

# The Significance of Seizures Related to Language and Speech in Epilepsy and Diagnostic Conundrums

Ankit Pandey\*

Department of Neurology, Graphic Era Deemed to be University, Dehradun, India

## Corresponding Author\*

Ankit Pandey

Department of Neurology, Graphic Era Deemed to be University, Dehradun, India

E-mail: ankitpand@gmail.com

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## Abstract

Even while the effect of epilepsy on expressive language has been extensively explored, examined, and supported by science, there isn't much evidence to support the contrary conclusion. What is the link between language use associated with disorders and epileptic seizures? What potential diagnostic conundrums can professionals in the professions of neurology, speech-language pathology, and allied fields encounter? How far along is research into psychogenic nonepileptic seizures, which can be difficult for doctors to correctly diagnose and hurt patients' health? To answer these questions, the current study examines the pathophysiological and psychogenic roots of stuttering, a prevalent and continuously intensifying (because of the COVID-19 pandemic) speech disorder. To highlight the difficulty and significance of accurately diagnosing stuttering-induced epilepsy, a particular subtype of language-induced epilepsy, it also examines the function of stuttering as a contributing factor to the emergence of epileptic seizures.

**Keywords:** Epilepsy • Seizures • Language-induced epilepsy • Stuttering • Psychogenic non-epileptic seizures

## Introduction

It has long been established that epilepsy can have an impact on language. The degree and character of the resulting linguistic disturbance are indeed determined by the type, severity, and primary cause of epilepsy as well as the method of therapy [1]. According to the clinical history of the patients and the drug's peculiarities, it has been specifically reported through case studies that some antiepileptic medications, including phenytoin, carbamazepine, lamotrigine, topiramate, valproate and levetiracetam gabapentin, and Divalproex sodium, have either induced the appearance or prevented the onset of language dysfunctioning. This information supports the initial hypothesis of this work. In a similar vein, one of the studies we looked at reports that ethosuximide and phenobarbital therapy prescribed to a 47-year-old male patient with epileptic seizures reduced clinical seizures, including stuttering, while anticonvulsant medication was not taken during specific periods, which revealed that clinical seizures were repeatedly precipitated by specific stimuli [2]. Numerous studies have examined the relationship between epileptic seizures and, inevitably, issues with language and speech fluency, including stuttering, as will be shown and demonstrated below. However, only a small number of research have examined how stuttering may result in epileptic seizures. This manuscript's main goals are to identify any patterns in the angles from which existing studies study the subject and to clarify the pertinent diagnostic conundrum.

## Stuttering

Speech disorders like stuttering or stammering are rather frequent.

According to DSM-V-TR (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision), it is a vocal phenomenon that is characterized by disruptions in the flow of speech and, more specifically, by the prevalence of at least one of the following: broken words, sound and syllable repetitions, prolongation of sounds, interjections, audible or silent blocking, circumlocutions, and monosyllabic whole word repetition. Individual differences in stuttering intensity can occur depending on a variety of variables, such as the context of communication, amount of exhaustion, and degree of fear. Researchers in a variety of disciplines, including neurology, genetics, linguistics, and neurosciences are becoming more and more interested in the issue as more than 70 million people stammer globally, according to the Stuttering Foundation. Aside from what the statistics indicate, it can be difficult to conclude why stuttering is a subject of discussion and/or research because it is closely entwined with a wide range of neurological and psychogenic diseases. Stuttering is a chronic condition that can occasionally persist into adulthood, common in young children (expected as part of the process of speech development between ages 3 and 8), and a symptom of trauma, brain injury, strokes, or epileptic seizures. However, to put it bluntly, stuttering is a common problem for young children. It might be a symptom of psychogenic background, linked to mental illnesses or social anxiety, as well as a marker of neurodegenerative disease. 73 children and 92 adults with stuttering issues were the subjects of two of the reviewed studies, which were carried out in 2009 and 2013. It is crucial to note that these studies found a connection between stuttering and social phobia, generalized anxiety disorder, panic disorder, and social anxiety disorder. The majority of people view stuttering as a symptom rather than a diagnosis of a fluency condition. Stuttering's obscure neurophysiology, which is one explanation for the literature's biased viewpoint, is a result of the condition's complexity. The hypothesis that most people organize their speech mechanisms in one brain hemisphere, typically the left, is currently under investigation. However, some people, typically left-handed or ambidextrous people, do so. Another explanation is that a potential diagnosis is less significant when stuttering first appears in adulthood without any prior history, family history, or obvious brain injury. The literature on the subject has recently focused on the potential link between stuttering and other neurological issues caused by COVID-19, which further obscures the diagnostic criteria for stuttering. For example, one case study reports that a 53-year-old female patient's stuttering and word-finding difficulties were caused by a reaction to the COVID-19 infection. Although it does not explicitly correlate COVID-19 with stuttering, another study undertaken in the United Kingdom in 2020 presents the first countrywide, cross-specialty surveillance study of acute neurological and psychiatric consequences of COVID-19 and opens the door for future research [3]. The study examines language-induced epilepsy because the aforementioned perspectives which see stuttering as a symptom, primarily in epilepsy have been the subject of much discussion in published studies from the 1960s to the present. A closer look at the psychogenic and neurological underpinnings of acquired stuttering, a symptom of language-induced epileptic seizures, may throw additional light on the relationship between stuttering and reflex and language-induced epilepsy. Overall, a study of this kind might highlight the need for additional research into the diagnostic conundrum of whether stuttering, reflex epilepsy, and language-induced epilepsy are the proven effects or the unproven causes. Reflex epilepsy, language-induced epilepsy, and any potential connections with stuttering must all be briefly explained at this point more for the sake of flow and clarity than for future inquiry.

