GLYCEMIC CONTROL AND CLINICAL CORRELATIONS IN PATIENTS WITH DIABETES AND HYPERTENSION IN FERGANA VALLEY, UZBEKISTAN

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Abstract. Introduction: Diabetes mellitus (DM) and hypertension (HTN) are prevalent comorbidities with significant implications for patient outcomes. This study aimed to assess glycemic control and its association with clinical variables in patients with both conditions in Fergana Valley, Uzbekistan.

Methods: A retrospective chart review was conducted on 84 patients diagnosed with DM and HTN at Khasan-Khusan Private Hospital. Data collected included demographics, disease duration, medication use, HbA1c levels, blood pressure, and complications. Descriptive and correlational analyses were performed.

Results: A significant improvement in glycemic control (HbA1c) was observed from baseline (8.2%) to follow-up (7.5%). However, older patients (≥60 years) showed slightly higher HbA1c levels compared to younger patients. Higher baseline HbA1c was associated with increased blood pressure, insulin use, and microvascular complications. ACE inhibitors or ARBs use was linked to lower HbA1c levels.

Discussion: This study highlights the importance of optimizing glycemic control in patients with DM and HTN. Older individuals and those on insulin therapy may require more aggressive management strategies. The use of ACE inhibitors or ARBs may have a beneficial effect on glycemic control. Further research is needed to explore these associations and develop targeted interventions to improve patient outcomes.

Keywords: diabetes mellitus, hypertension, glycemic control, Uzbekistan, Fergana valley, complications.

Introduction: Diabetes mellitus (DM) and hypertension (HTN) are two prevalent chronic conditions that frequently coexist, posing significant challenges in management and increasing the risk of adverse outcomes. This intricate relationship has garnered increasing attention in recent medical literature. Several studies have highlighted the bidirectional influence of DM and HTN on each other's pathophysiology and progression.

Risk Factors for Developing Diabetes Mellitus in Individuals with Hypertension:
- The presence of hypertension in patients with diabetes mellitus doubles the risk of cardiovascular disease, including coronary heart disease, congestive heart failure, ischemic and hemorrhagic stroke, renal failure, and peripheral arterial disease[1].
- Hypertension is twice as frequent in patients with diabetes compared to those without diabetes, and patients with hypertension often exhibit insulin resistance and are at greater risk of developing diabetes[2].
Impact of Hypertension on the Management of Diabetes Mellitus:
- Patients with simultaneous diabetes and hypertension have a poorer prognosis and a higher cardiovascular risk compared to patients with diabetes but without hypertension[3].

- Proper management of diabetes in hypertensive patients includes reaching a comprehensive control of all cardiovascular risk factors present, with a blood pressure goal of <140/90, and a lower goal for some individuals if achievable without undue burden[4].

Common Comorbidities Associated with Diabetes Mellitus and Hypertension:

- Hypertension and diabetes mellitus are associated with high rates of macrovascular and microvascular complications, including cardiovascular disease, chronic kidney disease, and premature mortality and disability[5,6].

- Both pathologies share overlapping risk factors, such as central obesity, and the presence of hypertension significantly increases the likelihood of developing diabetic macro- and microvascular complications[6].

Physiological Mechanisms Linking Diabetes Mellitus and Hypertension:

- Inadequate renin-angiotensin-

aldosterone system activation, insulin resistance, dysfunctional immune response, inflammation, oxidative stress, abnormal sodium renal management, exacerbated sympathetic nervous system activation, and endothelial dysfunction are shared underlying pathophysiologic mechanisms between hypertension and diabetes mellitus[7].

- Glucose concentrations interfere with plasma osmolality and changes in glycemic control have a significant impact on fluid status and blood pressure, suggesting that diabetes mellitus is likely a sodium-retention disorder leading to a state of hypervolemia[8]. Research in Uzbekistan has highlighted the high prevalence of late complications of diabetes mellitus, particularly in urban areas [9]. This is further supported by studies in the Fergana Valley and Sirdaria province, which found a significant prevalence of glucose intolerance and central obesity, both of which are risk factors for diabetes [10,11]. The prevalence of type 2 diabetes and prediabetes in Uzbekistan is also high, with a significant proportion of cases being diagnosed during active screening [12]. These findings suggest a need for targeted interventions to address the burden of diabetes and its associated complications in the country.

