INPLASY PROTOCOL

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None declared.

The diagnostic value of quantitative assessment of MR neurography in chronic inflammatory demyelinating polyradiculoneuropathy: a systematic review and meta-analysis

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Review question / Objective: The review question in this systematic review and meta-analysis is to assess the diagnostic performance of various quantitative magnetic resonance neurography (MRN) parameters in diagnosing chronic inflammatory demyelinating polyradiculoneuropathy (CIDP), and to identify the most suitable parameters for further clinical practice. CIDP is a challenging condition to diagnose due to the lack of specific biomarkers. Currently, the diagnosis often requires a combination of clinical manifestations, electrophysiology, magnetic resonance neurography (MRN), ultrasound, and nerve biopsy. This study aims to clarify the accuracy and reliability of quantitative MRN parameters in diagnosing CIDP to support better diagnostic approaches.

Information sources: The information sources came from PubMed, Ovid MEDLINE, Embase, Cochrane and ClinicalTrials.gov databases from September 1988 to March 1, 2023.

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 23 May 2023 and was last updated on 23 May 2023 (registration number INPLASY202350088).

INTRODUCTION

Review question / Objective: The review question in this systematic review and meta-analysis is to assess the diagnostic performance of various quantitative magnetic resonance neurography (MRN) parameters in diagnosing chronic inflammatory demyelinating polyradiculoneuropathy (CIDP), and to identify the most suitable parameters for further clinical practice. CIDP is a challenging condition to diagnose due to the lack of specific biomarkers. Currently, the diagnosis often requires a combination of clinical manifestations, electrophysiology, magnetic resonance

neurography (MRN), ultrasound, and nerve biopsy. This study aims to clarify the accuracy and reliability of quantitative MRN parameters in diagnosing CIDP to support better diagnostic approaches.

Rationale: The study was conducted to address the challenges in diagnosing Chronic Inflammatory Demyelinating Polyradiculoneuropathy (CIDP), a type of immune-mediated acquired polyneuropathy. As there are no specific diagnostic biomarkers for CIDP, it is often misdiagnosed. The diagnostic process currently requires a combination of clinical manifestations, electrophysiology, magnetic resonance neurography (MRN), ultrasound, and nerve biopsy. The role of MRI, especially its quantitative parameters, in diagnosing CIDP has been explored in previous studies, but the accuracy and reliability of these parameters remain unclear. Therefore, this systematic review and meta-analysis was conducted to assess the diagnostic performance of various quantitative MRN parameters in CIDP and to identify the most suitable parameters for further clinical practice.

Condition being studied: Chronic Inflammatory Demyelinating Polyneuropathy (CIDP) is a rare neurological disorder where the body's immune system attacks and damages the protective covering of the nerves, known as myelin. This results in nerve inflammation and leads to symptoms like weakness, numbness, and tingling in the arms and legs. It's a progressive disease, meaning it tends to worsen over time, and can lead to permanent disability if not properly diagnosed and treated. Diagnosis can be challenging due to its similar symptoms to other neuropathies and lack of specific biomarkers. The text discusses a review of the potential for using magnetic resonance neurography (MRN), a specialized MRI technique, to improve the diagnosis of CIDP. Chronic inflammatory demyelinating polyradiculoneuropathy (CIDP) is an immune-mediated neurological condition that causes weakness and sensory abnormalities in the upper and lower extremities. The disease can result in

irreversible disability if not accurately diagnosed and treated. The review discusses the difficulty in diagnosing CIDP as it often lacks specific biomarkers and can be confused with other neuropathies.

In an attempt to improve diagnostic accuracy, the review investigates the role of magnetic resonance neurography (MRN), a type of MRI, and its quantitative parameters in diagnosing CIDP. These parameters include the nerve's diameter, cross-sectional area, volume, and signal measurements, amongst others. The systematic review and meta-analysis aim to assess these MRN parameters' diagnostic performance and identify those that could be further applied in clinical practice.

The review finds heterogeneity in the accuracy and reliability of different MRN parameters in diagnosing CIDP, underscoring the need for continued research in this area. The analysis also highlights that some parameters, such as fractional anisotropy (a measure of nerve fiber integrity) and cross-sectional area, show promising results for diagnostic accuracy. However, more research is needed to validate these findings and standardize the use of MRN in CIDP diagnosis.

METHODS

Search strategy: Pubmed ("polyradiculoneuropathy, chronic inflammatory demyelinating"[MeSH Terms] OR ("polyradiculoneuropathy"[All Fields] AND "chronic"[All Fields] AND "inflammatory"[All Fields] AND "demyelinating"[All Fields]) OR "chronic inflammatory demyelinating polyradiculoneuropathy"[All Fields] OR "cidp"[All Fields] OR ("polyradiculoneuropathy, chronic inflammatory demyelinating"[MeSH Terms] OR ("polyradiculoneuropathy"[All Fields] AND "chronic"[All Fields] AND "inflammatory"[All Fields] AND "demyelinating"[All Fields]) OR "chronic inflammatory demyelinating polyradiculoneuropathy"[All Fields] OR ("chronic"[All Fields] AND "inflammatory"[All Fields] AND

