RESEARCH PAPER

Progressive Supranuclear Palsy–Parkinsonism Predominant Variant: A Clinicoradiological Case Report Highlighting the Hummingbird Sign, Mickey Mouse Sign, and MRPI 2.0

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Abstract

Progressive supranuclear palsy (PSP) is a variant of parkinsonism, in which initial symptoms can mimic Parkinson's disease. The parkinsonism-predominant variant of PSP (PSP-P) can present with bradykinesia and rigidity, so clinicoradiological correlation is crucial. Neuroimaging features like the hummingbird sign, Mickey Mouse sign, and Magnetic Resonance Parkinsonism Index 2.0 (MRPI 2.0) can help to inform diagnosis. A 75-year-old man had progressive gait imbalance, recurrent falls towards the back, downward gaze palsy, bradykinesia, axial rigidity, dysarthria, dysphagia, and poor response to levodopa over 1 to 1.5 years. Examination revealed supranuclear vertical gaze palsy, intact oculocephalic reflex, wide-based gait, postural instability and mild frontal executive dysfunction. CT and MRI showed selective midbrain degeneration with the hummingbird sign and Mickey Mouse sign. The midbrain-to-pons ratio was low at 0.14 and MRPI 2.0 was abnormal at 10.2. Other morphometric measurements were also consistent with PSP. This case underlines the usefulness of progressive clinical symptoms and qualitative and quantitative imaging features for the diagnosis of PSP-P and its differentiation from idiopathic Parkinson's disease

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1. Introduction

Progressive supranuclear palsy (PSP) is a neurodegenerative condition that is posturally unstable, falls frequently, has supranuclear gaze palsy, axial rigidity, bradykinesia, dysarthria, dysphagia, and progressive functional impairment. Initially reported by Steele, Richardson, and Olszewski, PSP is currently considered one of the primary atypical parkinsonian syndromes and can be a difficult diagnosis to make, especially in the initial phases of the disease when it may be clinically confused with Parkinson's disease and other Parkinson-plus disorders [1]. The clinical classification of PSP has also been narrowed down by the Movement Disorder Society diagnostic criteria, which has also underscored the heterogeneity of the PSP phenotypes, such as the parkinsonism-predominant form, also known as PSP-P [2].

PSP-P is a significant clinical subtype due to the possibility of the initial similarity to idiopathic Parkinson's disease, particularly in individuals who manifest with bradykinesia, rigidity, and partial or poor levodopa response. Nevertheless, later in the progression, other signs that include early postural instability, backward falls, vertical gaze limitation, axial predominance of rigidity, and bulbar symptoms might become more evident and suggestive of PSP as opposed to typical Parkinson's disease [3]. Late diagnosis can have an impact on prognostic counseling and symptomatic treatment [4]. This phenotype has also been noted to be becoming a clinically relevant variant that falls at the diagnostic border between PSP and Parkinson disease [5].

Neuroimaging, especially magnetic resonance imaging (MRI) has a useful supportive role in the diagnosis of PSP. Typical structural alterations of the midbrain have been broadly characterized and could be used to distinguish PSP and other parkinsonian diseases. One of them, the hummingbird sign of sagittal imaging, is an indicator of selective midbrain atrophy and relative sparing of the pons [6]. Mickey Mouse sign on axial imaging is a sign of flattening and concavity of the midbrain tegmentum and is another convenient

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qualitative sign of selective involvement of the midbrain in PSP. These radiographic results are particularly useful when applied together with the clinical image.

The current case is interesting in the sense that it shows a high clinicoradiological association between progressive characteristics of atypical parkinsonism and typical imaging characteristics of PSP. The presence of the hummingbird sign, Mickey Mouse sign, and supportive morphometric abnormalities in a clinically progressing parkinsonism-predominant presentation is an effective example of how neuroimaging may be used to aid the diagnosis of PSP-P in clinical practice.

2. Case Presentation

2.1 Patient Demographics

A 75-year-old male was evaluated for progressive gait imbalance and recurrent falls. MRI brain with MRA and MRV was performed on 08-Oct-2025 as part of the diagnostic workup.

2.2 Presenting Complaints

The patient had a history of progressive imbalance and frequent falls in the last 1 to 1.5 years. The falls were insidious in their development, gradually progressive, and were mostly backward. No loss of consciousness, seizures, or vertigo. Gradually, he found it hard to move his eyes voluntarily, especially when gazing down, which made it hard to engage in normal everyday tasks like walking down the stairs. This was succeeded by the slowness of movement and stiffness, which mostly affected the neck and trunk. He also experienced slurred speech and swallowing problems in the later stages of the disease. No severe resting tremor, no focal neurological deficits or autonomic dysfunction were reported.

