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Case Report

Atypical neurological decline in a teenager: A case of pantothenate kinase-associated neurodegeneration

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Abstract

Pantothenate Kinase-Associated Neurodegeneration (PKAN), formerly Hallervorden-Spatz disease, is a rare autosomal recessive neurodegenerative disorder characterized by progressive movement abnormalities and iron accumulation in the basal ganglia.
A 13-year-old male presented with a history of progressive gait disturbances, involuntary limb movements, and developmental regression. Imaging showed the pathognomonic "eye-of-the-tiger" sign in the globus pallidus. Supportive treatment was initiated.
This case demonstrates typical clinical and radiological findings of adolescent-onset PKAN. Early diagnosis can facilitate timely symptomatic intervention.

Keywords: Extrapyramidal sign, Hallervorden-Spatz disease, Dystonia, Dementia.

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1. Introduction

Pantothenate Kinase-Associated Neurodegeneration (PKAN), previously known as Hallervorden-Spatz disease, is a rare autosomal recessive neurodegenerative disorder caused by mutations in the *PANK2* gene located on chromosome 20p13.[1] PKAN is the most common subtype of a group of disorders classified under Neurodegeneration with Brain Iron Accumulation (NBIA), all of which share the hallmark feature of excessive iron deposition in the brain, particularly in the basal ganglia.[2,3]

The global prevalence is estimated between 1 and 9 cases per million individuals.[4] PKAN has two clinical forms: the classic form typically presents in early childhood or adolescence and progresses rapidly, while the atypical form has a later onset and a more protracted course.[5] The clinical manifestations include dystonia, spasticity, parkinsonism, dysarthria, cognitive decline, and visual impairment due to optic atrophy or retinal degeneration.[6-8] A hallmark radiologic sign, the “eye-of-the-tiger” appearance on MRI, reflects central hyperintensity surrounded by hypointensity in the globus pallidus, caused by gliosis and iron accumulation.[9]

We report a classic case of adolescent-onset PKAN with hallmark clinical and radiologic findings, aiming to raise awareness about this rare but significant condition.

2. Case Presentation

A 13-year-old male presented with a 3-year history of difficulty walking and frequent falls. His parents reported progressive slurring of speech and involuntary movements involving the limbs and shoulders. Initial developmental milestones were achieved on time; however, regression began at age 10, affecting motor, language, social, and fine motor skills. The child also developed memory deficits and poor academic performance.

On neurological examination, hypertonia was noted in all four limbs with brisk deep tendon reflexes and bilateral extensor plantar responses. Dystonic posturing and choreoathetoid movements were observed. Cranial nerve

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examination and cerebellar signs were unremarkable. Fundus examination revealed no optic pallor or pigmentary changes.

MRI of the brain revealed bilaterally symmetric hypointensities in the globus pallidus with central hyperintensity on T2-weighted images, giving the pathognomonic "eye-of-the-tiger" sign (**Figure 1**, **Figure 2**, **Figure 3**).[9] Family history was significant for an elder sibling with similar complaints, suggestive of a hereditary pattern. Genetic testing was recommended but not completed due to financial constraints.

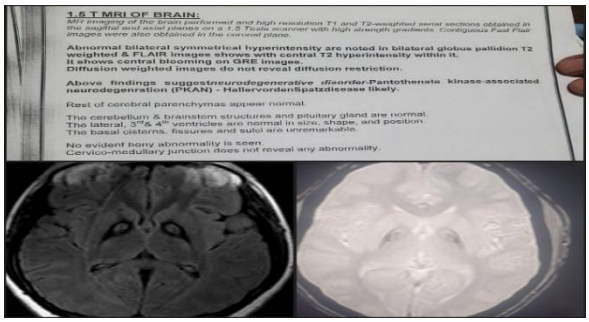

Figure 1: MRI showing symmetrical hypointensity in the globus pallidus and posterior limb of the internal capsule.

