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A Comparative Study of Age Related Macular Degeneration In Relation To SD-OCTand Fundus Photography.

Dr. (Mrs) M.Borooah[1],Dr.Deepanjan Ghosh[1] ,Dr.Kundan Singh[1]
[1](Department of Ophthalmology,Assam Medical College,Dibrugarh,India)

Abstract:Purpose: *To compare the combined diagnostic value of SD-OCT & fundus photography and SD-OCT alone in the detection of Age related Maculae Degeneration*
Setting: *Assam Medical College &Hospital,Dibrugarh.*
Study design: *Comparative, non-randomized study.*
Patients and Methods:*Total 120 eyes of 67 patients were examined. 76 eyes have been confirmed as cases after final results of all the investigations. 44 eyes without AMD were taken as controls and subjected to Fundus photography (First Color fundus photography and then Autofluorescence imaging) ,FFA (although it was not a part of our study but we have taken it as gold standard to validate the findings of fundus photography and SDOCT) and SD-OCT imaging.*
Results: *The combined result of fundus photography and SDOCT was prepared. Although CFP and FAF images are taken as gold standard for drusen measurement and diagnosis of GA, but they missed 4 cases of drusen in our study and gave one false positive result in DRY AMD. The results of SDOCT were better than fundus photography for neovascular AMD but for qualitative assessment of RPE, results of FAF was better than both CFP and SDOCT.*
Conclusion:*SD-OCT is a better diagnostic tool than Fundus Photography in the detection of ARMD*
Key words*: Fundus Photography,SD-OCT,ARMD,Fundus Fluorescein Angiography,Autofluorescence*.

I. Introduction

Age-related macular degeneration (AMD) is a chronic eye disease which causes blurred central vision, difficulty in reading, colour and contrast disturbances and metamorphopsia, which can be acute or insidious in onset, leading to severe vision loss in one or both eyes. However the peripheral vision is not affected, so total blindness does not occur. Age-related macular degeneration (AMD) is the leading cause of visual impairment in the elderly and the most common cause of registered blindness in the developed world. With time there is tendency to increase in the prevalence of AMD due to increasing proportion of population of elderly people due to rapid aging of the population in many developed and developing countries. It is estimated that approximately 30% of adults older than 75 years have some sign of AMD and approximately 10% develop advanced stages of the disease. Presently, evaluation of colour fundus photographs (CFPs) represents the gold standard for drusen measurement in nonneovascular AMD. Total drusen area and maximum drusen size are estimated by visual inspection of drusen in CFPs, with comparison to a set of standardized circles (circles made on transparent plastic were used previously but now caliper is available in the instrument).However, it can be challenging to reliably localize drusen against the varying background of the pigments of the macula, retinal pigment epithelium (RPE), and choroid. SD-OCT can serve in a better way in this regard hence both SD-OCT & CFP are required.

II. Materials & Methods.

2.1Aims & Objectives:

The aims of the study were:

1. To compare diagnostic utility of fundus photography (with Zeiss VISUCAM-500 fundus camera) and SD-OCT imaging in AMD.
2. To compare the combined diagnostic value of SD-OCT & fundus photography and SD-OCT alone.

2.2 Source Of Data:

Patient attending Outpatient Department and Retina Clinic of Department of Ophthalmology in Assam Medical College & Hospital, having clinically suspected or, diagnosed age related macular degeneration. Controls were also taken from Retina Clinic. Control eyes were required to show no signs for AMD, but other chorioretinal diseases including CNV secondary to any other disease but AMD were allowed.

2.3 Method Of Collection Of Data:

Total 120 eyes of 67 patients were examined. 76 eyes have been confirmed as cases after final results of all the investigations. 44 eyes without AMD were taken as controls.The cases were taken for CFP, AF & SD-OCT & determined at the level of clinical examination. Number, site, shape and size of the lesion was documented for each eye separately in each of the procedure.Patients were subjected to the following procedures-

1. Fundus photography (First Color fundus photography and then Autofluorescence imaging)
2. FFA (although it is not the part of our study but we have taken it as gold standard to validate the findings of fundus photography and SDOCT.)
3. SD-OCT imaging

2.4 Inclusion Criteria:

1. Age group > 50 years.
2. Minimum vision ≥ Perception of light.
3. Clinical fundus examination is suggestive of AMD (i.e. Drusen, RPE pigment alteration, grey green subretinal lesion with subretinal fluid, sub-RPE hemorrhage and cystic retinal changes.)
4. FFA showing evidence of AMD.

2.5Exclusion Criteria :

1. Minimum vision ≤ Perception of light.
2. Significant media opacity leading to inappropriate image quality on fundus photograph and OCT.
3. Patients with high refractive error.
4. Moderate to severe diabetic retinopathy causing significant interference in clinical, or SD- OCT findings.
5. Patient already undergone vitreoretinal surgery or laser photocoagulation.
6. No obvious fundus abnormality suggestive of AMD seen on examination.

