

# Cognitive Impairment in Patients with Left Temporal Lobe Epilepsy

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**Abstract:** *This paper attempts to decipher the impact, on an individual of the impairment of the left temporal lobe of the brain. In the process it looks at some of the other possibilities that could arise besides just Epilepsy. These other effects could be due to impairment of the temporal lobe, aided by other factors. The difference in the impact between children, young adults and elderly has also been mentioned. As it is a medical disease, the research in this area has been phenomenal, leading to far reaching gains in finding a treatment to counter the effects of this impairment.*

**Keywords:** Ehsaas Madan, Cognitive Impairment, Left Temporal Lobe Epilepsy

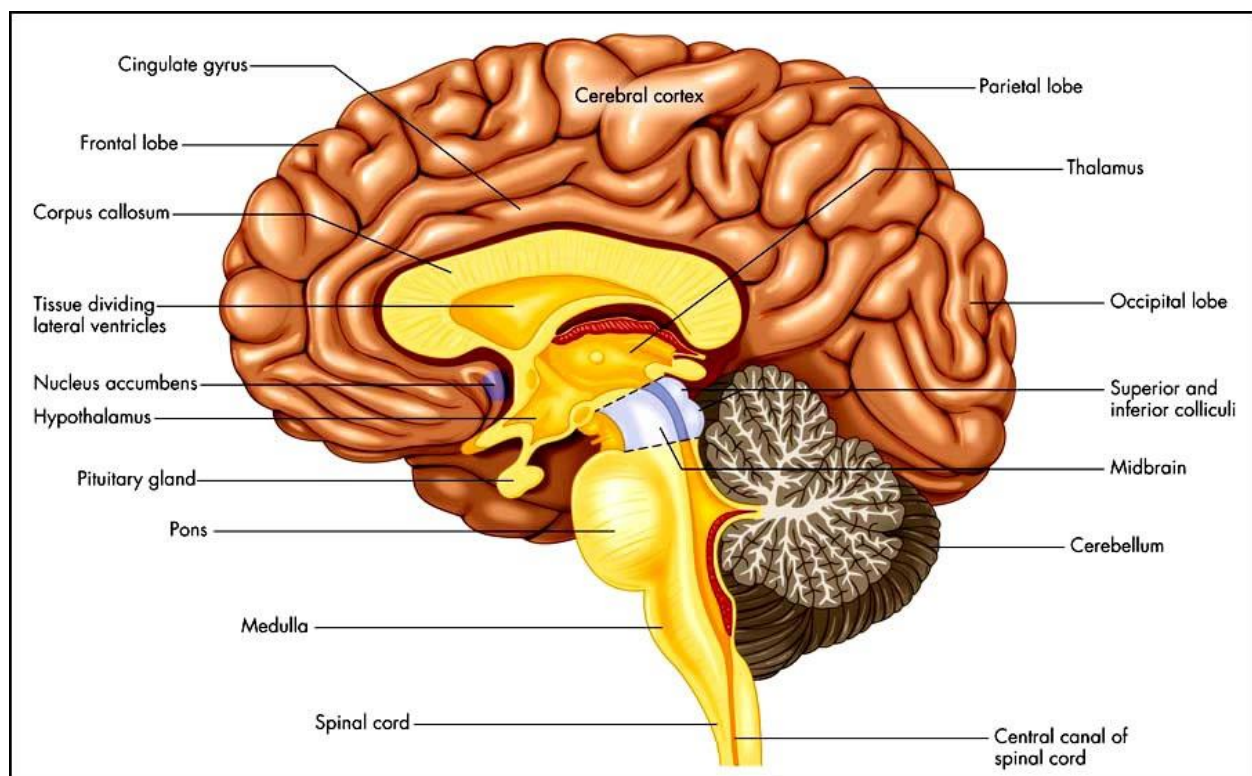
**Research Question:** The paper attempts to answer the impact of damage which has taken place on one of the four most important parts of the brain namely the left temporal lobe. Epilepsy is one of the major ones, but there some more which the paper attempts to study.

## 1. Definition

Temporal lobe epilepsy (TLE) is a chronic disorder of the nervous system. Epilepsy is a brain disorder that causes changes in brain cell activity that leads to seizures, periods of unusual behavior or feelings, and in some cases a loss of consciousness. This is the most common form of epilepsy. The seizures occur in the temporal lobe of the brain. They

may last for one or two minutes. For the person who is experiencing the attack, even a minute is a very long time.

