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A STUDY ON CLINICO-EPIDEMIOLOGICAL PROFILE OF PATIENTS PRESENTING WITH HYPOGLYCEMIA IN THE EMERGENCY ROOM OF TERTIARY CARE GOVERNMENT HOSPITAL

Emergency Medicine

Dr Rakesh K Kumar	MBBS, MD (Emergency medicine) Senior resident Department of emergency medicine B J Government Medical college & Sassoon General Hospital, Pune
Dr Rajeshwari Sanjay Vhora*	Professor and Head of Department Department of Emergency medicine B J Government Medical college & Sassoon General Hospital, Pune*Corresponding Author
Dr Harshad Dongre	Associate Professor Department of Emergency medicine B J Government Medical college & Sassoon General Hospital, Pune
Dr Dona Nimmy Jais	Senior Resident Department of Emergency medicine B J Government Medical college & Sassoon General Hospital, Pune
Dr Madhuri Ramesh Dhaware	Senior resident Department of emergency medicine B J Government Medical college & Sassoon General Hospital, Pune
Dr Shivani Vhora	Senior resident Department of emergency medicine B J Government Medical college & Sassoon General Hospital, Pune

ABSTRACT

Background: Hypoglycemia is a frequent, high-risk emergency with prominent neuroglycopenic manifestations. This study aimed to describe the clinical profile, precipitating factors, and short-term outcomes of hypoglycemic presentations to a tertiary-care emergency department in Pune, India. **Methods:** In this prospective observational study, consecutive patients aged ≥12 years presenting with hypoglycemia were enrolled after ethics approval and consent. Standardized case-record forms captured demographics, comorbidities, vitals, Glasgow Coma Scale (GCS), precipitating factors, anti-diabetic therapy, and outcomes. Descriptive statistics were summarized overall and by diabetes status. **Results:** Seventy-seven patients were included (mean age 54.29 ± 19.37 years; 63.6% male). Diabetes status: type 2 diabetes mellitus (T2DM) 58.4% (46/77), type 1 diabetes mellitus (T1DM) 9.1% (7/77), and no diabetes 32.5% (24/77). Reduced responsiveness was the dominant symptom (74%), and severe neurological impairment was common (GCS 3–8 in 81.6%). Median blood glucose at presentation was 43 mg/dL, with 42.9% meeting criteria for severe hypoglycemia (<40 mg/dL). Hypoxia (SpO_2 < 94%) occurred in 23.4%. Precipitating factors differed by diabetes status: among diabetics, drug-induced hypoglycemia predominated (62.3%; notably, 89.1% of T2DM were on glimepiride), whereas among non-diabetics, reduced oral intake (75%) and alcohol (54.2%) were most frequent. Overall, 83.1% recovered; recovery was universal in drug-induced cases, while non-recovery (16.9%) clustered with sepsis and decompensated chronic liver disease. **Conclusion:** Emergency hypoglycemia in this setting often presents with coma and severe biochemical derangement and disproportionately affects middle-aged/older adults. Distinct precipitant profiles—sulfonylurea exposure in diabetics versus reduced intake/alcohol in non-diabetics—support targeted prevention: medication review and cautious sulfonylurea use in T2DM. Early recognition and protocolized management are essential, particularly in patients with sepsis or liver disease.

KEYWORDS

Hypoglycemia; Emergency Department; Neuroglycopenia; Sulfonylurea; Glimepiride; Sepsis; India; Prospective Study.

INTRODUCTION

The most prevalent endocrine condition is diabetes mellitus. It includes a diverse range of hyperglycemic conditions marked by elevated blood glucose levels and abnormalities in the metabolism of fats and carbohydrates. "Diabetic ketoacidosis (DKA)", "hyperglycemic hyperosmolar state (HHS)", hypoglycemia, and hyperglycemia exemplify acute complications. [1]

