DOI: 10.55522/jmpas.V15I3.7059 ISSN NO. 2320 – 7418

International peer reviewed open access journal

Journal of Medical Pharmaceutical and Allied Sciences

Journal homepage: www.jmpas.com CODEN: JMPACO

Research article

Glycemic control outcomes and associated factors among inpatients with type 2 Diabetes mellitus and impaired renal function at Can Tho Central General Hospital in 2024

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Received - 20-02-2025**, Revised** - 28-04-2025, **Accepted** - 12-05-2026 **(DD-MM-YYYY)**

Refer This Article

Van-Dung Thach, Thi-Ngoc-Giau Truong, 2026. Glycemic control outcomes and associated factors among inpatients with type 2 Diabetes mellitus and impaired renal function at Can Tho Central General Hospital in 2024. Journal of medical pharmaceutical and allied sciences, V 15, I 3, Pages 08 – 16. Doi: https://doi.org/10.55522/jmpas.V15I3.7059.

ABSTRACT

Glycemic control in patients with type 2 diabetes mellitus and impaired renal function is clinically challenging because renal dysfunction may alter glucose metabolism, increase glycemic variability, and raise the risk of hypoglycemia. In this high-risk population, assessing glycemic control outcomes and related factors is essential for improving individualized treatment strategies. This study aimed to determine the rates of glycemic control and identify factors associated with glycemic control outcomes among inpatients with type 2 diabetes mellitus and impaired renal function at Can Tho Central General Hospital in 2024. A retrospective cross-sectional study was conducted using medical records of 310 inpatients with type 2 diabetes mellitus and impaired renal function treated at the Nephrology and Endocrinology Departments of Can Tho Central General Hospital from January to August 2024. Glycemic control was evaluated using fasting blood glucose, HbA1c, and overall glycemic control status. Fasting blood glucose was considered controlled when it ranged from 4.4 to 7.2 mmol/L, while HbA1c was considered controlled when it was ≤7.0%. Overall glycemic control was defined as achieving both fasting blood glucose and HbA1c targets. Associations between glycemic control outcomes and patient characteristics, renal disease status, and treatment-related factors were analyzed using odds ratios, 95% confidence intervals, and p-values. Among 310 patients, 195 patients achieved the fasting blood glucose target, accounting for 62.9%, while 174 patients achieved the HbA1c target, accounting for 56.1%. Overall glycemic control was achieved in 45.8% of patients, whereas 54.2% did not achieve overall control. No statistically significant association was found between fasting blood glucose control and sex, age group, number of comorbidities, admission glucose control status, type of kidney disease, chronic kidney disease stage, or insulin type. Similarly, HbA1c control was not significantly associated with sex, age group, number of comorbidities, admission HbA1c control status, type of kidney disease, chronic kidney disease stage, or insulin type. However, age group was significantly associated with overall glycemic control. Compared with patients younger than 40 years, patients aged 40-<60 years and those aged ≥60 years had significantly different odds of not achieving overall glycemic control, with p-values of 0.043 and 0.050, respectively. Glycemic control among inpatients with type 2 diabetes mellitus and impaired renal function remained suboptimal, particularly when both fasting blood glucose and HbA1c targets were considered together. Age group was the only factor significantly associated with overall glycemic control. These findings highlight the need for individualized monitoring and age-specific glycemic management strategies in this high-risk inpatient population.

Keywords: Type 2 diabetes mellitus, Impaired renal function, Glycemic control, Fasting blood glucose, HbA1c, Associated factors.

INTRODUCTION

Glycemic control is a major therapeutic goal in patients with type 2 diabetes mellitus (T2DM), particularly in those who already have impaired renal function. Persistent hyperglycemia contributes to vascular injury, accelerates renal function decline, and increases the risk of both microvascular and macrovascular complications. In patients with diabetic kidney disease or chronic kidney disease, maintaining appropriate blood glucose levels is clinically important not only to delay renal disease progression but also to reduce the risk of cardiovascular events, hospitalization, and premature mortality [1,2].

However, achieving glycemic control in patients with T2DM and impaired renal function is considerably more difficult than in patients with preserved kidney function. Declining renal function may alter insulin metabolism, reduce insulin clearance, increase glucose variability, and raise the risk of hypoglycemia. In advanced chronic kidney disease, poor appetite, malnutrition, dialysis-related metabolic changes, and multiple comorbidities may further complicate glucose management. Therefore, glycemic targets in this population should not be applied rigidly but should be individualized according to age, kidney function, comorbidities, nutritional status, and risk of hypoglycemia [3,4].

Fasting blood glucose and glycated hemoglobin (HbA1c) are commonly used indicators for evaluating glycemic control. Fasting blood glucose reflects short-term glycemic status, while HbA1c reflects the average blood glucose level over the previous two to three months. In patients with renal impairment, HbA1c remains an important monitoring marker, but its interpretation may be affected by anemia, altered red blood cell survival, dialysis, and erythropoietin use. For this reason, evaluating both fasting blood glucose and HbA1c may provide a more comprehensive assessment of glycemic control than relying on a single indicator [3,4].