2.3 Clinical History

The disease had a gradual progressive course of about 1 to 1.5 years. The first symptoms were the sense of imbalance and frequent backward falls that slowly deteriorated. As the disease progressed, the patient became limited in downward gaze, bradykinesia, axial stiffness, dysarthria, and dysphagia. The levodopa therapy was initiated due to the parkinsonian phenotype, but only slight clinical improvement was noted. This low response to levodopa, along with the progressive symptom profile, created the suspicion of an atypical parkinsonian syndrome as opposed to idiopathic Parkinson disease.

2.4 Neurological Examination

Upon examination, the patient was oriented and conscious. The facial expression was reduced and the blinking was low. Cranial nerve examination showed a vertical supranuclear gaze palsy, which is more evident in downward gaze. The oculocephalic reflex was intact, which favors a supranuclear cause of the eye movement abnormality. Motor analysis revealed that there was an increased tone with axial rigidity as compared to limb rigidity, bradykinesia, but muscle power remained intact. Gait examination revealed a broad-based, slow gait with severe postural instability and positive pull test with retropulsion. Mental higher functioning assessment revealed mild frontal lobe impairment with poor executive functioning.

2.5 Neuroimaging Findings

2.5.1 CT Findings

The CT scans that were ready to be published showed typical midbrain morphological alterations. The Mickey Mouse sign was observed in the axial CT image, with the decrease in the anteroposterior midline diameter of the midbrain, and the sagittal CT image revealed the hummingbird sign, which confirms the impression of selective atrophy of the midbrain (Figure 1).

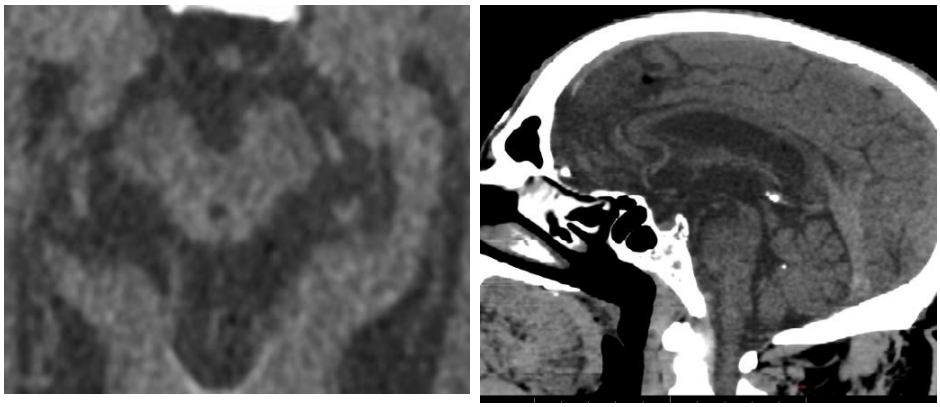


Figure 1. CT images demonstrating characteristic midbrain changes in PSP-P.

Figure 1 illustrates the typical qualitative CT-based findings of progressive supranuclear palsy-Parkinsonism predominant type, with the axial image depicting the Mickey Mouse sign of decreased anteroposterior midbrain diameter and the sagittal

image depicting the hummingbird sign of midbrain atrophy.

2.5.2 MRI Qualitative Findings

The bilateral lateral ventricles, cisternal spaces, and sulcal spaces were more prominent in age as demonstrated by MRI brain. The bilateral periventricular white matter and centrum semiovale had ill-defined patchy T2/FLAIR hyperintensities, which are consistent with small vessel ischemic changes, which are reported as Fazekas grade II. SWI demonstrated lack of hyperintensity in the posterior section of the bilateral substantia nigra, which is termed as lack of the swallow tail sign. More to the point, there was atrophy of the midbrain having a concave superior outline that creates the hummingbird sign. The axial imaging showed concave dorsolateral margins of the midbrain with a deep interpeduncular cistern, which is the Mickey Mouse sign. These qualitative results on sagittal and axial sections were also presented in the publication MRI figure panels (Figure 2.).