2.6 Statistical Analysis:

For each parameter to be evaluated, the following imaging modalities were defined as the gold standard: for presence of AMD, FP was used as the gold standard. For the presence of CNV, FA was defined as the gold standard. Sensitivity and specificity values for each imaging modality were calculated against the gold standard.

$$\text{Sensitivity} = \frac{TP}{TP + FN} \times 100$$

$$\text{Specificity} = \frac{TN}{TN + FP} \times 100$$

$$\text{Positive Predictive Value (PPV)} = \frac{TP}{TP+FP} \times 100$$

$$\text{Negative Predictive Value (NPV)} = \frac{TN}{TN + FN} \times 100$$

TP : True Positive; TN : True Negative; FP : False Positive; FN : False Negative

III. Results And Observations.

Table3.1: Cases Diagnosed On CFP&AF (Gold Standard For Dry AMD)

TYPE		NO. OF EYES	%
DRY AMD	Drusens	36	50.00
	GA	3	4.17
WET AMD	Active	9	12.50
	Inactive	24	33.33
TOTAL		72	100.00

Table 3.2: Cases Diagnosed In Clinical Examination CFP, FAF AndFFA

TYPE		NO. OF EYES	%
DRY AMD	Drusens	32	42.11
	GA	3	3.95
WET AMD	Active	29	38.16
	Inactive	12	15.79
TOTAL		76	100.00

Table 3.3: Cases Diagnosed On SDOCT

TYPE		NO. OF EYES	%
DRY AMD	Drusens	26	36.11
	GA	3	4.17
WET AMD	Active	29	40.28
	Inactive	14	19.44
TOTAL		72	100.00

Table 3.4: Combined Results OfFP And SDOCT

	CFP	AF	Net result of CFP +FAF	SDOCT	Combined Results
Drusen	37	36	36	26	29
GA	2	3	3	3	3
Active CNV	9	9	9	29	29
Inactive CNV	24	24	24	15	15
<10 Small Drusens	21	21	21	18	18

Table 3.5: Cases Diagnosed In FFA (Gold Standard ForCNV Activity)

TYPE		NO. OF EYES	%
DRY AMD		32	43.84
WET AMD	Classic	32	43.84
	Occult	9	12.33
TOTAL		73	100.00

Table 3.6 Statistical Table Of Testing Results Of Fundus Photography For All Types Of AMD

TEST RESULT	DISEASE	
	PRESENT	ABSENT
Positive	TP-68	FP-4
Negative	FN-6	TN-42

Sensitivity=91.89%
Specificity=91.66%
Positive Predictive Value (PPV)=94.44%
Accuracy=91.66%

Table 3.7Statistical Table Of Testing Results Of SDOCT For Drusens And Geographic Atrophy In AMD

TEST RESULT	DISEASE	
	PRESENT	ABSENT
Positive	TP-37	FP-0
Negative	FN-6	TN-77

Sensitivity=86.04%
Specificity=100%
Positive Predictive Value (PPV)=100%
Accuracy=95.83%

Table 3.8Results Of Fundus Photography In AMD

	SENSITIVITY (%)	SPECIFICITY (%)	POSITIVE PREDICTIVE VALUE(%)	ACCURACY (%)
DRUSEN AND GA	90.47	98.68	97.05	95.83
WET AMD	75.00	98.68	97.05	90.00
CNV ACTIVITY	31.01	95.60	69.23	80.00
OVERALL	91.89	91.66	94.44	91.66

Table 3.9Results OfSDOCT In AMD

	SENSITIVITY (%)	SPECIFICITY (%)	POSITIVE PREDICTIVE VALUE (%)	ACCURACY (%)
DRUSEN AND GA	86.04	100.00	100.00	95.83
WET AMD	97.61	94.87	91.11	95.83
CNV ACTIVITY	87.04	97.75	93.10	95.00
OVERALL	91.89	91.66	94.44	91.66

IV. Discussion

Prevalence of AMD is continuously increasing in the world and also in India due to rapid increase in the proportion of elderly.In developed countries it has become most common cause of blindness.Although there is no complete treatment for the disease but early intervention in the form of lifestyle modification, controlling dyslipidaemia, PDT, intravitreal injection of anti-VEGF can be promising for the patient in preventing significant visual loss.Multiple investigative modalities are available for diagnosis of AMD but now a day SDOCT is increasingly used in clinical trials as well as in clinical practice for the diagnosis and follow up of patients with neovascular AMD undergoing anti-VEGF therapy . The presence of characteristic features of AMD on FP such as drusen and RPE changes were missed on SDOCT in 10.3% (6 out of 58 eyes with drusen and RPE changes) of cases in our study. This may be explained by the SDOCT volume scan settings used, as the gap between two parallel OCT B-scans was approximately 120 µm On the other hand, AMD was diagnosed on SDOCT based on the presence of intermediate drusen in 13.7% (4 out of 29 eyes) of dry AMD cases that were

graded as control cases on FP. FA is commonly used as the gold standard for evaluating CNV lesions. Based on FA, CNV lesions components are categorized as classic or occult CNV leakage or staining scar tissue that may develop over time and indicate longstanding disease with poor visual function .SDOCT appeared to be highly sensitive and specific in detecting CNV in our study. Do et al. reported a sensitivity of only 40% for the detection of new-onset CNV on time-domain OCT .The low sensitivity may be explained by the use of time-domain OCT, as pathological features may be overlooked more easily compared to SDOCT due to the less dense scan pattern, lower image resolution, and higher rate of movement artefacts.

