



Original Article

Frequency of Brain Atrophy Diagnosed On Computed Tomography

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ARTICLE INFO

Key Words:

Brain Atrophy, Alzheimer disease, Age Related Atrophy, Trauma, Computed Tomography

How to Cite:

Munir, H. ., Arshad, N. ., Ali, A. ., Jamil, M. ., & John, A. . (2022). Frequency Of Brain Atrophy Diagnosed on Computed Tomography: Frequency of Brain Atrophy Diagnosed on Computed Tomography. *Pakistan Journal of Health Sciences*, 3(01). <https://doi.org/10.54393/pjhs.v3i01.53>

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Received Date: 31st May, 2022

Acceptance Date: 15th June, 2022

Published Date: 30th June, 2022

ABSTRACT

Brain atrophy is the loss of connections between neurons. It can be due to old age, trauma, ischemic stroke, multiple sclerosis, post infective and neurodegenerative diseases. **Objective:** To determine the frequency of brain atrophy on Computed Tomography. **Methods:** A cross sectional study conducted in Medicare international hospital, Gujranwala and DHQ, Kasur. The data was collected using convenient sampling technique from February 2022 to May 2022 after written consent. A sample size of 60 was calculated using mean from previous published studies. The age considered was maximum of 100 and minimum of 20 years. The study included all the patients who had focal and generalized brain atrophy. The equipment used for the evaluation was Toshiba Aquilion 64 slices CT scanner. **Results:** The mean age of patients was 79.88 ± 9.22 having minimum age of 57y and maximum age of 91y. The male patients were more frequent as 34(56.7%) and females as 26(43.3%). The brain atrophy was categorized as focal 14(23.3%) and generalized atrophy 46(76.7%). The patients of brain atrophy had history of smoking 30(39%), alcohol use 13(16.9%) and diabetes mellitus 15(19.5%) and the common symptoms include memory problems 25(33.3%), poor judgment 13(17.3%) and loss of language 11(14.7%). The most common cause of brain atrophy evaluated was due to old age 42(70%) following post traumatic 9(15%) and Alzheimer 4(6.7%). **Conclusion:** In conclusion, brain atrophy can be due to old age, trauma and Alzheimer disease. The common symptoms include memory problems and loss of language.

INTRODUCTION

The human brain is most complicated organ of human body lying in the cranial cavity. The brain consists of 100 billion connected nerves which are communicating altogether through trillions of synapses [1, 2]. A normal adult human brain weighs roughly 3 pounds and weighs between 1300 and 1400 grams and measures roughly 15 centimeters in length [3, 4]. The human brain is made up of around 100 billion neurons, which are a structural and functional unit of brain contains more than 100,000 kilometers of interconnections [5, 6]. These astounding figures have led to the conclusion that our cognitive skills are almost limitless [7]. The loss of neurons and decrease in connections between neurons is known as brain atrophy (cerebral atrophy) [8]. Cerebral palsy, dementia, and viral disorders are just a few of the ailments that induce brain shrinkage. The symptoms and degree of brain shrinkage

vary depending on the illness and the site of injury. Brain cells can be damaged and atrophy can result from injuries, disorders, and infections [9]. The trauma, diabetes and hypertension are two prevalent risk factors that have been linked to cognitive impairment in old age, hence the use of smoking and alcohol can also contribute in impairment due to brain atrophy [10] Cerebral atrophy is a condition that affects all individuals especially in old age. However, a variety of factors can increase cell loss, including damage, infection, and medical diseases including dementia, stroke, and Huntington's disease [6]. These situations can occasionally result in more serious brain injury and can be life-threatening [11]. The signs and symptoms of brain atrophy differ in all individuals because it is depending on which part of the brain is affected and affects such as loss of memory, disturbed learning & abstract thinking, and

administrative functions all are affected by dementia and cognitive impairment [12]. The Symptoms of brain atrophy includes seizures which are eruptions of abnormal electrical activity in the brain. The signs involve sudden and repeated jerky movements, loss of consciousness and convulsions. In some cases some patients also experience aphasia, a condition in which people have difficulty speaking and understanding language. The different areas of the brain might be affected by atrophy [13, 14].

Focal atrophy: It is a condition that affects cells in specific parts of the brain, resulting in a loss of function in those areas. The focal cerebral atrophy can be due to history of ischemic injury and trauma. Hemorrhage and contusion can also cause focal atrophy in the specific site of brain affected. Some neurodegenerative diseases showing dementia and cognitive impairment are as Alzheimer disease, Pick disease, Parkinson disease, Huntington disease [15].

