Original Research Article

Influence of Diabetes Mellitus on the outcome of critically ill patients in a tertiary care hospital of West Bengal: a record-based, observational study

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Abstract

Background: Critically ill patients with diabetes are at increased risk of development of complications. But the impact of diabetics on ICU outcome is unclear. Furthermore, there is scarcity of data from Indian ICU. In this study, we aimed at assessing the relationship between diabetes mellitus with specific ICU outcome in terms of duration of ICU stay, ICU mortality and ICU cure rate. We also tried to correlate the value of the capillary blood glucose level at the time of ICU admission with the duration of ICU stay. **Materials & Methods:** This was a hospital record based observational study. Anonymized data collection was done from the records of patients who were admitted in the ICU of Burdwan Medical College and Hospital during January 2020 to March 2020. Data regarding the capillary blood glucose value during the time of ICU admission, duration of ICU stay and ICU mortality were collected from the record section. **Results:** Among the retrieved data of 246 patients, 84 patients were diabetics (34.15%). The duration of ICU stay was found to be significantly higher among the diabetics population than those of non-diabetics. (p =.01) A moderately positive correlation was found between the capillary blood glucose level at the time of ICU admission and duration of ICU stay. However, no statistically significant difference was found in terms of mortality and ICU cure-rate between the two groups. **Conclusion:** From the present study we came to a conclusion that duration of ICU stay is influenced by the presence of diabetes with a positive correlation of ICU admission time capillary blood glucose level with the duration of ICU stay. Both ICU mortality and ICU cure-rate were independent of diabetes.

Keywords: Diabetes Mellitus, ICU, ICU mortality.

Introduction

Diabetes Mellitus (DM) refers to a group of metabolic disorders that share the common manifestation of hyperglycemia. Diabetes mellitus is the major endocrine epidemic of modern time.[**1**]The number of people suffering from diabetes has surged from 108 million in 1980 to 463 million in 2019. Additionally, the global prevalence of diabetes has risen from 4.7% in 1980 to 9.3% in 2019.[**2**] What worries us more, is the fact that India contributes significantly to this global epidemic of diabetes. Harbouring 69.2 million diabetes patients with a prevalence of 7.8%, India accounts for 16-17% of the world's total diabetics.[3]

On the other hand, hospitals across India cater to 5 million patients who need ICU admission per year. Unfortunately, 18.1% of these critically ill patients end up as non- survivors and another significant proportion are discharged with some sort of sequelae. What worsens this worrisome statistics is the prevalence of diabetes in these critical patients. The proportion of patients with diabetes admitted to the ICU is growing as a result of the worldwide increase of type 2

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diabetics. Study reported that about 38.73% of ICU patients are hyperglycemic in India.[4] It is now well-known that diabetes patients admitted to ICU are more prone to develop complications.[5-7] A strong association between diabetes and ICU bloodstream infection is established.[8] This may be attributed to the hampered immune cell functions associated with the disease.[9-10] Diabetes itself leads to a higher incidence of nearly all comorbidities including renal, cardiovascular and neuropathic diseases.[11] Further more, diabetic complications can directly impact the outcome of patients in ICU. However, the effect of stand-alone diabetes on a patient's risk of ICU mortality has been debated. A recent meta-analysis of 141 studies by Siegelaar et al. suggested that having a diagnosis of diabetes in the ICU does not itself directly lead to increased mortality in most ICU settings.[11] Another study demonstrated that higher HbA1c values and admission glucose values were predictive for mortality of ICU patients.[12]

So it is evident that there is serious need of more such investigations for coming to a specific conclusion. Moreover, Indian population varies largely from the western population owing to the diversity in the genetic pool and environmental factors which intensify the need of such study in our country. But unfortunately such kind of work is grossly missing in the Indian subcontinent.

This current study has been designed to establish association between presence of diabetes with ICU outcome in terms of duration of ICU stay and other related parameter like mortality, cure-rate at the time of discharge by gathering data from a tertiary care medical college in West Bengal, India.

