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Original Research Article

Determining the Link between Proliferative Diabetic Retinopathy and Type 2 Diabetes Mellitus, with an Emphasis on Hypothyroidism

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Abstract

Aim: To determine the connection between proliferative diabetic retinopathy and type 2 diabetes mellitus, with a focus on hypothyroidism.

Materials and Methods: This research was done at the Department of Medicine at IGIMS, located in Patna, Bihar, India for 10 months. 60 T2 DM patients who agreed to participate were examined and compared using the study proforma. To achieve the study's goal, two groups of 30 patients were compared. All patients had thyroid function testing, and two groups were formed: diabetics with thyroid dysfunction and those without.

Results: Thyroid dysfunction patients had diabetes for 1–20 years, with a mean of 8.62 years and a standard deviation of 4.4 years. Patients without thyroid dysfunction had diabetes for 6 months to 13 years, with a mean of 6.27 years and a standard deviation of 3.29 years. Patients with thyroid dysfunction had 42.8% retinopathy, whereas those without thyroid dysfunction had 30.4%. The difference was negligible. Patients with thyroid dysfunction had considerably increased rates of proliferative diabetic retinopathy.

Conclusion: Diabetics with hypothyroidism had a statistically significant connection with proliferative retinopathy, but not overall.

Keywords: Hypothyroidism, Diabetes, Retinopathy.

Introduction

Hypothyroidism and type 2 diabetes mellitus (T2DM) are two common endocrine illnesses that have a considerable impact on world health. Although thyroid dysfunction and diabetes-related problems, namely proliferative diabetic retinopathy (PDR), have traditionally been researched separately, recent data indicates an intricate relationship between the two. Proliferative diabetic retinopathy is a serious disorder that poses a danger to eyesight. It is characterized by the formation of new blood vessels on the retina, which, if left untreated, may result in visual impairment. Hypothyroidism, which is defined as insufficient synthesis of thyroid hormones, may worsen metabolic disruptions and possibly impact the development of diabetes complications. This introduction examines the growing body of data connecting hypothyroidism with proliferative diabetic retinopathy (PDR) in patients with type 2 diabetes mellitus (T2DM), emphasizing the underlying processes, clinical consequences, and the need for integrated care strategies. [1,2] Hypothyroidism is caused by a thyroid gland that is not functioning properly, resulting in a lack of thyroid hormones (triiodothyronine [T3] and thyroxine [T4]). These hormones play a crucial role in controlling metabolism and have a significant impact on several physiological processes, including energy expenditure, lipid metabolism, and glucose regulation. Hypothyroidism is linked to a decrease in the body's basic metabolic rate, elevated levels of cholesterol in the blood, and resistance to insulin. These variables raise the chance of developing and worsening type 2 diabetes mellitus (T2DM). Hypothyroidism may significantly affect patients with type 2 diabetes mellitus (T2DM), leading to metabolic disruptions that may worsen diabetic consequences, such as retinopathy. [3] Proliferative diabetic retinopathy is a more advanced phase of diabetic retinopathy, distinguished by the growth of new, delicate blood vessels on the retina and optic disc, a process known as neovascularization. These recently developed arteries have a tendency to bleed, resulting in vitreous hemorrhage, retinal detachment, and substantial loss of vision. The development of proliferative diabetic retinopathy

(PDR) is a complicated and multifaceted process. It is caused by long-term high blood sugar levels, oxidative stress, and inflammatory reactions. These factors lead to a lack of blood supply to the retina, known as retinal ischemia, and the subsequent growth of new blood vessels. Poor management of blood sugar levels, high blood pressure, and the length of time a person has had diabetes are widely recognized as significant variables that increase the likelihood of developing proliferative diabetic retinopathy (PDR). Hypothyroidism is linked to higher levels of insulin resistance and poor glucose metabolism, which may worsen high blood sugar in people with type 2 diabetes mellitus (T2DM). Diabetic retinopathy is primarily caused by chronic hyperglycemia, which results in endothelial dysfunction and heightened vascular permeability. [4]