"Type 1 diabetes mellitus (T1DM)", "type 2 diabetes mellitus (T2DM)", gestational diabetes, and other specific diabetes variants can be classified based on their etiology, which includes genetic defects, pancreatic disorders, endocrinopathies, drug or chemical induction, infections, and immune-mediated mechanisms. The defining characteristic of type 1 diabetes is the autoimmune, cell-mediated destruction of pancreatic β cells. Typically, these patients exhibit minimal insulin levels in the bloodstream[2]. "Type 2 diabetes mellitus (T2DM)" is a complex, chronic metabolic disorder. It is a critical global public health issue and a primary contributor to morbidity and mortality[3,4]. Chronically elevated plasma glucose levels are an indicator of type 2 diabetes, a complex and heterogeneous metabolic disorder. Genetic and environmental factors interact during the complicated pathogenesis. The two most significant pathophysiologic characteristics of T2DM are reduced insulin secretion and decreased insulin sensitivity (insulin resistance).

Hypoglycaemia, a prevalent endocrine emergency and a highly concerning complication for individuals with diabetes, is characterized by an episode of abnormally low plasma glucose levels, as well as symptoms that subside upon the restoration of euglycaemia[5]. Hypoglycemia is the most common and potentially fatal side effect of treating diabetes. Level 1 hypoglycemia can be defined by the "American Diabetes Association (ADA)" as a measurable glucose concentration that is higher than 54 mg/dL (>3.0mmol/L) but lower than 70mg/dL (<3.9mmol/L). It has been shown that in individuals without diabetes, a blood glucose concentration of 70mg/dL (3.9 mmol/L) is a threshold for neuroendocrine reactions to declining glucose. Hypoglycemia can cause tachycardia, shakiness, irritability, confusion, sweating, as well as hunger, among other symptoms. Regardless of symptoms, a measured glucose level of less than 70mg/dL (<3.9mmol/L) can be considered clinically significant because many diabetics have impaired hypoglycemia awareness and/or counterregulatory responses to hypoglycemia. Level 2 hypoglycemia, which is described as a blood glucose concentration below 54mg/dL (below 3.0mmol/L), is the first stage of neuroglycopenic symptoms and requires immediate intervention to effectively end the hypoglycemic event. A person with level 2 hypoglycemia who does not exhibit neuroglycopenic or adrenergic symptoms is probably less aware of hypoglycemia. This clinical situation requires evaluation and reevaluation of the method of treatment. No matter the glucose level, level 3 hypoglycemia is a severe event that affects mental and physical function and requires medical assistance. [6] Hypoglycemia can be confirmed by *Whipple's triad:* (1) symptoms indicative of hypoglycemia, (2) a low plasma glucose concentration assessed using an accurate method, and (3) alleviation of symptoms following an increase in plasma glucose levels. Collaboration as a data source indicates an estimated hypoglycemic prevalence of 7.1% in patients with T1DM and 7.3% in patients with T2DM who are on insulin. [7]

OBJECTIVES:

- To study the clinic epidemiological profile of patients presenting with hypoglycemia
- To study the precipitating factor of hypoglycemia
- To study the signs and symptoms of patients presenting with hypoglycemia in ER
- To study the associated co-morbidities
- To evaluate the outcome of the emergency care

METHODOLOGY:

This was a prospective observational study conducted in the "Department of Emergency Medicine" at a tertiary care government teaching hospital in Pune, India, aiming to assess the clinical characteristics, precipitating factors, and outcomes of patients presenting with hypoglycemia.

Inclusion Criteria:

- Age ≥ 12 years
- Clinical presentation with hypoglycemia
- Emergency department presentation

Exclusion Criteria:

- Age < 12 years
- Incomplete medical records
- Refusal of informed consent

The research was carried out following the approval of the "Institutional Ethics Committee". Before enrollment, participants or their legal representatives gave informed written consent.

Data collection was performed by the first author to ensure consistency. Each enrolled patient underwent clinical assessment and laboratory investigations. Standardized case record forms were used for consistent data capture, with regular monitoring to ensure data quality and compliance with ethical guidelines. Statistical analysis was performed using appropriate descriptive and inferential methods based on data distribution and variable types.