Objective

The Primary objective of this study was to assess the relationship of Diabetes Mellitus with different ICU outcomes. To be specific we tried to establish any association between the presence of Diabetes with ICU mortality, duration of ICU stay, ICU cure rate. A secondary objective was included to establish correlation between the capillary blood glucose level at the time of ICU admission ICU and the duration of ICU stay.

Materials and Methods

This was an observational, retrospective, record based study. The study was performed after approval from the institutional ethics committee of Burdwan Medical College.

Ethical clearance was obtained from the institutional ethics committee of Burdwan Medical College. For the study purpose the records of the patients who were admitted in the BMC critical care unit during the period of January 2020 to March 2020 were considered. The study did not involve any direct interaction with patients and hence data collection was anonymized. So, waiver of consent was obtained from the IEC. Patients having no record about blood glucose level during their ICU stay were excluded from the study.

Following records were collected from the patients' charts. age, gender, occupation, date of admission, duration of hospitalization, history of diabetes mellitus at the time of admission, Capillary blood glucose level at the time of admission, Lipid profiles, all measurements regarding blood glucose taken during ICU stay, date of discharge from hospital or date of death in ICU. Eligible patients were subsequently classified into two groups on the basis of presence or absence of Diabetes Mellitus as inferred from the glycemic Measurements during ICU stay.The current case definition of Diabetes Mellitus provided by the American Diabetic Association was taken into consideration. All the collected data were tabulated and analysed for drawing inference.

Statistical Analysis

Fisher's exact test was used for the assessment of association between Diabetes Mellitus and mortality. The same test was also applied for assessing relationship between Diabetes Mellitus and ICU cure rate. For the evaluation of relationship between Diabetes Mellitus and duration of ICU stay, the mean duration of ICU stay of the two groups were compared using Independent Sample t Test. 95% Confidence interval was considered to be statistically significant. It was apart of the statistical analysisplan to obtain a scatter plot to identify any linear relationship between the capillary blood glucose level at the time of ICU admission and the duration of ICU stay and in case of a linear relationship, calculating a Pearson's product moment correlation coefficient '**r**'to determine the strength of the relationship.

Results

A total number of 246 patients were eligible for the study. Among them 84 patients (34.15%) were found to be diabetics and the rest 162 patients were non-diabetics. Baseline characters are described in **table 1**

and **table 2**. There was no significant difference between the two groups in terms of age, gender, lipid profile and occupation. However, there was significant difference in the distribution of baseline morbidities between the two groups. (Refer to **table 1 and 2**)

Table 1: Baseline characteristics of the diabetics and non-diabetics group

Base line characteristics	Diabetics 84, 34.15%	Non-Diabetics 162, 65.85%	Total 246, 100%	P- value
Age	51.29±1.59	55.09±2.42	53.98±1.36	0.313
Gender				
Male	M: N=46,54.7%	M: N=76, 46.9%	M: N=122,49.6%	0.06
Female	F: N= 38, 45.3%	F: N= 86, 53.1%	F: N=124,51.4%	0.07
Occupation				
Farmer	22 (26.5%)	51 (31.5%)	73 (29.7%)	0.086
Labour	12 (14.3%)	22 (13.6%)	34 (13.8%)	0.233
Home-maker	19 (22.3%)	35 (21.6%)	54 (22%)	0.132
Student	06 (7.1%)	20 (12.3%)	26 (10.6%)	0.043
Business-man	10 (11.9%)	15 (9.3%)	25 (10.2%)	0.342
Teacher	10 (11.9%)	12 (7.4%)	22 (8.9%)	0.012
Service person	05 (6%)	07 (4.3%)	12 (4.8%)	0.087
Lipid profile				
Total cholesterol	194.23±2.23	189.35±4.23	191.12±3.12	0.086
Triglyceride	133.08±3.21	129.25±2.22	130.98±2.89	0.128
HDL-C	43.04± 3.11	45.05±2.34	44.81±2.09	0.243
LDL-C	89.08± 2.03	87.09±2.23	87.98±2.78	0.348

