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# Unveiling the Role of the Globus Pallidus in Schizophrenia: A Case Report and Neuroimaging Study

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**Abstract** **Case Report**

Schizophrenia is a complex psychiatric disorder characterized by anomalies in thought, perception, and behavior. Despite advancements in pharmaceutical treatments, managing the disorder remains challenging. Recent research has focused on understanding its biological basis, with particular attention to subcortical structures like the basal ganglia and thalamus, including the globus pallidus. Anomalies in the globus pallidus have been associated with various neurological and psychiatric conditions, showcasing its importance in schizophrenia. However, studies specifically examining abnormalities within the globus pallidus in schizophrenia are limited. In this case report we present the case of a 22-year-old male, Mr. A, diagnosed with schizophrenia. Mr. A exhibited auditory hallucinations, paranoid delusions, and disorganized behavior. Neurological examinations and laboratory tests ruled out underlying medical causes, prompting further investigation with neuroimaging studies. Magnetic resonance imaging revealed bilateral and symmetrical signal anomalies in the posterior part of the globus pallidus, consistent with previous research implicating the basal ganglia in schizophrenia.

**Keywords:** Globus pallidus, MRI, neuroanatomy, neuroimaging, schizophrenia.



## INTRODUCTION

Despite advances in pharmaceutical discovery, treating schizophrenia, a complex condition marked by abnormalities in thought, perception, and behavior, remains a significant problem [1]. Research is currently focused on understanding its biological foundation, with the thalamus and basal ganglia emerging as essential players in its presentation as subcortical structures. The globus pallidus is of particular importance because it regulates extrapyramidal motor activity and is involved in memory, emotion, and other cognitive processes [2]. Anomalies in this structure have been implicated in various neurological and psychiatric conditions, including Parkinson's disease and Huntington's disease [3].

Though studies on the neurobiology of schizophrenia are rapidly expanding, few have focused on abnormalities inside the globus pallidus. This case report presents the clinical and neuroimaging findings of a schizophrenia patient with identified anomalies in this region. This study aims to deepen comprehension of the disorder's underlying mechanisms and potentially unearth novel avenues for therapeutic intervention.

## CASE PRESENTATION

Mr. A, a 22-year-old male, presented to our psychiatric consultation with a history of auditory hallucinations, paranoid delusions, and disorganized behavior. He claimed to have had upsetting auditory hallucinations for the previous eight months, during which he described voices criticizing and plotting against him. Alongside these auditory hallucinations, Mr. A experienced paranoid delusions, strongly believing that he was being watched by the government. He claimed to be under constant surveillance, which caused him much distress and altered his function while making it difficult for him to go about his everyday business.

Mr. A had no significant past medical history and denied any history of substance abuse or psychiatric disorders in the family. He had never been hospitalized for psychiatric reasons before and had no prior contact with mental health services. However, he reported experiencing increasing social withdrawal and declining occupational functioning over the past year, coinciding with the onset of his psychotic symptoms. He had become increasingly isolated, avoiding social interactions and neglecting his work responsibilities.

During the initial assessment, Mr. A presented disorganized speech and behavior, with tangential thought processes. it was difficult for him to maintain coherent conversations, while frequently veering off-topic and providing irrelevant or nonsensical responses to questions. He appeared restless and agitated, exhibiting repetitive movements such as pacing and hand-wringing. His affect was blunted, with a limited range of emotional expression, and he displayed reduced eye contact. He denied any perceptual disturbances or mood symptoms such as depression or mania.

Mr. A underwent a comprehensive neurological examination, which revealed no focal neurological deficits or abnormalities. His cranial nerves were intact, and motor strength and coordination were within normal limits. There were no signs of tremor, rigidity, or abnormal involuntary movements suggestive of a movement disorder. Sensory examination was unremarkable, with intact sensation to light touch, temperature, and proprioception.

Laboratory investigations, including a complete blood count, comprehensive metabolic panel, thyroid function tests, and toxicology screening, were performed to rule out any underlying medical or metabolic causes of Mr. A's symptoms. All laboratory tests returned within normal limits, ruling out any acute medical or toxicological etiologies for his psychosis.

Given the severity and persistence of Mr. X's psychotic symptoms, further investigation with neuroimaging studies was warranted to rule out any structural brain abnormalities. Magnetic resonance imaging (MRI) scans of the brain were obtained using a high-resolution imaging protocol. The MRI scans revealed structural abnormalities in the globus pallidus, a key component of the basal ganglia. Specifically, there was evidence of Bilateral and symmetrical signal anomalies involving the posterior part of the globus pallidus with hyperintensity on T2 and FLAIR sequences, and diffusion hyperintensity.

