

“Motor Band Sign” Seen in Motor Neuron Disease

ABSTRACT

Introduction: The “motor band sign” is an emerging magnetic resonance imaging (MRI) feature of upper motor neuron degeneration in motor neuron diseases. It appears as a curvilinear hypointensity along the primary motor cortex on iron-sensitive sequences such as susceptibility-weighted imaging (SWI). **Case Report:** A 62-year-old male presented with a 3-year history of progressive gait disturbance, trivial falls, and dysarthria, followed by difficulty rising from a chair over six months. Examination revealed spastic dysarthria, upper motor neuron signs, and proximal lower-limb weakness. MRI brain demonstrated symmetric curvilinear hypointensity along the bilateral precentral gyri on SWI and GRE sequences, consistent with the motor band sign. Electrodiagnostic studies did not show lower motor neuron involvement, supporting a diagnosis of primary lateral sclerosis. **Discussion:** The motor band sign represents abnormal iron deposition within the deep cortical layers of the precentral gyrus due to neurodegeneration and microglial activation. It is best detected using susceptibility-sensitive sequences such as SWI and GRE. **Conclusion:** Recognition of the motor band sign on MRI may assist in the identification of motor neuron disease, particularly when conventional imaging is otherwise unremarkable.

Keywords: Amyotrophic lateral sclerosis; Motor band sign; Motor neuron disease; Primary lateral sclerosis; Susceptibility-weighted imaging

INTRODUCTION

Motor neuron diseases (MNDs) are progressive neurodegenerative disorders characterized by degeneration of upper and lower motor neurons, resulting in progressive weakness, spasticity, and disability. Magnetic resonance imaging (MRI) is primarily used to exclude structural mimics of MND, as routine sequences are often normal or demonstrate only subtle abnormalities.¹ However, susceptibility-sensitive MRI techniques have increasingly demonstrated characteristic signal changes within the primary motor cortex in patients with upper motor neuron degeneration.^{2,3}

The “motor band sign” is a curvilinear or ribbon-like hypointensity along the precentral gyrus, corresponding to the primary motor cortex, best appreciated on susceptibility-weighted imaging (SWI) or gradient-recalled echo (GRE) sequences.^{2,3} Recognition of the motor band sign on susceptibility-sensitive MRI sequences can provide an important radiological clue in patients presenting with pyramidal syndromes or suspected motor neuron disease, particularly when routine MRI sequences appear unremarkable. We present a case highlighting the motor band sign on susceptibility-weighted MRI as an important imaging clue in upper motor neuron–predominant MND.

Case Report

A 62-year-old male with no known comorbidities presented with a 3-year history of gradually progressive gait disturbance associated with trivial falls, followed by progressive speech difficulty. He further developed difficulty rising from a chair

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and required a walker for ambulation over the past 6 months. His family also reported episodes of emotional incontinence. There was no history of seizures, cognitive decline, sensory symptoms, or bowel and bladder disturbances.

On examination, speech was spastic dysarthric without tongue wasting or fasciculations. Motor examination revealed wasting of the small muscles of the hands with subtle limb fasciculations and spasticity in all four limbs, more pronounced in the lower limbs. Muscle strength was preserved in the upper limbs (grade 5/5) with proximal weakness in both lower limbs (grade 4/5). Deep tendon reflexes were brisk with bilateral Hoffmann’s and Wartenberg signs, while plantar responses were extensor and jaw jerk was absent. His gait was narrow-based with short steps and spontaneous ankle clonus. Sensory and cerebellar examinations were normal.

MRI brain demonstrated bilateral symmetric curvilinear hypointensity along the precentral gyri, best appreciated on

SWI and GRE sequences, consistent with the motor band sign (Figure 1). Screening MRI of the spine revealed mild diffuse cervical and lumbar disc bulges without evidence of cord compression.

Electrodiagnostic studies did not show lower motor neuron involvement and did not fulfill the El Escorial criteria for amyotrophic lateral sclerosis. Based on the clinical findings of isolated upper motor neuron involvement with supportive neuroimaging features, a diagnosis of primary lateral sclerosis (PLS) was made.

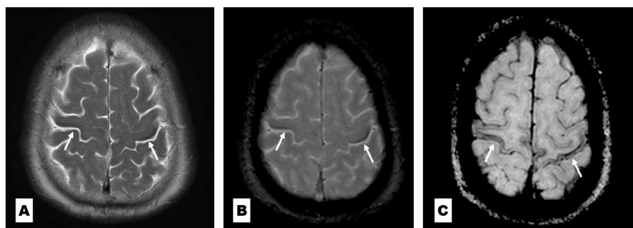


Figure 1: MRI Brain axial T2 weighted image (A) and axial SWI (B) and axial GRE images (C) showing bilateral symmetric abnormal curvilinear T2 hypointensity in the precentral gyri, known as motor band sign (white arrows)

DISCUSSION

The motor band sign is an increasingly recognized magnetic resonance imaging feature of upper motor neuron–predominant MND, particularly amyotrophic lateral sclerosis (ALS) and primary lateral sclerosis (PLS).^{1,3} The pathophysiological basis of the motor band sign is believed to be abnormal iron accumulation within the deep cortical layers of the primary motor cortex, predominantly within activated microglia.^{4,5} Postmortem MRI–pathology correlation studies have demonstrated that iron-related magnetic susceptibility changes correspond to regions of neurodegeneration and microglial activation rather than nonspecific age-related iron deposition.⁴ The motor cortex is physiologically iron-rich, and pathological exaggeration of this feature likely underlies the characteristic hypointense “band” seen in ALS and PLS.^{2,4}

In ALS, the motor band sign has been reported across disease stages and may be present even when electrophysiological evidence of lower motor neuron involvement is limited or inconclusive.^{3,6} Budhu *et al.* highlighted the diagnostic value of careful scrutiny of SWI sequences, particularly in patients with prominent upper motor neuron signs where conventional MRI may otherwise appear unremarkable.¹ Detection rates of the motor band sign are significantly higher with SWI compared to conventional T2 or FLAIR imaging, with reported sensitivities approaching 70–80% when iron-sensitive sequences are used.^{6,7}

Despite its diagnostic utility, the motor band sign is not entirely specific to MND, as pathological cortical iron accumulation has also been described in other

neurodegenerative disorders such as Parkinson’s disease and Alzheimer’s disease.^{8,9} However, when correlated with clinical findings, it can serve as an important imaging clue in patients presenting with unexplained pyramidal syndromes or suspected motor neuron disease.

CONCLUSION

In summary, the motor band sign represents a meaningful imaging marker of UMN degeneration in ALS and PLS. Its presence on iron-sensitive MRI sequences can enhance diagnostic confidence, particularly in early or atypical presentations, and may aid in distinguishing UMN-predominant motor neuron disease from mimics.

Clinical Significance

Early identification of this imaging marker may support clinical suspicion of upper motor neuron degeneration and guide further diagnostic evaluation.

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