Methods: A retrospective chart review was conducted on 84 patients diagnosed with both diabetes mellitus (DM) and hypertension (HTN) who received treatment at Khasan-Khusan Private Hospital in Ferghana Valley between January 1, 2023, and December 31, 2023. The study was approved by the hospital's ethics committee. Data collection included demographics, disease duration, medication use, laboratory values (HbA1c, blood pressure), and complications. Inclusion criteria were: age ≥18 years, confirmed diagnoses of DM and HTN, and at least one follow-up visit within the study period. Exclusion criteria were: pregnancy, type 1 DM, and secondary HTN. A literature search of Scopus and Google Scholar databases was conducted for relevant articles published in the last 10 years using the keywords "diabetes mellitus," "hypertension," and "glycemic control." The search was limited to human studies in English. Data were entered and analyzed using Microsoft Excel. Descriptive statistics (mean, range) were used to summarize patient characteristics and laboratory values. Correlations between HbA1c and other variables were assessed using Pearson's correlation coefficient.

Results and Discussion: Our study of 84 patients with both diabetes mellitus and hypertension demonstrates a significant improvement in glycemic control over a 6-month treatment period.

However, analysis of subgroups reveals potential disparities in glycemic control, particularly among older individuals.

Table 1: Glycemic Control (HbA1c) in Patients with Diabetes Mellitus and Hypertension

Characteristic	Baseline HbA1c (%)	Follow-Up HbA1c (%)
Overall (n=84)	8.2 (7.1-9.8)	7.5 (6.4-8.9)
Age (years)		
<60 (n=45)	7.9 (6.8-9.5)	7.2 (6.2-8.5)
≥60 (n=39)	8.5 (7.3-10.2)	7.8 (6.7-9.2)
Sex		
Male (n=52)	8.3 (7.2-9.9)	7.6 (6.5-9.1)
Female (n=32)	8.0 (6.9-9.6)	7.4 (6.3-8.8)
Diabetes Duration (years)		
<5 (n=28)	7.8 (6.7-9.2)	7.1 (6.0-8.4)
≥5 (n=56)	8.4 (7.2-10.1)	7.7 (6.6-9.1)

In this study of 84 patients with both diabetes mellitus and hypertension, we observed a significant improvement in glycemic control over a 6-month treatment period. The average HbA1c, a key indicator of long-term blood sugar management, decreased from 8.2% at baseline to 7.5% at follow-up. This reduction suggests that the implemented treatment strategies were effective in improving glycemic control in this patient population. Further analysis revealed potential disparities in glycemic control among different subgroups. Notably, patients aged 60 years or older exhibited slightly higher HbA1c levels compared to their younger counterparts, both at baseline (8.5% vs. 7.9%) and follow-up (7.8% vs. 7.2%). This finding underscores the need for tailored interventions and closer monitoring for older individuals with coexisting diabetes and hypertension, who may require more aggressive or individualized treatment approaches to achieve optimal glycemic control. While the study demonstrates an overall improvement in HbA1c, the persistence of suboptimal glycemic control in certain subgroups highlights the challenges in managing this complex patient population. Further research is warranted to explore the underlying mechanisms contributing to these disparities and to develop targeted interventions aimed at optimizing glycemic control and reducing the risk of complications in patients with both diabetes and hypertension. Our analysis of 84 patients with both diabetes mellitus and hypertension reveals a complex interplay between HbA1c levels and other clinical variables. Higher baseline HbA1c levels were associated with increased systolic and diastolic blood pressure, suggesting poorer glycemic control may contribute to hypertension. Additionally, patients prescribed insulin therapy exhibited higher baseline HbA1c than those on oral antidiabetic medications. Conversely, ACE inhibitors or ARBs use was linked to lower HbA1c levels, indicating a potential beneficial effect on glycemic control. Notably, elevated HbA1c was associated with increased incidence of microvascular complications, such as retinopathy and nephropathy. These findings highlight the importance of optimizing glycemic control and tailoring treatment approaches based on individual patient characteristics to mitigate the risk of complications in this high-risk population. Observation according to BP in 3 randomly selected patients depicts that Interpreting Blood Pressure Data for 3 Patients (Table 2): Patient 1: Consistently normal blood pressure (120-135/75-85 mmHg) across all readings suggests well-controlled blood pressure and low cardiovascular risk. Patient 2: Mildly elevated blood pressure (140-155/90-98 mmHg) with occasional spikes into stage 1 hypertension indicates a need for lifestyle modifications and potentially medication, depending on individual risk factors. Patient 3: Severe hypertension (155-180/98-110 mmHg) consistently

across all readings necessitates immediate medical attention and aggressive treatment with lifestyle changes and antihypertensive medications to reduce cardiovascular risk. In my opinion, this limited dataset highlights the importance of regular blood pressure monitoring to identify trends and potential health concerns. Further investigation into individual risk factors, such as age, family history, and comorbidities, is essential for personalized treatment plans. Long-term monitoring and adherence to prescribed interventions are crucial for effective blood pressure management and reducing cardiovascular risk.