Generalized Atrophy: It is a condition in which brain cells all across the brain are affected. It can be due to increasing age, alcohol & drug use, end stage multiple sclerosis, post traumatic, post infective and some neurodegenerative diseases [16].

Normal brain ageing refers to age-related structural changes and function of the human brain that occurs in the general population but do not cause clinically significant impairments [17]. The shrinkage of brain happens in the specified sites; it doesn't get involved in every part of the brain. That is how it differs from focal and generalized atrophy. The brain shrink is likely to get worse with the age as you become older and some areas of the brain, while some parts of the brain may shrink more quickly than other. Due to this the parameters are used for the identification and measurement of brain atrophy [18].

The individual in the age of 30s or 40s the size of the brain starts to decline with increasing age. The shrinkage may accelerate more quickly after you reach 60 [19]. With Increasing age, the cerebral cortex become wrinkled outer and thins away [20]. All areas of the brain perform specific functions. The atrophy in specific area can have function disturbed as the frontal lobe controls the recalling of memory and emotions. The brain atrophy in frontal lobe can also affects control of impulses, skills of problem solving, ability of social interaction, and motor functional responses. A common site for atrophy is temporal lobe located behind the ears, which functions to interpret words to talk, how to read and write, and connection of words and their meanings, might also show signs of thinning [21].

The current study will imply that normal brain will result in brain atrophy with increasing age. The brain atrophy can occur due to aging, trauma, diabetes and neurodegenerative diseases such as Alzheimer, Parkinson, Pick's and Huntington disease which can impacts cognition and mental disturbance in older life. The study findings will

explain the clinical consequences of ischemic injury, brain neurodegeneration, and the onset of clinical symptoms of cognitive impairment followed by brain atrophy. This data will provide important clinical context for interpreting changes in brain size linked with age, trauma and other pathologies related with trauma.

METHODS

It was a Cross sectional study conducted in Medcare international hospital, Gujranwala, Pakistan. The data were collected using convenient sampling technique from February 2022 to May 2022 after informed and written consent. A sample size of 60 was calculated using mean from previous published studies [22-25]. The age group considered was maximum of 100 years and minimum of 20 years old. The study included all the patients who had focal atrophy due trauma, ischemic stroke, post infective and neurodegenerative diseases showing dementia and cognitive impairment due to as Alzheimer disease, Pick disease, Parkinson disease, Huntington disease. The study also included generalized atrophy due to increasing age, alcohol & drug use, end stage multiple sclerosis. The patients other than brain atrophy were excluded from the study. The equipment used for the evaluation was Toshiba Aquilion 64 slices CT scanner with Peak voltage 120kvp, 300mA, 64 detectors, 20-25 FOV, and 3 to 5 mm slice thickness. The soft tissue reconstruction was done on Kernel FC64, acquisition.

RESULTS

The results of current study were based on 60 patients. The age considered was maximum of 100 and minimum of 20 years old. The quantitative data age was calculated as descriptive statistics mean \pm standard deviation, maximum, minimum and range. The qualitative data like gender frequency and percentage was calculated and displayed in the form of table and bar chart. The findings evaluated on Computed Tomography, signs and symptoms and risk factors are mentioned as frequency and percentage displayed in the form of tables and bar charts. The total of 60 patients were included in the study. The patients had minimum age of 57 years and maximum age of 91 with age range of 34. The mean age was 79.8 ± 9.2 . According to gender distribution males were most frequent having 34(56.7%) and females having frequency of 26(43.3%). The Table 1 shows the type of brain atrophy that patients were suffering in which the most common was generalized brain atrophy with 46(76.7%). The focal atrophy due to post trauma was 14(23.3%).

Type of brain atrophy	Frequency	Percent
Focal	14	23.3
Generalized	46	76.7
Total	60	100.0

Table 1: Frequency distribution of type of brain atrophy in patients

Table 2 shows that the patients of brain atrophy had history of smoking 30(39%), alcohol use 13(16.9%), diabetes mellitus 15(19.5%), neurodegenerative diseases 4(5.2%), infection 4(5.2%) and head injury 9(11.7%).

Risk factors of brain atrophy	Frequency	Percent
Genetic history of neuro- degenerative diseases	4	5.2
Head/ Brain injury	9	11.7
Infection	4	5.2
Alcohol use disorder	13	16.9
Diabetes mellitus	15	19.5
Smoking	30	39.0
Total	75	97.4
Total	77	100.0

Table 2: Frequency distribution of clinical history patients

Table 3 shows that the patients of brain atrophy had common symptoms such as Memory problems 25(33.3%), poor judgment 13(17.3%), loss of language 11(14.7%), mood and personality changes 10(13.3%) and seizures 7(9.3%).