RESULT AND OBSERVATION:

Age:

Table 1: Age analysis of hypoglycemic patients

Age	Mean	Minimum	Maximum	Standard deviation
	54.29	21	88	19.37

Table 2: age distribution of hypoglycemic patients

Age Group	Count	Percentage
< 30 years	12	15.60%
30-49 years	19	24.70%
50-69 years	25	32.50%
≥ 70 years	21	27.30%

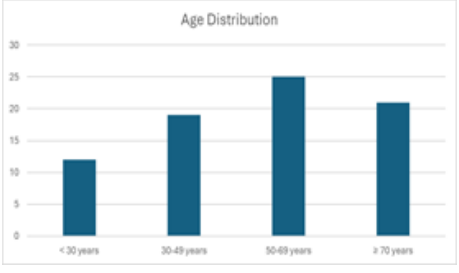


Figure 1: Age distribution of hypoglycemic patients

The age distribution shows that hypoglycemia affects patients across all age groups, with the highest prevalence in the 50-69 years age group (32.5%). The elderly population (≥70 years) represents more than a quarter of cases (27.3%), which is clinically significant given the increased vulnerability and potential complications in this age group.

Gender:

Table 3: Gender distribution

Gender	Count	Percentage
Male	49	63.60%
Female	28	36.40%

Males are nearly twice as likely to present with hypoglycemia in an emergency department setting compared to females.

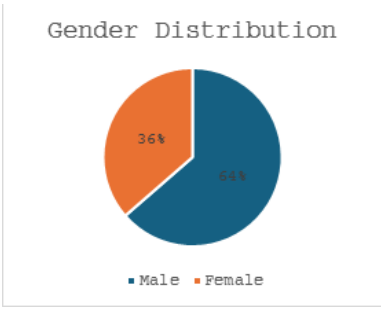


Figure 2: Gender distribution

Symptoms:

Table 4: Symptoms of hypoglycemia patients

Serial Number	Symptom	Count	Percentage of Patients
1	Reduced Responsiveness	57	74.00%
2	Sweating	18	23.40%
3	Fever	12	15.60%
4	Seizure	11	14.30%
5	Giddiness	11	14.30%
6	Breathlessness	10	13.00%
7	Skin Redness	6	7.80%
8	Tremors	6	7.80%
9	Palpitation	6	7.80%
10	Loose Stool	5	6.50%

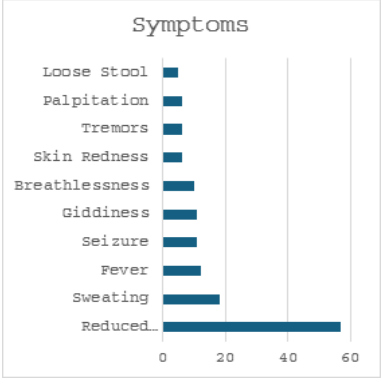


Figure 3: Symptoms of hypoglycemia in patients

Table 5: category of symptoms

Category	Symptom Count	Percentage of Total Symptoms
Neurological	81	45.50%
Autonomic	32	18.00%
Infectious/Inflammatory	22	12.40%
Gastrointestinal	15	8.40%
Respiratory	14	7.90%
Constitutional	12	6.70%
Genitourinary	2	1.10%

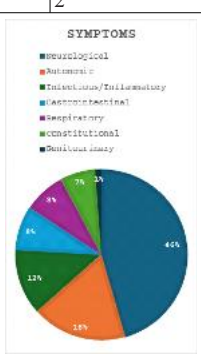


Figure 4: Symptoms of hypoglycemia

The overwhelming prevalence of neurological symptoms (45.5%) confirms that hypoglycemia primarily manifests as altered mental status in emergency presentations. The high frequency of reduced responsiveness makes it a critical screening symptom for hypoglycemia in emergency departments.

Vitals:

Pulse rate:

Most patients have pulse rates between 90 bpm and 120 bpm, consistent with autonomic activation during hypoglycemic episodes

Table 6: Analysis of pulse rate of hypoglycemia patients

Pulse rate (beats/min)	Minimum	Maximum	Mean	Standard deviation
	78	130	102	14

Blood Pressure:

Table 7: Analysis of Blood pressure in hypoglycemic patients Min-minimum, Max-maximum, SD-standard deviation

Parameter	Mean	Median	Min	Max	SD
Systolic BP	111.00	110.00	60.00	170.00	23.21
Diastolic BP	70	70.00	40.00	100.00	13.23
Mean Arterial	83.99	86.67	46.67	123.33	15.53

Hypoglycemia presentations involve complex hemodynamic changes, with both hypertensive and hypotensive patterns requiring tailored management approaches in emergency settings.