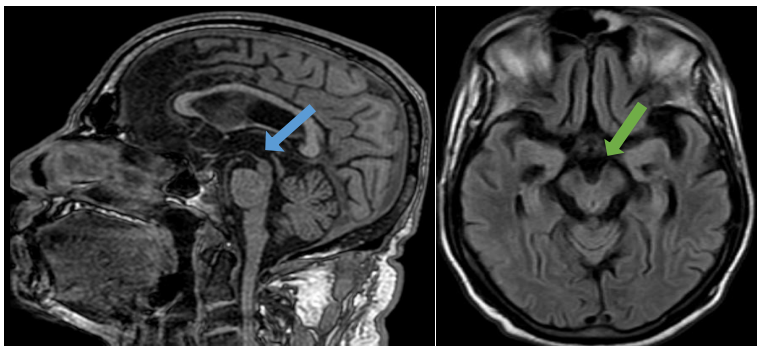
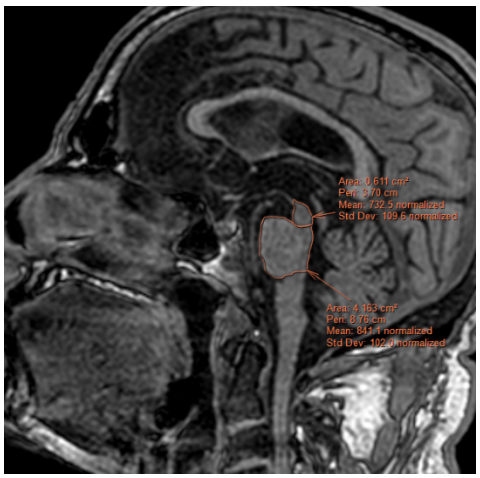


Figure 2. MRI images showing qualitative markers of PSP-P.

Figure 2 illustrates the major qualitative MRI features of PSP-P, In sagittal imaging, blue arrow reveals midbrain atrophy and superior midbrain concavity which is a hummingbird sign, and in axial imaging, green arrow reveals concave dorsolateral midbrain margins and a deep interpeduncular cistern which is a Mickey Mouse sign.

2.5.3 MRI Quantitative Findings

The MRI report recorded a decreased midbrain to pons ratio of about 0.14 which is less than the normal range of more than 0.16. The Magnetic Resonance Parkinsonism Index 2.0 was reported to be about 10.2 and was considered as abnormal. The publication image sheet also had measurement panels pertaining to morphometric measurement and recorded a pons-to-midbrain ratio of 6.813, MCP/SCP ratio of 6.0, V3/FH ratio of 0.25 and MRPI 2.0 index of 10.2. Collectively, these quantitative data were indicative of a morphometric pattern of PSP. The measurement panels were sagittal and coronal, which showed morphometric MRI parameters applicable to the PSP assessment, such as pons and midbrain measurements to estimate the midbrain-to-pons ratio and peduncular measures to calculate MRPI 2.0 (Figure 3).



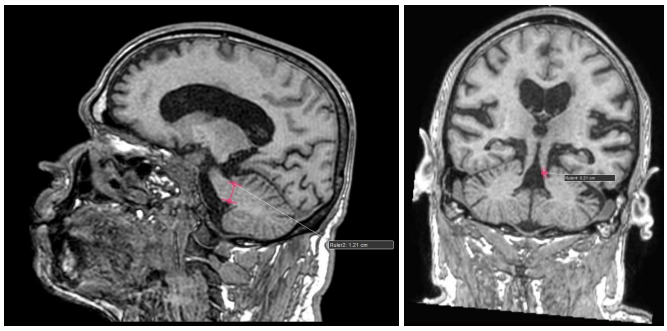


Figure 3. Morphometric MRI measurements relevant to PSP assessment.

Figure 3 illustrates the sagittal and coronal morphometric MRI values employed in quantitative analysis in PSP, pons and midbrain values in the estimation of midbrain-to-pons ratio and peduncular values in the calculation of MRPI 2.0.
Other axial MRI measurement images also showed ventricular and axial parameters that are used in the calculation of MRPI 2.0, such as frontal horn width, third ventricle measurement, and the corresponding axial structural plane on which morphometric assessment is performed (Figure 4).

