MACULAR GANGLION CELL COMPLEX (MGCC) THICKNESS CHANGES ANALYSIS IN MILD COGNITIVE IMPAIRMENT USING SPECTRAL DOMIAN OCT (SD-OCT), AS A NEWER BIOMARKER

Vishrutha[1], Viswanath B.N[1], Shashidhar[1], Ravi[1], Sandhya[1], Rashmi H G[1], Nagarathna Magganur[1], Pooja[1]
[1]Department of ophthalmology, Minto ophthalmic hospital, RIO
Bangalore Medical College and Research Institute, Bangalore

ABSTRACT

BACKGROUND
Mild cognitive impairment is a syndrome in which the patient will have subjective and objective memory deficit or have impairment of other cognitive function other than memory. The annual conversion rate from MCI to Alzheimer's disease has been reported as 10 to 15 %.It is estimated that by 2020 , approximately 70% of the world population aged 60 and above will be living in developing countries with Dementia 14.2 % in India .Optical Coherence Tomography (OCT) is a non-invasive, non-contact imaging technique to analyze the thickness of macular ganglion cell complex thickness, decrease in thickness can correspond to neuronal death and loss of axons in macular ganglion cell complex.

METHODS
This is a non-randomized hospital based prospective cross-sectional study conducted at Minto Ophthalmic Hospital attached to BMCRI. Conducted from November 2019 to May 2021. This study was done 36 eyes of 35 patients. They were assessed by Mini Mental State Examination (MMSE) and spectral domain OCT done for the analysis of macular ganglion cell complex thickness changes.

RESULTS
It showed significant decrease in MGCC thickness in patients with mild cognitive impairment by SD OCT.

CONCLUSION
This concludes MGCC thickness analysis by SD - OCT is a newer tool in early detection of dementia or any other neurodegenerative conditions and helps in prevention of further progression to Alzheimer's disease. Hence it is good to carryout OCT analysis in elderly people aged more than 60 to detect early neurodegenerative changes for early management.

KEYWORDS
Macular ganglion cell complex, spectral domain OCT, Mild cognitive impairment, Mini Mental State Examination, Alzheimer's disease.

Corresponding Author:
Dr. Nagarathna Magganur, Department Of Ophthalmology, Minto Ophthalmic Hospital, Rio, Bangalore Medical Collage And Research Institute, Bangalore.
E-mail: nagu.magga@gmail.com

How to Cite This Article:

Vishrutha, Viswanath B.N, Shashidhar, Ravi, Sandhya, Rashmi H G, Nagarathna Magganur, Pooja. MACULAR GANGLION CELL COMPLEX (MGCC) THICKNESS CHANGES ANALYSIS IN MILD COGNITIVE IMPAIRMENT USING SPECTRAL DOMIAN OCT (SD-OCT), AS A NEWER BIOMARKER. J Evid Based Med Healthc 2022;9(02):1-7.

Submission 19-01-2022,
Peer Review 25-01-2022,
Acceptance 02-02-2022,
Published 09-02-2022.

INTRODUCTION

Mild Cognitive Impairment (MCI) is defined as impairment in cognitive function especially memory with normal performance of daily activities.[1] MCI represents a clinical condition in which the risk of developing dementia is increased and is accepted as transitional stage between "healthy" and "dementia", it overlies between normal aging and Alzheimer's disease. It is considered as a neurodegenerative condition and which has multiple etiologies.[2] The prevalence of dementia in the world is 46.8 million, expected to be doubled by 2035.[3] About 10 % to 15% MCI patients will develop Alzheimer's disease per year and even 1 - 2 % of healthy individuals are at risk developing Alzheimer's disease.

Macula is an oval pigmented region at the posterior pole of retina. Macular ganglion cell complex composed of inner three layers of retina (nerve fiber layer + ganglion cell layer + inner plexiform layer).[4] There is a developmental association between brain and retina. Eye is developed as an extension from diencephalon.[5] There are structural similarities between retinal nerve fibers and neurons in central nervous system.[6]

Optical Coherence Tomography (OCT) is a non-invasive, non-contact imagining to assess the thickness of Macular Ganglion Cell Complex (MGCC) thickness and used in various diseases of retina including glaucoma, optic neuropathy etc.[7] A decreased thickness can correspond to neuronal death and loss of axons in MGCC.