Previous studies have shown that glycemic control in patients with T2DM and renal impairment remains suboptimal. Nguyen Thi Huynh Mai reported that among patients with T2DM and impaired renal function at Can Tho City General Hospital, the rate of achieving fasting blood glucose target after three months of treatment was 40.44%, while the rate of achieving HbA1c target was 52.00% [5]. Lu et al. found that adherence to clinical guidelines was significantly associated with better HbA1c target achievement in patients with diabetic nephropathy, emphasizing the importance of appropriate monitoring and treatment management in this population [6]. These findings suggest that glycemic outcomes are influenced by multiple clinical and treatment-related factors rather than by medication use alone.

Several factors may affect glycemic control in patients with T2DM, including age, sex, comorbidities, baseline glycemic status, renal disease severity, and treatment characteristics. In patients with impaired renal function, these factors may interact in complex ways. Older patients often have longer disease duration, more comorbidities, altered pharmacokinetics, and a higher risk of treatment-related adverse events. Patients with advanced kidney disease may require less aggressive glycemic targets to avoid hypoglycemia, while those with poor long-term control may require closer follow-up and treatment adjustment. International and Vietnamese studies have also suggested that treatment complexity and clinical complications may contribute to poor glycemic control among patients with T2DM [7,8].

Can Tho Central General Hospital receives many inpatients with T2DM and renal impairment from Can Tho and neighboring provinces. This patient group often presents with advanced kidney disease, multiple comorbidities, and unstable clinical conditions during hospitalization. Therefore, assessing glycemic control outcomes and identifying related factors in this setting is necessary to provide practical evidence for improving inpatient diabetes management. This study was conducted to determine the rates of fasting blood glucose control, HbA1c control, and overall glycemic control among inpatients with T2DM and impaired renal function treated at Can Tho Central General Hospital in 2024. The study also examined selected factors associated with these outcomes, including demographic characteristics, admission glycemic status, renal disease characteristics, number of comorbidities, and insulin type.

MATERIALS AND METHODS

Study design and setting

This was a retrospective cross-sectional descriptive and analytical study based on medical records. The study was conducted at the Nephrology and Endocrinology Departments of Can Tho Central General Hospital, Vietnam. Medical records of inpatients treated from January 1, 2024 to August 30, 2024 were reviewed. The study focused on evaluating glycemic control outcomes and selected associated factors among patients with type 2 diabetes mellitus and impaired renal function.

Study population

The study population included medical records of inpatients aged 18 years or older who were diagnosed with type 2 diabetes mellitus according to the diagnostic criteria of the Vietnamese Ministry of Health and had impaired renal function. Renal impairment included chronic kidney disease from stage 1 to stage 5 according to the classification of the Vietnamese Ministry of Health, or acute kidney injury diagnosed according to KDIGO 2012 criteria, including acute kidney injury superimposed on chronic kidney

disease [9,10]. Medical records were included if patients were hospitalized during the study period and contained sufficient information for evaluating glycemic control outcomes. Records were excluded if they were damaged, incomplete, missing essential data, belonged to patients who escaped from hospital or were transferred to another hospital, or belonged to pregnant or breastfeeding women.

Sample size and sampling method

The sample size was calculated using the formula for estimating a single population proportion. With a 95% confidence level, Z = 1.96, an accepted margin of error of d = 0.06, and p = 0.52 based on the study by Nguyen Thi Huynh Mai reporting that 52.0% of patients achieved the HbA1c target [5], the minimum required sample size was 267 medical records. After adding 15% to account for incomplete records, the required sample size was 307 and was rounded to 310. During the study period, there were 930 inpatient treatment records of patients with T2DM and renal impairment. Systematic random sampling was applied with a sampling interval of k = 930/310 = 3. All eligible records were numbered from 1 to 930, the first record was randomly selected from numbers 1 to 3, and every third record was selected until 310 medical records were obtained.

Study variables

The main outcome variables were fasting blood glucose control, HbA1c control, and overall glycemic control at discharge. Fasting blood glucose control was classified as achieved when fasting blood glucose was between 4.4 and 7.2 mmol/L. HbA1c control was classified as achieved when HbA1c was ≤7.0%. Overall glycemic control was classified as achieved when both fasting blood glucose and HbA1c targets were met. Independent variables included sex, age group, number of comorbidities, fasting blood glucose control at admission, HbA1c control at admission, type of kidney disease, chronic kidney disease stage, and insulin type. Age was grouped into <40 years, 40-<60 years, and ≥60 years. The number of comorbidities was grouped into fewer than three diseases, three to five diseases, and more than five diseases. Kidney disease was classified as acute kidney disease or chronic kidney disease. Chronic kidney disease stage was classified according to the recorded disease stage in the medical records. Insulin type was classified as rapid- or short-acting insulin, long-acting insulin, or premixed insulin.

Data collection

Data were extracted from medical records using a structured data collection form. The form recorded demographic characteristics, renal disease status, comorbidities, fasting blood glucose and HbA1c values at admission and discharge, and insulin type. Each medical record was reviewed according to the inclusion and exclusion criteria before data extraction. The collected data were checked against the original medical records to reduce missing or inconsistent information, then coded for statistical analysis.