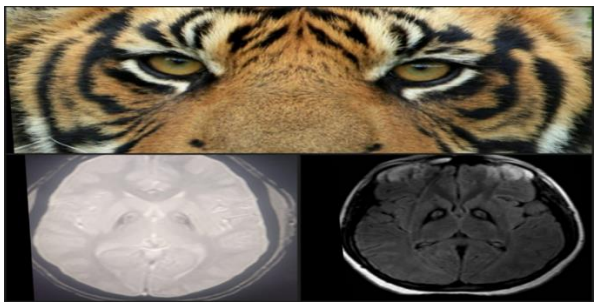

Figure 2: "Eye-of-the-tiger" sign—central hyperintensity within the globus pallidus on T2-weighted MRI.

Figure 3: Clinical image of the affected child demonstrating dystonic posturing.

The diagnosis of classic PKAN was made based on clinical features, imaging findings, and family history. Treatment was initiated with oral baclofen and trihexyphenidyl for dystonia, along with pantothenic acid supplementation. The patient was also referred for regular physiotherapy, occupational therapy, and psychological support.

3. Discussion

Pantothenate Kinase-Associated Neurodegeneration (PKAN) is the most prevalent subtype of Neurodegeneration with Brain Iron Accumulation (NBIA), a group of disorders marked by dysregulated iron metabolism in the brain. PKAN arises due to biallelic mutations in the *PANK2* gene, which encodes pantothenate kinase 2, a mitochondrial enzyme essential for the first regulatory step in coenzyme A (CoA) biosynthesis from pantothenic acid (vitamin B5).[1,3] Impaired *PANK2* function leads to mitochondrial dysfunction, oxidative stress, and subsequent neurodegeneration, particularly affecting regions of high metabolic demand like the globus pallidus.[3,10]

The hallmark "eye-of-the-tiger" sign seen on T2-weighted MRI is both sensitive and specific to PKAN. It consists of a central hyperintensity (due to gliosis and spongiosis) surrounded by hypointense iron deposition in the globus pallidus.[9] Although this radiological finding is virtually diagnostic, it may be absent in early or atypical forms of the disease, making genetic testing a critical adjunct where available.[3]

The differential diagnosis includes other NBIAs (e.g., PLA2G6-associated neurodegeneration, mitochondrial membrane protein-associated neurodegeneration), Wilson disease, Huntington's disease, and juvenile Parkinsonism.[7] Clinical distinctions and characteristic imaging findings, such as the presence or absence of pigmentary retinopathy and specific basal ganglia involvement, help narrow the differential.

PKAN has two major phenotypes: classic and atypical. Classic PKAN typically manifests before age 10 with rapid progression, as in our case, while atypical PKAN may have onset in the second or third decade with slower progression and more prominent speech abnormalities and psychiatric symptoms.[5,6] Our patient exhibited typical features of classic PKAN, including generalized dystonia, spasticity, and cognitive decline, reinforcing the importance of recognizing age-specific presentation patterns.

Management remains largely symptomatic. Dystonia can be addressed with anticholinergics like trihexyphenidyl, GABA agonists such as baclofen, and benzodiazepines.[10] In severe cases, intrathecal baclofen pumps and deep brain stimulation (DBS) of the globus pallidus interna have been reported with variable success.[11] Physical and occupational therapy play an essential role in maintaining functional independence.

Emerging treatments are focused on disease modification. Deferiprone, an iron chelator that crosses the blood-brain barrier, has been trialed with modest reductions in basal ganglia iron, though clinical benefits remain

controversial.[10] Ongoing clinical trials are investigating high-dose pantothenate, coenzyme A analogs, and gene therapy approaches targeting *PANK2* mutations.[11] These strategies hold promise for altering the disease course in future generations.

This case underscores the importance of early clinical suspicion, especially in children presenting with progressive extrapyramidal symptoms and family history. Timely MRI and supportive multidisciplinary care can significantly improve symptom control and patient quality of life, even in the absence of curative options.

4. Conclusion

This case report presents a classic adolescent-onset PKAN patient with typical clinical and radiologic features. Recognition of this rare condition is critical, especially in the early stages when supportive therapy can help preserve function and delay progression. Greater awareness, timely neuroimaging, and multidisciplinary care are crucial in improving outcomes in affected individuals.

5. Human Subjects

Consent was obtained or waived by all participants in this study.

6. Conflicts of Interest

None.

7. Source of Funding

All authors have declared that no financial support was received from any organization for the submitted work.

8. Other Relationships

All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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