Hypothyroidism often leads to dyslipidemia, which is characterized by increased levels of low-density lipoprotein (LDL) cholesterol and triglycerides. Dyslipidemia is an established risk factor for diabetic retinopathy. It plays a role in the development of hard exudates and macular edema, which may speed up the progression to proliferative diabetic retinopathy (PDR). Both hypothyroidism and type 2 diabetes mellitus (T2DM) are linked to elevated levels of inflammatory cytokines and indicators of oxidative stress. The inflammatory processes may harm the blood vessels in the retina, leading to the growth of new blood vessels and the advancement of proliferative diabetic retinopathy (PDR). Hypothyroidism may cause tissue hypoxia as a result of decreased cardiac production and hindered oxygen supply. Hypoxia is an important trigger for the increase of VEGF, a crucial mediator of neovascularization in PDR. [5] The correlation between hypothyroidism and proliferative diabetic retinopathy (PDR) in persons with type 2 diabetes mellitus (T2DM) has important clinical consequences. First and foremost, it emphasizes the need of doing a thorough examination of the endocrine system in patients with type 2 diabetes mellitus (T2DM), which should include regular screening for thyroid dysfunction. Timely identification and treatment of hypothyroidism in these individuals has the potential to reduce the likelihood of developing severe diabetic retinopathy. Furthermore, using comprehensive treatment techniques that address both glucose and thyroid hormone levels may have a positive impact on avoiding or decelerating the advancement of PDR. Improving the administration of thyroid hormone replacement treatment in individuals with hypothyroidism and type 2 diabetes mellitus (T2DM) has the potential to enhance metabolic regulation and lessen the impact of diabetic complications. [6] Ultimately, this relationship highlights the need of using a multidisciplinary approach when providing therapy for individuals with T2DM. Close cooperation among endocrinologists, ophthalmologists, and primary care physicians is crucial for promptly identifying and effectively treating thyroid dysfunction and diabetic retinopathy.

Materials and Methods

This research was done at the Department of Medicine at IGIMS, located in Patna, Bihar, India for 10 months. A total of 60 patients diagnosed with Type 2 Diabetes Mellitus (T2 DM) were included in the research. Only those patients who were willing to participate were tested and compared using a proforma specifically prepared for the study. The research aimed to compare two groups, each consisting of 30 patients.

Methodology

Thyroid function tests were conducted on all patients, resulting in the formation of two groups. The first group consisted of diabetes patients with thyroid dysfunction, whereas the second group consisted of diabetic patients without thyroid dysfunction. The ophthalmologist performed fundoscopy on all patients to evaluate retinopathy. The inclusion criteria was that only individuals with Type 2 Diabetes Mellitus who were above 18 years old were eligible for the study. The exclusion criteria included individuals who were taking medications that might impact their thyroid profile, as well as those with a history of hypertension, ischemic heart disease, smoking, and chronic alcoholism.

Quantitative Analysis

The statistical analysis was conducted using SPSS 16 software.

Results

A total of sixty individuals diagnosed with type 2 diabetes mellitus (T2 DM) were categorized into two groups, consisting of 30 patients each. One group included patients with thyroid dysfunction, while the other group consisted of patients without thyroid dysfunction. The age range of diabetes patients in the group with thyroid dysfunction was between 41 and 75 years, with an average age of 57.56 years and a standard deviation of 8.5. The minimum age of diabetes patients in the group without thyroid dysfunction was 35 years, while the highest age was 68 years. The mean age of this group was 54.6 years, with a standard deviation of 9.08. The age range of patients in the group with thyroid dysfunction ranged from 41 to 75 years, with an average age of 57.56 years and a standard deviation of 8.5. The minimum age of patients in the group without thyroid dysfunction was 35 years, while the greatest age was 68 years. The mean age of the group was 54.6 years, with a standard deviation of 9.08 years. The average age of the cases and controls was same. The given information is shown in Table 1.

The proportion of males and females among patients in the group with thyroid dysfunction was 43.3% and 56.7% respectively, whereas in the group without thyroid dysfunction, it was 46.66% and 53.44% respectively. The gender distribution was balanced. (Table 2) In the group of patients with thyroid dysfunction, the duration of diabetes ranged from 1 to 20 years, with an average length of 8.62 years and a standard deviation of 4.4 years. The diabetes duration ranged from a minimum of 6 months to a maximum of 13 years, with an average of 6.27 years and a standard deviation of 3.29 years among patients in the group who did not have thyroid dysfunction. (Table 3) The prevalence of retinopathy in patients with thyroid dysfunction was 42.8%, whereas in patients without thyroid dysfunction it was 30.4%. However, this difference was not statistically significant (p value 0.559). The information is shown in Table 4.