Statistical analysis

Data were entered and managed using Microsoft Excel and analyzed using SPSS version 25.0. Categorical variables were presented as frequencies and percentages. Continuous variables were presented as mean, standard deviation, minimum, and maximum values where appropriate. Associations between glycemic control outcomes and related factors were analyzed using odds ratios, 95% confidence intervals, and p-values. A p-value of less than 0.05 was considered statistically significant.

Ethical considerations

This study used retrospective data from archived medical records at Can Tho Central General Hospital. The study was approved by the hospital's Board of Directors and Scientific Council. Patient information was coded and kept confidential. Data were used only for scientific research purposes, and no personal identifying information was presented in the study.

RESULTS

Glycemic control outcomes

A total of 310 inpatients with type 2 diabetes mellitus and impaired renal function were included in the analysis. At discharge, 195 patients achieved the fasting blood glucose target, accounting for 62.9%, whereas 115 patients did not achieve the target, accounting for 37.1%. The mean fasting blood glucose level was 7.1 ± 2.9 mmol/L.

Regarding HbA1c control, 174 patients achieved the HbA1c target, accounting for 56.1%, while 136 patients did not achieve the target, accounting for 43.9%. The mean HbA1c level was 8.0 ± 1.5%.

When both fasting blood glucose and HbA1c targets were considered together, 142 patients achieved overall glycemic control, accounting for 45.8%, while 168 patients did not achieve overall control, accounting for 54.2%. This indicates that the proportion of patients achieving comprehensive glycemic control was lower than the proportions achieving either fasting blood glucose or HbA1c control alone.

Factors associated with fasting blood glucose control

The association between fasting blood glucose control and patient characteristics is presented in Table 2. Among female patients, 133 patients achieved fasting blood glucose control, accounting for 60.7%, while 86 patients did not achieve control, accounting for 39.3%. Among male patients, 62 patients achieved control, accounting for 68.1%, while 29 patients did not achieve control, accounting for 31.9%. The association between sex and fasting blood glucose control was not statistically significant, with OR = 1.38, 95% CI: 0.82-2.32, p = 0.219.

By age group, fasting blood glucose control was achieved

in 8 patients aged <40 years, accounting for 80.0%; 52 patients aged 40-<60 years, accounting for 59.1%; and 135 patients aged ≥60 years, accounting for 63.7%. No statistically significant association was found between age group and fasting blood glucose control. Compared with the <40-year group, the OR was 2.77 for the 40-<60-year group, with 95% CI: 0.56-13.81, p = 0.214; and 2.28 for the ≥60-year group, with 95% CI: 0.47-11.02, p = 0.305.

Regarding the number of comorbidities, fasting blood glucose control was achieved in 8 patients with fewer than three comorbidities, accounting for 66.7%; 140 patients with three to five comorbidities, accounting for 60.9%; and 47 patients with more than five comorbidities, accounting for 69.1%. No statistically significant association was observed between the number of comorbidities and fasting blood glucose control.

Table 1: Glycemic control outcomes among patients with type 2 diabetes mellitus and impaired renal function

Glycemic control indicator	Achieved n (%)	Not achieved n (%)	Mean ± SD
Fasting blood glucose	195 (62.9)	115 (37.1)	7.1 ± 2.9 mmol/L
HbA1c	174 (56.1)	136 (43.9)	8.0 ± 1.5%
Overall glycemic control	142 (45.8)	168 (54.2)	-

Table 2: Association between fasting blood glucose control and patient characteristics

Variable	Achieved n (%)	Not achieved n (%)	OR (95% CI)	p-value
Sex				
Female	133 (60.7)	86 (39.3)	1.38 (0.82-2.32)	0.219
Male	62 (68.1)	29 (31.9)	Reference	-
Age group				
<40 years	8 (80.0)	2 (20.0)	Reference	-
40-<60 years	52 (59.1)	36 (40.9)	2.77 (0.56-13.81)	0.214
≥60 years	135 (63.7)	77 (36.3)	2.28 (0.47-11.02)	0.305
Number of comorbidities				
<3 diseases	8 (66.7)	4 (33.3)	Reference	-
3-5 diseases	140 (60.9)	90 (39.1)	1.29 (0.38-4.39)	0.689
>5 diseases	47 (69.1)	21 (30.9)	0.89 (0.24-3.30)	0.866

Table 3: Association between fasting blood glucose control at discharge and at admission

Admission fasting blood glucose control	Achieved at discharge n (%)	Not achieved at discharge n (%)	OR (95% CI)	p-value
Achieved	102 (58.6)	72 (41.4)	0.66 (0.40-1.08)	0.08
Not achieved	93 (68.4)	43 (31.6)	Reference	-

Association between fasting blood glucose control at discharge and fasting blood glucose control at admission

Among patients who achieved fasting blood glucose control at admission, 102 patients also achieved control at discharge, accounting for 58.6%, while 72 patients did not achieve control at discharge, accounting for 41.4%. Among patients who did not achieve fasting blood glucose control at admission, 93 patients achieved control at discharge, accounting for 68.4%, while 43 patients did not achieve control at discharge, accounting for 31.6%. There was no statistically significant association between fasting blood glucose control at admission and fasting blood glucose control at discharge, with OR = 0.66, 95% CI: 0.40-1.08, p = 0.08.