Signs and symptoms of brain atrophy	Frequency	Percent
Hallucinations	9	12.0
Loss of language'	11	14.7
Memory problems	25	33.3
Mood and personality changes	10	13.3
Poor judgment	13	17.3
seizures	7	9.3
Total	75	100.0

Table 3: Frequency distribution of signs and symptoms of brain atrophy in patients

Table 4 shows that the most common brain atrophy was due to old age 42(70%) following post traumatic 9(15%) and Alzheimer 4(6.7%).

Signs and symptoms of brain atrophy	Frequency	Percent
Age related brain atrophy	42	70.0
Post traumatic	9	15.0
Post infective	3	5.0
Multiple sclerosis	1	1.7
Alzheimer disease	4	6.7
Parkinson disease	1	1.7
Total	60	100.0

Table 6: Findings of brain atrophy on Computed tomography(CT)

DISCUSSION

The current study included all the patients who had focal atrophy due trauma, ischemic stroke, post infective and neurodegenerative diseases showing dementia and cognitive impairment due to Alzheimer disease, Pick disease, Parkinson disease, Huntington disease. The study also included generalized atrophy due to increasing age, alcohol & drug use, end stage multiple sclerosis. The current study found that the mean age of patients was 79.88 ± 9.22 which showing that the cerebral atrophy was commonly occurring in old age. Chrzan (2019) also found that brain atrophy was common in elder age up to 70 to 99 [24]. The previous study showed brain atrophy measures having significant differences amongst the age. After 40 years of age, the mean BVI fell statistically significantly. The loss of mental activity paralleled the progression of

brain shrinkage, which increased with age, trauma, and Alzheimer's disease. The previous literatures such as (Chrzan, 2019) evaluated the cause of brain atrophy as age related and due to trauma and neurodegenerative disease such as Alzheimer's disease [24]. The current study found the most common brain atrophy was due to old age 42(70%) following post traumatic 9(15%) and Alzheimer 4(6.7%). The current study has similar results with the previous literature which was evaluated on Computed Tomography having almost same protocols. Another study by Zahid (2015) found aging one of the most common factors linked to shrinkage of brain (atrophy) followed by Alzheimer disease and trauma [23]. The diagnoses of Alzheimer's disease, neuropathy, tumor, and alcoholism were all ruled out. The study used conventional Computed Tomography using Toshiba equipment in helical, using voltage of 120 kVp, the tube current of 300mA, and the slice thickness of 3 to 5m. The use of alcohol and smoking was also reported in the current study as the patients with atrophy had history of smoking 30(39%) and alcohol use 13(16.9%). The age related brain atrophy is a progressive process that affects elder people much more than young. The current and previous studies used Computed tomography to evaluated brain. Cerebral atrophy can be detected using both CT and MRI. Literature shows that MRI could be a better modality for studying soft tissues structures. MRI became a natural choice for studying brain atrophy due to visualization of soft tissue structures but Computed Tomography is more routinely used in clinical practice due to availability and reliability. CT is used for nearly all emergency imaging in the developing world due to its quick evaluation. CT imaging is also commonly utilized in neurosurgery and neuro diagnosis because to its comparatively short scanning time, reduced motion artifacts, and inexpensive cost. The current findings have explained the clinical consequences of ischemic injury, brain neurodegeneration, and the onset of clinical symptoms of cognitive impairment followed by brain atrophy. This data provided important clinical context for interpreting changes in brain size is linked with age, trauma and other pathologies related with trauma and resulting in brain atrophy.

CONCLUSION

In conclusion, the current study found that brain atrophy is the loss of connections between neurons. It can be due to old age, trauma, ischemic stroke, multiple sclerosis, post infective and neurodegenerative diseases such as Alzheimer and Parkinson disease. The study also reported the association of brain atrophy with the previous history of diabetes, smoking and alcohol use. The patients had memory problems, poor judgment, loss of language, mood and personality changes and less frequently seizures. The age related brain atrophy is a progressive process that

affects elder people much more than young and CT is useful for nearly all neuro diagnosis including brain atrophy. CT scan is preferred over MRI because of its comparatively shorter scanning time, easy accessibility, reduced motion artifacts and inexpensive cost.

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