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THE RELATIONSHIP BETWEEN DIABETIC RETINOPATHY AND COGNITIVE IMPAIRMENT IN ELDERLY TYPE 2 DIABETES MELLITUS PATIENTS IN A TERTIARY CARE HOSPITAL, KOLAR.

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ABSTRACT

The prevalence of both type 2 diabetes and dementia has increased significantly over the past 2 decades. These parallel increases may be explained by a common metabolic pathology because type 2 diabetes is an independent risk factor for the development of Alzheimer disease. Diabetes has also been associated with cognitive impairment, which is defined as the degree of cognitive dysfunction that exists between normal aging and dementia. Cognitive impairment, even when mild, is a predictor for the development of dementia and Alzheimer disease. Therefore, identifying the disease processes that link diabetes and cognitive impairment could be important for identifying patients at risk for dementia and for the development of preventive interventions in the diabetes population. **Objective of The Study:** To study the association between severity of diabetic retinopathy and cognitive impairment in elderly diabetic individuals. **Statistical Analysis and Results:** A descriptive study method was done and 100 patients of elderly diabetics were taken up for the study. Fundoscopy was done to see for retinopathy and MMSE scale was done see for cognitive impairment. Various variables like HbA1c and cognitive function and retinopathy changes were taken into consideration and P value was calculated for knowing the association between these variables. P value of < 0.05 was taken as significant. **Results:** There was an association between HbA1C levels and cognitive impairment and patients with higher HbA1C have more cognitive impairment. The association between HbA1C levels and Diabetic retinopathy changes aws also seen in our study. But interestingly we found that there was no significant association between Diabetic retinopathy and severity of cognitive Impairment. **Conclusion:** A poor control of diabetes was found to cause cognitive impairment and severe retinopathy changes, but there was no association between diabetic retinopathy changes and severity of cognitive dysfunction.

KEYWORDS: Diabetic retinopathy, Cognitive impairment, HbA1c levels.

INTRDUCTION

The prevalence of both type 2 diabetes and dementia has increased significantly over the past 2 decades. These parallel increases may be explained by a common metabolic pathology because type 2 diabetes is an independent risk factor for the development of Alzheimer disease. Diabetes has also been associated with cognitive impairment, which is defined as the degree of cognitive dysfunction that exists between normal aging and dementia.

Cognitive impairment, even when mild, is a predictor for the development of dementia and Alzheimer disease. Therefore, identifying the disease processes that link diabetes and cognitive impairment could be important for identifying patients at risk for dementia and for the development of preventive interventions in the diabetes population. A systematic review of six studies reported an increased risk of cognitive impairment in patients with Diabetic Retinopathy (DR) and type 1 and type 2 diabetes.[1]

There is a high association between retinopathy and hypertension, dyslipidemia and macrovascular disease, factors that have been associated with cognitive impairment.[1]

Type 2 diabetes is associated with an increased risk of age-related cognitive impairment and decline in addition to higher incidences of stroke and dementia. Retinal and cerebral small vessels share similar embryological origin, size, structure, and physiological characteristics including the blood-brain and blood-retinal barrier. The retinal vascular bed can be directly visualized noninvasively with retinal photography and fundoscopy. Typical retinopathic changes associated with diabetes are associated with white matter lesions in the brain, magnetic resonance imaging (MRI)-defined cerebral infarcts and incident stroke. It was hypothesized that increasing severity of DR would be associated with poorer cognitive ability and with greater cognitive decline, thus providing evidence for an effect of cerebral microvascular disease on accelerated age-related cognitive decline in people with type 2 diabetes. Due to the considerable homology between retinal and cerebral microvasculature, retinal vascular changes are likely to provide an indirect marker of concomitant changes in the brain microvasculature.[2]

It is thought that this association is based on the same metabolic abnormality rather than cause and effect. However, it can be said that an association between microvessel damage in the retina and kidney and cerebral vasculature is through hyperglycemia and insulin resistance in diabetic patients which impair microvessels through endothelial dysfunction as a result of glycation, oxidative stress and increased activity of the polyol pathway as compared with nondiabetic people.[3]

OBJECTIVES OF STUDY

1. To study the association between severity of diabetic retinopathy and cognitive impairment in elderly diabetic individuals.

MATERIALS AND METHODS

Source of data(sample)

Study design- Descriptive study.

Diabetic patients with diabetes and with diabetic retinopathy who are admitted to Department of General Medicine were taken for the study.

