

Assessing Optic Nerve Involvement in MS: Accuracy of VEP, MRI, OCT and a Proposal for Combined Diagnostic Strategies

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BACKGROUND

The updated diagnostic criteria for multiple sclerosis (MS) have recognized the optic nerve as a fifth anatomical area for confirming dissemination in space. This revision highlights the importance of accurately identifying optic neuritis (ON), including subclinical forms.

OBJECTIVE

To evaluate the diagnostic accuracy of visual evoked potentials (VEPs), orbital magnetic resonance imaging (MRI), and optical coherence tomography (OCT) in detecting ON, and to identify the most effective test combinations for clinical use.

METHODS

This cross-sectional study included 33 patients with relapsing-remitting MS (RRMS) and prior unilateral ON (ON+), 33 matched neurological controls without ON (ONIND), and 107 RRMS patients without clinical ON. All participants underwent VEPs, orbital MRI, and OCT (peripapillary and macular scans), assessed using OSCAR-IB QC4 and APOSTEL 2.0 standards. Diagnostic performance was evaluated via ROC curves, and a decision-making algorithm was developed to integrate optic nerve testing into the diagnostic workflow.

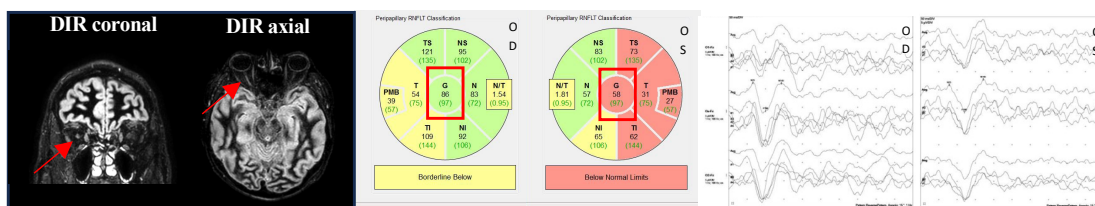


Figure 1. Multimodal evaluation showing right optic neuritis on DIR MRI (A), left optic nerve damage on peripapillary OCT (pRNFL difference >5%) (B), and delayed conduction along left optic nerve on VEPs (C).

RESULTS

Among individual tests, VEPs showed the highest diagnostic performance (AUC = 0.91; sensitivity 93.9%; specificity 87.5%), while OCT reached high specificity (92.2%) but lower sensitivity (69.7%; AUC = 0.81), and MRI achieved perfect specificity (100%) with limited sensitivity (63.6%). The best-performing combination was MRI or (VEP + OCT) (AUC = 0.91; sensitivity 84.9%; specificity 96.9%). Other strategies also performed well: the 1-out-of-3 rule (any positive) yielded AUC = 0.91 with 100% sensitivity and 82.8% specificity, and the 2-out-of-3 rule (≥ 2 positives) reached AUC = 0.89 with 81.8% sensitivity and 96.9% specificity. Figure 2 shows the percentage of patients testing positive on each diagnostic modality among the 107 RRMS ON-.

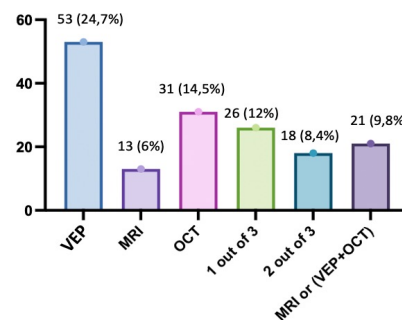


Figure 2. Bar graph showing the proportion of eyes testing positive on individual and combined diagnostic tests in 107 RRMS patients without prior optic neuritis.

CONCLUSIONS

Our findings support the use of a multimodal strategy for optic nerve assessment in MS with the choice of diagnostic rule tailored to the clinical context: the 1-out-of-3 rule may be preferred in cases with limited MRI dissemination and positive CSF, while more specific rules (2-out-of-3 or MRI or [VEP+OCT]) may improve reliability when MRI dissemination is broader but CSF is negative or unavailable. This strategy aligns with upcoming criteria and may enable earlier detection of clinical and subclinical ON.