The prevalence of proliferative diabetic retinopathy was considerably greater in diabetic individuals with thyroid dysfunction (p value: 0.02). The text "(Table5)" remains unchanged.

Table 1: Age distribution

	MEAN AGE IN YRS	STANDARD DEVIATION
Group with thyroid dysfunction	57.56	8.5
Group without thyroid dysfunction	54.6	9.08

Table 2: Sex distribution

SEX	Group with thyroid dysfunction	Group without thyroid dysfunction
MALES	13	14
FEMALES	17	16
TOTAL	**30**	**30**

Table 3: Duration of diabetes

	MEAN DURATION OF DIABETES IN YEARS	STANDARD DEVIATION
Group with thyroid dysfunction	8.62	4.4
Group without thyroid dysfunction	6.27	3.29

Table 4: Occurrence of retinopathy

RETINOPATHY	Group with thyroid dysfunction	Group without thyroid dysfunction
PRESENT	9	7
ABSENT	21	23

Table 5: Occurrence of proliferative retinopathy

PDR	Group with thyroid dysfunction	Group without thyroid dysfunction
PRESENT	5	0
ABSENT	25	30

Discussion

Descriptive research was conducted on a cohort of 60 patients diagnosed with type 2 diabetes mellitus who either visited the Medicine OPD or were admitted to the medical wards. The patients were categorized into two groups, one with thyroid dysfunction and the other without, each consisting of 30 patients. A comparison was made between the two groups regarding the occurrence of retinopathy. Thyroid function tests, including TSH/T3/T4, were conducted on all patients. Those with thyroid dysfunction were placed in one group, whereas those without thyroid dysfunction were placed in the other group. All individuals in the thyroid dysfunction group were diagnosed with hypothyroidism in this research. The age of patients in the group with thyroid dysfunction varied from 41 to 75 years, with a mean age of 57.56 ± 8.553 years. The age of patients in the group without thyroid dysfunction varied between 35 and 68 years, with a mean age of 54.6 ± 9.08 years. The proportion of males and females in the former group was 43.3% and 56.7% respectively, whereas in the later group it was 46.66% and 53.44% respectively. The disparity in average age and gender did not exhibit statistical significance, with p-values of 0.162 and 0.795, respectively. Within the cohort of individuals with thyroid dysfunction, the length of time they had been diagnosed with diabetes varied from 1 to 20 years. The average duration of diabetes in this group was 8.62 years, with a standard deviation of 4.4 years. The individuals in the group who did not have thyroid dysfunction had a duration of diabetes that varied from 6 months to 13 years, with an average of 6.27 years and a standard deviation of 3.29 years. The difference in the duration of diabetes between the two groups did not show statistical significance. [7]

The prevalence of retinopathy in the group with thyroid dysfunction was 42.8%, whereas in the group without thyroid dysfunction it was 30.4%. The obtained result was determined to be statistically insignificant, with a p-value of 0.559. Non-proliferative diabetic retinopathy (NPDR) constituted 57% of diabetic retinopathy (DR) instances among individuals in the group with thyroid dysfunction. The individuals in the group without thyroid problems only had non-proliferative diabetic retinopathy. The correlation was shown to be statistically insignificant, with a p-value of 0.317. [8] The research conducted by Chen et al. demonstrated that thyroid dysfunction was not a contributing factor to the development of retinopathy in general. Several studies have shown that hypothyroid people are more likely to have a higher degree of sight-threatening retinopathy. [9] In a comparable research, Kim et al. discovered a correlation between retinopathy and thyroid dysfunction. However, the duration of DM in their research shown a considerable disparity, with those suffering from thyroid dysfunction experiencing a longer duration. [10] The prevalence of proliferative diabetic retinopathy was considerably greater in diabetic individuals with thyroid dysfunction. This was similar to the investigations conducted by Yang et al. in Beijing and Dan et al. in Shenyang. [11, 12]

Conclusion

There was no significant statistical link between diabetic retinopathy and hypothyroidism in general. However, there was a statistically significant association between proliferative retinopathy in diabetes individuals and hypothyroidism. Therefore, diabetics with hypothyroidism have a greater rate of retinopathy development. It is necessary to check for thyroid dysfunction early and ensure that hormone levels are normalized.

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