Inclusion Criteria

1. Diabetic patients above the age of 60 years.
2. Patients with diabetic retinopathy.

Exclusion Criteria

1. Severe mental illness
2. Terminal illness
3. Type 1 diabetes mellitus
4. Severe visual impairment.

Method of collection of data

A structured and pretested proforma was used to collect data of elderly diabetic patients with diabetic retinopathy regarding history, complaints, past history, family history, treatment history were taken.

Fundoscopy was done in these patients to see for severity of diabetic retinopathy.

MMSE was done to test for cognitive impairment in these patients.

Written informed consent was taken. Other relevant investigations like FBS, PPBS, HbA1c were done.

This study was intended to see for association of severity of diabetic retinopathy and cognitive impairment in elderly diabetic patients.

STATISTICAL ANALYSIS & RESULTS

A total of 100 cases of elderly diabetic patients with diabetic retinopathy were taken into the study and MMSE was done to see for cognitive dysfunction.

A Descriptive study method was done.

CORRELATION BETWEEN HB1AC AND DIABETIC RETINOPATHY

Correlations		HbA1C	RETINOPATHYCHANGES
HbA1C	Pearson Correlation	1	.569**
	Sig. (2-tailed)		.000
	Sum of Squares and Cross-products	301.277	104.881
	Covariance	3.043	1.059
	N	100	100
RETINOPATHYCHANGES	Pearson Correlation	.569**	1
	Sig. (2-tailed)	.000	
	Sum of Squares and Cross-products	104.881	112.910
	Covariance	1.059	1.141
	N	100	100

CORRELATIONS BETWEEN HB1AC AND COGNITIVE IMPAIRMENT

Correlations						
		HbA1C	**MILDCOGNITIVE IMPAIRMENT**	**MODERATECOGNITIVEIMPAIRMENT**	**SEVERECOGNITIVEIMPAIRMENT**	**NOCOGNITIVEIMPAIRMENT**
HbA1C	Pearson Correlation	1	-.018	.135	-.155	-.007
	Sig. (2-tailed)		.859	.179	.124	.949
	Sum of Squares and Cross-products	301.277	-1.417	10.964	-9.049	-.498
	Covariance	3.043	-.014	.111	-.091	-.005
	N	100	100	100	100	100
MILDCOGNITIVEIMPAIRMENT	Pearson Correlation	-.018	1	-.438**	-.247*	-.379**
	Sig. (2-tailed)	.859		.000	.013	.000
	Sum of Squares and Cross-products	-1.417	20.590	-9.280	-3.770	-7.540
	Covariance	-.014	.208	-.094	-.038	-.076
	N	100	100	100	100	100
MODERATECOGNITIVEIMPAIRMENT	Pearson Correlation	.135	-.438**	1	-.265**	-.407**
	Sig. (2-tailed)	.179	.000		.008	.000
	Sum of Squares and Cross-products	10.964	-9.280	21.760	-4.160	-8.320
	Covariance	.111	-.094	.220	-.042	-.084
	N	100	100	100	100	100
SEVERECOGNITIVEIMPAIRMENT	Pearson Correlation	-.155	-.247*	-.265**	1	-.229*
	Sig. (2-tailed)	.124	.013	.008		.022
	Sum of Squares and Cross-products	-9.049	-3.770	-4.160	11.310	-3.380
	Covariance	-.091	-.038	-.042	.114	-.034
	N	100	100	100	100	100
NOCOGNITIVE IMPAIRMENT	Pearson Correlation	-.007	-.379**	-.407**	-.229*	1
	Sig. (2-tailed)	.949	.000	.000	.022	
	Sum of Squares and Cross-products	-.498	-7.540	-8.320	-3.380	19.240
	Covariance	-.005	-.076	-.084	-.034	.194
	N	100	100	100	100	100
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