Association between fasting blood glucose control and renal disease characteristics

Among patients with acute kidney disease, 7 patients achieved fasting blood glucose control, accounting for 53.8%, while 6 patients did not achieve control, accounting for 46.2%. Among patients with chronic kidney disease, 188 patients achieved control, accounting for 63.3%, while 109 patients did not achieve control, accounting for 36.7%. The association between kidney disease type and fasting blood glucose control was not statistically significant, with OR = 1.48, 95% CI: 0.48-4.51, p = 0.490.

For chronic kidney disease stage, fasting blood glucose control was achieved in 6 patients with stage 2 disease, accounting for 50.0%; 22 patients with stage 3 disease, accounting for 57.9%; 44 patients with stage 4 disease, accounting for 66.7%; and 116 patients with stage 5 disease, accounting for 64.1%. No statistically significant association was found between chronic kidney disease stage and fasting blood glucose control.

Association between fasting blood glucose control and insulin type

Among patients receiving long-acting insulin, 48 achieved fasting blood glucose control, accounting for 59.3%, while 33 did not achieve control, accounting for 40.7%. Among patients receiving premixed insulin, 39 achieved controls, accounting for 65.0%, while 21 did not achieve control, accounting for 35.0%. Among patients receiving rapid- or short-acting insulin, 107 achieved controls, accounting for 63.7%, while 61 did not achieve control, accounting for 36.3%.

There was no statistically significant association between insulin type and fasting blood glucose control. Compared with long-acting insulin, the OR was 1.28 for premixed insulin, with 95% CI: 0.64-2.55, p = 0.49; and 1.21 for rapid- or short-acting insulin, with 95% CI: 0.70-2.08, p = 0.50.

Factors associated with HbA1c control

The association between HbA1c control and patient characteristics is presented in Table 6. Among female patients, 122 achieved HbA1c control, accounting for 55.7%, while 97 did not achieve control, accounting for 44.3%. Among male patients, 52 achieved control, accounting for 57.1%, while 39 did not achieve

control, accounting for 42.9%. No statistically significant association was found between sex and HbA1c control, with OR = 1.06, 95% CI: 0.65-1.74, p = 0.817.

By age group, HbA1c control was achieved in 8 patients aged <40 years, accounting for 80.0%; 47 patients aged 40-<60 years, accounting for 53.4%; and 119 patients aged ≥60 years, accounting for 56.1%. The association between age group and HbA1c control was not statistically significant.

Regarding the number of comorbidities, HbA1c control was achieved in 7 patients with fewer than three comorbidities, accounting for 58.3%; 127 patients with three to five comorbidities, accounting for 55.2%; and 40 patients with more than five comorbidities, accounting for 58.8%. No statistically significant association was found.

Table 4: Association between fasting blood glucose control and renal disease characteristics

Variable	Achieved n (%)	Not achieved n (%)	OR (95% CI)	p-value
Type of kidney disease				
Acute kidney disease	7 (53.8)	6 (46.2)	1.48 (0.48-4.51)	0.490
Chronic kidney disease	188 (63.3)	109 (36.7)	Reference	-
Chronic kidney disease stage				
Stage 2	6 (50.0)	6 (50.0)	Reference	-
Stage 3	22 (57.9)	16 (42.1)	1.38 (0.37-5.06)	0.630
Stage 4	44 (66.7)	22 (33.3)	2.00 (0.58-6.92)	0.270
Stage 5	116 (64.1)	65 (35.9)	1.78 (0.55-5.76)	0.330

Table 5: Association between fasting blood glucose control and insulin type

Insulin type	Achieved n (%)	Not achieved n (%)	OR (95% CI)	p-value
Long-acting insulin	48 (59.3)	33 (40.7)	Reference	
Premixed insulin	39 (65.0)	21 (35.0)	1.28 (0.64-2.55)	0.49
Rapid- or short-acting insulin	107 (63.7)	61 (36.3)	1.21 (0.70-2.08)	0.50

Table 6: Association between HbA1c control and patient characteristics

Variable	Achieved n (%)	Not achieved n (%)	OR (95% CI)	p-value
Sex				
Female	122 (55.7)	97 (44.3)	1.06 (0.65-1.74)	0.817
Male	52 (57.1)	39 (42.9)	Reference	-
Age group				
<40 years	8 (80.0)	2 (20.0)	Reference	-
40-<60 years	47 (53.4)	41 (46.6)	3.49 (0.70-13.37)	0.127
≥60 years	119 (56.1)	93 (43.9)	3.13 (0.65-15.07)	0.156
Number of comorbidities				
<3 diseases	7 (58.3)	5 (41.7)	Reference	-
3-5 diseases	127 (55.2)	103 (44.8)	1.14 (0.35-3.68)	0.832
>5 diseases	40 (58.8)	28 (41.2)	0.98 (0.28-3.40)	0.975