As age increases, there is 1.3 µm thinning of ganglion cell complex per year.[8] The thickness of retinal nerve fiber layer and ganglion cell complex layer decreases with age.[9]

METHODS

Source of Data

OPD / IPD department of ophthalmology, Minto ophthalmic hospital, BMCRI. Cases referred from psychiatry department Victoria hospital.

Methods of Collection of Data

A. Study design: Hospital based, Non-randomized, and Prospective cross - sectional study

B. Study period: 1.5 years (November 2019 to May 2021)

C. Place of study: Bowring and Lady Curzon Hospital and Minto ophthalmic Hospital, BMCRI

D. Sample size: 35

E. Inclusion Criteria:

1. Subjects with no cognitive impairment.
2. Subjects with cognitive impairment
3. Patient willing to give informed consent.

F. Exclusion Criteria:

1. Patient not willing to give informed consent
2. Coexistence of ocular pathology like high myopia, glaucoma, optic nerve pathology, retinal vascular disease, media opacity like cataract, choroidal neovascularization etc.

DISCUSSION

In our study we evaluated 36 eyes of 40 patients of whom overall Macular Ganglion cell complex layer (GC + IPL + RNFL) thickness was found to be 82.73±10.07done by using SD OCT by manual segmentation (En face analysis) in patients with mild cognitive impairment and mean age was 67.765 ± 6.88years

A study conducted by Magda Gharbiya et al, prospective cross-sectional study carried out on 21 patients (mean age 73.1 +_6.9yr) with mild to moderate AD and 21 are matched (mean age 70.3 +_7.3) healthy controls, RNFL was measured by OCT, choroidal thickness was significantly thinner in AD than in controls eye (p<0.05).[10]

A study conducted by Anju Kuriakose et al, case–control study was done on 88 eyes of 44 patients, of which 27 belong to mild CI (MCI) and 17 were controls, showed the mean age in Group 1 (MCI) as 67 ± 3.79 years and Group 2 (control) as 64.29 ± 3.46 years and GC + IPL thickness showed overall thinning in all quadrants of which super temporal, inferonasal, inferior quadrants were thinnest, inferonasal quadrant showed 68.82 ± 10.00 and inferior quadrant showed 69.00 ± 7.80.[11]

There is a developmental association between brain, retina and optic nerve. Embryologically eye developed from extensions so called optic cup from diencephalon of central nervous system.[5] The microvascular system shares common physiology. There are structural similarities between retinal ganglion cells, CNS neurons and fibers of optic nerve. The retinal ganglion cells also undergo same neurodegenerative processes affecting neurons.[6]

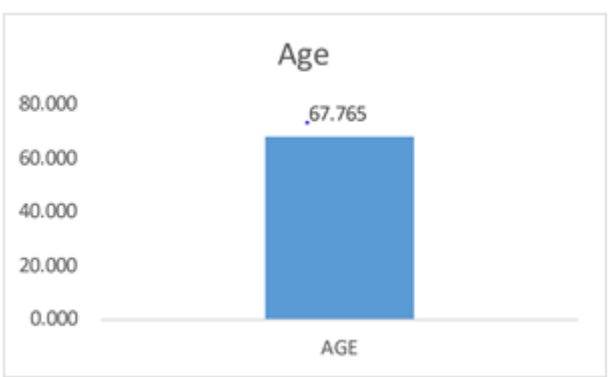
Hence it is suggested to carryout routine evaluation of retina with OCT in all patients more than 60 years, so that we can detect early neurodegenerative changes for early management and so that we can prevent progression or delay progression to dementia / Alzheimer's disease. OCT showed significant thinning in MGCC thickness.[11]

V Chandra et al. found that overall prevalence rate of 0.84 % for dementia in the population aged more that 55years and overall prevalence rate of 1.36 % in the population more than 65years. In our study mean age was found to be 67.8 years. The greater age was associated with higher prevalence of dementia and Alzheimer's diseases.[12]

