil threads in Alzheimer's Pick's diffuse Lewy body disease and in progressive supranuclear palsy. J Neuropathol Exp Neurol 51: 594-600
[10]. Cochran EJ, Fox JH, Mufson EJ (1994) Severe panencephalic Pick's disease with Alzheimer's disease-like neuropil threads and synaptophysin immunoreactivity. Acta Neuropathol 88: 479-484
[11]. Jones L. The cell biology of Huntington's disease. In: Bates G, Harper P, Jones L, eds. Huntington's disease. New York: Oxford University Press, 2002: 348–62.
[12]. Saudou F, Finkbeiner S, Devys D, Greenberg ME. Huntingtin acts in the nucleus to induce apoptosis but death does not correlate with the formation of intranuclear inclusions. Cell 1998; 95: 55–56.
[13]. Peter MF, Nucifora FC Jr, Kushi J, et al. Nuclear targeting of mutant Huntingtin increases toxicity. Mol Cell Neurosci 1999; 14: 121–81.
[14]. Wellington CL, Leavitt BR, Hayden MR. Huntington disease: new insights on the role of huntingtin cleavage. J Neural Transm Suppl 2000; 58: 1–17
[15]. Lunkes A, Mandel JL. A cellular model that recapitulates major pathogenic steps of Huntington's disease. Hum Mol Genet 1998; 7: 1355–61.
[16]. The Huntington's Disease Collaborative Research Group. A novel gene containing a trinucleotide repeat that is expanded and unstable on Huntington's disease chromosomes. Cell 1993; 72: 971–83.
[17]. Mukai H, Isagawa T, Goyama E, et al. Formation of morphologically similar globular aggregates from diverse aggregation-prone proteins in mammalian cells. Proc Natl Acad Sci USA 2005; 102: 10887–92.
[18]. Rangone H, Humbert S, Saudou F. Huntington's disease: how does huntingtin, an anti-apoptotic protein, become toxic? Pathol Biol 2004; 52: 338–42.
[19]. Rubinsztein DC. Molecular biology of Huntington's disease (HD) and HD-like disorders. In: Pulst S, ed. Genetics of movement disorders. California: Academic Press, 2003: 365–77.
[20]. Bates GP, Benn C. The polyglutamine diseases. In: Bates G, Harper P, Jones L, eds. Huntington's disease. New York: Oxford University Press, 2002: 429–74.
[21]. Mills IG, Gaughan L, Robson C, et al. Huntingtin interacting protein 1 modulates the transcriptional activity of nuclear hormone receptors. J Cell Biol 2005; 170: 191–200
[22]. Cha JH. Transcriptional dysregulation in Huntington's disease. Trends Neurosci 2000; 23: 387–92.
[23]. Hickey MA, Chesselet MF. Apoptosis in Huntington's disease. Prog Neuropsychopharmacol Biol Psychiatry 2003; 27: 256–65.
[24]. Panov AV, Burke JR, Strittmatter WJ, Greenamyre JT. In vitro eff ects of polyglutamine tracts on Ca2+-dependent depolarization of rat and human mitochondria: relevance to Huntington's disease. Arch Biochem Biophys 2003; 410: 1–6
[25]. Bae BI, Xu H, Igarashi S, et al. P53 mediates cellular dysfunction and behavioral abnormalities in Huntington's disease. Neuron 2005; 47: 29–41.
[26]. DiProspero NA, Chen EY, Charles V, Plomann M, Kordower JH. Early changes in Huntington's disease patient brains involve alterations in cytoskeletal and synaptic elements. J Neurocytol 2004; 33: 517–33.
[27]. Modregger J, DiProspero NA, Charles V, Tagle DA, Plomann M. PACSIN 1 interacts with huntingtin and is absent from synaptic varicosities in presymptomatic Huntington's disease brains. Hum Mol Genet 2002; 11: 2547–58.
[28]. Freeman W, Morton AJ. Regional and progressive changes in brain expression of complexin H in a mouse transgenic for the Huntington's disease mutation. Brain Res Bull 2004; 63: 45–55.
[29]. Charrin BC, Saudou F, Humbert S. Axonal transport failure in neurogenerative disorders: the case of Huntington's disease. Pathol Biol 2005; 53: 189–92.
[30]. Zuccato C, Liber D, Ramos C, et al. Progressive loss of BDNF in a mouse model of Huntington's disease and rescue by BDNF delivery. Pharmacol Res 2005; 52: 133–39.
[31]. Gauthier LR, Charrin BC, Borrell-Pages M, et al. Huntingtin controls neurotrophic support and survival of neurons by enhancing BDNF vesicular transport along microtubules. Cell 2004; 118: 127–38.
[32]. Busch A, Engemann S, Lurz R, et al. Mutant huntingtin promotes the fibrillogenesis of wild-type huntingtin: a potential mechanism for loss of huntingtin function in Huntington's disease. J Biol Chem 2003; 278: 41452–61.
[33]. Pulst SM, Nechiporuk A, Nechiporuk T, et al. Moderate expansion of a normally biallelic trinucleotide repeat in spinocerebellar ataxia type 2. Nat Genetics 1996; 14: 237–38.
[34]. Komure O, Sano A, Nishino N, et al. DNA analysis in hereditary dentatorubral-pallidoluysian atrophy: correlation between CAG repeat length and phenotypic variation and the molecular basis of anticipation. Neurology 1995; 45: 143–49.
[35]. Halliday GM, McRitchie DA, Macdonald V, Double KL, Trent RJ, McCusker E. Regional specificity of brain atrophy in Huntington's disease. Exp Neurol. 1998 Dec;154(2):663-72. doi: 10.1006/exnr.1998.6919. PMID: 9878201.
[36]. Parekh, N., Bhagat, A., Raj, B. et al. Artificial intelligence in diagnosis and management of Huntington's disease. Beni-Suef Univ J Basic Appl Sci 12, 87 (2023).
[37]. Yale Medicine, Huntington's Disease, Fact sheet

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24SEP629

[38]. Stoker TB, Mason SL, Greenland JC, et al, Huntington's disease: diagnosis and management, Practical Neurology 2022;22:32-41.
[39]. Nature,28/07/2024, [https://www.nature.com/]
[40]. UtDallas,08/08/2024, [https://www.utdallas.edu/]
[41]. Docplayer,12/08/2024, [https://docplayer.net]
[42]. Walker, F. O. (2007). Huntington's disease. The Lancet, 369(9557), 218-228.
[43]. Researchgate,23/08/2024, [https://www.researchgate.net/]
[44]. Coursehero,23/08/2024, [https://www.coursehero.com/]
[45]. UCLA,25/08/2024, [brainpath.medsch.ucla.edu]
[46]. UMDNJ, 26/08/2024, [www2.umdnj.edu]
[47]. NLM,26/08/2024, [https://www.ncbi.nlm.nih.gov/]
[48]. Blackhurst, B.M., Funk, K.E. Viral pathogens increase risk of neurodegenerative disease. Nat Rev Neurol 19, 259–260 (2023). https://doi.org/10.1038/s41582-023-00790-6