Table 7: Association between HbA1c control at discharge and at admission

Admission HbA1c control	Achieved at discharge n (%)	Not achieved at discharge n (%)	OR (95% CI)	p-value
Achieved	95 (60.5)	62 (39.5)	1.44 (0.89-2.31)	0.12
Not achieved	79 (51.6)	74 (48.4)	Reference	-

Association between HbA1c control and renal disease characteristics

Among patients with acute kidney disease, 8 achieved HbA1c control, accounting for 61.5%, while 5 did not achieve control, accounting for 38.5%. Among patients with chronic kidney disease, 166 achieved controls, accounting for 55.9%, while 131 did not achieve control, accounting for 44.1%. The association between kidney disease type and HbA1c control was not statistically significant, with OR = 0.79, 95% CI: 0.25-2.48, p = 0.688.

For chronic kidney disease stage, HbA1c control was achieved in 9 patients with stage 2 disease, accounting for 75.0%; 19 patients with stage 3 disease, accounting for 50.0%; 38 patients with stage 4 disease, accounting for 57.6%; and 100 patients with stage 5 disease, accounting for 55.2%. No statistically significant association was found between chronic kidney disease stage and HbA1c control.

Association between HbA1c control and insulin type

Among patients receiving long-acting insulin, 45 achieved HbA1c control, accounting for 55.6%, while 36 did not achieve control, accounting for 44.4%. Among patients receiving premixed insulin, 38 achieved controls, accounting for 63.3%, while 22 did not achieve control, accounting for 36.7%. Among patients receiving rapid- or short-acting insulin, 90 achieved controls, accounting for 53.6%, while 78 did not achieve control, accounting for 46.4%.

There was no statistically significant association between insulin type and HbA1c control. Compared with long-acting insulin, the OR was 1.38 for premixed insulin, with 95% CI: 0.70-2.74, p = 0.35; and 0.92 for rapid- or short-acting insulin, with 95% CI: 0.54-1.57, p = 0.77.

Factors associated with overall glycemic control

Overall glycemic control was defined as achieving both fasting blood glucose and HbA1c targets. Among female patients, 97

achieved overall glycemic control, accounting for 44.3%, while 122 did not achieve control, accounting for 55.7%. Among male patients, 45 achieved controls, accounting for 49.5%, while 46 did not achieve control, accounting for 50.5%. The association between sex and overall glycemic control was not statistically significant, with OR = 1.23, 95% CI: 0.75-2.01, p = 0.406.

Age group was significantly associated with overall glycemic control. Among patients aged <40 years, 8 achieved overall control, accounting for 80.0%, while 2 did not achieve control, accounting for 20.0%. Among patients aged 40-<60 years, 38 achieved control, accounting for 43.2%, while 50 did not achieve control, accounting for 56.8%. Compared with the <40-year group, the OR was 5.26, 95% CI: 1.06-26.22, p = 0.043. Among patients aged ≥60 years, 96 achieved control, accounting for 45.3%, while 116 did not achieve control, accounting for 54.7%. Compared with the <40-year group, the OR was 4.83, 95% CI: 1.00-23.30, p = 0.050.

Regarding the number of comorbidities, overall glycemic control was achieved in 6 patients with fewer than three comorbidities, accounting for 50.0%; 102 patients with three to five comorbidities, accounting for 44.3%; and 34 patients with more than five comorbidities, accounting for 50.0%. No statistically significant association was found.

Table 8: Association between HbA1c control and renal disease characteristics

Variable	Achieved n (%)	Not achieved n (%)	OR (95% CI)	p-value
Type of kidney disease				
Acute kidney disease	8 (61.5)	5 (38.5)	0.79 (0.25-2.48)	0.688
Chronic kidney disease	166 (55.9)	131 (44.1)	Reference	-
Chronic kidney disease stage				
Stage 2	9 (75.0)	3 (25.0)	Reference	-
Stage 3	19 (50.0)	19 (50.0)	0.33 (0.08-1.43)	0.140
Stage 4	38 (57.6)	28 (42.4)	0.45 (0.11-1.83)	0.270
Stage 5	100 (55.2)	81 (44.8)	0.41 (0.11-1.57)	0.190

Table 9: Association between HbA1c control and insulin type

Insulin type	Achieved n (%)	Not achieved n (%)	OR (95% CI)	p-value
Long-acting insulin	45 (55.6)	36 (44.4)	Reference	-
Premixed insulin	38 (63.3)	22 (36.7)	1.38 (0.70-2.74)	0.35
Rapid- or short-acting insulin	90 (53.6)	78 (46.4)	0.92 (0.54-1.57)	0.77

Table 10: Association between overall glycemic control and patient characteristics

