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A SYSTEMATIC STUDY TO CORRELATE FUNDUS AUTOFLUORESCENCE PATTERNS AND VISUAL ACUITY IN CASES OF DRY AGE RELATED MACULAR DEGENERATION

Dr Archana Singh	MS, Armed Forces Medical College, Pune
Dr Sandeep Shankar*	MS,Professor, Armed Forces Medical College, Pune *Corresponding Author
Dr MA Khan	MS, Professor Command Hospital (AF), Bangalore
Dr Harikrishnan V	MS, Armed Forces Medical College, Pune
Dr Sunandan Bhatta	MS, Armed Forces Medical College, Pune

ABSTRACT

Background: Dry ARMD is an ageing change affecting the central retina. FAF patterns in ARMD are extensively studied; however, their prognostic implications are still in nascent stage.

Objective: This study attempts towards correlation between FAF patterns and visual acuity in cases of dry ARMD in order to provide an objective clinical prognostic marker.

Method: A total of 110 eyes of 60 patients were subjected to FAF. Specific FAF patterns were noted for each case and compared with the International FAF classification. These patterns were statistically correlated with the visual acuity of the cases.

Result: The 110 eyes were divided into two groups, first group of early ARMD (108 eyes) and the second group of geographic atrophy (02 eyes). First group showed seven FAF patterns. The second group showed focal pattern. Two patterns (Normal & minimal) were associated with better visual acuity.

Conclusion: FAF patterns in of dry ARMD showed similarity to the internationally accepted classification with a few variations. However, when these patterns were correlated with the visual acuity, no significant visual impairment was observed in normal and minimal FAF patterns.

KEYWORDS : Dry Age related macular degeneration, fundus Autofluorescence, geographic atrophy

INTRODUCTION

Dry ARMD is a leading cause of irreversible blindness in the elderly population in developed countries. Dry ARMD is a slowly progressive disease unlike wet ARMD which causes sudden onset profound vision loss. Although definitive treatments are available for wet ARMD, there are only a few established management options for dry ARMD and these are, more preventive than curative in nature. The prevalence of early and late ARMD in India is noted to be similar to that in western countries.

Dry ARMD is characterized by accumulation of lipofuscin and N-retinyledene-N retinylethanolamine in the sub RPE region in the early stages which progressively results in degeneration of RPE, photoreceptors, Bruch's membrane and choriocapillaris and results in geographic atrophy. Dry ARMD is a clinically diagnosed disease which, can be established by investigations like colour fundus photography, fundus autofluorescence (FAF) and optical coherence tomography (OCT).

FAF imaging uses the fluorescent property of lipofuscin to not only view the RPE morphology but also to assess the areas of atrophy and RPE dysfunction. FAF images can be obtained by confocal scanning laser ophthalmoscopy (cSLO) or by modified fundus camera (mFC) which uses a filter developed by Spaide et al. Although cSLO is a better modality for FAF due to its enhanced signal to noise ratio, mFC is a cheaper and easily available noninvasive option for assessing the same.

Using the international FAF classification system defined by the FAM-study group (Fundus autofluorescence in Age related macular degeneration), Frankfurt, Germany, a total of eight different patterns were noticed in eyes with clinically diagnosed dry ARMD based upon the presence of drusen or pigment changes at the macula. Apart from normal FAF, these were classified as minimal change, focal increased, patchy, linear, lacelike, reticular and speckled patterns. Although, studies have been done to define variations in these FAF patterns in different populations, the prognostic implication of these patterns based on the visual acuity are yet to be interpreted in detail.

This study is designed in an attempt, to correlate these FAF patterns with their respective visual acuity, in cases of ARMD, to generate clues with prognostic implications in such patients.

METHODS

The study selected cases of dry ARMD based upon the presence of drusen & pigment alterations in the centre of the macula from amongst the patients attending the vitreoretinal clinic in a tertiary care hospital. Best corrected visual acuity (BCVA) was recorded at 6m using Snellen's chart. Subsequently, the patient's pupil was dilated with 1% tropicamide drops. The type of ARMD based upon the age – related eye disease study (AREDS) classification was recorded in each case. These cases were divided into two groups; the first group included early and intermediate drusen with or without pigment alterations at the macula. The second group included cases with central geographic atrophy. Color fundus photographs of all cases were captured using the Zeiss fundus camera and then, each eye was also subjected to FAF with the fundus camera using an excitatory filter of 488nm developed by Spaide et al. The images were evaluated, classified and archived into the two groups: early and intermediate ARMD group & central geographic atrophy group as described earlier. The FAF patterns of every eye was photographically compared with the international classification of FAF patterns in early dry ARMD defined by the FAM group. The classification system of Holz et al (10) was used to classify the FAF pattern of the central geographic atrophy group. The assigned patterns of individual cases were then correlated with their respective visual acuity and a statistical comparison performed between these variables.