RESULTS

Descriptive Statistics	Mean	Std. Deviation
AGE	67.765	6.8846

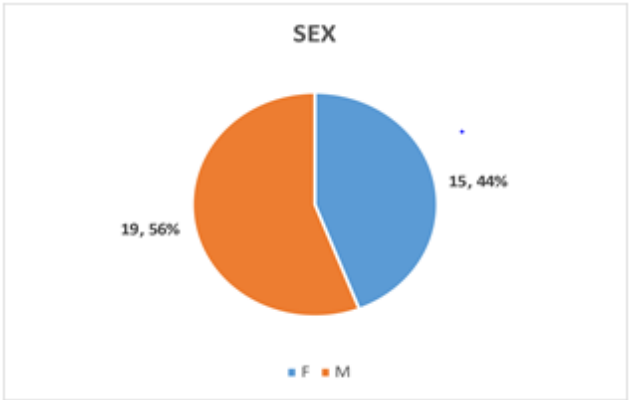
Table 1: Age Distribution Among The Study Population



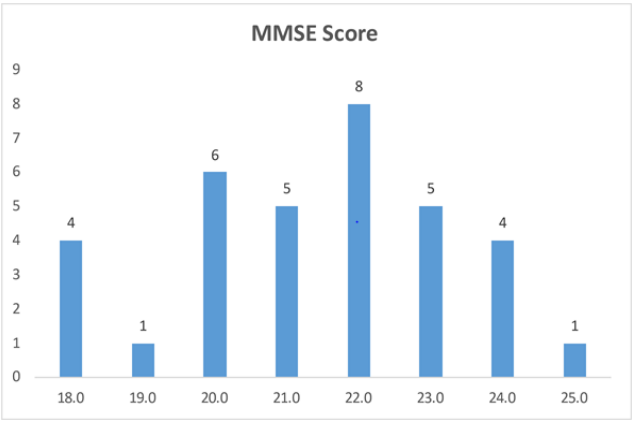
In Our Study Mean Age Distribution among Study Population Was 67.765±6.88

SEX		Frequency	Percent
Valid	F	15	44.1
	M	19	55.9
	Total	34	100

Table 2: Sex Distribution Among The Study Population



In Our Study Sex Distribution among Study Population Was 56% Male And 44% Female



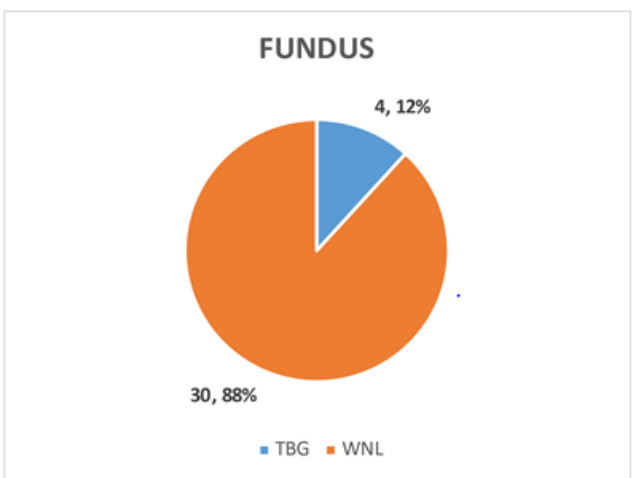
In Our Study Mean MMSE Score among Study Population Was 21.42±1.9

FUNDUS			
		Frequency	Percent
	TBG	4	11.8
	WNL	30	88.2
Valid	Total	34	100

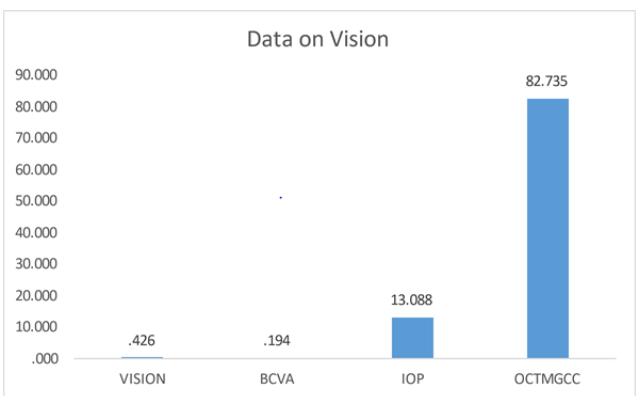
Table 3: Fundus Findings Among Study Population

VISION	0.426	0.1693
BCVA	0.194	0.1099
IOP	13.088	2.0056
OCTMGCC	82.735	10.0794

Table 5: Mean Macular Ganglion Cell Complex Thickness Among Study Population, Vision, BCVA And IOP



In Our Study 88% Population Fundoscopy Showed With In Normal Limit Fundus And 12% Showed Tessellated Background



In Our Study Average Vision Among Study Population Showed 0.426±0.1693, Average Best Corrected Vision (BCVA) Showed 0.194±0.1099, Mean IOP Was 13.088±2.0056 Mmhg And Mean MGCC Thickness Assessed By SDOCT Was 82.735±10.0794.