Variable	Achieved n (%)	Not achieved n (%)	OR (95% CI)	p-value
Sex				
Female	97 (44.3)	122 (55.7)	1.23 (0.75-2.01)	0.406
Male	45 (49.5)	46 (50.5)	Reference	-
Age group				
<40 years	8 (80.0)	2 (20.0)	Reference	-
40-<60 years	38 (43.2)	50 (56.8)	5.26 (1.06-26.22)	0.043
≥60 years	96 (45.3)	116 (54.7)	4.83 (1.00-23.30)	0.050
Number of comorbidities				
<3 diseases	6 (50.0)	6 (50.0)	Reference	-
3-5 diseases	102 (44.3)	128 (55.7)	1.26 (0.39-4.01)	0.702
>5 diseases	34 (50.0)	34 (50.0)	1.00 (0.29-3.41)	1.000

Table 11: Association between overall glycemic control and renal disease characteristics

Variable	Achieved n (%)	Not achieved n (%)	OR (95% CI)	p-value
Type of kidney disease				
Acute kidney disease	6 (46.2)	7 (53.8)	0.99 (0.32-3.00)	0.98
Chronic kidney disease	136 (45.8)	161 (54.2)	Reference	-
Chronic kidney disease stage				
Stage 2	6 (50.0)	6 (50.0)	Reference	-
Stage 3	17 (44.7)	21 (55.3)	0.81 (0.22-3.00)	0.75
Stage 4	31 (47.0)	35 (53.0)	0.89 (0.26-3.03)	0.85
Stage 5	82 (45.3)	99 (54.7)	0.83 (0.26-2.67)	0.75

Table 12: Association between overall glycemic control and insulin type

Insulin type	Achieved n (%)	Not achieved n (%)	OR (95% CI)	p-value
Long-acting insulin	37 (45.7)	44 (54.3)	Reference	-
Premixed insulin	33 (55.0)	27 (45.0)	1.45 (0.74-2.84)	0.27
Rapid- or short-acting insulin	71 (42.3)	97 (57.7)	0.87 (0.51-1.48)	0.61

Association between overall glycemic control and renal disease characteristics

Among patients with acute kidney disease, 6 achieved overall glycemic control, accounting for 46.2%, while 7 did not achieve control, accounting for 53.8%. Among patients with chronic kidney disease, 136 achieved controls, accounting for 45.8%, while 161 did not achieve control, accounting for 54.2%. There was no statistically significant association between type of kidney disease and overall glycemic control, with OR = 0.99, 95% CI: 0.32-3.00, p = 0.98.

For chronic kidney disease stage, overall glycemic control was achieved in 6 patients with stage 2 disease, accounting for 50.0%; 17 patients with stage 3 disease, accounting for 44.7%; 31 patients with stage 4 disease, accounting for 47.0%; and 82 patients with stage 5 disease, accounting for 45.3%. No statistically significant association was found between chronic kidney disease stage and overall glycemic control.

Association between overall glycemic control and insulin type

Among patients receiving long-acting insulin, 37 achieved overall glycemic control, accounting for 45.7%, while 44 did not achieve control, accounting for 54.3%. Among patients receiving premixed insulin, 33 achieved controls, accounting for 55.0%, while 27 did not achieve control, accounting for 45.0%. Among patients receiving rapid- or short-acting insulin, 71 achieved controls, accounting for 42.3%, while 97 did not achieve control, accounting for 57.7%.

There was no statistically significant association between insulin type and overall glycemic control. Compared with long-acting insulin, the OR was 1.45 for premixed insulin, with 95% CI: 0.74-2.84, p = 0.27; and 0.87 for rapid- or short-acting insulin, with 95% CI: 0.51-1.48, p = 0.61.

Summary of associated factors

In summary, fasting blood glucose control was not significantly associated with sex, age group, number of comorbidities, fasting blood glucose control at admission, type of kidney disease, chronic kidney disease stage, or insulin type. HbA1c control was also not significantly associated with sex, age group, number of comorbidities, HbA1c control at admission, type of kidney disease, chronic kidney disease stage, or insulin type.

For overall glycemic control, age group was the only factor showing a statistically significant association. Patients aged 40-<60 years and those aged ≥60 years had significantly different overall glycemic control outcomes compared with patients aged <40 years. Other factors, including sex, number of comorbidities, type of kidney disease, chronic kidney disease stage, and insulin type, were not significantly associated with overall glycemic control.

DISCUSSION

This study assessed glycemic control outcomes and associated factors among inpatients with type 2 diabetes mellitus and impaired renal function at Can Tho Central General Hospital in 2024. The results showed that 62.9% of patients achieved the fasting blood glucose target, while 56.1% achieved the HbA1c target. However, when both indicators were considered simultaneously, only 45.8% achieved overall glycemic control. This finding indicates that achieving a single glycemic indicator does not necessarily reflect comprehensive glycemic control in patients with impaired renal function.

The difference between fasting blood glucose control and overall glycemic control is clinically meaningful. Fasting blood glucose reflects glycemic status at a specific time point and may improve during hospitalization because patients receive closer monitoring, dietary control, and treatment adjustment. In contrast, HbA1c reflects longer-term glycemic exposure over the previous two to three months and may remain elevated despite short-term improvement in fasting blood glucose. Therefore, the combined assessment of fasting blood glucose and HbA1c provides a stricter and more comprehensive evaluation of glycemic control.

