Abstract

Purpose: To study the fundus autofluorescence findings in patients with ocular toxoplasmosis at various stages of healing, and also to find out its role in monitoring the inflammation.

Methods: It was a prospective observational case series study involving 21 eyes of 19 patients with ocular toxoplasmosis. Out of the 21 eyes eleven eyes had reactivation of previous toxoplasma retinochoroiditis scar, four eyes had primary retinochoroiditis lesion, two eyes had Toxoplasma neuroretinitis and four eyes had healed retinochoroiditis scar. All patients had undergone standard ophthalmological examination and autofluorescence imaging. Findings observed at presentation and during follow up visits were described.

Results: Eight males and eleven females were included in the study with a mean age of 23yrs. The mean log MAR Visual acuity on presentation was 0.8. All the active lesions were observed as poorly defined area of hyperautofluorescence corresponding to the active retinochoroiditis lesion in fundus imaging (Amorphous pattern). As the lesion healed a well demarcated rim shaped area of hypoautofluorescence was observed surrounding the central hyperautofluorescence by 2-4 weeks (Ring pattern). The hypoautofluorescence was found to be progressing in centripetal fashion, until complete disappearance of the central hyperautofluorescence between six to 20 weeks (Atrophic pattern).

Conclusion: A well defined sequence of changes on fundus autofluorescence was identified in patients with ocular toxoplasmosis at various stages of healing. Findings of the current study suggest that Fundus autofluorescence may be a helpful tool for monitoring the inflammatory process associated with ocular toxoplasmosis.

Introduction

Toxoplasma gondii infection has worldwide distribution, and toxoplasmic retinochoroiditis is the most common form of posterior uveitis in otherwise healthy individuals. Classically, toxoplasmic retinochoroiditis appears as a focus of inner retinitis adjacent to an old chorioretinal scar, and is accompanied by vitritis. During the healing process, the acute lesions resolve, leaving a chorioretinal scar with well-defined hyperpigmented borders and central chorioretinal atrophy. The current study investigates Fundus Autofluorescence (FAF) findings during acute disease and over a 24-week period of follow-up in patients with various clinical forms of active ocular toxoplasmosis.

Patients and methods

A prospective observational case series including patients with biomicroscopic evidence of active ocular toxoplasmosis was designed to evaluate the Fundus Autofluorescence findings during acute disease and their changes over a 24-week period of follow-up. 21 eyes of 19 patients with clinical/serological diagnosis of ocular toxoplasmosis were included in the study. Out of the 21 eyes eleven eyes had reactivation of previous Toxoplasma retinochoroiditis scar, four eyes had primary retinochoroiditis lesion, two eyes had Toxoplasma neuroretinitis and four eyes had healed retinochoroiditis scar. All patients evaluated at the Retina and Uveitis Section of the Department of Ophthalmology, with a diagnosis of active ocular toxoplasmosis between January 2013 and March 2013 were included in the study. The diagnosis was based on the clinical findings, the presence of an active white focal retinal lesion, with or without associated hyperpigmented chorioretinal scars, and confirmed by laboratory studies. All patients had undergone standard ophthalmological examination, fundus imaging and autofluorescence imaging on presentation and during follow up visits. Images were captured with the Carl Zeiss
FF450 fundus camera with Visupac 4.4. The Carl Zeiss used an exciter filter of 510–580 nm and a barrier filter of 650–735 nm. Lab investigations done in all patients included routine hemogram, Mantoux test and Toxoplasma IgG and IgM antibodies. All patients were treated with combination of sulfamethoxazole (800 mg) and trimethoprim (160 mg) orally twice daily for 6 weeks and Azithromycin 500 mg loading dose followed by 250 mg once daily for one month. All patients received prednisolone orally in tapering doses. In cases of Sulpha allergy, treated with Clindamycin 300 mg four times a day for 6 weeks. Patients were reviewed every 2 weeks for two months then every month.

Eight males and eleven females were included in the study. Age group ranged between 12 years to 45 years with a mean age of 23yrs. Out of the nineteen patients two patients had bilateral presentation. The mean log MAR Visual acuity on presentation was 0.8. Four patients had a primary retinochoroiditis patch, of which two patients had macular involvement with initial vision of less than 1[log MAR]. Other two patients had active retinochoroiditis patches involving the superotemporal quadrant. Eleven patients had reactivation of a previous retinochoroiditis scar of which nine were involving the macula. Two patients presented with neuroretinitis with juxtapapillary choroiditis lesion. Two patients had bilateral involvement, with one eye macular scar and other eye reactivation of previous scar. IgG was positive in nine out of twenty patients and IgM was positive only in one patient with a previous scar reactivation. Seventeen patients were treated with Bactrim DS and Azithromycin along with steroids. Two of them had sulphamethoxazole and were treated with Clindamycin. The mean follow up was 20 weeks.

