Clinical neuro-ophthalmology troubles encompasses a wide range of topics giving impairment of vision or hypo-vision. The commonest are optic nerve disorders and most of this presentation is devoted to optic nerve diseases and their investigation. Loss of optic nerve function in Optic Neuropathy (ON) is the results of a combination of loss of nerve fibres from wallerian axonal degeneration, conduction block from demyelination and "physiological block" in ischaemic fibres. Retinal Ganglion Cells (RGC) represent the final output neurons of the vertebrate retina as they collect information about the visual world sensed by receptors. In optic atrophy, a lethal insult (compression, ischaemia, inflammation, toxins, genetics defects) to the retinal ganglion cells or to the axons results in death of both structures. The hallmark of visual loss due to acquired ON disease is a central scotoma, because axons serving macular vision appear to be differentially sensitive to disease processes throughout the course of nerve. Exception to this principle are an altitudinal field defect, suggesting infarction of the retrolaminar portion of the optic nerve head, a centrocaecal scotoma suggesting heredofamilial or toxic damage to the fibres of the maculopapillary bundle, and a constricted field with preserved acuity suggesting either post-papilloedema optic atrophy or a retinal dystrophy. When there is acute loss of function with a normal optic nerve head on fundoscopy, the term retrobulbar optic neuropathy (RBON) is used. When visual loss is associated with disc swelling, the terms papillitis or papillopathy are often used. Optic atrophy may follow both variants after about 6 weeks. The most frequent ON is glaucoma, but in neurological field the most frequent and typical are inflammatory optic neuropathies, that include a wide range of immune related, granulomatous and infective disorders in addition to the common idiopathic form. Cases in which disc swelling is seen are referred to as papillitis; most frequently the disc is not swollen and the term retrobulbar neuritis (RBON) is used. Other form are ischaemic, heredo-familial and congenital, extrinsic optic nerve compression, tumor, toxic nutritional and traumatic ON. Clinical manifestation are visual loss, colour vision troubles, unilateral loss of visual field, pupillary afferent defect. Clinical ON assessment require visual acuity testing and psychophysiological test of vision (contrast sensitivity, colour vision, visual fields), fundoscopy and pupillary examination. Contemporary involve convergence of several specialized investigation: flash (F) and pattern (P) Visual Evoked Potentials (VEP) and F or P Electroretinography (ERG), Optical Coherence Tomography (OCT), Ultrasound, Doppler and Colour Doppler, neuroimaging (CT and MRI scans). They allow location of lesion sites (retina, optic nerve, chiasm or other segments of posterior visual pathways: optic tracts, lateral geniculate nucleus, visual radiations and visual association areas). Main aim of this lecture is the neurologists approach and its limitations to vision impairment in a wide range of optic nerve disorders. The physical basis of certain perceptual functions rely on the concept of parallel processing, helpful to an overview of the organization of the visual pathways.
The post-receptoral visual pathway of primates contains three major parallel streams: the achromatic or magnocellular; the chromatic red-green (R-G) or parvocellular; the chromatic blue-yellow (B-Y) or koniocellular (K) (Livingstone and Hubel, J. Neurosci., 1988). Moreover there are in the primate retina different cells selectively tuned to detect surprisingly subtle "features of the visual scene” including colour, size, direction and speed of motion. Among these trigger features, colour stimuli have recently received special attention (Porciatti and Sartucci, CLINPH., 1996 and 1999). Several recent work suggest that red-green (R-G) and blue-yellow (B-Y) equiluminant stimuli and achromatic luminance Yellow-Black (Y-Bk) stimuli emphasize the contribution of parvo-, konio- and magnocellular streams respectively to either Pattern Electroretinograms (PERGs) or Visual Evoked Potentials (VEPs) and proved to increase sensitivity of electrophysiological tests in ON ( Sartucci et al., 2001, 2003, 2005 and 2006).

Here we address the question of selective stimulation of visual pathway subsystem in patients with ON by investigating several of the main neurological conditions (e.g.: Multiple Sclerosis, Glaucoma Idiopathic Parkinson’s Disease and Multiple System Atrophy, etc.) and review these techniques applicable to certain abnormalities of visual perception.

The recorded stimulus-dependent response abnormalities suggest a differential retinal and post-retinal impairment, and moreover they can be usefully employed to detect and characterize selective visual subsystem involvement in some optic nerve disorders.

References