Compared with the study by Nguyen Thi Huynh Mai, in which 40.44% of patients achieved the fasting blood glucose target after three months and 52.00% achieved the HbA1c target, the present study showed a higher fasting blood glucose control rate and a slightly higher HbA1c control rate [5]. However, the overall glycemic control rate in the present study remained below 50%, suggesting that glycemic management in patients with impaired renal function remains difficult. This finding is consistent with previous studies showing that glycemic control in patients with diabetes and chronic kidney disease, especially those approaching end-stage renal disease or receiving dialysis, is often suboptimal [11,12].

The lower HbA1c control rate compared with fasting blood glucose control may be explained by several clinical factors. Many patients with renal impairment have long-standing diabetes, fluctuating glucose levels, multiple comorbidities, and complex treatment regimens. In addition, HbA1c interpretation in chronic kidney disease requires caution because it may be affected by anemia, dialysis, erythropoietin use, altered red blood cell survival, and uremic conditions. Although HbA1c remains an important marker of long-term glycemic control, it should be interpreted together with clinical context and short-term glucose values in patients with impaired renal function [3,13].

Regarding associated factors, fasting blood glucose control was not significantly related to sex, age group, number of comorbidities, admission fasting blood glucose control, type of

kidney disease, chronic kidney disease stage, or insulin type. Similarly, HbA1c control was not significantly associated with sex, age group, number of comorbidities, admission HbA1c control, renal disease characteristics, or insulin type. These findings suggest that individual glycemic indicators may be affected by multiple interacting factors rather than by one single demographic or clinical variable.

Age group was the only factor significantly associated with overall glycemic control. Patients aged 40-<60 years and those aged ≥60 years showed statistically significant differences in overall glycemic control compared with patients younger than 40 years. This suggests that older age groups may have greater difficulty achieving simultaneous control of both fasting blood glucose and HbA1c. In clinical practice, older patients often have longer diabetes duration, more comorbidities, reduced renal function, altered drug metabolism, and higher vulnerability to hypoglycemia. These characteristics may limit the intensity of glycemic management and make comprehensive glycemic control more difficult.

This finding is consistent with previous evidence that age may influence glycemic control outcomes in patients with type 2 diabetes mellitus. Ghabban et al. reported that age was associated with glycemic control among patients with type 2 diabetes mellitus, suggesting that glycemic outcomes may vary across age groups [7]. However, the direction and magnitude of this association may differ depending on study population, treatment setting, disease severity, comorbidity burden, and glycemic target definitions. In the present study, age was significantly associated only with overall glycemic control, not with fasting blood glucose or HbA1c alone. This supports the value of using combined glycemic assessment when evaluating treatment outcomes in complex patients.

The absence of a significant association between renal disease stage and glycemic control may be partly explained by the distribution of the study population. Most patients had chronic kidney disease, and many were in advanced stages. This limited variation between renal disease categories may reduce the ability to detect differences. In addition, glycemic control in renal impairment depends not only on kidney disease stage but also on nutritional intake, dialysis status, insulin metabolism, insulin dose adjustment, acute illness, and clinician monitoring [11,13].

The study also found no statistically significant association between insulin type and glycemic control outcomes. This does not mean that insulin type has no clinical relevance. Rather, glycemic control may depend more on insulin dose adjustment, timing of administration, nutritional intake, dialysis status, injection technique, and close monitoring than on insulin type alone. Previous research has suggested that complex treatment regimens, medication-related problems, and treatment adherence may contribute to poor glycemic control among patients with type 2 diabetes mellitus [8,13,14].

The proportion of patients who did not achieve overall glycemic control was 54.2%, highlighting the need for more individualized management. In patients with impaired renal function, treatment should not focus only on lowering glucose values but also on avoiding hypoglycemia, monitoring nutritional status, managing comorbidities, and adjusting therapy according to renal function. For older patients and those with multiple chronic diseases or advanced renal impairment, glycemic targets should be individualized to balance treatment effectiveness and safety [3,4,13,15].

Overall, the findings indicate that glycemic control among inpatients with type 2 diabetes mellitus and impaired renal function remains a major clinical challenge. Although fasting blood glucose and HbA1c control rates were moderate, fewer than half of patients achieved comprehensive glycemic control. Age group was significantly associated with overall glycemic control, suggesting the need for age-sensitive management strategies, closer monitoring, and individualized intervention plans in this high-risk inpatient population.

CONCLUSION

Among 310 inpatients with type 2 diabetes mellitus and impaired renal function treated at Can Tho Central General Hospital in 2024, 62.9% achieved the fasting blood glucose target and 56.1% achieved the HbA1c target. However, only 45.8% achieved overall glycemic control, while 54.2% did not achieve simultaneous control of both fasting blood glucose and HbA1c.

No statistically significant association was found between fasting blood glucose control and sex, age group, number of comorbidities, admission fasting blood glucose control, type of kidney disease, chronic kidney disease stage, or insulin type. HbA1c control was also not significantly associated with sex, age group, number of comorbidities, admission HbA1c control, renal disease characteristics, or insulin type.