Respiratory Rate:

Table 8: Analysis of respiratory rate Min-Minimum, Max-Maximum, SD- Standard deviation

Respiratory Rate(cycles/min)	Min	Max	Mean	SD
	14	32	20	4.59

The positive correlation between respiratory and pulse rates demonstrates the integrated stress response in hypoglycemia, where both cardiovascular and respiratory systems respond coordinately to metabolic crisis.

Saturation:

Table 9: Analysis of oxygen saturation

SpO2(%)	Minimum	Maximum	Median	Standard deviation
	64	99	97	6.28

Table 10: Distribution SpO2

SpO2	Count	Percentage(%)
Normal	59	76.62
Hypoxia (<94)	18	23.38

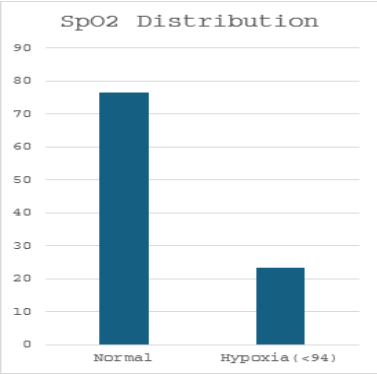


Figure 5: Distribution of SpO2 in Hypoglycemic patients

Blood Sugar Level:

Table 11: Analysis of Blood sugar level

Blood Sugar Level	
Minimum	17.00 mg/dL
Maximum	64.00 mg/dL
Median	43.00 mg/dL
Standard Deviation	12.06 mg/dL

Table 12: Distribution of hypoglycemia

Hypoglycemia	Count	Percentage (%)
Mild (<70 - 54mg/dl)	18	23.37
Moderate (<54 - 40mg/dl)	26	33.76
Severe (<40mg/dl)	33	42.85

42.9% of patients (33 out of 77) had critical hypoglycemia (<40 mg/dL), requiring immediate and aggressive glucose replacement therapy

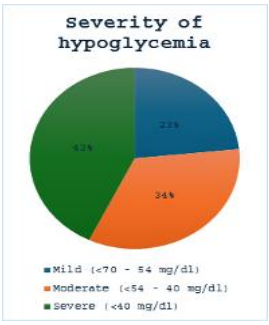


Figure 6: Pie chart showing the severity of hypoglycemia GCS:

Table 13: GCS distribution of patients

Category	Range	Count	Percentage
Severe	GCS 3-8	62	81.60%
Moderate	GCS 9-12	14	18.40%

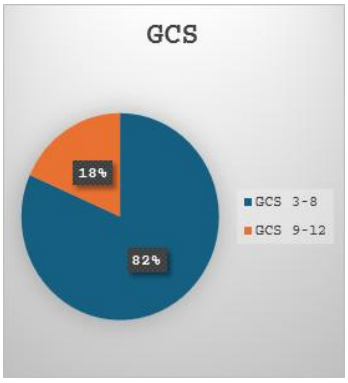


Figure 7: Pie chart showing GCS of patients on presentation to ER

81.6% of patients are comatose (GCS ≤8), emphasizing that hypoglycemic presentations in emergency settings predominantly involve altered consciousness. The complete absence of patients with mild impairment (GCS 13-15) suggests that conscious, alert patients with hypoglycemia either don't reach emergency care or are managed in different settings. Lower glucose levels predict worse neurological outcomes, with a clear stepwise deterioration.