CI= 95% and 80% power

Table 2: Baseline morbidity leading to ICU admission between diabetics and non-diabetics

Baseline characteristics	Diabetics 84, 34.15%	Non-diabetics 162, 65.85%	Total 246, 100%	P- value
Root cause of ICU admission				
DKA& HHS	31 (36.9%)	00 (0%)	31 (12.6%)	.001
CVA	04 (4.8%)	08 (4.9%)	12 (4.9%)	.012
Meningitis	04 (4.8%)	12 (7.40%)	16 (6.5%)	.009
Gynaecological	08 (9.6%)	22 (13.6%)	30 (12.1%)	.003
AKI	06 (7.1%)	02 (1.2%)	08 (3.2%)	.021
Cardio-vascular	08 (9.6%)	29 (17.9%)	37 (15%)	.061
Hepatic failure	03 (3.6%)	09 (5.6%)	12 (4.9%)	.009
Respiratory failure	09 (10.7%)	32 (19.7%)	41 (16.7%)	.044
Surgical	04 (4.8%)	14 (8.6%)	18 (7.3%)	.004
Intoxication	01 (1.2%)	12 (7.4%)	13 (5.3%)	.001
Infective	03 (3.6%)	14 (8.6%)	17 (6.9%)	.009
Others	03 (3.6%)	08 (4.9%)	11 (4.5%)	.032

CI= 95% and 80% power

It was found that 28.53 % patients among diabetics ended as non-survivors in comparison to 22.22% in non-diabetics. Tough the proportion of death among diabetics was higher, there was no statistically significant difference of mortality between the two group as derived from the Fisher's exact test. **Figure1** show the graphical representation of the relationship between diabetes mellitus and ICU mortality.

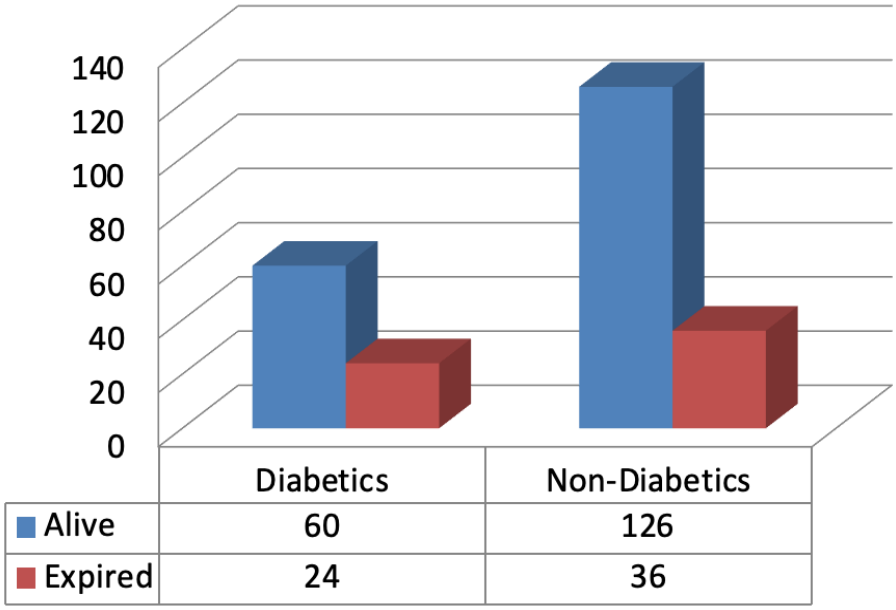

Figure 1: Mortality was found to be independent of the presence of diabetes (*p = 0.380)*

CI=95% and 80% power

However, comparison between the two groups on mean duration of ICU stay revealed a statistically significant longer ICU stay among diabetics.**Figure 2** shows the comparison of the two mean ICU Stays.

