Role of HBA1C as Prognostic Marker in Diabetic Sepsis: An Observational Study

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ABSTRACT

Background

Diabetes mellitus metabolic disorder that is characterised by long-term hyperglycemia and is linked to disturbances of carbohydrate, fat and protein metabolism. Glycated haemoglobin (HbA1c) is formed due to non-enzymatic glycation reflects chronic glucose control in the last three 3 months.There are only few studies that say HbA1c is an important predictor of mortality or death rate among patients with type 2 diabetes with sepsis. So, this study was undertaken to assess if HbA1c can be used as a prognostic factor in diabetic patients with sepsis.

Aim

To determine the predictive value or prognostic role of HbA1c in mortality and duration of hospital stay among patients with type 2 diabetes.

Methods

This observational study was conducted at a tertiary care centre named Fathima Medical College and Hospital, Kadapa, Andhra Pradesh among 100patients with type 2 diabetes with sepsis. The study was done from January 2022 to December2022. Age, gender, mean HB1C levels, mean SOFA scores, mean CRP levels, mortality rate and duration of hospitalization were assessed.

Results

Most of the patients were aged 61 to 70 years. Most of the patients were males. Mortality rate is 20%, Mean

HB1C levels, mean SOFA score, mean duration of hospitalization were more in non-survivors compared to survivors.

Conclusion

HbA1c, SOFA score, CRP, and duration of hospitalization were found to have significant association with 30 DAYS mortality rate among patients with diabetes and sepsis.

Keywords

Diabetes, Glycated haemoglobin, Hyperglycemia, Sepsis, Prognostic Marker.

INTRODUCTION

Diabetes mellitus metabolic disorder that is characterised by long-termhyperglycemiaand is linked to disturbances of carbohydrate, fat and protein metabolism. It causes chronic damage and dysfunction to various organs of the body especially eyes, kidneys, eyes, nerves, blood vessels and heart.Patients with diabetes will have morefrequency and severity of infections. One vital factor responsible for enhanced incidence and severity of infections could be due to rgan dysfunction and impaired immune defence mechanisms.[1]Increased plasma glucose levels among hospitalized patients areinfluenced by various factors like glucose level before the acute stress, drug intake, onset of illness,and time at which the sample is taken. Glycated haemoglobin (HbA1c)is formed due to non-enzymatic glycation reflects chronic glucose control in the last three 3 months.[2,3]

Malnutrition, dehydration, vascular insufficiency, platelet dysfunction, neuropathy, complement disorders increase the risk of infections and sepsis among diabetic patients.[4-7] Glycemic control is the most important prevention and treatment step in diabetes patients with sepsis.[8-10]There are only few studies that say HbA1c is an important predictor of mortality or death rate among patientswith type 2 diabetes with sepsis. So, this study was undertaken to assess if HbA1c can be used as a prognostic factor in diabetic patients with sepsis.

AIM

To determine the predictive value or prognostic role of HbA1c in mortality and duration of hospital stay among patients with type 2 diabetes.

MATERIALS AND METHODS

Source of data: This observational study was done on patients with type 2 diabetes mellitus who got admitted with sepsis at our tertiary care center named Fathima Medical College and Hospital at Kadapa, Andhra Pradesh, India.

Study duration: The study was done for 12 months from January 2022 to December 2022.

INCLUSION CRITERIA

- Patients aged above 35 years
- Males and females with type 2 diabetes and sepsis
- Patients who provided informed consent to participate in the study.

EXCLUSION CRITERIA

- Patients with type 1 diabetes mellitus
- Patients with chronic renal failure.
- Patients with end stage cancers.
- Pregnant and lactating women
- Patients who are using immunosuppressant's
- Patients with liver failure
- Patients with anaemia- this may cause changes in HBA1C levels.

SAMPLING

Simple random sampling method was used to select study population.

SAMPLE SIZE CALCULATION

As per the previous study, incidence of sepsis among patients with diabetes was 17%.[11] At confidence intervals of 95%, with an error of 5%, the minimum sample size came to be 85. So, we included 100 patients in our study.

After selecting patients, they were subjected to the following steps:

1. History
2. Clinical examination
3. HbA1c on the day of admission
4. Associating HbA1c with CRP, SOFA scores
5. To look for outcome of patients after 30 days

PARAMETERS ASSESSED

- Age
- Gender
- HBA1C levels
- Mortality rate
- SOFA (sequential organ failure assessment) score
- Duration of hospitalization

SOFA Score

It helps to monitor the functioning of the organ systems among critically ill patients.[12]

These 6 organ systems are used in calculating this Score:

Cardiovascular system

Respiratory system

Liver

Renal system

Central nervous system

Coagulation

The score ranges from 0 to 24. It can be calculated serially and rise in the score in the first 24 to 48 hrs indicate increased risk of mortality.

STATISTICAL ANALYSIS

Data analysis was done using Microsoft excel 2019 office version. The results were expressed as mean ± S.D, percentages. Association between duration of hospitalization, mortality rate and HBA1C levels were assessed using chi-square test. Association between numerical parameters was done using students t test.

P value < 0.05 was considered significant.

ETHICAL CONSIDERATIONS

Informed consent form was taken from every subject who participated in the study.

RESULTS

DEMOGRAPHY

Age: In the current study, most patients were 61 to 70 years.

