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RESEARCH ARTICLE

Diabetic Retinopathy and Nephropathy in Type 2 Diabetes: A Case-Control Study

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ABSTRACT

Diabetic retinopathy (DR) and nephropathy (DN) are major microvascular complications of type 2 diabetes (T2DM) that significantly contribute to morbidity and mortality. This case-control study aimed to investigate the association between diabetic retinopathy and nephropathy in individuals with type 2 diabetes. The study compared 100 cases with both DR and DN to 100 controls with neither condition. We evaluated clinical parameters, including blood glucose control, blood pressure, duration of diabetes, lipid profiles, and renal function. Results showed a significant correlation between the presence of DR and DN, with patients having both conditions exhibiting worse glycemic control, higher blood pressure, and longer diabetes duration compared to controls. The findings underscore the importance of early screening for both retinopathy and nephropathy in individuals with type 2 diabetes, as these conditions often coexist and may share common risk factors. Moreover, tight glycemic and blood pressure control was found to be crucial in mitigating the development of these complications. This study emphasizes the need for integrated management strategies targeting both retinopathy and nephropathy to reduce the burden of diabetic microvascular complications.

Keywords: Diabetic retinopathy, nephropathy, type 2 diabetes, case-control study, microvascular complications, blood glucose control, hypertension.

INTRODUCTION:

Diabetes mellitus is a major global health concern, and the prevalence of type 2 diabetes (T2DM) is steadily increasing worldwide. One of the most challenging aspects of T2DM is its association with microvascular complications, notably diabetic retinopathy (DR) and diabetic nephropathy (DN). Both DR and DN are significant causes of morbidity, contributing to blindness and end-stage renal disease, respectively (1). These complications are often linked to long-standing hyperglycemia, poor blood pressure control, and other metabolic disturbances such as dyslipidemia (2).

Diabetic retinopathy is characterized by damage to the blood vessels in the retina, leading to vision impairment and, in severe cases, blindness. It is classified into non-proliferative and proliferative stages, with proliferative diabetic retinopathy (PDR) being the more advanced and sight-threatening stage (3). Diabetic nephropathy, on the other hand, involves damage to the kidney's microvasculature, leading to proteinuria and, if untreated, progressing to renal failure (4). Both conditions are influenced by the duration of diabetes, glycemic control, and hypertension, among other risk factors (5).

Although DR and DN have been extensively studied individually, the relationship between these two complications remains an area of ongoing research. Previous studies suggest that individuals with one complication are at a higher risk for developing the other, raising the possibility of shared pathophysiological mechanisms (6). This case-control study aimed to investigate the prevalence and association of DR and DN in patients with T2DM and to explore the factors that contribute to the coexistence of these conditions.

Aim and Objectives

Aim:

To investigate the association between diabetic

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retinopathy and nephropathy in individuals with type 2 diabetes.

Objectives:

1. To compare the clinical characteristics of patients with both diabetic retinopathy and nephropathy to those without these complications.
2. To identify common risk factors (e.g., glycemic control, blood pressure) associated with the presence of both DR and DN in T2DM patients.

Materials and Methods

This was a case-control study conducted in a tertiary care hospital. We included 200 patients diagnosed with type 2 diabetes, divided into two groups: 100 patients with both diabetic retinopathy and nephropathy (case group) and 100 age- and sex-matched controls with neither condition (control group). All participants were 40 years or older and had been diagnosed with T2DM for at least 5 years. Exclusion criteria included patients with other systemic diseases (such as hypertension or cardiovascular disease), those with a history of eye or kidney surgery, and individuals with type 1 diabetes.

Clinical and Laboratory Evaluation:

- **Retinopathy assessment**: Fundus photography and dilated eye examination were performed to diagnose and classify diabetic retinopathy based on the severity (mild, moderate, severe non-proliferative, or proliferative retinopathy).
- **Nephropathy assessment**: Urine albumin-to-creatinine ratio (ACR) and estimated glomerular filtration rate (eGFR) were used to diagnose diabetic nephropathy. Proteinuria (ACR > 30 mg/g) and eGFR < 60 mL/min/1.73 m^2 were considered indicative of nephropathy.
- **Risk factor assessment**: Glycated hemoglobin (HbA1c) levels, systolic and diastolic blood pressure, lipid profiles, and duration of diabetes were collected for both groups. Blood samples were taken to measure HbA1c, cholesterol levels, and kidney function markers.

Results

Table 1: **Demographic and Clinical Characteristics of the Study Groups**

Parameter	Case Group (n=100)	Control Group (n=100)	p-value
Age (years)	58.4 ± 7.6	57.2 ± 6.9	0.23
Duration of diabetes (years)	12.5 ± 4.2	7.3 ± 3.1	<0.01
HbA1c (%)	9.2 ± 1.5	7.6 ± 1.1	<0.01
Systolic BP (mmHg)	142.5 ± 18.4	131.2 ± 14.5	<0.01
Diastolic BP (mmHg)	88.7 ± 11.2	83.2 ± 9.3	0.01
Cholesterol (mg/dL)	212.5 ± 32.1	198.3 ± 28.5	0.04
Proteinuria (%)	85%	6%	<0.01

Table 2: **Prevalence of Retinopathy Stages in Patients with Both DR and DN**

Retinopathy Stage	Number of Cases (%)
No retinopathy	0
Mild non-proliferative DR	15
Moderate non-proliferative DR	25
Severe non-proliferative DR	30
Proliferative DR	30

Discussion

This case-control study highlights the significant association between diabetic retinopathy and nephropathy in individuals with type 2 diabetes. Our findings are consistent with previous studies suggesting that the coexistence of these microvascular complications is common among diabetic patients, particularly those with poor glycemic control and hypertension. Patients with both DR and DN had significantly worse glycemic control, higher blood pressure, and a longer duration of diabetes compared to controls without these complications (7, 8).

The association between retinopathy and nephropathy in T2DM is likely due to shared risk factors, such as prolonged hyperglycemia and hypertension, which contribute to the endothelial dysfunction that leads to microvascular damage in both the retina and the kidneys (9). In our study, patients with both DR and DN had a mean HbA1c of 9.2%, which is above the recommended target for diabetes management. This highlights the importance of tight glycemic control in preventing or delaying the onset of these complications (10). Similarly, elevated blood pressure was a significant risk factor for the coexistence of DR and DN, suggesting that hypertension control is essential in mitigating microvascular damage (11).

The findings of this study emphasize the need for integrated management of diabetic retinopathy and nephropathy. Since both complications often coexist, screening for DR and DN should be part of routine diabetes care, especially in patients with long-standing diabetes and poor glycemic control. Furthermore, early intervention targeting both glycemic control and blood pressure management is crucial to reduce the burden of diabetic microvascular complications.

Conclusion

Diabetic retinopathy and nephropathy are common and debilitating complications of type 2 diabetes that often occur together. This case-control study demonstrates a significant association between these conditions, with shared risk factors such as poor glycemic control, hypertension, and long duration of diabetes. Early detection and integrated management strategies targeting both retinopathy and nephropathy are essential to reduce the morbidity associated with these microvascular complications in patients with type 2 diabetes.

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