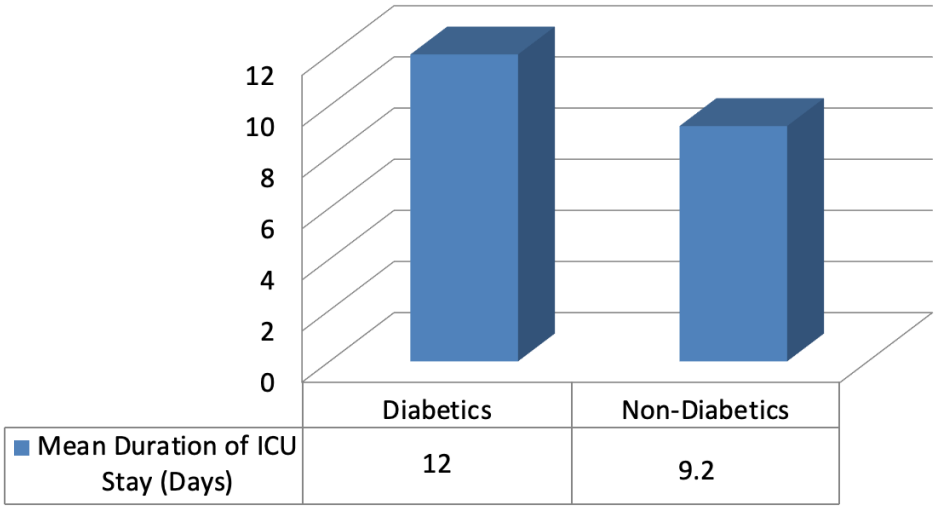

Figure 2: Mean duration of ICU stay was higher among diabetics. This difference was statistically significant (*p = 0.001*)

CI=95% and 80% power

The ICU cure rate was measured by the presence or absence of sequelae at the time of discharge from ICU. An absence of sequelae indicated cure.No statistically significant difference was found between the two groups on the basis of ICU cure rate. **Figure 3** shows the comparison of the ICU cure rates between the two groups.

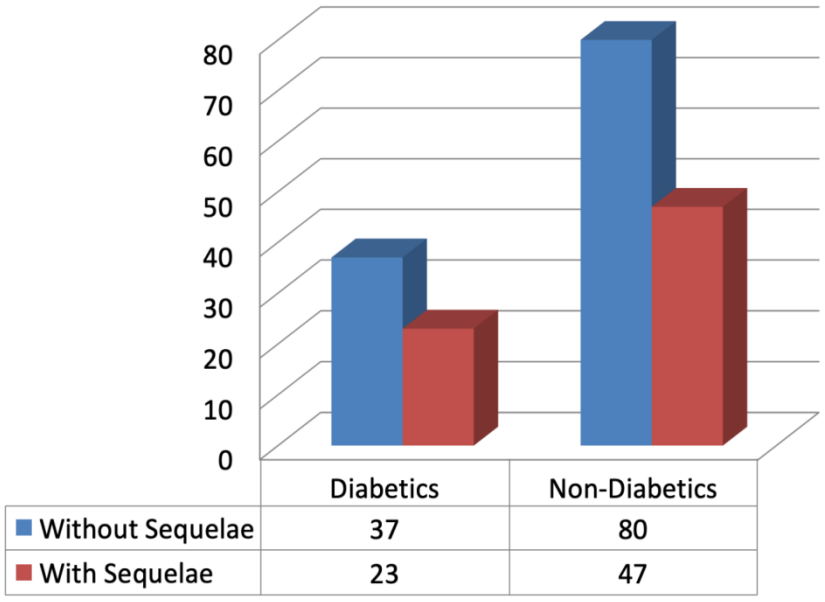

Figure 3: ICU cure rate was independent of the presence of Diabetes Mellitus. (*p = 0.493)*