MMSE Score			
		Frequency	Percent
	18	4	11.8
	19	1	2.9
	20	6	17.6
	21	5	14.7
	22	8	23.5
	23	5	14.7
	24	4	11.8
Valid	25	1	2.9
	Total	34	100

Table 4: Mean Mini Mental State Examination Score Among Study Population

Descriptive Statistics	Mean	Std. Deviation	N	Range	Minimum	Maximum
AGE	67.765	6.8846	34	30	58	88
VISION	0.426	0.1693	34	0.6	0.2	0.8
BCVA	0.194	0.1099	34	0.3	0	0.3
IOP	13.088	2.0056	34	8	10	18
OCTMGCC	82.735	10.0794	34	34	65	99
MMSE Score	21.412	1.9088	34	7	18	25
Valid N (listwise)			34			

CONCLUSION

- Macular ganglion cell complex (RNFL + GC + IPL) layer showed significant thinning.
- From this study we can conclude that MCI patients were found to develop neurodegenerative changes in retina.
- With the help of OCT, we can evaluate the retina and detect early changes in retina nerve fiber layer (thinning), hence helps in early detection and management of

neurodegenerative disorders.

• Hence it is suggested to carryout routine evaluation of retina with OCT in all patients more than 60 years, so that we can detect early neurodegenerative changes for early management and so that we can prevent progression or delay progression to dementia / Alzheimer's disease. OCT showed significant thinning in MGCC thickness.

• This study suggests that Macular Ganglion Cell Complex (MGCC) changes are sensitive and newer biomarker for early detection of neurodegenerative disorders.

REFERENCES

[1] Kesler A, Vakhapova V, Korczyn AD, et al. Retinal thickness in patients with mild cognitive impairment and Alzheimer's disease. Clin Neurol Neurosurg. 2011 1;113(7):523-6.

[2] Liu D, Zhang L, Li Z, et al. Thinner changes of the retinal nerve fiber layer in patients with mild cognitive impairment and Alzheimer's disease. BMC Neurol. 2015; 15(1):1-5.

[3] Lee MJ, Abraham AG, Swenor BK, et al. Application of optical coherence tomography in the detection and classification of cognitive decline. J Curr Glaucoma Pract. 2018;12(1):10.

[4] kanski

[5] London A, Benhar I, Schwartz M. The retina as a window to the brain—from eye research to CNS disorders. Nature Reviews Neurology. 2013; 9(1):44-53.

[6] Ikram MK, Cheung CY, Wong TY, et al. Retinal pathology as biomarker for cognitive impairment and Alzheimer's disease. J Neurol Neurosurg Psychiatry. 2012 1; 83(9):917-22.

[7] Ascaso FJ, Cruz N, Modrego PJ, et al. Retinal alterations in mild cognitive impairment and Alzheimer's disease: an optical coherence tomography study. J Neurol. 2014 ; 261(8):1522-30.

[8] Shariati MA, Park JH, Liao YJ. Optical coherence tomography study of retinal changes in normal aging and after ischemia. Invest Ophthalmol Vis Sci. 2015 1;56(5):2790-7.

[9] Shariati MA, Park JH, Liao YJ. Optical coherence tomography study of retinal changes in normal aging and after ischemia. Invest Ophthalmol Vis Sci. 2015 1; 56(5):2790-7.

[10] Gharbiya M, Trebbastoni A, Parisi F, et al. Choroidal thinning as a new finding in Alzheimer's disease: evidence from enhanced depth imaging spectral domain optical coherence tomography. J Alzheimers Dis. 2014 1; 40(4):907-17.

[11] Kuriakose A, Kakkanatt AC, Mathai MT, et al. Retinal changes in patients with mild cognitive impairment: An optical coherence tomography study. Kerala Journal of Ophthalmology. 2019 1; 31(2):126.

[12] Chandra V, Pandav R, Dodge HH, et al. Incidence of Alzheimer's disease in a rural community in India: the Indo–US study. Neurology. 2001 25; 57(6):985-9.