Agreement between SDOCT and FA regarding the activity of CNV lesions in our study was seen in 78% (25 cases) of all 31 cases diagnosed with active CNV on FA.Fourteen eyes demonstrated CNV leakage on FA in the absence of intra or subretinal fluid on SDOCT, and 11 eyes showed signs for CNV activity on SDOCT without evidence of CNV leakage on FA. Khurana et al. reported a sensitivity of 90% and specificity of 47% for SDOCT to detect CNV activity seen on FA.

V. Conclusion

The following conclusions can be drawn from the results of the present study:-

1. Despite some discrepancies in the diagnosis of different types of AMD, overall results of SDOCT are excellent.
2. CFP when combined with FAF gives more accurate results.
3. FAF imaging is best tool for evaluation RPE status among all imaging technics.
4. SDOCT is highly sensitive and specific for the detection of different types of AMD.
5. CFP and FAF combined with SDOCT results were better than SDOCT alone.
6. For over all diagnosis of CNV, SDOCT is equally sensitive to FFA but less sensitive for CNV activity.
7. SDOCT is highly sensitive and specific for detection of CNV activity but cannot be considered to replace FFA.

References

[1]. Klen R, Klin BEK, Davis MD. The Epidemiology of Age Related Degeneration. AMJ Ophthalmol 2004.
[2]. Bressler NM. Age-related macular degeneration is the leading cause of blindness. JAMA. 2004; 291: 1900–1901
[3]. Hutchinson J, Tay W. Symmetrical central choroid-retinal disease occurring in senile persons. R Lond Ophthalmic Hosp Rep J Ophthalmic Med Surg 1874; 8: 231-44
[4]. Haab O. Etkrankungen der Macula Lutea, CentralbatAugenheilkd 1885; 9: 384-391. Duke Elder S. System of ophthalmology, Vol.9.London: kimpton; (1966)
[5]. Catherine B.Smith, R.Theodore Smith- Autofluorescence of basal laminar drusen. Retina.2007 October; 27(8): 1101-1106.
[6]. Gass J, Jallow S, Davis B. Adult vitelliform macular detachment occurring in patients with basal laminar drusen Am J Ophthalmol 1985. 99(4): 445-459.
[7]. KhuranaRN, Dupas B, Bressler NM. Agreement of time-domain and spectral-domain optical coherence tomography with fluorescein leakage from choroidal neovascularization. Ophthalmology.2010; 117: 1376–1380.
[8]. P. A. Keane, P. J. Patel, S. Liakopoulos, F. M. Heussen, S. R. Sadda, and A. Tufail, "Evaluation of age-related macular degeneration with optical coherence tomography, " Survey of Ophthalmology, vol. 57, no. 5, pp. 389–414, 2012.
[9]. N. Jain, S. Farsiu, A.A.Khanifar et al., "Quantitative comparison of drusen segmented on SD-OCT versus drusen delineated on color fundus photographs, " Investigative Ophthalmology and Visual Science, vol. 51, no. 10, pp. 4875–4883, 2010.
[10]. I. Barbazetto, A. Burdan, N. M. Bressler et al., "Photodynamic therapy of subfovealchoroidal neovascularization with verteporfin: fluorescein angiographic guidelines for evaluation and treatment—TAP and VIP report no. 2, " Archives of Ophthalmology, vol. 121, no. 9, pp. 1253–1268, 2003.
[11]. D. V. Do, E.W. Gower, S. D. Cassard et al., "Detection of new onset choroidal neovascularization using optical coherence tomography: the AMDDOC study, " Ophthalmology, vol. 119, no. 4, pp. 771–778, 2012.
[12]. P. A. Keane, R. A. Bhatti, J. W. Brubaker, S. Liakopoulos, S. R. Sadda, and A. C. Walsh, "Comparison of clinically relevant findings from high-speed Fourier-domain and conventional time-domain optical coherence tomography, " American Journal of Ophthalmology, vol. 148, no. 2, pp. 242–248, 2009.
[13]. Young, RW: Pathophysiology of age–related macular degeneration, SurvOphthalmol 31: 291–306, 1995.
[14]. Sarks, SH: Ageing and degeneration in the macular region: a clinico–pathological study, Br J Ohihalmol 60: 324–341, 1976.
[15]. Fine, BS, and Yanoff, M: Ocular histology: a text and atlas, ed 2, Hagerstown, Md, 1979, Harper and Row, Publishers, mc, p47.