If we analyse the structure of the brain, the temporal lobe is one of the four major lobes of the cerebrum. Lobes are major divisions of the brain.



**Figure 1:** Structure of the Brain

Source: Google image.



**Figure 2:** Lobes of the brain

Source: Google image

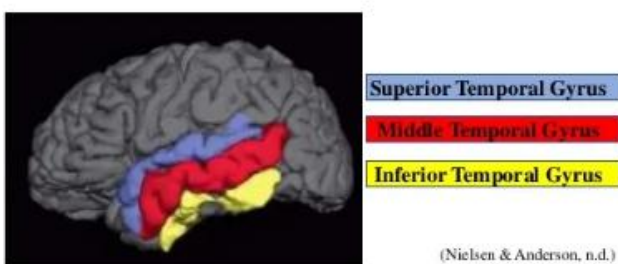
The lobes are 1) frontal, 2) parietal, 3) temporal, 4) occipital. The frontal lobe is responsible for major functions of the brain which include memory, intelligence, concentration, temper, and personality. The occipital lobes are located at the back. The left lobe assimilates what is happening on the right side, while the right occipital lobe assimilates what is occurring on the right side. The parietal considers signals from all parts of the brain. The temporal lobes are located on each side of the brain. They are close to the ears. They are important in processing emotions, visual perception, speech memory, language, and stimuli. As mentioned earlier the right temporal lobe controls the left side of the body and the left lobe controls the right side of the body. The left temporal lobe is responsible for speech, language recognition, controlling an individual's ability to speak and write, it is also responsible for the comprehension of words. It is located beneath the lateral fissure in the cerebral hemispheres on both sides of the brain. These are associated with memory, emotion, language, as well as auditory processing.

because of the temporal lobes. Any damage to the Left Temporal Lobe results in abnormal changes to emotions for example, sudden fear, or ecstatic feeling etc. The medical name for these types of distressed feelings is called "focal seizures". During such an attack the person is aware of what is happening around him /her but is helpless. They are just unable to respond. At times this results in repetitive movement of hands and legs. These actions cannot be controlled by the person.

## 2. Symptoms

One of the most common symptoms of seizures is a sense of **aura**. This is an unusual sensation that the patient feels. It acts like a warning before a storm. But the patient should be able to recognize it. It normally consists of unusual changes before the onset of the attack; it could be visual changes or nausea just before the onset of an attack. This **aura** may be due to change in brain activity. The patient may realize that there is a pattern before the onset of the attack.

### Structure and Function of the Left Temporal Lobe



**Figure 3:** Structure and Function of the Left Temporal Lobe

Source: Google image

This lobe is very important for the understanding and use of language. This lobe also takes care of hearing, listening, processing of visual inputs, as well as both reading and speaking. Thus, the fact that we appreciate and understand and the way we express ourselves in a particular language is

Cognitive impairment is the definition of one's condition. It is a term used to describe someone's current state. It could take the form of a state of confusion, loss of memory, trouble in understanding. In my research paper the cognitive impairment is due to issues in the left temporal lobe of the brain. Cognitive impairment could be due to urinary infection, pneumonia, vitamin deficiency, dehydration, or even due to reactions to medication and genetic disorders. It is a condition whereby the person appears confused, agitated, moody. Another word to describe it could be a **delirious state**

## 3. Impacts of Impairment

One of the problems that could arise due to the impairment is an impact on the pattern of language performance. The impact could be so severe that the language could be characterized as "agrammatic". Besides this, damage to this

part of the brain could lead to difficulty in identification and categorization of objects, difficulty in learning and retaining new information, and impacting long term memory. One of the most common effects of impairment of the left temporal lobe is seizures. Medical experts say that some of the causes of the seizure could be due to:

- Severe damage to the brain
- History of infections like meningitis or encephalitis
- Blood vessel deformities in the brain
- Stroke
- Brain tumors
- Genetics
- Scarring (gliosis) in the hippocampus part of the temporal lobe. (Gliosis means that there are fibrous glial cells. Glial cells are those that support the nerve cells. These cells are produced by the body, which could be due to the damage of the central nervous system. The hippocampus is known to be the “flash drive” of the brain, it is associated with decision making as well as assimilation of past events. It is also associated with learning and emotions.)