"demyelinating"[All Fields] AND "polyradiculoneuropathy"[All Fields])) AND ("magnetic resonance imaging"[MeSH Terms] OR ("magnetic"[All Fields] AND "resonance"[All Fields] AND "imaging"[All Fields]) OR "magnetic resonance imaging"[All Fields] OR "mri"[All Fields] OR ("magnetic resonance imaging"[MeSH Terms] OR ("magnetic"[All Fields] AND "resonance"[All Fields] AND "imaging"[All Fields]) OR "magnetic resonance imaging"[All Fields]) OR "DTI"[All Fields] OR ("musculoskelet regen"[Journal] OR "ment retard"[Journal] OR "magn reson gott"[Journal] OR "mr"[All Fields]))
Ovid MEDLINE and Embase
((CIDP or "Chronic inflammatory demyelinating polyradiculoneuropathy" or "Chronic inflammatory polyneuropathy" or "Chronic relapsing polyneuropathy") and (MRI or "magnetic resonance imaging" or DTI or "Diffusion Tensor Imaging" or MR or "magnetic resonance")).mp. [mp=ti, ab, hw, tn, ot, dm, mf, dv, kf, fx, dq, bt, nm, ox, px, rx, ui, sy, ux, mx]
ClinicalTrials.gov and Cochrane
CIDP OR (Chronic Inflammatory Demyelinating Polyneuropathy) AND (MRI or magnetic resonance imaging).

Participant or population: The population being studied are patients with Chronic inflammatory demyelinating polyradiculoneuropathy (CIDP), an immune-mediated acquired polyneuropathy presenting with proximal weakness in the upper and lower extremities, along with sensory abnormalities.

Intervention: The intervention being evaluated is the use of quantitative Magnetic Resonance Neurography (MRN) parameters in the diagnosis of CIDP. This includes parameters like diameter, cross-sectional area, volume, fractional anisotropy (FA), signal-to-noise ratio (SNR), contrast-to-noise ratio (CNR), contrast ratio (CR), and the contrast-enhancement ratio (CER).The population being studied are patients with Chronic inflammatory demyelinating polyradiculoneuropathy (CIDP), an immune-mediated acquired polyneuropathy presenting with proximal weakness in the upper and lower

extremities, along with sensory abnormalities.

Comparator: The comparison or control in the studies includes a healthy control group for measuring the diagnostic accuracy of the quantitative MRN.

Study designs to be included: The study designs being reviewed include cohort and cross-sectional studies, and the data are analyzed through a systematic review and meta-analysis following the PRISMA guidelines.

Eligibility criteria: The results with other parameters, namely, nT2w (T2w nerve/T2w muscle), T2 relaxation time and apparent diffusion coefficient (ADC) from four studies were excluded for their low sensitivity and unreliability.10, 11, 14, 21 The nerve site that yielded the largest AUC was recorded if the same parameter was used in several nerve sites (e.g. brachial plexus or lumbosacral plexus)

Information sources: The information sources came from PubMed, Ovid MEDLINE, Embase, Cochrane and ClinicalTrials.gov databases from September 1988 to March 1, 2023.

Main outcome(s): The primary outcomes of this meta-analysis were pooled sensitivity and specificity.

Data management: Data were extracted into a designed format containing (1) author, country and year of publication; (2) study design; (3) study population and participants; (4) MRI sequences and selected nerve sites; (5) cut-off value; (6) the number of CIDP patients with abnormal MRI and total CIDP patients; (7) true positive (TP), true negative (TN), false positive (FP), and false negative (FN) values.
We extracted the parameters containing diameter, CSA, volume, FA, SNR, CNR, CR, and CER as results of the included studies. The results with other parameters, namely, nT2w (T2w nerve/T2w muscle), T2 relaxation time and apparent diffusion coefficient (ADC) from four studies were

excluded for their low sensitivity and unreliability.[10, 11, 14, 21] The nerve site that yielded the largest AUC was recorded if the same parameter was used in several nerve sites (e.g. brachial plexus or lumbosacral plexus).

Quality assessment / Risk of bias analysis:
The quality of the included studies was assessed based on a 15-item modified Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2).[22] Two reviewers independently assessed each potentially eligible study. Four domains and 14 questions were assessed to evaluate risk bias from the diagnostic validity.

Strategy of data synthesis:
e meta-analyzed pairs of sensitivity and specificity using a bivariate random-effects model, which incorporated the correlation between sensitivity and specificity.

Subgroup analysis:
Subgroup analysis was performed into four groups: diameter, CSA, signal related parameters (CR, CNR, SNR) and FA. It showed the fractional anisotropy (FA) with the highest sensitivity of 0.85 (95% CI 0.77-0.90) and cross-sectional area (CSA) with the highest specificity of 0.95 (95% CI 0.85-0.99).

Sensitivity analysis:
Sensitivity analyses that removed studies with potential bias showed consistent results with the primary meta-analyses.

Language restriction:
English-language literature only.

Country(ies) involved:
China.

Keywords:
Chronic inflammatory demyelinating polyradiculoneuropathy· Magnetic resonance neurography · Diagnosis· Meta-analysis· Systematic review.

Dissemination plans:
We plan to publish this systematic review and meta-analysis in the British Journal of Radiology.

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