Co-Morbidity:

Table 14: Co-morbidity of hypoglycemic patients

Co-morbidity	Count	Percentage(%)
Diabetes	53	68.83
Hypertension	30	38.96
Ischemic Heart Disease	9	11.68
Cerebrovascular Accident	8	10.38
Decompensated Chronic Liver Disease	2	2.59

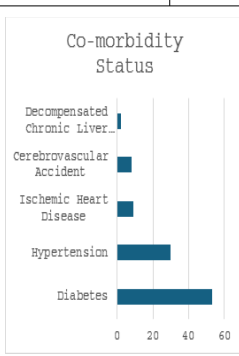


Figure 8: Bar chart showing the co-morbidity of hypoglycemia patients

Most of the hypoglycemic patients are diabetic, which shows that hypoglycemia is a complication of diabetes. The most associated co-morbidity is hypertension (38.96%).

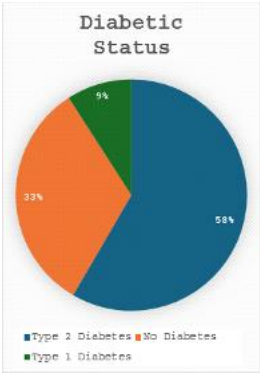
Diabetic Status:

46 out of 77 patients are Type 2 diabetic, 7 are Type 1 diabetic, and 24 are non-diabetic. Showing hypoglycemia is more common in Type 2 diabetic patients than in non-diabetic and Type 1 diabetic patients.

Table 15: Diabetic Status of Patients

Diabetes Status	Count	Percentage
Type 2 Diabetes	46	58.40%
No Diabetes	24	32.50%
Type 1 Diabetes	7	9.10%

Figure 8: Pie chart showing diabetic status of the hypoglycemia patients



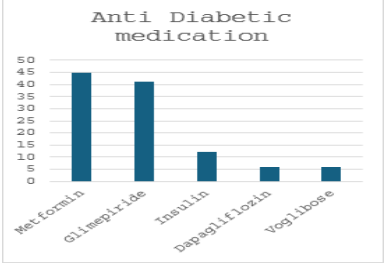
Anti Diabetic medication:

Table 16: Anti diabetic medication

Medication	Count
Metformin	45
Glimepiride	41
Insulin	12
Dapagliflozin	6
Voglibose	6

Of the 7 Type DM patients, all are on insulin therapy. 24 patients are not diabetic, not on any anti diabetic medications. Out of the 45 Type 2 DM 45 are on Metformin, 41 are on glimepiride. 23 are on a combination of metformin plus sulfonylurea. 89.1% of Type 2 diabetics on Glimepiride, there's a significant opportunity for hypoglycemia.

Figure 9: Bar chart showing anti diabetic medication



Precipitating Factor:

Table 17: precipitating factors for hypoglycemia

Precipitating Factor	Count	Percentage (%)
Reduced Oral Intake	33	42.9
Drug Induced	33	42.9
Sepsis	18	23.4
Alcohol Induced	13	16.9
Acute Gastroenteritis	5	6.5
Liver Disease	2	2.6
OHA Consumption	1	1.3

Figure 10: Bar chart showing precipitating factors for hypoglycemia

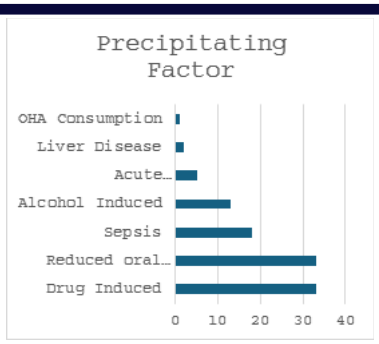


Table 18: precipitation factor in relation to diabetic status

Precipitating Factor	Diabetic (n=53)	Non-diabetic (n=24)
Drug Induced	33 (62.3%)	0 (0.0%)
Reduced Oral Intake	15 (28.3%)	18 (75.0%)
Sepsis	15 (28.3%)	3 (12.5%)
Alcohol Induced	0 (0.0%)	13 (54.2%)
Acute Gastroenteritis	2 (3.8%)	3 (12.5%)
OHA Consumption	0 (0.0%)	1 (4.2%)
Liver Disease	0 (0.0%)	2 (8.3%)

Drug-induced hypoglycemia (62.3%) is most common in diabetic patients, while reduced oral intake (75%) and alcoholism (54.2%) are most common in non-diabetic patients. 28 patients have multiple precipitating factors. Of these, 12 patients have drug-induced plus reduced oral intake as precipitating factors, and another 12 have alcoholism and reduced oral intake as a precipitating factor. Sepsis or infection-induced hypoglycemia is more common in diabetic patients than in non-diabetics. Diabetic patients need focused medication management and dosing optimization, and non-diabetic patients require nutritional assessment and alcohol counselling.