One of the other major impacts of impairment of frontal lobe besides seizures is Dementia. The symptoms under this include:

- Inappropriate actions
- Lack of concern
- Exhibiting poor judgement
- Repetitive behavior
- Poor hygiene
- Overeating
- Lack of interest

There could be an impact on the speech and language of the patient; under this the common issues could be in the form of:

- Impairment and or loss of speech
- Language difficulties

Besides the above there are some noted issues which arise out of movement disorders. Amongst them the more common ones are:

- Tremor
- Rigidity
- Muscle spasms
- Poor coordination
- Difficulty in swallowing
- Muscle weakness

#### 4. Frontal lobe disease in elderly and young patients

This disease if it manifests itself at a young age results in behavioural abnormalities and executive dysfunction. When these lesions occur early in life it leads to underlying damage of personality. On examining the relationship of lesions in the frontal lobe and personality changes, one finds

that in the formative years when personalities are being formed any lesion in the frontal lobe leads to be of the severe category. As children start developing, the effect becomes more and more severe. The impact differs if the similar type of syndrome is noticed among adults. The seizure pattern differs with age. Cognitive defects differentially effect the daily life experiences of children. They adversely impact their academic performance. But as they are small it is difficult to recognize.

It is easier to study the defining characteristics of TLE in adults than it is with respect to children. But the mapping that has been done for adults can be a basis for analysing the impact of the disease for children. Like adults, children with TLE are more likely to demonstrate specific semiologies when their seizures arise from specific portions of the Temporal Lobe. The challenge here is that in children with their brain growing and developing, it becomes challenging for the doctor to prescribe a course of treatment. Early detection becomes important for remedial measures. Another issue that must be addressed is, that children have the inherent ability to adapt to adverse circumstances, even if it is with respect to the brain. This is known as (neuralplasticity), and it does not necessarily mean adaptive plasticity. In children temporal lobe epilepsy does not indicate mental retardation, but the child does face issues in language, memory, socioperceptive competence and executive functions.

#### 4.1 Cognitive Impairment in adults

One of the main impacts of Temporal lobe damage is of course seizures. This is what also occurs in children. But besides this, impairment of the frontal lobe does lead to OCD (obsessive-compulsive order), which can further lead to Autism. This is manifested as the child grows up. It may not be a very apparent symptom at a young age. Temporal lobe abnormality that results in autism is likely to be due to the impairment of the temporal lobe. Such patients face a deficiency in language and social behavior. This is likely to be accompanied by intellectual impairment. It is important to note that all these responsibilities lie in the domain of the frontal lobe.

In fact, frontal and temporal lobe malfunctioning do result in autism and other related disorders like Autism, Pervasive Development Disorder (PDD), Attention Deficit Hyperactive Disorder (ADHD), Obsessive and Compulsive Disorder (OCD).

Understanding autism requires an analysis of its history. The first view in the early 19<sup>th</sup> century indicated that it was a brain disorder that may have reared its head at a very early stage in an infant's life, but major symptoms occurred at the age of 2 or 3 years, In the earlier years this disease was considered one that had to be treated by a psychologist or a psychiatrist. But as research on this disease continued, the discovery led to the development of a thought process that it was more of a medical condition. This discovery opened research gates and the process of finding a medical solution and treatment is now well on its way.

The clinical name for Autism is autism spectrum disorder (ASD). It is a condition that affects communication and social skills. The patient might have an increased sensitivity to sound, smell, touch, and anything in the environment. Normally this condition is apparent in children. The symptoms of adults can be different from that what exists in children. At times adults have learned to live with their symptoms over the years. This cannot happen suddenly it has to exist right from childhood. It may start with an OCD syndrome which might then border towards ASD. Researchers have found an overlap between the two. Studies have indicated that many autistic people have some form of anxiety. Some of them may specifically have OCD. At times people with OCD, may also have undiagnosed autism.

Besides the above, damage to the temporal lobe could lead to;

- Prosopagnosia, which essentially means difficulty in interpreting visual information. Visual Agnosia is also a result of temporal lobe damage. This results in the fact that the patient might have perfectly clear vision, but he is unable to tell what he is looking at.
- The patient could also suffer from hearing difficulties not to spoken words but with respect to other sounds.
- Another deficiency could be with respect to attention problems this implies that the person has difficulty in picking out any one thing and paying attention to it.
- Memory loss is another very common problem that is associated with the disease.
- Epilepsy the most common could be due to a brain injury that could lead to focal seizures.
- Amygdala is another result of a temporal lobe damage. This may result in individuals experiencing anger or aggression due to difficulties in understanding their environment. In adults with Frontal Lobe Epilepsy (FLE), cognitive deficits and behavioral disturbances range from impaired attention to the more complex behaviors involved in planning, selecting goals, anticipating outcomes, and initiating reactions. (Helmstaedter et al., 1966, 1998; Upton&Thompson, 1996, 1997a, b; Exner et al., 2002)

