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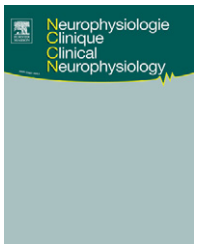

ORIGINAL ARTICLE

Correlation between functional and structural assessments of the optic nerve and retina in multiple sclerosis patients

Corrélation entre l'évaluation fonctionnelle et structurelle du nerf optique et de la rétine des patients atteints de sclérose en plaques

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KEYWORDS
Multiple sclerosis;
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OCT;
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Visual fields

Summary
Objective. — The aim of this study was to evaluate the correlation between functional eye examinations (visual evoked potentials: VEPs; pattern electroretinogram: PERG) and structural measurements of the optic nerve (optical coherence tomography: OCT; scanning laser polarimetry: GDx) in patients with multiple sclerosis (MS).
Methods. — Patients with definite MS and disease-free controls were enrolled in the study.
VEPs and PERG were recorded in all subjetcs. Ophthalmologic examination, including visual acuity, visual field determination, OCT and GDx were performed.
Results. — Nineteen MS patients and 19 age- and sex-matched controls were included in the study. Significant differences between both groups were observed with respect to VEP (P100 latency and amplitude), PERG (N95 amplitude and N95/P50 ratio) and OCT parameters (average, temporal and macular volume). There were a statistically significant correlation between VEP or PERG parameters and OCT or GDx results.
Conclusions. — In MS patients, axonal loss in ganglion cells can be detected with OCT and GDx. PERG is a useful complementary tool to identify this damage.

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MOTS CLÉS
Sclérose en plaques ;
Nerf optique ;
Potentiels évoqués visuels ;
Électrorétinogramme par inversion de damier ;
OCT ;
GDx ;
Champ visuel

Résumé
But de l'étude. — Évaluer la corrélation entre des épreuves fonctionnelles (électrorétinogramme par inversion de damier: ERGD; potentiels évoqués visuels par inversion de damier: PEVD) et structurelles (polarimétrie à balayage laser: GDx; tomographie en cohérence optique: OCT) chez des patients présentant une sclérose en plaques.
Patients et méthodes. — Des patients présentant une sclérose en plaques et des sujets sains appariés en âge et sexe ont été inclus dans l'étude. Les PEVD et ERGD ont été enregistrés chez tous les sujets. Un examen ophtalmologique a également été réalisé chez tous les sujets; il incluait: la mesure de l'acuité visuelle, la détermination du champ visuel, la polarimétrie à balayage laser (GDx) et la tomographie en cohérence optique (OCT).
Résultats. — Dix-neuf patients avec sclérose en plaques et 19 sujets contrôle ont été inclus dans l'étude. Des différences significatives entre les deux groupes ont été observées pour les PEVD (amplitude et latence de la composante P100), l'ERGP (amplitude de la composante N95 et rapport entre les amplitudes N95/P50) et les paramètres de l'OCT (moyenne, volume temporal et maculaire). Les paramètres PEVD ou ERGD étaient significativement corrélés aux résultats de l'OCT ou du GDx.
Conclusions. — Chez les patients ayant une sclérose en plaques, l'atteinte axonale des cellules ganglionnaires peut être détectée avec l'OCT et le GDx. L'ERGD est un examen complémentaire très utile pour identifier ces lésions.

Introduction

Visual evoked potentials (VEP) may be delayed in patients with Multiple Sclerosis (MS) [3,24,26,34]. The pattern electroretinogram (PERG) also displays early abnormalities in MS patients, mainly in the N95 component [10,11,13]. Although the exact PERG generators have yet to be fully elucidated, current evidence suggests that the N95 component of the PERG is a contrast-related component generated in relation to retinal ganglion cell function, while the P50 component is partly ganglion cell-derived, though with a contribution from structures distal to the ganglion cells in the visual pathways [14].

Since axonal damage is considered to give rise to progressive disability in MS [20], some authors have searched for a reliable tool to quantify it [17,19]. Ganglion cell axons, which are a part of the CNS, are commonly affected in MS, not only in eyes with a prior episode of optic neuritis, but also in eyes with no known prior episode [4,5,7,8,32]. Since this layer lacks myelin, structural evaluation of the retinal nerve fiber layer (RNFL) has been proposed as a useful biomarker of MS activity [15,28].

There is little available evidence concerning the existence of any correlations between morphological evaluations (using Optical coherence tomography (OCT) and/or Scanning laser polarimetry, GDx) and neurophysiological evaluations (VEPs or PERG) of the optic nerve [32,23]. The aim of this study was to evaluate not only the performance of VEPs, PERG, OCT and GDx in the same MS sample population, but also to determine if there is any correlation between these methods of functional and structural assessments of the optic nerve.

Methods

Patients

Nineteen patients with definite multiple sclerosis (MS group) and 19 sex- and age-matched controls were enrolled in the study. The mean ages of the MS patients were 42.9 years (range 38.4—47.3), and 47.0 years (range 42.6—51.3), respectively. The local ethics committee approved the research protocol, which adhered to the tenets of the Declaration of Helsinki. All participants provided written informed consent.

MS was diagnosed by standard clinical and neuroimaging criteria [27]. The following information was collected for each MS patient: disease duration, Expanded Disability Status Scale (EDSS) and presence of prior episodes of optic neuritis, as reported by the neurologist and/or the patient. Since most patients suffered from the relapsing-remitting MS phenotype, we focused our study on this group of patients. Although the study included patients with and without a prior episode of optic neuritis, patients with an optic neuritis attack less than six months prior to the study, as well as those with a visual acuity of 20/200 or less in both eyes were excluded from the study, as this would have been incompatible with some of the examinations. Healthy controls had no ophtalmological or neurological disease and a visual acuity of 20/30 or better.

All patients underwent neurologic assessment and complete ophthalmologic examination. Evaluation of the optic nerve was performed by means of functional and structural assessments and included VEPs and PERG, visual acuity determination (LogMAR), colour vision assessment (Ishihara pseudoisochromatic plates), visual field examination, OCT and GDx.

Visual evoked potentials

VEPs were recorded using a Neuronic sensewitness 4.0 (Neuronic Zaragoza, Spain) in a dark room and with full correction of refraction whenever required, in keeping with previous recommendations [2]. Every patient underwent 10 min of dark adaptation before the examination. Electrodes were applied to the scalp and positioned as follows: active electrode at Oz, reference at Fpz, and ground at Cz. The bioelectric signals were filtered (band—pass 1—100 Hz). The