RESULTS

A total of 120 eyes of 60 patients were considered in the study. Patients' age ranged between 55-80 years with 53% patients in the 60-70 years age group. 10 eyes were excluded from the study. Causes of exclusion were wet ARMD in 02 eyes, dense cataract in 07 cases and 01 eye was found to be phthisical. Of 110 eyes, 96 (87.2%) had hard drusen (>63µm), 10 (0.9%) had soft confluent drusen (>123µm), 02 eyes had pigment alterations associated with small drusen (<63µm) and 02 eyes manifested with central geographic atrophy. FAF images in 108 eyes with early and intermediate ARMD were classified based on the work

of Bindewald et al. as defined by the FAM group. Seven patterns (normal, minimal, focal, patchy, linear, reticular, speckled) were similar to the published classification; however lacelike pattern was not found in our study (Table 1 & Fig 2)

Normal FAF: It is characterized by presence of background fluorescence and gradual decrease towards the foveola. It was found in 21 eyes with mean vision of 0.33 LogMAR.

Minimal change FAF: It shows limited increase or decrease in background FAF. This was found in highest number of eyes (47) with a mean visual acuity of 0.38 LogMAR.

Focal increased pattern: It is characterized by at least one spot (<200μm in diameter) of markedly increased FAF. It was seen in 19 eyes with a mean visual acuity of 0.45 LogMAR.

Patchy pattern: Shows presence of at least one large area (>200μm) of markedly increased FAF. These areas may or may not correspond to large, soft drusen and area of depigmentation. It was seen in 12 eyes with a mean visual acuity of 0.37 Log MAR.

Linear pattern: Is defined by the presence of at least one linear area of increased FAF, this linear area usually corresponds to hyper pigmented lines on fundus photographs. This was evident only in 05 eyes with a mean visual acuity of 0.46 LogMAR.

Reticular pattern: Defined by multiple small areas (<200μm) of decreased FAF. These could be present in or out of foveolar region. These areas correspond to visible drusen in fundus photography. This was seen only in 02 eyes with mean visual acuity of 0.35 LogMAR.

Speckled pattern: Is characterized by presence of variety of FAF abnormalities in a large area. In our study this pattern was evident in 02 eyes only with a mean visual acuity of 0.35 LogMAR.

FAF pattern of geographic atrophy were classified based upon holz et al study.(10) only 02 eyes in the study showed central geographic atrophy and FAF pattern in them was focal type:

Focal pattern of geographic atrophy: 02 eyes in the study showed geographic atrophy and FAF showed focal pattern with mean visual acuity of 1.05 LogMAR.

On correlation of these patterns with the mean visual acuity it was noted that both normal and minimal FAF patterns were affecting visual acuity equally and were associated with good visual acuity. Patchy and focal patterns also illustrated good visual acuity; however in view of low sample size the correlation was not statistically significant. Visual acuity in focal pattern of geographic atrophy was low which remains consistent with the clinical diagnosis of geographic atrophy. Comparison between the various patterns suggested that significant difference existed between geographic atrophy and all other group, which is suggestive of the fact that progression of the disease results in deterioration of visual acuity. None of the patterns in first group showed significant difference in visual acuity; however normal and minimal pattern showed similar visual acuity.(Fig 1)

		Age			Vision		
		n	Mean	SD	n	Mean	SD
Group 1	None	21	67.10	7.59	21	0.33	0.26
Group 2	Minimal	47	67.11	7.11	47	0.38	0.18
Group 3	Patchy	12	62.17	6.28	12	0.37	0.33
Group 4	Reticular	2	78.00	0.00	2	0.35	0.21
Group 5	Focal	19	71.00	7.10	19	0.45	0.30
Group 6	Speckled	2	66.00	0.00	2	0.10	0.14
Group 7	Linear	5	62.60	9.74	5	0.46	0.15
Group 8	Fovealatrophy	2	81	0	2	1.05	0.35

