Association of Estimated Glomerular Filtration Rate with Hba1c and Microvascular Complications in Type 2 Diabetes

Salman Tariq1,* , Nabeel Yousaf Chaudhary1, Talha Ibad2, Mahrukh Naeem1, Jawiria Javid1, Sajeela Riaz1

Abstract

Introduction: As a leading cause of death and disability worldwide, diabetes directly affects people and increases their risk of cardiovascular and renal illness. Type 2 diabetes has microvascular complications that are linked to hemoglobin A1c and the estimated glomerular filtration rate.

Material-Methods: This cross-sectional study was conducted in Wazirabad Institute of Cardiology, Gujranwala during June 2021 till December 2021. A total of 200 people with diabetes, both men and women, participated in the study. An electronic form was utilized to collect all demographic information, a history of illness, and blood transfusion history, as well as any other relevant information that could be found. A thorough clinical examination was conducted on each of the participants.

Results: A total of 200 patients, both male and female, were surveyed. Study participants were found to have a 24.6 % prevalence of diabetes overall, with 200 people diagnosed with the condition after the study (95% confidence interval: 21.90 - 27.49). 31.5 % who participated in the research reported having a history of illness (P 0.001).

Conclusion: To conclude that HbA1c and renal function decline in type 2 diabetes patients are directly linked, with the connection being greater in those who have microalbuminuria than in those who have normal kidney function.

Introduction

Every country in the globe has a high rate of diabetes-related mortality due to cardiovascular and renal illness, as well as diabetes itself [1]. Over time, diabetic kidney damage is reduced by long-term glycemic control [2, 3]. High blood pressure exacerbates diabetic microvascular complications. There is a risk of developing microvascular complications, such as renal and retinal disease (BP). In diabetics, the progression of renal injury is aided by factors such as high blood pressure and hyperglycemia [5].

Insulin resistance and decreased pancreatic insulin production are both symptoms of type 2 diabetes mellitus, which is an endocrine infection with a long-term course. Milder microangiopathies and macrovascular problems are associated with type 2 diabetes's persistent hyperglycemia [6, 7]. Chronic hyperglycemia is the most prevalent cause of diabetic retinopathy, the most common microangiopathy. It is also known as diabetic glomerulosclerosis (DGS) or diabetic kidney disease (DN). ESRD is primarily caused by it [7]. GFR and microalbuminuria are two clinically relevant markers.

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of renal function. Although microalbuminuria is a key clinical indicator of diabetes, it has also been linked to the development of diabetic ketoacidosis [8]. Microalbuminuria, on the other hand, does not occur concurrently with diabetes. The rate at which the kidneys filter fluid is known as GFR, and it may be approximated using formulae (eGFR). The GFR rises early in diabetes due to high blood sugar levels but falls subsequently due to renal function deterioration. In contrast, microalbuminuria is rising. Changes in GFR emerge before changes in microalbuminuria in diabetics. In truth, several factors impact a person’s risk of acquiring diabetes-related problems [9, 10].

Diabetes-related illnesses such as diabetic neuropathy, retinal degeneration, and renal function impairment have been linked to decreased estimated glomerular filtration rate (eGFR). eGFR should be assessed in diabetics. Currently, there is limited information on the relationship between renal disease and microvascular issues [10].

**Objectives**

As a key goal of the study, researchers will investigate the relationship between glomerular filtration rate and hemoglobin A1c and the development of microvascular problems in type 2 diabetes.

**Materials and Methods**

This cross-sectional study was conducted in Wazirabad Institute of Cardiology, Gujranwala during June 2021 till December 2021. A total of 200 people with diabetes, both men and women, participated in the study. An electronic form was utilized to collect all demographic information, a history of illness, and blood transfusion history, as well as any other relevant information that could be found. A thorough clinical examination was conducted on each of the participants. When assessing diabetics, researchers carefully looked at their microvascular problems. An RX Imola semi-robotized analyzer from Randox Biosciences used a colorimetric technique to assess glucose levels after at least 8 hours of fasting and 2 hours after dinner.

