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Clinical Aspects of MS & Related Diseases - Diagnosis and differential diagnosis

P1000
Reassessing Dissemination in Space: The Role of Spinal Cord Lesion Burden in Early Multiple Sclerosis Diagnosis

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Introduction: According to current diagnostic criteria for MS, the presence of at least one brain lesion must be present at the time of diagnosing transverse myelitis to satisfy the criterion of dissemination in space (DIS).
Objectives/Aims: This study aimed to evaluate whether the presence of more than one spinal cord lesion at the onset of the first clinical event increases the risk of developing relapsing-remitting MS (RRMS), and whether this finding alone might be sufficient to satisfy the DIS criterion.
Methods: We performed a retrospective analysis of clinical and radiological data in patients who presented with myelitis. Only spinal cord lesions involving <3 vertebral segments were considered. Patients were excluded if they exhibited brain lesions typical of MS, neuromyelitis optica spectrum disorder (NMOSD), MOG antibody-associated disease (MOGAD), or presented with features suggestive of an alternative diagnosis. Clinical and paraclinical variables were compared between patients who converted to RRMS during follow-up (M-MS) and those who did not (M-nMS). Differences between groups were assessed using non-parametric tests, and Cox regression analysis was adjusted by age in accordance with the study objectives.
Results: Eighty-five patients were included: 33 in the M-MS group and 52 in the M-nMS group. The median age was 35 years (IQR:30–39) and 42 years (IQR:32.5–51), respectively (p=0.03). Women predominated in both groups (73% and 58%, p=0.1). At onset, multiple spinal cord lesions were observed in 51.1% of M-MS vs. 21% of M-nMS (p=0.004). Oligoclonal bands (OCB) in cerebrospinal fluid were significantly more frequent among patients who converted to MS (58% vs. 15%, p<0.001).
In univariable analysis, each variable was significantly associated with RRMS conversion. A multivariable Cox regression model demonstrated that the presence of multiple spinal cord lesions at onset was independently associated with increased risk conversion to RRMS, (HR=2.2, 95%CI=1.1–4.4, p=0.02). The coexistence of OCB positivity and multisegmental myelitis was associated with a markedly increased risk (HR=2.6, 95%CI=1.3–5.4, p=0.008).
Conclusion: Multisegmental spinal cord lesions at onset were more frequent among patients who subsequently developed MS, particularly when combined with OCB. These findings suggest that multiple spinal cord lesions may fulfill DIS criteria, even without brain lesions. Further prospective studies are warranted to validate these findings.

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P1001
The Implication of the Blood-Brain Barrier integrity on serum Neurofilament Light Chain levels as a marker for neuro-axonal injury

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Introduction: The blood-brain barrier (BBB) is critical for central nervous system homeostasis, and its dysfunction is linked to various neurological disorders. Neurofilament Light Chain (NfL), a biomarker for neuroaxonal damage, is detectable in cerebrospinal fluid (CSF) and serum. However, the effect of BBB integrity on serum NfL levels is not fully understood.
Objectives/Aims: This study investigates how BBB disruption influences the correlation between CSF and serum NfL levels using two different analytical platforms.
Methods: We analyzed NfL levels in paired CSF and serum samples from 77 patients categorized by BBB integrity. The CSF/serum albumin quotient (Q_{Alb}) was used to evaluate BBB integrity (intact: N=34, disrupted: N=43). NfL concentrations were measured using the HD-X (Single Molecule Array) and Lumipulse G600 II (Chemiluminescent Enzyme Immunoassay) platforms.
Results: For HD-X, CSF NfL levels in the intact BBB group were 434.00 pg/ml (IQR: 274.50–1175.00), and in the disrupted group, 1117.00 pg/ml (IQR: 538.50–3009.00), p<0.001. Serum NfL was 9.42 pg/ml (IQR: 6.25–23.07) in the intact group and 22.15 pg/ml (IQR: 11.38–43.43) in the disrupted group, p=0.003. Using Lumipulse, CSF NfL in the intact BBB group was 323.50 pg/ml (IQR: 207.00–1189.50), and 915.00 pg/ml (IQR: 519.50–2426.50) in the disrupted group, p<0.001. Serum NfL was 12.20 pg/ml (IQR: 8.95–30.78) in the intact group and 32.56 pg/ml (IQR: 15.35–62.28) in the disrupted group, p=0.004.