Age group was significantly associated with overall glycemic control. Patients aged 40-<60 years and those aged ≥60 years showed statistically significant differences in overall glycemic control compared with patients younger than 40 years. These findings suggest that comprehensive glycemic control remains difficult in patients with type 2 diabetes mellitus and impaired renal function, particularly in older age groups.

Recommendations

Clinical monitoring should be strengthened for patients with type 2 diabetes mellitus and impaired renal function, especially those aged 40 years and older. In addition to fasting blood glucose, HbA1c should be regularly assessed to evaluate long-term glycemic control. However, HbA1c results should be interpreted carefully in

patients with advanced renal impairment, anemia, dialysis, or conditions affecting red blood cell turnover.

Glycemic management should be individualized according to age, renal function, comorbidity burden, nutritional status, dialysis status, and hypoglycemia risk. For older patients and those with advanced chronic kidney disease, treatment targets should balance glycemic effectiveness with safety rather than focusing only on strict glucose reduction.

Hospitals should strengthen clinical pharmacy involvement in monitoring glycemic control, reviewing insulin regimens, identifying medication-related problems, and supporting appropriate dose adjustment in patients with renal impairment. Particular attention should be given to insulin dose titration, timing of administration, nutritional intake, and prevention of hypoglycemia.

Patient education should also be enhanced, especially regarding blood glucose monitoring, insulin administration technique, recognition and management of hypoglycemia, diet, and treatment adherence. This is important because glycemic control may depend not only on medication selection but also on how treatment is administered and followed in daily practice.

Future studies should investigate additional factors that may influence glycemic control, including duration of diabetes, dialysis status, nutritional intake, medication adherence, insulin dose adjustment, injection technique, hypoglycemic events, socioeconomic factors, and medication-related problems. Prospective and multicenter studies are also needed to better evaluate changes in glycemic control over time and identify independent predictors of treatment outcomes in patients with type 2 diabetes mellitus and impaired renal function.

REFERENCES

1. Hill CJ, Cardwell CR, Patterson CC, et al, 2014. Chronic kidney disease and diabetes in the National Health Service: a cross-sectional survey of the U.K. national diabetes audit. Diabetic Medicine. 31(4), Pages 448-454. Doi: 10.1111/dme.12312. Epub 2013 Oct 1.

2. Afkarian M, Sachs MC, Kestenbaum B, et al, 2013. kidney disease and increased mortality risk in type 2 diabetes. Journal of the American Society of Nephrology. 24(2), Pages 302-308. Doi: 10.1681/ASN.2012070718

3. Kidney Disease, 2020. Improving Global Outcomes. KDIGO Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease. Kidney International.

4. Vietnam Association of Diabetes and Endocrinology, 2018. Recommendations on Diabetic Kidney Disease. Hanoi: Vietnam Association of Diabetes and Endocrinology.

5. Lu J, 2020. Influence of guideline adherence and parameter control on the clinical outcomes in patients with diabetic nephropathy. BMJ Open Diabetes Research & Care. 8(1), Doi:10.1136/bmjdrc-2019-001166.

6. Ghabban HJ, Althobaiti B, Farouk IM, 2020. Diabetic complications and factors affecting glycemic control among patients with type 2 diabetes mellitus attending the chronic illness clinics at Tabuk, Saudi Arabia. Cureus. 12(11), Page e11683. Doi: 10.7759/cureus.11683.

7. Haghighatpanah M, Nejad ASM, Thunga G, et al, 2018. Factors that correlate with poor glycemic control in type 2 diabetes mellitus patients with complications. Osong Public Health and Research Perspectives. 9(4), Pages 167-174. Doi: 10.24171/j.phrp.2018.9.4.05.

8. Khwaja A, 2012. KDIGO clinical practice guidelines for acute kidney injury. Nephron Clinical Practice. 120(4), Pages c179-c184. doi:10.1159/000339789.

9. Rhee JJ, Ding VY, Rehkopf DH, 2015. Correlates of poor glycemic control among patients with diabetes initiating hemodialysis for end-stage renal disease. BMC Nephrology. 16, Page 204. Doi:10.1186/s12882-015-0204-4.

10. Luk AOY, 2016. Quality of care in patients with diabetic kidney disease in Asia: The Joint Asia Diabetes Evaluation (JADE) Registry. Diabetic Medicine. 33(9), Pages 1230-1239. Doi:10.1111/dme.13014.

11. Garla V, Yanes-Cardozo L, Lien LF, 2017. Current therapeutic approaches in the management of hyperglycemia in chronic renal disease. Reviews in Endocrine and Metabolic Disorders. 18(1), Pages 5-19. Doi:10.1007/s11154-017-9416-1.

12. Busch M, 2016. Glycaemic control and antidiabetic therapy in patients with diabetes mellitus and chronic kidney disease: cross-sectional data from the German Chronic Kidney Disease cohort. BMC Nephrology. 17(1), Page 59. Doi: 10.1186/s12882-016-0273-z.

13. Park J, Lertdumrongluk P, Molnar MZ, et al, 2012. Glycemic control in diabetic dialysis patients and the burnt-out diabetes phenomenon. Current Diabetes Reports. 12(4), Pages 432-439. Doi:10.1007/s11892-012-0286-3.