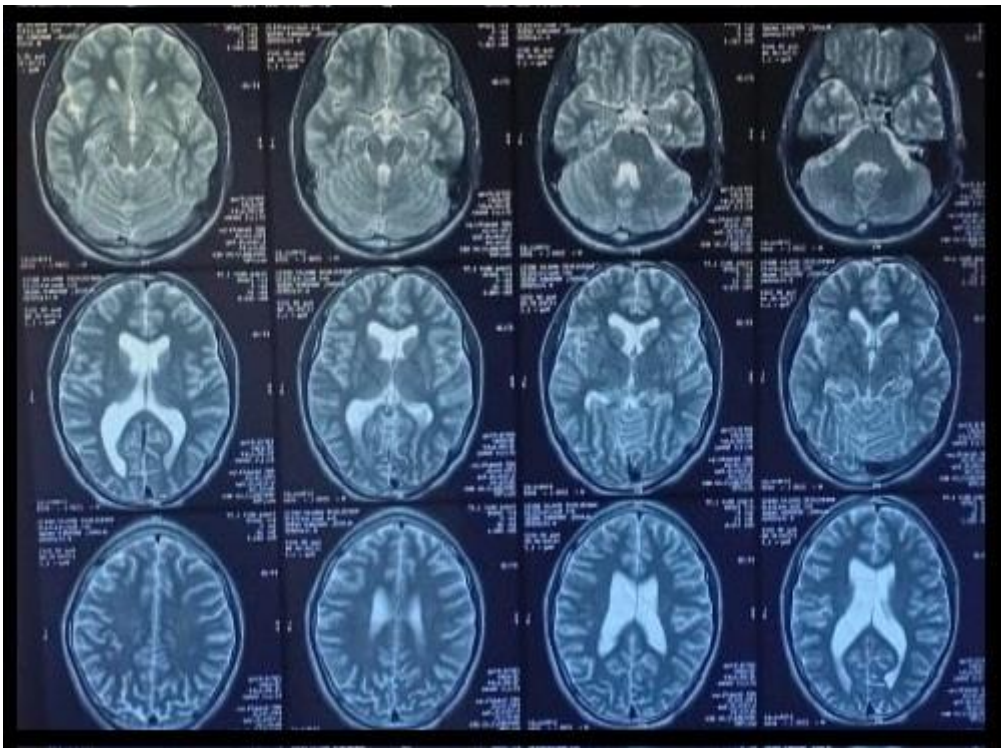

**Figure 1: Magnetic resonance imaging of the brain showing T2 hyperintensity signals involving the posterior part of the globus pallidus**

Based on the clinical presentation, neuroimaging findings, and exclusion of other medical and psychiatric conditions, Mr. A was diagnosed with schizophrenia according to the criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). The presence of prominent psychotic symptoms, including auditory hallucinations and paranoid delusions, coupled with disorganized speech and behavior, was consistent with a diagnosis of schizophrenia.

Following the diagnostic evaluation, pharmacotherapy with antipsychotic medication was initiated to target his psychotic symptoms and stabilize his condition. He was started on a second-generation antipsychotic medication: olanzapine, with close monitoring of his symptoms and side effects. To ensure comprehensive care for Mr. A, A multidisciplinary approach involving collaboration between psychiatrists and psychologists is needed.

For the Follow-Up, Mr. A was scheduled for regular appointments to monitor his treatment response and adjust his medication regimen as needed. He showed gradual improvement in his psychotic symptoms over several weeks, with a reduction in the frequency and intensity of his auditory hallucinations and paranoid ideation. He also showed improvement in his social functioning and engagement in occupational activities. With ongoing treatment and support, Mr. A is working to achieve stabilization of his symptoms and improve his quality of life.

## DISCUSSION

The pathophysiology of schizophrenia is intricate and influenced by various factors, including genetic predisposition, environmental elements, and neurobiological irregularities. Despite ongoing efforts, the exact cause of schizophrenia remains elusive. Recent studies have employed functional neuroimaging techniques to explore the neural circuitry associated with structural and functional changes, as well as clinical manifestations, in schizophrenia

Much of this work centers around abnormalities of the basal ganglia including the globus pallidus, and its connections with the cortex [4, 5].

Abnormalities in the basal ganglia are thought to disrupt intricate neural circuits known as cortico-striato-thalamo-cortical loops, which play crucial roles in motor control, cognition, and emotion regulation [6].

Dysregulation within these circuits may contribute to the emergence of psychotic symptoms and cognitive deficits observed in schizophrenia. Specifically, aberrant functioning of the globus pallidus, a key component of the basal ganglia, has been linked to alterations in motor planning, inhibition of unwanted movements, and regulation of cognitive processes [7].

The neuroimaging findings in Mr. A, revealing bilateral and symmetrical signal anomalies in the posterior part of the globus pallidus, are consistent with previous research implicating the basal ganglia in schizophrenia. Hyperintensity on T2 and FLAIR sequences, as well as diffusion hyperintensity, suggest alterations in tissue microstructure and integrity within the globus pallidus.

In many studies, several regions of outward deformation in the globus pallidus were observed [8], specifically larger left globus pallidus volumes. A comprehensive multi-site study revealed that individuals diagnosed with schizophrenia exhibit larger volumes of the left and right globus pallidus compared to healthy controls. Additionally, there was evidence of schizophrenia-specific leftward asymmetry in pallidum volume [9].

Recent research has also indicated an enlarged left pallidal volume in individuals exhibiting at-risk mental states and subclinical psychotic experiences [10], while other studies observed that in patients not receiving antipsychotic medication, a smaller external segment of the globus pallidus was linked to increased symptom severity [11].

The precise relationship between globus pallidus volume and symptom severity was discussed in many studies that suggested a positive correlation between larger volumes and more severe symptoms [12, 13], specifically the right globus pallidus. It was also noted that the volume of the globus pallidus was larger in patients with a chronic history of schizophrenia in comparison with healthy individuals. Some other alterations were also noted such as left-right difference in globus pallidus volume [9] that may reflect other features of schizophrenia

Other studies demonstrate the presence of abnormal functional interactions of the globus pallidus in individuals with first-episode schizophrenia as well as evidence of their association with longitudinal deficits observed relatively early in the course of the disorder [6].

## CONCLUSION

In conclusion, schizophrenia is a complex and challenging psychiatric disorder with intricate etiology and rich symptomatology. Many advancements in research have been achieved in recent years, and much progress was noted in terms of comprehension of the neurobiological functioning of schizophrenia and specifically the abnormalities of cerebral structures, including the globus pallidus that plays an important role in the disorder's pathogenesis; much work remains needed to fully understand the complex interplay between genetic, environmental, and neurobiological factors contributing to this disorder, in the hope of serving as a means for novel therapeutic interventions to help improve the prognosis of such complicated disorder.

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