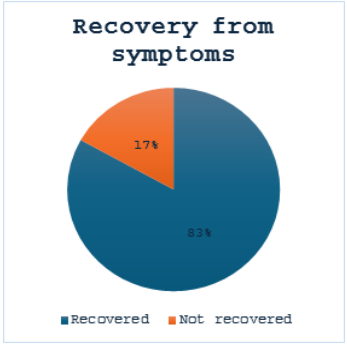
Outcome:

Table 19: Showing outcome of hypoglycemia

Outcome Category	Count	Percentage
Recovered	64	83.10%
Not recovered	13	16.90%
Total	77	100.00%

100% of the drug-induced hypoglycemia patients recovered from the symptoms. 31 out of the 33 patients with hypoglycemia due to reduced oral intake had recovered from the symptoms.13 patients out of 77 did not recover from the hypoglycemic symptoms despite the administration of glucose. The most common precipitating cause in patients who have not recovered from the symptoms is decompensated chronic liver disease and sepsis or infection.

Figure 11: Pie chart showing the recovery from the symptoms of hypoglycemia



DISCUSSION:

With a mean age of 54.29 years, our study found that hypoglycaemic patients were predominantly male (63.6%). This result is in line with earlier research by Su et al., which found that 51.6% of hypoglycaemia cases in emergency departments were male. With the highest prevalence in the 50–69 age group (32.5%) and significant involvement of elderly patients ≥70 years (27.3%), the age distribution demonstrated significant representation across all age groups. This demographic pattern aligns with current literature indicating increased vulnerability to hypoglycemia in older populations due to multiple comorbidities and polypharmacy. [8][9]

The symptom profile in our study was dominated by reduced responsiveness (74%), followed by autonomic symptoms such as sweating (23.4%). This presentation pattern reflects the neuroglycopenic predominance typically seen in severe hypoglycemic presentations requiring emergency care. Neurological symptoms comprised 45.5% of total symptoms, significantly higher than autonomic symptoms (18%), consistent with the established hierarchy of hypoglycemic symptom development, where neuroglycopenic symptoms become more prominent as glucose levels decline further. [10]

The Glasgow Coma Scale distribution was particularly striking, with 81.6% of patients presenting with severe impairment (GCS 3-8), indicating comatose states. This result is consistent with earlier studies by Matsumoto et al., which showed a strong correlation between GCS scores and plasma glucose levels, especially in patients with moderate to severe hypoglycaemia. The complete absence of patients with mild neurological impairment (GCS 13-15) in our study suggests that conscious patients with hypoglycaemia either self-manage or are treated in outpatient settings before requiring emergency care. [11]

Our biochemical analysis revealed a median blood glucose of 43 mg/dL, with 42.9% of patients presenting with severe hypoglycaemia (<40 mg/dL). This severity distribution is more pronounced than reported in some previous studies, possibly reflecting the tertiary care nature of our institution and the severity of cases requiring emergency intervention. The correlation between lower glucose levels and worse neurological outcomes (GCS scores) supports the established pathophysiology of glucose-dependent neuronal function. [12][13]

Significant differences between patients with and without diabetes were found when precipitating factors were identified. In diabetic patients, drug-induced hypoglycemia was the predominant cause (60.4%), while in non-diabetic patients, reduced oral intake (75%) and alcohol-induced hypoglycemia (54.2%) were most common. This pattern aligns with recent literature emphasizing the significant role of sulfonylureas, particularly glimepiride, in severe hypoglycemic episodes. [14][15]

Our finding that 89.1% of Type 2 diabetic patients on glimepiride experienced hypoglycemia is concerning and consistent with recent safety data. Zullo et al. demonstrated that glimepiride use resulted in 60% higher rates of severe hypoglycemia compared to glipizide among elderly patients. The high prevalence of sulfonylurea-induced hypoglycemia in our study supports current recommendations for more cautious use of these agents, especially in elderly and vulnerable populations. [16]