## On reflex epilepsy

Reflex is a phrase that has been specifically chosen to characterize situations in which a highly regular stimulus or movement causes a seizure. The seizure-inducing factor in other types of epilepsy, however, might be a local metabolic shift within the focus or a change in a blood-borne molecule that can affect the focus. Depending on the type, the frequency of reflex epilepsies can be as high as 25% for photosensitive epilepsy, television-induced epilepsy, or video-game-induced epilepsy [4]. The International League Against Epilepsy (ILAE) Task Force on

Classification and Terminology Organization has observed and categorized two possible major types of reflex epilepsy, referred to as primary or idiopathic reflex epilepsy and secondary or symptomatic reflex epilepsy, respectively. Additional types of reflex epilepsy, such as mitogenic, eye-closure, orofacial reflex, myoclonic, and praxis induction epilepsy have also been defined. Cortical foci are the norm in cases of primary or idiopathic reflex epilepsy, and a strong connection with family history and early-life presentation has been seen. On the other hand, a very particular class of stimuli is useful in treating secondary or symptomatic reflex epilepsy, even though the precise stimulus used may vary from case to case and occur later in life in patients with related neurological and non-epileptic impairment. Primary reflex epilepsy typically has a benign prognosis and a fair response to medicine, whereas symptomatic reflex epilepsy lacks recognizable symptomatology and has a far worse response to therapy for focal seizures brought on by certain stimuli [5].

### On language-induced epilepsy

A subtype of reflex epilepsy known as language-induced epilepsy appears to be triggered by specific linguistic inputs. Higher-level cognitive tasks, such as speaking, writing, calculating, paying attention, playing chess, reading music, and playing an instrument, among others, have been observed to occasionally cause focal or generalized seizures. To prevent misunderstandings, it is believed crucial to distinguish language-induced epilepsy from praxis-induced epilepsy, which are seizures brought on by nonverbal higher brain functions related to spatial processing, ideation, or motions. Our literature study found evidence that language in any of the three modalities of reading, writing, and speaking can trigger seizures. This type of epilepsy is used to explain seizures brought on by unsuccessful attempts to speak, read, or write, while published scientific studies only partially explore the topic, even though it is connected to numerous aspects of patients' daily lives. A small amount of research has been done on graphemic or writing epilepsy as a subtype of language-induced epilepsy, according to the literature review done for the current work [6]. However, the occurrence of such studies highlights the need for additional research into how certain tasks needing sophisticated mental involvement for bodily functions can trigger myoclonic jerks in people with juvenile myoclonic epilepsy. Writing is undoubtedly a mentally demanding task that involves praxis sub-activity. This discovery highlights the causal connection between a stimulus and the onset of epileptic seizures as well as the distinctions between general praxis-induced epilepsy and graphemic epilepsy. Similarly to this, our research shows that there have been cases of patients whose seizures started while they tried to talk. While many cases of language-induced epilepsy, caused by argumentative talking and writing or even singing and recitation, have been reported to a greater extent (compared to reading-triggered epilepsy), language-induced epilepsy is cited as being less contested by publications [7]. Language-related tasks, including reading, can cause seizures.

### Stuttering's function and relation to reflex epilepsy

Speech therapy and mental health professionals have debated the relationship between stress and stuttering for years. The dominant paradigm during the 20th century acknowledged psychological variables, such as stress, rather than physiological ones as potential causes for stuttering to occur. A 2009 study found that 50% of adults who stammer experience social anxiety. Case studies and other types of research have identified stuttering as a phenomenon of social anxiety for adolescents and adults. Dr. Lisa Iverach's studies from 2009 and 2014 emphasize that, in addition to other interventions aimed at the potential psychogenic or neurophysiological underpinnings of the phenomenon, speech therapy is necessary to treat stuttering, which can be a direct cause of social anxiety rather than merely a symptom. Stuttering has, however, also been linked to seizures, particularly in individuals going through stressful times. Studies suggesting that there may be some relationship between speech impediment and epilepsy have increased the idea that stuttering is "a relative of epilepsy" over the past 10 years. While a study evaluation reveals that rates of stuttering among patients with epilepsy are greater than in the general population, other studies explicitly link stuttering to the condition and the development of epileptic crises. Additionally, it appears that children who stammer are more likely to develop epilepsy than children who do not stutter, according to research that suggests a connection between stuttering and epilepsy. Another case study from 1988 that reported instances of patients who occasionally stutter during spontaneous reflex seizures and