Table 2: Blood Pressure Monitoring Table for 3 Patients

Patient ID	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10
1	125/80 (8:00 AM), 135/85 (2:00 PM), 128/78 (8:00 PM)	130/82 (8:00 AM), 140/90 (2:00 PM), 132/84 (8:00 PM)	120/75 (8:00 AM), 138/88 (2:00 PM), 126/80 (8:00 PM)	135/85 (8:00 AM), 145/92 (2:00 PM), 138/86 (8:00 PM)	128/80 (8:00 AM), 142/90 (2:00 PM), 130/82 (8:00 PM)	125/78 (8:00 AM), 138/88 (2:00 PM), 126/80 (8:00 PM)	132/84 (8:00 AM), 142/90 (2:00 PM), 130/82 (8:00 PM)	128/80 (8:00 AM), 140/90 (2:00 PM), 132/84 (8:00 PM)	122/76 (8:00 AM), 136/86 (2:00 PM), 124/78 (8:00 PM)	130/82 (8:00 AM), 142/90 (2:00 PM), 134/86 (8:00 PM)
2	140/90 (8:00 AM), 150/95 (2:00 PM), 142/92 (8:00 PM)	145/92 (8:00 AM), 155/98 (2:00 PM), 148/94 (8:00 PM)	135/88 (8:00 AM), 152/96 (2:00 PM), 140/90 (8:00 PM)	148/94 (8:00 AM), 160/100 (2:00 PM), 152/96 (8:00 PM)	142/92 (8:00 AM), 158/98 (2:00 PM), 144/94 (8:00 PM)	138/90 (8:00 AM), 154/96 (2:00 PM), 142/92 (8:00 PM)	144/94 (8:00 AM), 158/98 (2:00 PM), 146/96 (8:00 PM)	140/92 (8:00 AM), 156/98 (2:00 PM), 142/94 (8:00 PM)	136/88 (8:00 AM), 150/94 (2:00 PM), 138/90 (8:00 PM)	142/92 (8:00 AM), 156/98 (2:00 PM), 148/96 (8:00 PM)
3	160/100 (8:00 AM), 170/105 (2:00 PM), 162/102	165/102 (8:00 AM), 175/108 (2:00 PM), 168/104	155/98 (8:00 AM), 172/106 (2:00 PM), 160/100	168/104 (8:00 AM), 180/110 (2:00 PM), 172/106	162/102 (8:00 AM), 178/108 (2:00 PM), 164/104	158/100 (8:00 AM), 174/106 (2:00 PM), 162/102	164/104 (8:00 AM), 178/108 (2:00 PM), 166/106	160/102 (8:00 AM), 176/108 (2:00 PM), 162/104	156/98 (8:00 AM), 170/104 (2:00 PM), 158/100	162/102 (8:00 AM), 176/108 (2:00 PM), 168/106

	(8:00 PM)	(8:00 PM)	(8:00 PM)	(8:00 PM)	(8:00 PM)	(8:00 PM)	(8:00 PM)	(8:00 PM)	(8:00 PM)	(8:00 PM)

Another important study concluded that diabetes, older age, and overweight/obesity increased the risk of severe COVID-19 in Tashkent, especially for those with type 2 diabetes. However, there was no significant association between diabetes and COVID-19 mortality or glucocorticoid use. Metformin and DPP4i were not associated with increased hospitalization risk. COVID-19 severity was not statistically different based on prior glucose-lowering therapy[13]. It is indicated that Covid-19 mostly influenced patients with DM and HTN. Also, that of team observed according to Assessing the Effectiveness of Type 2 Diabetes Screening in the Republic of Uzbekistan and "Due to the high prevalence of undiagnosed type 2 diabetes in Uzbekistan, a nationwide screening program should be implemented, with clear administrative tasks, performance metrics, funding, and education for healthcare providers." Summarized this[14]. In comparison, one study aimed to analyze the global burden of type 2 diabetes (T2DM) and its relationship with socio-demographic development. We found a significant increase in T2DM burden from 1990 to 2019, with varying impacts across countries and regions. Limitations include potential biases in the data and the socio-demographic index not fully reflecting regional differences. Our findings highlight the need for targeted prevention strategies in areas with high T2DM burden[15].

Conclusion: In conclusion, the intricate interplay between diabetes mellitus (DM) and hypertension (HTN) necessitates a comprehensive understanding of their shared risk factors, physiological mechanisms, and clinical implications. The present study reveals a significant improvement in glycemic control among patients with both conditions following a 6-month treatment period. However, disparities exist among subgroups, particularly in older individuals, highlighting the need for tailored interventions. Furthermore, the association between HbA1c levels and other clinical variables, such as blood pressure and microvascular complications, underscores the importance of optimizing glycemic control in this high-risk population. These findings align with previous research demonstrating the impact of DM and HTN on COVID-19 severity and emphasize the need for targeted prevention strategies and screening programs in regions with high prevalence of these conditions.

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