Visual field defect diagnosis

During a visual field acuity test, also called a perimetry test, you will respond to a series of flashing lights while looking straight ahead. Your responses will help the doctor determine whether you have a visual field loss.

The area of vision loss gives clues as to where in the visual pathway a problem has occured. Vision begins with special receptors at the back of the eye in the retina. The image captured by each eye is sent to the brain by the optic nerves (Fig. 1). When the nerves reach the optic chiasm, they cross over each other. The nerve fibers from the inside half of each retina cross to the other side of the brain, while the nerve fibers from the outside half of the retina stay on the same side of the brain. At the end of the optic nerve, the optic radiations send the images to the occipital lobe at the back of the brain. The area where vision is interpreted is called the primary visual cortex.

Liang et al published a study to investigate the clinical applicability of Diffusion spectrum magnetic resonance imaging (DSI)) for quantitative detection of visual pathway abnormalities to predict the degree of visual field defects (VFD) in patients with pituitary neuroendocrine tumors.

Sixty-five patients with pituitary neuroendocrine tumors and 33 healthy controls underwent conventional MRI and DSI scanning that allowed high-angular-resolution fiber tracking. Optic chiasmal compression and VFD were confirmed in all patients via radiological and neuro-ophthalmological examinations. Quantitative assessments of chiasmal lift, VFD, and DSI parameters from the optic nerve, optic tract, and optic radiation were performed. Group comparisons and correlation analyses were conducted in patients and controls. Using the 5-fold cross-validation method, the support vector machine classifiers were constructed to predict the degree of visual defects.

The mean values of quantitative anisotropy and generalized fractional anisotropy in the optic nerve and optic tract showed significant differences between patients and controls ($p < 0.05$). These parameters were also significantly correlated with the chiasmal lift distance and degree of visual defects ($p < 0.05$). All patients were divided into mild ($n = 42$) and severe ($n = 23$) VFD groups, using the mean deviation value of -8 dB as the threshold. The classifiers achieved an accuracy of 0.83, a sensitivity of 0.78, and a specificity of 0.86 to discriminate against patients with mild and severe visual defects.

Using high-angular-resolution fiber tracking, DSI may provide quantitative information to detect visual pathway abnormalities and be a potential diagnostic tool for determining the degree of visual field defects in pituitary neuroendocrine tumors.

Key points: • Abnormal QA and GFA values of the optic nerve and optic tract in adenoma patients • Close relationship between DSI parameters and VFD degree in adenoma patients • The classifiers achieved an accuracy of 0.83, the sensitivity of 0.78, and specificity of 0.86 to discriminate patients with mild and severe VFD [1].

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Liang L, Lin H, Lin F, Yang J, Zhang H, Zeng L, Hu Y, Lan W, Zhong H, Zhang H, Luo S, Mo Y, Li W, Lei Y. Quantitative visual pathway abnormalities predict visual field defects in patients with pituitary neuroendocrine tumors: a diffusion spectrum imaging study. Eur Radiol. 2021 Apr 24. doi: 10.1007/s00330-021-07878-x. Epub ahead of print. PMID: 33893857.