

Incidence of Hypoglycemia in Insulin-Treated Diabetic Patients: A Retrospective Observational Study

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Abstract:

Background: Hypoglycemia is one of the most common and potentially serious adverse effects of insulin therapy in patients with diabetes mellitus. It contributes to poor treatment adherence, increased morbidity, and higher healthcare utilization.

Objective: To determine the incidence, severity, and associated risk factors of hypoglycemia in insulin-treated diabetic patients using retrospective hospital data.

Methods: A retrospective observational study was conducted using medical records of insulin-treated diabetic patients attending a tertiary care hospital from January 2022 to December 2023. Incidence and severity of hypoglycemic episodes were analyzed. Statistical analysis included chi-square test and logistic regression, with $p < 0.05$ considered significant.

Results: Among 150 insulin-treated patients, hypoglycemia was documented in 62 patients (41.3%). There were 32.0%, 7.3%, and 2.0% of patients with mild, moderate, and severe hypoglycemia, respectively. Older age, longer duration of diabetes, and intensive insulin regimens were significantly associated with hypoglycemia ($p < 0.05$).

Conclusion: Hypoglycemia is highly prevalent among insulin-treated diabetic patients. Identification of high-risk patients and individualized insulin strategies are essential to reduce hypoglycemic events.

Keywords: Hypoglycemia, Insulin therapy, Diabetes mellitus, Retrospective study.

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Introduction

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia requiring long-term pharmacological management. Insulin therapy continues to be a crucial treatment modality for individuals with advanced type 2 diabetes mellitus and for those experiencing insufficient glycaemic control on oral hypoglycemic agents [1,2]. Insulin therapy is effective, but it often causes low blood sugar, which is a big problem for managing diabetes well [3].

Hypoglycemia is when your blood sugar level is low enough to cause symptoms or harm, usually less than 70 mg/dL. Severe hypoglycemia can lead to seizures, loss of consciousness, cardiac arrhythmias, and potentially death [4]. Recurrent hypoglycemic episodes can diminish hypoglycemia awareness and markedly decrease quality of life [5].

Previous clinical trials and real-world studies have documented diverse incidence rates of hypoglycemia in insulin-treated patients, affected by variables including age, duration of diabetes, insulin regimen, renal function, and comorbidities [6–9]. Older people and people who have had diabetes for a long time are especially at risk [10].

In developing nations, inadequate patient education, inconsistent glucose monitoring, and the absence of systematic insulin titration exacerbate the risk of hypoglycemia [11]. Nevertheless, information regarding the incidence of hypoglycemia from actual clinical environments in India is still scarce.

Therefore, this retrospective observational study was conducted to evaluate the incidence, severity, and contributing factors of hypoglycemia in insulin-treated diabetic patients at a tertiary care hospital.

Materials and Methods

Study Design and Setting: This retrospective observational study was conducted at a tertiary care teaching hospital using medical records from January 2022 to December 2023.

Study Population: Patients with diabetes mellitus receiving insulin therapy for at least 6 months were included.

Inclusion Criteria

- Adults (≥ 18 years)
- Diagnosis of diabetes mellitus

- Treatment with insulin therapy
- Documented blood glucose records

Exclusion Criteria

- Gestational diabetes
- Incomplete medical records
- Patients not on insulin

Sample Size: A total of 150 insulin-treated diabetic patients were included.

Data Collection: Data on age, sex, duration of diabetes, insulin regimen, documented hypoglycemic episodes, and severity were collected.

Definitions

- **Mild hypoglycemia:** Self-managed symptoms
- **Moderate hypoglycemia:** Required assistance
- **Severe hypoglycemia:** Required medical intervention

Statistical Analysis: Data were analyzed using SPSS version 25. Categorical variables were analyzed using chi-square test. Logistic regression was used to identify predictors of hypoglycemia. A p-value < 0.05 was considered statistically significant.

Results

Study Population and Baseline Characteristics:

A total of 150 insulin-treated diabetic patients were included in the final analysis. The baseline demographic and clinical characteristics of the study population are summarized in Table 1. The mean age of patients was 56.4 ± 9.2 years, with a predominance of males (60%) compared to females (40%). The mean duration of diabetes mellitus was 9.3 ± 3.8 years. Regarding insulin therapy, 46.7% of patients were receiving basal insulin alone, while 53.3% were treated with a basal-bolus insulin regimen (Table 1).

Table 1: Baseline Demographic and Clinical Characteristics of Insulin-Treated Patients (n = 150)

Parameter	Value
Age (years, mean ± SD)	56.4 ± 9.2
Male/Female	90 / 60
Duration of diabetes (years)	9.3 ± 3.8
Basal insulin therapy	70 (46.7%)
Basal-bolus insulin regimen	80 (53.3%)

Incidence of Hypoglycemia: Out of 150 patients, 62 patients (41.3%) experienced at least one documented hypoglycemic episode during the study period, while 88 patients (58.7%) reported no hypoglycemia. The overall incidence of

hypoglycemia among insulin-treated diabetic patients is illustrated in Figure 1. Patients receiving insulin therapy thus demonstrated a substantial burden of hypoglycemic events in real-world clinical practice.