**Biochemical analysis**

Microalbumin excretion in the urine, the HbA1c level, and the serum creatinine level were also performed as additional assays. The estimated glomerular filtration rate was calculated using the MDRD method, which was implemented in Matlab (eGFR). MDRD computed the estimated GFR for all type II diabetic patients to assess their stage of renal disease.

**Statistical analysis**

Collection and analysis of data were carried out with the help of SPSS version 19. The average and standard deviation of each number were provided.

**Results**

A total of 200 patients, both male and female, were surveyed. Study participants were found to have a 24.6 percent prevalence of diabetes overall, with 200 people diagnosed with the condition after the study (95 percent confidence interval: 21.90 - 27.49). 31.5 percent of participants who participated in the research reported having a history of illness (P 0.001).

95 (83%) patients of the 115 patients without microvascular confusions of had HbA1c < 7.0 (Table 5). 80 (70%) patients of the 115 patients without microvascular entanglements had term < 5 years (table 03).

<table>
<thead>
<tr>
<th>Status</th>
<th>Total (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetic</td>
<td>24.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Type-2</td>
<td>32</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Non diabetic</td>
<td>68.5</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 1: Distribution of participants according to disease

<table>
<thead>
<tr>
<th>Duration of Diabetes</th>
<th>No. of Patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 years</td>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>&gt; 5 years</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Characterizes the microvascular complications in Diabetes.

<table>
<thead>
<tr>
<th>Duration of Diabetes</th>
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<td>115</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3: Differentiates patients based on HbA1c. Patients without microvascular complications.

**Discussion**

Like endothelial cell mischief, microvascular irritants are produced [7]. Our investigation demonstrated a link between high blood pressure, poor glycemic management, and microvascular diseases. Several free risk factors for the microvascular disease have been found. Age, glycated hemoglobin, length of diabetes, and the presence of serum oily

<table>
<thead>
<tr>
<th>Platelet index</th>
<th>Normal range</th>
<th>Std. deviation t P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPV (fL)</td>
<td>8.6-15.5 fL</td>
<td>1.63</td>
</tr>
<tr>
<td>PDW (fL)</td>
<td>9.0-14 fL</td>
<td>3.15</td>
</tr>
<tr>
<td>PCT (%)</td>
<td>0.22-0.24%</td>
<td>0.056</td>
</tr>
</tbody>
</table>

Table 4: Comparison of Platelet indices in two study groups
oils are all indications that one is at more risk of developing

Individuals with type 2 diabetes who have a GFR of less
than 60 ml/min/1.73 m2 have chronic renal impairment when
their HbA1c levels change over time [4, 5]. No previous
studies have looked at the link between HbA1c fluctuation
and an annual decrease in eGFR in people with type 2 and
type 1 diabetes. [9] HbA1c CV is an independent predictor
of eGFR deterioration in diabetics for the first time. In
nephropathy (ACR30 mg/g), the researchers reported a
stronger connection between HbA1c fluctuations and
impairment of renal function [12] than in normoalbuminuria.

HbA1c variability is more easily linked to microvascular
problems than short-term glucose fluctuations. Chronic renal
damage in persons with type 2 diabetes has been associated
with variations in HbA1c [1–2]. In contrast to other
recognized predictors of diabetic nephropathies, such as the
mean HbA1c, Penno et al. found SD-HbA1c to be related to
albuminuria. In the absence of established GFR predictors,
albuminuria and CV-HbA1c were shown to be directly
related to GFR decline [14].

Conclusion

Compared to type 2 diabetes patients with normal
kidney function, those who had microalbuminuria had a
higher hemoglobin A1c. Type 2 diabetics with low eGFR
had lower HbA1c levels, but they were more likely to have
microvascular complications.

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