that stuttering may even be the only indication of the episode also showed the connection. Interestingly, the observation that stuttering entirely disappeared after a seizure supports the previously accepted theory that stuttering may be the cause of the seizure and not necessarily its result [8]. Other researchers observe a connection between speech impairment and the aberrant bioelectrical activity of the right temporal brain. According to their theories, this anomaly may cause epilepsy and stuttering by acting as both a trigger and a cause. They, therefore, confirm that there is a possible causal link between epilepsy and stuttering. Additionally, it has been demonstrated that adults may appear with both epilepsy and stuttering after brain injury or brain intoxication (such as with copper), but not usually at the same time, which could potentially imply that the causes of both conditions are the same [9]. In a well-known case study, a patient with chronic epilepsy and stuttering had neurosurgery while under local anesthetic, and as a result of the procedure, the patient was able to speak clearly for the first time. Following surgery, this improvement persisted, and epileptic episodes stopped at the same time. This example suggested that stuttering and epilepsy may share a common genesis. Numerous experts have concluded that there is a clear causal relationship between stuttering and epilepsy. Nine family members with acquired stuttering, idiopathic generalized epilepsy, or language-induced epilepsy from three generations participated in the study. EEG (video-polygraphic electroencephalogram) recordings were made on each subject when they were awake and asleep. The study showed the phenotypic variety of the connection of the language-related reflex seizure (ictal stuttering) phenotype with idiopathic generalized epilepsy, and it suggested that this type of reflex epilepsy is more like generalized epilepsy than focal one.

### The role of ictal stuttering

About 25% of patients with refractory epileptic seizures who are assessed also experience Psychogenic Nonepileptic Seizure-Like Episodes (PNES). Since misdiagnosis results in the prescription of needless antiepileptic medicine with subsequent adverse effects and a large cost burden, this finding is crucial for clinicians who treat refractory cases of seizures (up to 4 billion USD). PNES and epileptic seizures share several clinical characteristics. In adult patients, Ictal Stuttering (IS) can be utilized as a helpful sign to assist differentiate between PNES and epileptic seizures. In a 2004 study, Vossler et al. compared and assessed two groups of patients with PNES and epileptic seizures for IS. Interestingly, IS was only detected among PNES participants (8.5% of 117 patients). The "yellow" clinical characteristics of PNES are additional criteria that help clinicians differentiate between these two groups of diseases. Particularly, PNES seizures are typically distinguished by a slow onset, a longer ictal length (>2 min), and a stimulus that is frequently an emotionally unpleasant occurrence. Compared to patients with an epileptic seizure, patients with PNES have a greater prevalence of psychiatric problems including cluster A or B personality disorders. As far as PNES diagnosis goes, EEG video monitoring is the gold standard. The diagnosis of PNES is almost impossible to make if there are no EEG changes during a clinical event and accompanying clinical spells that are not compatible with seizure types that should cause changes in EEG recording [10]. Overall, clinicians should exercise extreme caution when evaluating refractory cases of seizures due to the diagnostic challenges posed by the clinical manifestations of both PNES and epileptic seizures. This is because misdiagnosis eventually prevents patients from receiving effective treatment for their condition.

### Conclusions

One of the frequently observed signs or effects of hospitalized patients with some form of epilepsy is stuttering. The difficulties in making a diagnosis for patients stem not only from the intricacy of the stuttering phenomena but also from what scientific studies about it show. These studies enrich the larger scientific community, which in turn influences our knowledge of the problem. This essay has made an effort to clarify how stuttering has been discussed in the literature from 1960 to 2022. Our results show that our initial theory regarding the topic's dissimilar investigation is correct. 642 studies exploring how epilepsy impacts language have been published on PubMed and Scopus. When it comes to the scientific literature on language-induced epilepsy, the number of publications on the subject interestingly lowers to 50%, and just 62 articles investigate the relationship between stuttering and epilepsy. This finding, together with the relationship between the neurological and psychogenic causes of stuttering and epilepsy, make up the physicians' diagnostic "bank" on instances that, as shown, indicate there is still an unexplored territory in the field of research. Reflex, induced,

drug-induced, COVID-19-related, and induced stuttering, along with genetic predisposition, are partially examined; however, there is clear interest and case studies cry for additional investigation. This study highlights current research directions, educates the scientific community on the pathophysiology and genetics of stuttering and epilepsy, and emphasizes the importance of accurate diagnosis. It was not yet able to pinpoint particular pathophysiological pathways that language use as a trigger for ES and epilepsy share. Numerous neurological and developmental diseases and conditions, such as Gilles de la Tourette syndrome, intellectual disability, obsessive-compulsive disorder, linguistic difficulties, and attention deficit hyperactivity disorder are associated with stuttering. Although definitive results that prove or rule-out direct connections/causality between stuttering and epileptic seizures are not yet at the disposal of the scientific community, attempts to investigate such connections by researchers are deemed important for the prevention of misdiagnosis or diagnosis, the article reveals research trends and concludes that some sort of connections between stuttering and epileptic seizures has been the focus of studies/articles. To solve diagnostic problems, it is true that more research has to be done on the less well-established causes of stuttering and epilepsy.

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