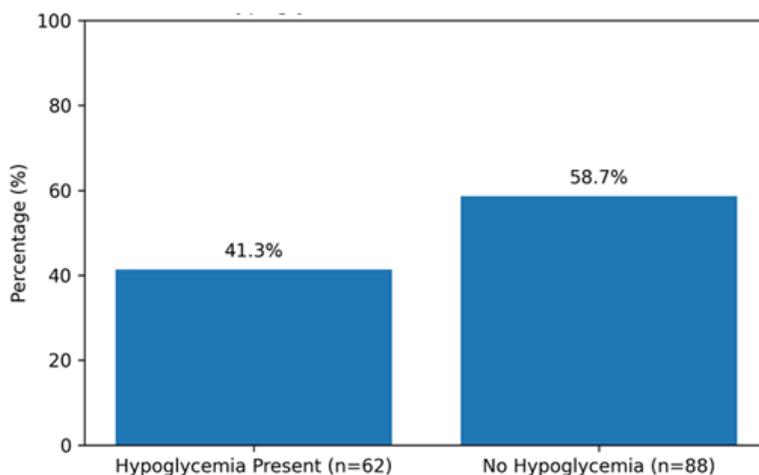


Figure 1: Incidence of Hypoglycemia in Insulin-Treated Diabetic Patients

Severity of Hypoglycemic Episodes: The severity distribution of hypoglycemia among affected patients is presented in Table 2. Mild hypoglycemia was the most frequently observed category, occurring in 48 patients (32.0%), followed by

moderate hypoglycemia in 11 patients (7.3%). Severe hypoglycemia requiring medical intervention was documented in 3 patients (2.0%). These findings indicate that although most hypoglycemic episodes were mild, clinically

significant moderate-to-severe events were also observed (Table 2).

Table 2: Severity of Hypoglycemic Episodes Among Study Participants

Severity of hypoglycemia	Number of patients (%)
Mild	48 (32.0%)
Moderate	11 (7.3%)
Severe	3 (2.0%)

Factors Associated with Hypoglycemia:

Associations between hypoglycemia and selected demographic and clinical variables are shown in Table 3. Patients aged ≥ 60 years had a significantly higher incidence of hypoglycemia compared to those aged < 60 years (52.4% vs 34.1%, $p = 0.021$). Similarly, patients with a duration of diabetes exceeding 10 years showed a higher frequency of hypoglycemia (57.1%) compared to those with shorter disease duration ($p = 0.013$).

Furthermore, patients treated with basal-bolus insulin regimens demonstrated a significantly greater incidence of hypoglycemia (61.3%) compared to those receiving basal insulin alone ($p = 0.008$). These results indicate that advanced age, longer duration of diabetes, and intensive insulin therapy are significant risk factors for hypoglycemia in insulin-treated diabetic patients (Table 3).

Table 3: Association Between Clinical Variables and Hypoglycemia

Variable	Hypoglycemia present (%)	p-value
Age ≥ 60 years	52.4	0.021
Duration of diabetes > 10 years	57.1	0.013
Basal-bolus insulin regimen	61.3	0.008

Summary of Key Findings

Overall, the results demonstrate a high incidence of hypoglycemia (41.3%) among insulin-treated diabetic patients. Mild hypoglycemia constituted the majority of cases, while severe hypoglycemia was relatively uncommon. Older age, longer duration of diabetes, and use of intensive insulin regimens were significantly associated with increased hypoglycemia risk, as summarized in Tables 1–3 and Figure 1.

Discussion

This retrospective study demonstrates a high incidence of hypoglycemia (41.3%) among insulin-treated diabetic patients. These findings are consistent with previous studies reporting hypoglycemia as a frequent complication of insulin therapy [12–14].

The prevalence of mild hypoglycemia in this study corresponds with real-world data indicating that numerous episodes are underreported yet clinically significant [15]. Severe hypoglycemia is less common, but it is much more dangerous and can lead to heart problems and death [16].

Advanced age and longer duration of diabetes were significant predictors of hypoglycemia, likely due to impaired counter-regulatory responses and reduced hypoglycemia awareness [17]. Intensive insulin regimens were also linked to a higher risk, which shows how important it is to carefully titrate and monitor [18].

Studies have shown that patient education and simplified insulin regimens can significantly reduce hypoglycemia incidence [19,20]. In Indian settings, limited access to self-monitoring and structured diabetes education further increases vulnerability [21].

Early identification of high-risk patients and individualized insulin strategies are crucial to minimize hypoglycemia and improve long-term outcomes [22–25].

Limitations

The retrospective design limits causal inference. Mild hypoglycemic episodes may have been underreported. Long-term outcomes were not assessed.

Conclusion

Hypoglycemia is a common complication among insulin-treated diabetic patients, particularly in elderly individuals and those on intensive insulin regimens. Regular monitoring, patient education, and individualized insulin therapy are essential to reduce hypoglycemic risk.

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