Three patterns of Fundus autofluorescence patterns were observed.

In a primary active retinochoroiditis lesion, on presentation a poorly defined area of amorphous hyperautofluorescence corresponding to the area of clinically observed lesion was observed (Amorphous pattern). As the lesions healed on follow up between two and seven weeks (median 4 weeks), there was an obvious decrease in the area of amorphous fluorescence encompassing the active retinochoroiditis lesion, and a well defined rim shaped area of hypoautofluorescence observed around the central hyperautofluorescence (Ring pattern). Between 4 and 21 weeks (median 10 weeks) the rim shaped hypoautofluorescence area was found to be progressing in a centripetal fashion until complete disappearance of the adjacent central hyperautofluorescent region (Atrophic pattern) was noted between 14 and 20 weeks (median 16 weeks). (Fig:1) In a healed Toxoplasma retinochoroiditis a well defined area of hypoautofluorescence was noted corresponding to the fundus lesion. (Fig 2) In cases of reactivation of previous scar a well defined hypoautofluorescence corresponding to the scar and a poorly defined area of hyperautofluorescence at one edge was noted in the site of reactivation, which became hypoautofluorescent as it healed. (Fig:3) Foveal hypo autofluorescence was associated with decreased visual acuity in 2 eyes.

**Discussion**

Fundus autofluorescence (FAF) imaging is a noninvasive imaging method which provides additional information not obtainable with other imaging techniques, or ordinary fundus examination. Fundus autofluorescence imaging is an in vivo imaging method for metabolic mapping of naturally or pathologically occurring fluorophores of the ocular fundus. The dominant sources are fluorophores such as A2–E in lipofuscin granules that accumulate in the post mitotic retinal pigment epithelium as a by-product of the incomplete degradation of photoreceptor outer segments. Additional in-trinsic fluorophores may occur with disease in the various retinal layers or the subneurosensory space. Minor fluorophores such as collagen and elastin in choroidal blood vessel walls may become visible in the absence or atrophy of RPE cells. Bleaching phenomena and loss of photopigment may result in increased FAF by reduced absorbance of the excitation light. Finally, pathological alterations in the inner retina at the central macula where the FAF signal is usually partially masked by luteal pigment (lutein and zeaxanthin) may result in manifest variations in FAF intensities.

Recording of FAF is relatively easily accomplished, requires little time and is non-invasive. FAF signals are emitted across a broad spectrum ranging from 500 to 800 nm. With the confocal scanning laser ophthalmoscope, excitation is usually induced in the blue range (lambda=488 nm), and an emission filter between 500 and 700 nm is used to detect emission of the autofluorescence signal. Excitation when using the fundus camera is usually done in the green spectrum (535 to 580 nm) and emission is recorded in the yellow-orange spectrum (615 to 715 nm). Because of the difference in excitation and emission spectra, in addition to technical differences between the cSLO and the fundus camera, theoretical considerations would imply that the composition of the detected autofluorescent signal may vary between the systems.
The amount of Autofluorescence is determined by the amount of fluorophores, which varies during the acute and resolution phases of inflammation. Hypertrophy and reactive hyperplasia of retinal pigment epithelium (RPE) is associated with increase in AF (hyper autofluorescence), due to accumulation of fluorophores. Combination of hyperautofluorescence with hypoautofluorescence pattern was seen in healing retinochoroiditis. Healed lesions appeared as hypoautofluorescence because of RPE atrophy in a retinochoroiditis scar.

Combination of hyperautofluorescence at one edge of a hypoautofluorescent scar was suggestive of reactivation of a Retinochoroiditis scar. Foveal hypo autofluorescence was associated with decreased visual acuity in two eyes.

**Conclusion**

A well defined sequence of changes on fundus autofluorescence was identified in patients with ocular toxoplasmosis at various stages of healing. Fundus autofluorescence can be used as an additional investigational tool in the diagnosis and management of Ocular Toxoplasmosis. Fundus autofluorescence in eyes with Retinochoroiditis reflects the changes in the outer retinal layers corresponding with the activity of the disease.

**References**