Alcohol-induced hypoglycaemia represented 16.9% of cases overall but was particularly prominent (54.2%) among non-diabetic patients. This finding is consistent with established mechanisms of alcohol-induced hypoglycaemia, including impaired gluconeogenesis and enhanced insulin sensitivity. The demographic pattern of alcohol-related hypoglycaemia (predominantly younger males) observed in our study aligns with previous research by Gallo et al. [17][18]

The high prevalence of diabetes (68.83%) and hypertension (38.96%) among our patients reflects the typical comorbidity burden in hypoglycaemic populations. The presence of multiple precipitating factors in 28 patients emphasizes the multifactorial nature of hypoglycemic episodes, particularly the common combination of drug-induced mechanisms with reduced oral intake, and alcohol consumption with poor nutritional status. [19][20]

The association between sepsis and poor outcomes in hypoglycaemic patients has been well-established in recent literature. Hirata et al. demonstrated that septic patients with severe hypoglycaemia had significantly higher 28-day mortality (71.4%) compared to euglycemic patients (8.7%). Our findings support this association, with sepsis being identified as a major factor in patients who failed to recover. [23]

The hemodynamic profile of our patients showed complex patterns with both hypertensive and hypotensive presentations. The mean systolic blood pressure of 111 mmHg with significant standard deviation (23.21) reflects the variable cardiovascular response to hypoglycemia. The elevated mean pulse rate (102 bpm) is consistent with adrenergic activation during hypoglycemic episodes. The correlation between elevated pulse and respiratory rates (mean 20 cycles/min) demonstrates the integrated stress response characteristic of severe hypoglycemia. Our findings have several important clinical implications. First, the high prevalence of severe hypoglycemia (GCS ≤8) emphasizes the need for immediate and aggressive management protocols in emergency departments. Second, the strong association between sulfonylurea use and hypoglycemic emergencies supports recommendations for more judicious use of these agents, particularly in elderly patients with multiple comorbidities. [24]

The identification of distinct precipitating factor patterns between diabetic and non-diabetic patients suggests the need for targeted prevention strategies. For diabetic patients, medication review and dose adjustment protocols are crucial, while for non-diabetic patients, screening for alcohol use disorders and nutritional assessment should be prioritized. [25]

CONCLUSION:

This study provides comprehensive insights into the clinical characteristics and outcomes of hypoglycemic patients presenting to the emergency department. The prevalence of severe cases (GCS ≤8 in 81.6%) and the elevated incidence of severe biochemical hypoglycemia (<40 mg/dL in 42.9%) underscore the urgent nature of hypoglycemic emergencies necessitating prompt medical attention.

The distinct patterns of precipitating factors between diabetic and non-diabetic patients highlight the need for targeted prevention strategies. Drug-induced hypoglycemia, particularly from sulfonylureas like glimepiride, remains a significant concern in diabetic patients, while alcohol-related hypoglycemia and reduced oral intake are predominant in non-diabetic populations.

The favourable outcomes in drug-induced hypoglycemia (100% recovery) contrast sharply with the poor prognosis in patients with underlying sepsis or liver disease, emphasizing the importance of addressing concurrent medical conditions. The demographic pattern showing significant involvement across all age groups, with vulnerability in elderly patients, supports current recommendations for individualized glycemic targets and careful medication selection.

These findings advocate for enhanced preventive strategies, including regular medication review in diabetic patients, particularly those on sulfonylureas, and comprehensive assessment of alcohol use and nutritional status in non-diabetic patients presenting with hypoglycemia. The high rate of severe neurological impairment at presentation underscores the importance of public education about hypoglycemia recognition and the need for prompt medical attention.

To better understand the long-term neurological outcomes and create more effective prevention protocols for high-risk populations, future prospective studies with longer follow-up periods are required. The integration of continuous glucose monitoring and structured medication management programs may help reduce the incidence of severe hypoglycemic episodes requiring emergency intervention.

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