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REVIEW

Vision and multiple sclerosis

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Abstract
Multiple sclerosis can affect vision in many ways, including optic neuritis, chronic optic neuropathy, retrochiasmal visual field defects, higher order cortical processing, double vision, nystagmus and also by related ocular conditions such as uveitis. There are also side effects from recently introduced multiple sclerosis treatments that can affect vision. This review will discuss all these aspects and how they come together to cause visual symptoms. It will then focus on practical aspects of how to recognise when there is a vision problem in a multiple sclerosis patient and on what treatments are available to improve vision.
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Abbreviations: EDSS, expanded disability status scale; EQ-5D, EuroQuol questionnaire; ETDRS, early treatment diabetic retinopathy study; MRI, magnetic resonance imaging; MS, multiple sclerosis; MSVQ-7, MS-specific vision questionnaire; NARCOMS, North American Research Committee on Multiple Sclerosis; NEI-VFQ 25, 25-Item National Eye Institute visual function questionnaire; NICE, National Institute of Health and Clinical Excellence; ONTT, Optic Neuritis Treatment Trial; OCT, optical coherence tomography; PML, progressive multifocal leucoencephalopathy; RNFL, retinal nerve fibre layer; UFOV, useful field of vision; UK, United Kingdom; VEP, visual evoked potentials

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1. Introduction

Multiple sclerosis (MS) is a common disease in countries of higher latitudes. Much is known about the nature of ongoing physical disability due to chronic MS, although the impact of the disease on patients' vision has been less studied. Vision is, however, rated by MS patients as their second most important bodily function after walking (Heesen et al., 2008). Also, patients with visual impairment for whatever reason have reduced health-related quality of life scores on every dimension of the EuroQol questionnaire (EQ-5D) than the general population and patients with other chronic conditions such as type II diabetes, coronary artery disease and hearing impairment (Langelaan et al., 2007). Visual symptoms are very common in MS. In a population-based study of morbidity of MS, in the month before assessment 33% of MS patients reported blurred vision and 26% reported diplopia (Swingler and Compston, 1992). In a survey of patients on the North American Research Committee on Multiple Sclerosis (NARCOMS) register, 66.5% reported some visual disability with 14% reporting moderate, severe or total visual disability (Salter et al., in press).

2. Causes of visual problems in multiple sclerosis

Vision in MS may be affected by a number of reasons, which are discussed below. These may occur in isolation, usually as a relapses, however, patients with chronic MS will often have a combination of problems, which can have an additive effect to impair vision.

2.1. Optic neuritis

Optic neuritis causes acute, usually unilateral, visual impairment. It is a very common early manifestation of MS. In one series, isolated optic neuritis was the first presenting attack of MS in 21% of cases (Confavreux and Vukusic, 2006) and in another series, 46% of MS patients had an attack of optic neuritis at some point during their disease course (Burman et al., 2011). The presentation and differential diagnosis of optic neuritis has been reviewed elsewhere (Hickman et al., 2002, 2008).

The long-term prognosis for vision following optic neuritis is generally good. The Optic Neuritis Treatment Trial (ONTT) followed up 294 of the original cohort of 454 patients for at least 15 years following their initial presentation with a first episode of acute optic neuritis. 72% of the originally affected eyes had a visual acuity of ≥20/20 and 66% of patients had ≥20/20 acuity in both eyes. Six patients (2%) had a visual acuity ≤20/40 in both eyes but only 3 (1%) had a visual acuity ≤20/200 in both eyes (Optic Neuritis Study Group, 2008). Poor visual outcome was usually related to having recurrent attacks of optic neuritis (The Optic Neuritis Study Group, 2004). Also, patients who went on to develop MS during the course of the study had poorer visual function on testing than those who had remained with isolated optic neuritis, but the differences were small.

Optic chiasmitis can occur in MS. The clinical features are similar to typical optic neuritis. In the days before magnetic resonance imaging (MRI) it was often mistaken for bilateral optic neuritis because the visual impairment affects both eyes. Typical bitemporal field defects may only be present early on in the presentation or during the convalescent phase (Hickman et al., 2008).

2.2. Chronic optic neuropathy

It has been known for a long time that the optic nerves are affected by MS, even in the absence of having episodes of optic neuritis: visual evoked potentials (VEP) show delay in the P100 response, suggestive of demyelination (Halliday et al., 1973); optic nerve atrophy has been demonstrated with MRI (Davies et al., 1998) and axonal loss in the retinal nerve fibre layer (RNFL) has been demonstrated on both ophthalmoscopy (Frisén and Hoyt, 1974) and with optical coherence tomography (OCT) (Henderson et al., 2008). However, progressive loss of vision to blindness due to chronic optic neuropathy, akin to progressive locomotor disability, is extremely unusual. The reasons for this are not known. There may be more in built redundancy within the optic nerves compared with the corticospinal tracts, to preserve usable vision despite significant axonal loss (Frisén and Quigley, 1984). Walking requires the integration of the motor, co-ordination and sensory systems therefore locomotor disability may result from the additive effect of damage in the different systems. Lastly, plasticity and cortical remodelling may occur more readily in the visual than in the locomotor system (Toosy et al., 2005).

There is a subset of MS patients though who develop profound visual loss. These are the MS patients who also carry the Leber's mutation, the so-called Harding's disease, after Anita Harding who first described the association

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