CI=95% and 80% power

A moderately positive correlation was found to be present between the capillary blood glucose level at the time of ICU admission and the duration of ICU stay as derived from the Pearson product moment coefficient. (Referto figure 4)

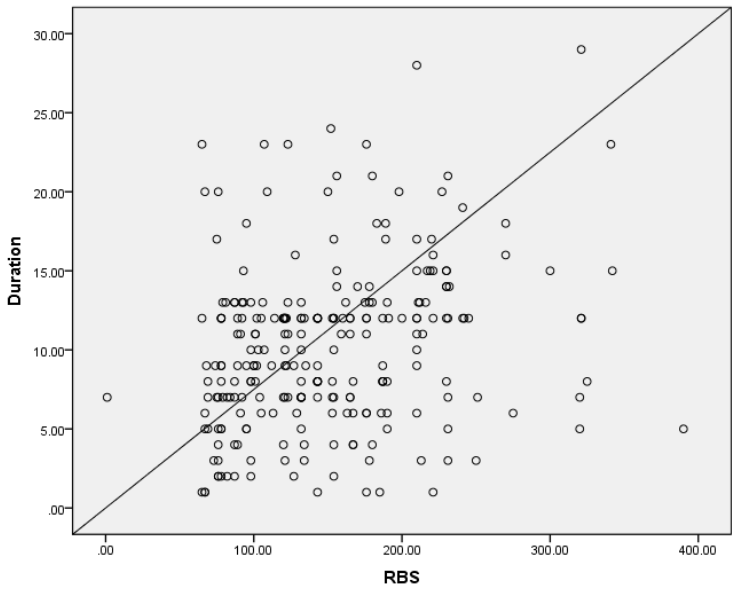

Figure 4: A moderate positive correlation (*r = 0.41*) was established between the value of RBS at the time of admission and the duration of ICU stay

Discussion

We performed a retrospective, record based study to find out the effect of Diabetes Mellitus on different ICU outcomes.The finding of our study showed that presence of Diabetes Mellitus was associated with the mean duration of ICU stay. A significant correlation was also happened to exist between the value of capillary blood glucose level at the time of ICU admission and the duration of ICU stay.

In a meta-analysis compiling of 141 studies, which was conducted by Siegelaar SE et.el. found no association between the presence of stand- alone Diabetes Mellitus and risk of mortality.[12]

Tough the proportion of death among diabetics was higher in our study, no statistically significant difference of mortality between the two groups were established. It was found that 28.53 % patients among diabetics ended as non-survivors in comparison to 22.22% in non-diabetes. The absence of statistical significance might have been resulted due to relatively small sample size.

Dharmalingam M. et.al. reported that about 38.73% of ICU patients are hyperglycaemic in India, which was reflected in this study.

Stress-induced hyperglycemia has been linked to increased mortality in hospitalized patients.[13,14] It occurs due to counter-regulatory hormones and cytokines leading to increased gluconeogenesis and insulin resistance.[15] Zaman A el.al. showed that dysglycaemia occurring due to admission in the intensive care unit were associated with overall longer length of stay in all patients.[16] In our study also this stress induced hyperglycaemia might have played a confounding role in the outcome variables.

According to a study conducted by Mahmoodpoor A el.al., HbA1c happened to be significantly associated with ICU mortality in previously undiagnosed Diabetes Mellitus patients.[13] The unavailability of data regarding glycated haemoglobin remained a limitation in our study.

Conclusion

Diabetes Mellitus was associated with increased mean duration of ICU stay. A significant linear correlation was also existed between the value of RBS at the time of ICU admission and the duration of ICU stay. There were no statistically significant difference in ICU mortality and ICU cure rate between diabetics and non-diabetics though higher proportion of diabetics ended

up as non survivors. Further studies involving larger study population is recommended.

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