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P1449
Comparing Deep Learning Models for MS Lesion Segmentation in Brain MRI: AClinically-Oriented Evaluation of UNet, CDCG-UNet, and Swin-UNet

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Introduction: Efficient monitoring and accurate detection of lesions associated with multiple sclerosis (MS) on magnetic resonance imaging (MRI) scans is essential for diagnosis, treatment, and planning, which is often difficult due to the heterogeneity of lesions and the intricate nature of volumetric data. Automated segmentation of lesions using deep learning techniques has shown potential, yet automated segmentation using different networks has not been comprehensively evaluated. Comparison of standard UNet, CDCG-UNet, and Swin-UNet architectures serves as the basis for this study. These architectures have been used for cancers, herein the same architecture is used for lesions.
Objectives/Aims: This study compares three deep learning models—UNet, CDCG-UNet (a CNN enhanced with attention mechanisms), and Swin-UNet (a newer transformer-based model)—to determine which is most effective for segmenting MS lesions in brain MRIs.
Methods: Two MRI datasets were used:

- MSSEG 2016, manually annotated lesions from 53 patients and
- Shifts 2.0, simulating variability in scanners and imaging protocols.

Pre-processing: bias correction, intensity normalization, and conversion to a uniform orientation. Slices were analyzed in coronal, axial, sagittal, with segmentation results fused using majority voting. Assessment metrics: Dice score, Intersection over Union (IoU), Precision, Recall, and F1 score.
Results: Across all views and datasets, Swin-UNet consistently outperformed the other models:
Coronal view: Swin-UNet (IoU: 0.6262, F1: 0.6857), CDCG-UNet (IoU: 0.4706, F1: 0.6346), UNet (IoU: 0.4378, F1: 0.6034).
Axial view: Swin-UNet (IoU: 0.7015, F1: 0.7417), CDCG-UNet (IoU: 0.4509, F1: 0.6054), UNet (IoU: 0.4191, F1: 0.5755).
Sagittal view: Swin-UNet (IoU: 0.5715, F1: 0.6368), ahead of UNet and CDCG-UNet.
Conclusion: Swin-UNet, a transformer-based architecture, showed superior accuracy and robustness in segmenting MS lesions across multiple brain planes and imaging conditions. Its ability to capture both local and global features likely contributes to its high performance. This makes it a promising tool for future clinical integration, potentially enhancing radiological workflows and lesion monitoring. Future directions include applying the model to spinal MRIs and exploring its role in clinical decision support systems.

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P1450
Cladribine tablets-treated multiple sclerosis patients show different spatio-temporal patterns of acute, chronic and resolving brain inflammatory activity

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Introduction: Cladribine tablets (CladT) have been shown to reduce acute inflammation in the brain of people with MS (pwMS). However, the dynamics of inflammatory activity, including chronic and resolving inflammation, remain unclear.
Objectives/Aims: To evaluate the spatio-temporal patterns of acute, resolving and chronic lesional activity in pwMS treated with CladT over a 4-year period.
Methods: MRI data (T1-w/T2-w images) of 178 pwMS from the MAGNIFY-MS Extension (NCT03369665) study were analysed. For each pwMS, MRI was acquired 12 times over a 4-year period. New + enlarging (N+E) lesions, slowly expanding lesions (SELs) and shrinking + disappearing (S+D) lesions were assessed at each time point and served as markers of acute, chronic and resolving inflammation, respectively. N+E and S+D maps were obtained using subtraction images. SELs were detected using an in-house developed tool able to provide the time of occurrence, determined as the time point when lesion intensity differed from white matter. Differences in accrual