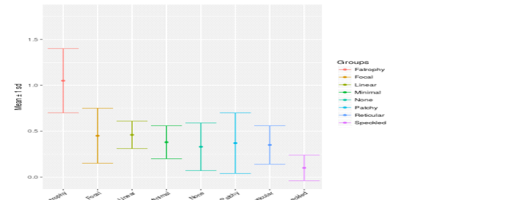**Table 1 – Correlation of FAF patterns with visual acuity**

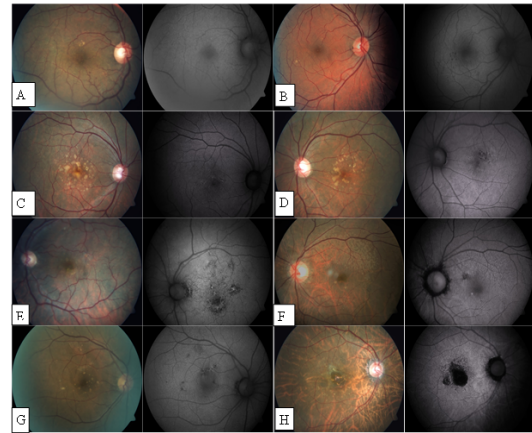**Fig 1- Correlation of visual acuity with FAF patterns**

Fig 2- Pattern of FAF in Dry ARMD A: Normal, B: Minimal, C: Focal increased, D: Patchy, E: Speckled, F: Reticular, G: Linear, H: Focal geographic atrophy

DISCUSSION
ARMD is one of the causes for irreversible blindness in the Indian population, with a prevalence of late ARMD of 1.2% seen in the age group of 60-79 years and 2.5% in the above 80 years age group . The clinical diagnosis of dry ARMD is made by 90 D biomicroscopy and indirect ophthalmoscopy and is based upon the presence of hard or soft drusen with or without pigment changes at the macula. SD-OCT, FFA and FAF by the modified fundus camera or the confocal scanning laser are established investigative modalities for the confirmation of ARMD.

In a study by Bindewald et al, patterns of FAF in 100 eyes with early AMD were classified into 8 patterns. Speckled was the most common pattern noted in 26% of cases in their study. In our study 110 eyes of clinically diagnosed dry ARMD were included out of which 108 eyes were classified in group 1(early and intermediate ARMD) cases and 02 eyes were classified in group 2 (central geographic atrophy). Detailed assessment of the eyes of group 1 showed 07 patterns of FAF which were similar to that elucidated by Bindewald et al. However, the lacelike pattern was not seen in our study. In our study, the most common pattern was seen to be of minimal FAF change unlike the study by Bindewald et al. A study of the Indian scenario by Pradeep et al corroborated 06 of the 08 FAF patterns of the Bindewald et al study. Lacelike and speckled patterns were also not seen in their study. This difference in the findings suggests that there exists a morphological difference in the FAF pattern when compared to the existing classification. Our study suggested that minimal change in FAF is the most common variant and this pattern doesn't affect the visual acuity to a significant extent. FAF pattern with normal autofluorescence is also a common pattern observed in the study with no significant effect on the vision. Another finding that was noted in our study was that, the patchy and reticular patterns also showed less impairment of visual acuity but since the sample size of these patterns were small, the observation is not considered statistically significant. The worst effect on the visual acuity was noted in the cases of central geographic atrophy (group 2), which is in accordance with the well-known fact that the total loss of photoreceptors, RPE and Bruch's membrane in these cases causes significant and irreversible loss of vision. Correlation between visual acuity and the various patterns suggested no significant difference except in cases of geographic atrophy, which suggests that, the FAF patterns may not provide a reliable guideline regarding the progression of the disease. However this study was a cross sectional study and a follow up study would be required to assess the progression of the disease based upon the FAF pattern.

The classification of FAF patterns in the evaluation of dry ARMD using the phenomenon of autofluorescence is a recent development. FAF patterns may be based upon genetic or environmental factors(11). Correlation of these patterns with the stages of the disease and their clinical significance is something that needs to be studied in the future. To our best knowledge the correlation of these FAF patterns with visual acuity has not done been attempted in any other study. Our study could recruit only small sample sizes for specific FAF patterns like patchy, reticular and speckled; hence the correlation with visual acuity was not statistically significant in these subsets. Another limitation of our study was that, it was designed as a cross sectional study and thus lacked the level of evidence that could be achieved with a follow up study. However this study has certainly succeeded in its aim of forging a novel paradigm in the objective assessment of cases of clinically diagnosed dry ARMD and heralding a new era in the quest for new modalities to assist in the prognostication of this disease.

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