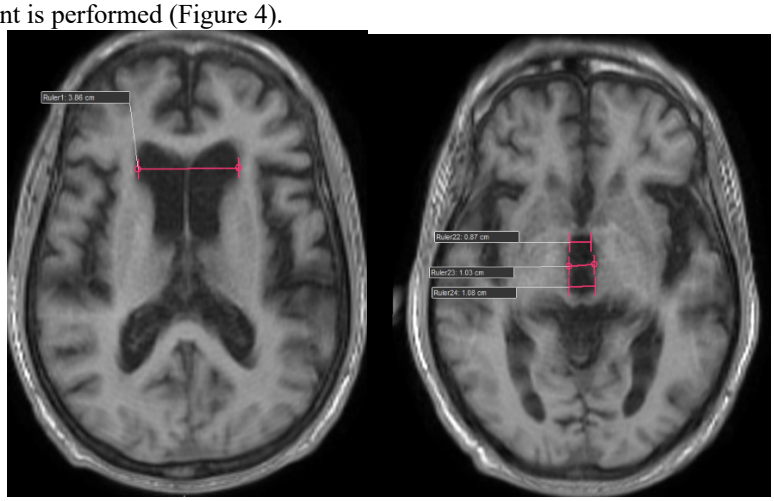


Figure 4. Axial MRI measurements contributing to MRPI/MRPI 2.0 assessment.

Figure 4 contains the combined measurement image that illustrates the axial MRI measurements applied in the MRPI 2.0 evaluation, which are the frontal horn width, the third ventricle width, and the overall axial structural plane to be used in the morphometric evaluation. The measurement sheet that comes with it indicates a pons to midbrain ratio of 6.8, MCP/SCP ratio of 6.0, V3/FH ratio of 0.25 and MRPI 2.0 of 10.2.

2.6 Other Investigations

The rest of the cerebral parenchyma was said to be normal as per age except the changes mentioned above. The basal ganglia, internal capsule, corpus callosum, thalami, cerebellopontine angles, sella, pituitary, parasellar structures, orbital structures, calvarium, craniovertebral junction, and cervicomedullary junction were not remarkable. MRA demonstrated age-normal intracranial arterial anatomy, including normal ICA, MCA, ACA, ACOM, PCA, basilar trunk, vertebral arteries and vertebrobasilar junction. MRV demonstrated normal dural venous sinuses without significant venous sinus thrombosis and venous malformation.

2.7 Differential Diagnosis

The primary differential diagnoses were the idiopathic Parkinson disease and other atypical parkinsonian disorders. Parkinson was in the list due to bradykinesia and rigidity but the preponderance of backward falls, vertical supranuclear gaze palsy, axial rigidity, dysarthria, dysphagia, and little response to levodopa were against typical Parkinson. Other Parkinson-plus syndromes were also included though the hummingbird sign, Mickey Mouse sign, low midbrain-pons ratio and abnormal MRPI 2.0 were highly suggestive of progressive supranuclear palsy. The radiology report particularly suggested that one should consider atypical parkinsonian disorder/Parkinson-plus syndrome, that is, progressive supranuclear palsy-Parkinsonism predominant variant.

2.8 Disease Progression

The patient had a slow progressive course over a period of approximately 1 to 1.5 years. The first significant symptoms were imbalance and backward falls. Voluntary downward gaze was then impaired with time, then bradykinesia and axial stiffness worsened. Dysarthria and dysphagia occurred in the later stages of the disease, which is an indication of further advancement of the disease to the bulbar region. Little

reaction to levodopa supplemented the clinical impression of an atypical and not an idiopathic parkinsonian disorder.

2.9 Final Diagnosis

Based on the progressive clinical picture, poor levodopa response, neurological examination, and supportive imaging findings, the final diagnosis was Parkinsonism-predominant variant of progressive supranuclear palsy (PSP-P). Table 1 provides a summary of the most important clinical and imaging findings.

Table 1. Summary of Clinical and Imaging Findings in the Present Case

Parameter	Finding	Relevance
Demographics	75-year-old male	Age group compatible with degenerative parkinsonian syndrome
Symptom duration	1–1.5 years, gradually progressive	Supports chronic neurodegenerative course
Initial symptoms	Imbalance and recurrent backward falls	Early postural instability favors PSP
Ocular findings	Difficulty in downward gaze; vertical supranuclear gaze palsy; preserved oculocephalic reflex	Characteristic feature supporting PSP
Motor findings	Bradykinesia; axial rigidity greater than limb rigidity	Pattern favors PSP over idiopathic Parkinson's disease
Gait findings	Broad-based slow gait; marked postural instability; positive pull test with retropulsion	Supports atypical parkinsonism
Bulbar symptoms	Dysarthria and dysphagia	Suggests progression with brainstem involvement
Cognitive findings	Mild frontal executive dysfunction	Consistent with frontal-subcortical involvement
Levodopa response	Minimal improvement	Supports atypical rather than typical Parkinson's disease
CT findings	Mickey Mouse sign on axial CT; hummingbird sign on sagittal CT	Characteristic qualitative midbrain changes
MRI qualitative findings	Midbrain atrophy; hummingbird sign; Mickey Mouse sign	Strong radiological support for PSP
SWI finding	Absence of swallow tail sign	Supportive of parkinsonian disorder
White matter changes	Fazekas grade II small-vessel ischemic changes	Background finding
Midbrain-to-pons ratio	~0.14	Quantitative evidence of disproportionate midbrain atrophy
MRPI 2.0	~10.2, abnormal	Supports PSP-P
Additional morphometric values	Pons-to-midbrain ratio 6.8; MCP/SCP 6.0 ; V3/FH 0.25	Additional quantitative support
MRA/MRV	Normal	No major vascular abnormality
Radiology impression	Atypical parkinsonian disorder/Parkinson-plus syndrome; PSP-P suggested	Imaging impression supports diagnosis
Final diagnosis	PSP-P	Final clinicoradiological diagnosis