CORRELATION BETWEEN DIABETIC RETINOPATHY AND COGNITIVE IMPAIRMENT

Correlations						
		MILDCOGNITIVEIMPAIRMENT	**MODERATECOGNITIVEIMPAIRMENT**	**SEVERECOGNITIVEIMPAIRMENT**	**NOCOGNITIVEIMPAIRMENT**	**RETINOPATHYCHANGES**
MILDCOGNITIVEIMPAIRMENT	Pearson Correlation	1	-.438**	-.247*	-.379**	-.122
	Sig. (2-tailed)		.000	.013	.000	.228
	Sum of Squares and Cross-products	20.590	-9.280	-3.770	-7.540	-5.870
	Covariance	.208	-.094	-.038	-.076	-.059
	N	100	100	100	100	100
MODERATECOGNITIVE IMPAIRMENT	Pearson Correlation	-.438**	1	-.265**	-.407**	.122
	Sig. (2-tailed)	.000		.008	.000	.227
	Sum of Squares and Cross-products	-9.280	21.760	-4.160	-8.320	6.040
	Covariance	-.094	.220	-.042	-.084	.061
	N	100	100	100	100	100
SEVERECOGNITIVEIMPAIRMENT	Pearson Correlation	-.247*	-.265**	1	-.229*	-.179
	Sig. (2-tailed)	.013	.008		.022	.075
	Sum of Squares and Cross-products	-3.770	-4.160	11.310	-3.380	-6.390
	Covariance	-.038	-.042	.114	-.034	-.065
	N	100	100	100	100	100
NOCOGNITIVEIMPAIRMENT	Pearson Correlation	-.379**	-.407**	-.229*	1	.133
	Sig. (2-tailed)	.000	.000	.022		.186
	Sum of Squares and Cross-products	-7.540	-8.320	-3.380	19.240	6.220
	Covariance	-.076	-.084	-.034	.194	.063
	N	100	100	100	100	100
RETINOPATHYCHANGES	Pearson Correlation	-.122	.122	-.179	.133	1
	Sig. (2-tailed)	.228	.227	.075	.186	
	Sum of Squares and Cross-products	-5.870	6.040	-6.390	6.220	112.910
	Covariance	-.059	.061	-.065	.063	1.141
	N	100	100	100	100	100
**. Correlation is significant at the 0.01 level (2-tailed).						
*. Correlation is significant at the 0.05 level (2-tailed).						

All these variables were taken into consideration and P value was calculated comparing the variables in the study. P value of < 0.05 was taken as significant.

- There is association between HbA1C levels and cognitive impairment and patients with higher HbA1C were found to have cognitive impairment which was significant.
- There is association between HbA1C levels and Diabetic retinopathy and patients with higher HbA1C levels were found to have severe diabetic retinopathy changes.
- But interestingly in our study we found that there was no significant association between Diabetic retinopathy and severity of cognitive Impairment.

DISCUSSION

Although an increased risk of cognitive impairment in patients with diabetic retinopathy was found in the reviewed studies, a relationship between severity of diabetic retinopathy and cognitive impairment has not been established. Also, in a study by Crosby-Nwaobi et al stated that cognitive impairment was not associated with the degree and severity of diabetic retinopathy, and on the contrary, that cognitive decline was greater in patients with no and mild retinopathy as compared with those with advanced retinopathy.[3]

The pathways underlying these associations may be multiple. Pre-diabetes factors such as obesity, or other co-morbidities such as hypertension and dyslipidemia, may play a role, and diabetic effects on large and small vessels serving the brain are also likely.[4]

A recent review concluded that retinal microvascular changes showed consistent and moderately strong associations in cross-sectional studies with dementia, with relative cognitive impairment in people without dementia, and with brain imaging abnormalities. On the other hand, the few longitudinal studies only showed marginal associations with dementia or cognitive decline, but more consistent links with progression of brain imaging abnormalities: relatively weak for vascular caliber measurements, intermediate for arteriovenous nicking and focal narrowing, and strong for retinopathy. These associations were also stronger in people with both hypertension and diabetes. This suggests that increased damage to retinal vessels is associated with increased cognitive impairment.[4]

However, not all studies have supported this. In a sample of middle aged people without stroke, retinopathy was associated with poorer cognitive function. One study supported that retinal vasculature images are worth considering as potential risk markers for cognitive decline in people with diabetes, potentially at a relatively early stage after diagnosis.

In another study it was noted that the link with cognitive function might well be independent of retinopathy, possibly reflecting underlying mechanisms implicated in both T2DM and cognitive impairment, or underlying mechanisms in T2DM increasing the risk of cognitive impairment. Hence, further research is needed to confirm the findings, to ascertain the extent to which these measures predict cognitive decline prospectively.[4]

CONCLUSION

1. A poor control of diabetes was found to cause cognitive impairment and severe retinopathy changes.
2. According to this study we couldn’t find any association of diabetic retinopathy changes and severity of cognitive dysfunction.

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