#### 4.2 Cognitive Impairment in Children

Frontal lobe epilepsy (FLE) is the second most common type of localization-related epilepsies of childhood. The impact on children is largely cognitive. The impact depends on the severity of the damage, but by and large the effect is seen in the child's basic functions, in the form of attention deficiency and or hyperactivity disorder. What is most apparent among the studies that have been conducted is that pediatric FLE is frequently complicated by impairment of cognitive function, behavioral disturbances, and therapy resistance. The frontal lobes in particular impact the essential functions like;

- Basic neurologic functions e. g., motor functions, olfaction etc.
- Voluntary eye movements
- Speech and language abilities
- Executive functions

- Motivational behaviors
- Social competency (Cummings and Miller, 2007)

It is a researched fact that temporal lobe epilepsy is normally associated with cognitive deficits specific to the temporal lobe, mainly in the sphere of learning and in particular reading and memory. This has been observed in both children and adults; their impairment has been in mental flexibility, set shifting, perseveration, inhibitory control, verbal fluency, and maintenance of attention. (Rzezak et al., 2007).

#### 5. Remedies

Several studies have indicated a genetic predisposition of the distinct neuropsychological impairment patterns, which might be caused by thalamo-frontal-cortical network dysfunction. This analysis is supported by results obtained by conducting MRI (Magnetic Resonance Imaging). They indicate executive functioning and structural changes in both the frontal lobes in the early onset of the disease.

Treatment for temporal lobe impairment requires a personalized plan that targets every individual's secondary effects. As the effected portion impacts the cognitive function like memory and communication, rehabilitating exercises can go a long way in correcting the impairment. This exercise help in promoting adaptive changes and strengthens neural pathways in the brain.

There are speech therapists (also known as Speech-language Pathologists) who have successfully treated temporal lobe impairments.

Occupational therapy helps individuals in improving their functional cognition by repetitively practicing everyday activities. As temporal lobe damages the performance of daily activities it is imperative to continuously work on improving them by continuous repetition.

If the impairment leads to a seizure, then the course of treatment usually follows the following pattern;

- Neurological exam
- Blood tests, to check for signs of infection, genetic conditions, blood sugar levels or electrolyte imbalances
- Electroencephalogram (EEG). This helps the doctor study the electric activity of the brain and helps in revealing to the doctor whether a seizure is likely to occur again.
- Computerized tomography (CT) scan. This reveals whether they are any abnormalities in the brain.
- Positron emission tomography (PET). Low dose of radioactive material is injected, so that the active areas of the brain are visualized
- Single-photon emission computerized tomography (SPECT). Here a radioactive material is injected to obtain a 3-D image of the brain.

The above are primarily investigative procedures. The treatment normally takes the form of:

Medication: In most cases they can treat temporal lobe seizures via medicines. But many of these medicines have side effects like fatigue, weight gain, dizziness etc.

If medication does not solve the problem, then surgery can be resorted to. This works very well for those patients where the seizure originates at the same place in the brain every time. The other forms of treatment could be of the following type:

- Vagus nerve stimulation. This treatment sends signals to the brain that inhibit seizures. But this treatment might still require a low dose of medication.
- Responsive neurostimulation: In this case a device is implanted on the surface of the brain, so that it can detect seizure activity, and can send stimulation to the brain to stop the seizure activity
- Dietary therapy. A ketogenic diet can improve seizure control.

The fact that almost all these cases are being treated by a medical doctor implies that a lot of research is continuously happening, in the hope that a medication or a procedure could be developed so that it eases the patient's misery.

## 6. Conclusion

Impairment of the left temporal lobe of the brain leads to a lot of distress in patients. This primarily leads to the onset of seizures. In infants damage impairs their cognitive skills, which really are not noticed till they are four plus. Once the disease is detected it is possible to treat it with therapy. As the child grows continuous reinforcement of certain actions, make it easier for the child to handle this defect. If the defect leads to a situation of continuous seizure, then there are various ways to treat it. The first and foremost is medication followed by several procedures that are conducted on the brain and the nerves leading to the brain. All of them try and prevent the seizure from reoccurring. This impairment is also due to imbalance in the circuit of the brain. Given that science and research has made great strides, it would soon be a reality, whereby such debilitating diseases would have a cure, and thus put an end to the suffering of the patient as well as the caregivers.

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