2.10 Ethical / Consent Statement

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and its amendments. Written informed consent was obtained from the patient for the publication of this case report, including any relevant images. The patient was informed about the purpose of the report and gave consent for its dissemination in medical literature while ensuring anonymity.

3. Discussion

Progressive supranuclear palsy (PSP) is a non-classical type of parkinsonian syndrome where neuroimaging is becoming a more and more significant supportive tool in the diagnosis. The current case is particularly applicable due to the fact that imaging shows typical midbrain alterations that are well explained in the literature. Morphological abnormalities of the related midbrain have been described as supportive imaging features in PSP such as characteristic axial contour changes [7].

Quantitative morphmetric analysis is also important as evidenced in this case. The midbrain-pons ratio of about 0.14 is lower than the normal midbrain-pons ratio and is indicative of an uneven loss of the midbrain. Past studies have revealed that the midbrain-to-pons ratio is a simple and specific MRI measure that can be used to distinguish PSP and Parkinson disease and other parkinsonian conditions [8]. In the current case, such low ratio adds to the impression of a degenerative process of PSP-pattern.

The progressive imbalance of the patient, frequent backward falls, vertical supranuclear gaze palsy with downgaze preeminence, axial rigidity more than limb

rigidity, bradykinesia, dysarthria, dysphagia, and little response to levodopa are all very much compatible with PSP-parkinsonism predominant variant (PSP-P). It has been demonstrated that MRI-based indices are especially helpful in the differentiation between PSP-P and Parkinson disease when the clinical picture is similar in the initial stages [9].

An abnormal MRPI 2.0 value was also reported in the MRI report and the publication image set had other measurements of MRPI 2.0. Even more recent investigations have also confirmed the usefulness of MRPI 2.0 in differentiating between PSP-parkinsonism and Parkinson's disease, even by automated measurement methods [10]. The quantitative imaging aspect of this case is especially useful because of these findings.

Recent reviews have also highlighted the fact that MRI markers can enhance confidence in the identification of PSP and in distinguishing it among other parkinsonian disorders, especially when clinical manifestations change over time [11]. This is significant in the current case, where the imaging results are closely associated with the progressive clinical process of the patient and assist with the ultimate diagnosis.

Moreover, meta-analytic data indicate that MRPI 2.0 has a good diagnostic ability in distinguishing between PSP and Parkinson disease [12]. All in all, the presence of hummingbird sign, Mickey Mouse sign, low midbrain-to-pons ratio, and abnormal MRPI 2.0 give excellent clinicoradiological evidence of PSP-P. The case is also educational as it demonstrates how both qualitative and quantitative imaging markers can be employed in everyday practice, even though imaging should never be viewed outside of the clinical picture.

4. Conclusion

The case illustrates a good clinicoradiological manifestation of progressive supranuclear palsy-Parkinsonism predominant type. Characteristic imaging findings such as the hummingbird sign, Mickey Mouse sign, low midbrain-to-pons ratio, and abnormal MRPI 2.0 supported the presence of the progressive imbalance, frequent backward falls, vertical supranuclear gaze palsy, axial rigidity, bradykinesia, dysarthria, dysphagia, and poor levodopa response in the patient. The presence of both qualitative and quantitative MRI markers enhanced the confidence of the diagnosis and contributed to the differentiation of this disorder and idiopathic Parkinson disease. Moreover, both CT and MRI images were available, which enhanced the educational quality of the case by showing how structural midbrain changes can be identified in different imaging modalities. In general, this report demonstrates that close clinical evaluation along with specific neuroimaging are essential in the early diagnosis and identification of PSP-P.

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