Table 1 shows age distribution of patients

Age group	% of patients
36-40	11%
41-50	20%
51-60	33%
61-70	36%
Above 70	10%

Gender: Most of the patients were males in our study,

Graph 1: Gender distribution of patients
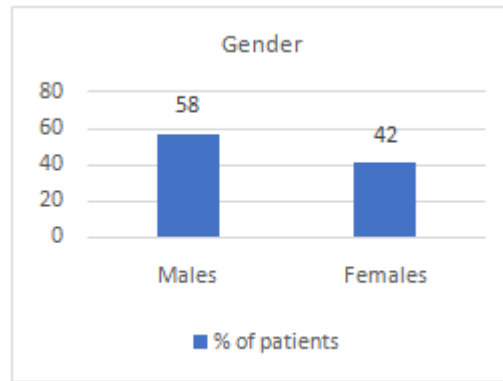
Mortality Rate

19% of patients died within 30 days of hospital admission.

Table 2 shows the mortality rate of patients

Outcome	% of patients
Alive	80%
Dead	20%

Mean HBA1C Levels

The mean HBA1C levels were more among non-survivors.(p=0.001).

Table 3 shows mean HBA1C levels among survivors and non-survivors

Group	Mean HBA1C	P value
Survivors	7.4±2.1%	0.0001
Non survivors	10.2±2.4	

SOFA Score

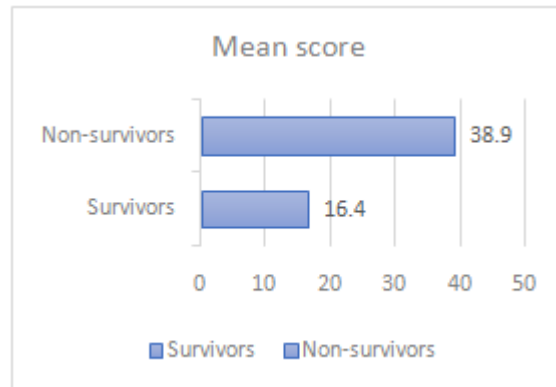The mean SOFA score was significantly more among non-survivors (p=0.001).

Graph 2 shows SOFA score
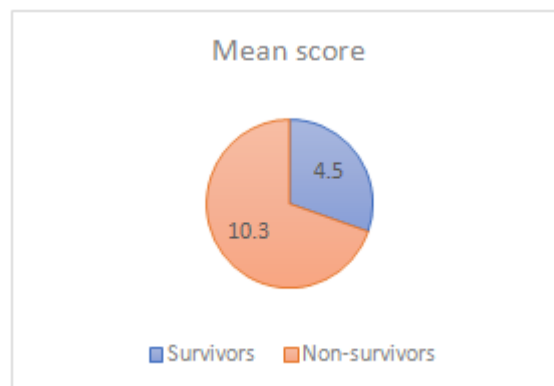
Mean CRP

Mean CRP levels were significantly more in non survivors compared to survivors.

Graph 3 shows mean CRP levels

Mean Duration of Hospitalization

Mean duration of hospitalization is significantly more among non-survivors compared to survivors.

Table 4 shows mean duration of hospitalization

Group	Mean duration of hospitalization	P value
Survivors	7.2±1.4 days	0.0001
Non survivors	13.1±1.9 days	

DISCUSSION

The current study was conducted at a tertiary care centre among 100 patients with type 2 diabetes with sepsisfrom January 2022 to December 2022. Age, gender, mean HB1C levels, mean SOFA scores, mean CRP levels, mortality rate and duration of hospitalization were assessed. Results showed that most of the patients were aged 61 to 70 years. Most of the patients were males. Mortality rate is 20%, Mean HB1C levels, mean SOFA score, mean duration of hospitalization were more in non-survivors compared to survivors.In the study of **Juhasz et al**.[13]112 patients with diabetes and sepsiswere included. Authors found significant positive correlation between plasma glucose levels and HbA1c. They also found significant correlation between duration of hospital

stay and HbA1c, similar to our study findings. Negative correlations were seen in some studies between HB1AC and antidiabetic therapy and white blood cell count. One explanation behind some of the negative correlations between white blood cell count and mean plasma glucose and HBA1C and white blood cell count could be due to glucose toxicity, which in turn is due to defective pancreatic beta cells.[14-16]

In the study done by **Gornik et al**.[17]admitted diabetic patients with sepsis were included. HbA1c was assessed on 1st hospital day. 286 patients were finally included. The mortality rate was 21.7%, which is almost similar to the current study.Patients who survived had significantly less mean HbA1c compared

to survivors, similar to the current study. There is significant association between HBA1C levels and mortality rate, and SOFA scores, similar to our study. Only few studies were done to find an association between HbA1c level at the time of admission and ICU mortality.[18-21] Our study results show that a premorbid glycemic state helps to predict the degree of organ dysfunction after ICU admission among patients with sepsis.

In the study of **Lee YS et al[22]**90 patients were included. There is significant association between HbA1c level and degree of organ damage progression, similar to our study as per SOFA scores. As per logistic regression analysis high HbA1c level was an independent predictor of organ dysfunction. Especially patients with HbA1c level more than 6.5% showed significantly more liver and kidney dysfunction after 3 daysof ICU admission compared to patients with HbA1c level <6.5%.

LIMITATIONS

1. Small sample size
2. Fasting and post prandial glucose levels were not assessed.

CONCLUSION

HbA1c, SOFA score, CRP, and duration of hospitalization were found to have significant association with 30 DAYS mortality rate among patients with diabetes and sepsis. Thus, we concluded that HbA1c is as efficacious SOFA score as a prognostic factor in diabetes patients with sepsis.

The study is self-sponsored.

There were no conflicts of interest.

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