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Type 2 Diabetes Mellitus and Hyperglycemia in Medical-IcuMorbidiy, Mortality and Functional Outcome

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Abstract

Introduction: Diabetes mellitus, a major lifestyle disease is undoubtedly the most challenging public health problem of 21st century with a worldwide prevalence of 387 million (8.3%) and predicted to be 592 million by 2035. 77% of people with diabetes live in low- and middle-income countries. India, once known as the 'diabetes capital of the world' was home to 61.3 million patients with T2DM in 2011 with predictions of 101.2 million diabetics by 2030. India is second only to China which is home to 92.3 million diabetics. The International Diabetes Federation estimated a doubling of diabetic population between 1995 and 2005, and predicted 70 million diabetics by 2025. **Materials and Methods:**Patients admitted to the Medical ICU during a consecutive period of four months from November 2014 to February 2015.Study was conducted among the patients admitted to the Medical ICU through the OP Department and casualty. Detailed history and physical examination along with relevant investigations were done after getting written, informed consent A proper proforma was set up emphasizing history, physical findings, and investigations.**Results:**Out of the total 144 patients 27 (18.75%) were found hyperglycemic with a history of Diabetes Mellitus and 20 (13.88%) were hyperglycemic without a history of DM. Rest ofthemi.e 97patients(67.36%)were found to be normoglycemic.**Conclusion:** Patients admitted with Infections and Poisoning have a higher chance to remain normoglycemic. Patients with Cardiovascular diseases are prone to become hyperglycemic. Snake bite and other poisonings have lesser chance to develop hyperglycemia. Hyperglycemia in general leads a poor functional outcome. Treatment with Insulin does not cause any significant variation in the mortality rate of the glycemic group when compared to the normoglycemics. Hyperglycemia can lead to increased mortality. Known diabetics and new hyperglycemics have equal mortality rate.
Keywords: Diabetes mellitus, Infections and Poisoning, ICU

Introduction

Diabetes mellitus, a major lifestyle disease is undoubtedly the most challenging public health problem of 21st century with a worldwide prevalence of 387 million (8.3%) and predicted to be 592 million by 2035. 77% of people with diabetes live in low- and middle-income countries. India, once known as the 'diabetes capital of the world' was home to 61.3 million patients with T2DM in 2011 with predictions of 101.2 million diabetics by 2030. India is second only to China which is home to 92.3 million diabetics. The International Diabetes Federation estimated a doubling of diabetic population between 1995 and 2005, and predicted 70 million diabetics by 2025.[1]The current scenario of diabetes in India is likely to worsen in the coming decade. The greatest numbers of people with diabetes are between 40 and 59 years of age. Even though the prevalence of microvascular complications of diabetes like retinopathy and nephropathy are comparatively lower in Indians, premature coronary artery disease is much higher in Indians compared to other ethnic groups. Given the lifelong costs associated with diabetes, many individuals.[2,3]Stress hyperglycemia is caused by several endogenous and exogenous factors. Endogenous contributors include counter- regulatory hormones, increased cytokines, increased insulin resistance, and decreased glucose uptake. All these processes impair glucose uptake into peripheral tissues, increase circulation of free

fatty acids (FFAs), and stimulate gluconeogenesis and glycogenolysis[4,9]Blood glucose goals have shifted from one extreme to the other over the past two decades. Hyperglycemia in the ICU is best managed with insulin therapy.Patients with stress hyperglycemia with no previous history of diabetes have worse clinical outcome compared to those with pre-existing diabetes with a comparable degree of hyperglycemia[6] The impact of hyperglycemia on clinical outcomes depends upon a number of factors including the intensity of hyperglycemic response, the underlying diagnosis, and the prevalent risk of infection. Patients with stress hyperglycemia had a higher mortality rate and longer hospital stay compared to those with known diabetes and those with normoglycemia[8]. A significant association between hyperglycemia and adjusted mortality was demonstrated.[5]

Though the burden of stress hyperglycemia is well established there is a dearth of study in this regard especially in the Medical ICU of Govt: Medical College, Kozhikode which is one of the leading tertiary care centre in Kerala.

Materials and Methods

Study group: Patients admitted to the Medical ICU of Government Medical College, Kozhikode.

Period of study: One year.

Centre of study: Department of General Medicine, Government Medical College, and Kozhikode.

Sample size: Patients admitted to the Medical ICU during a consecutive period of four months from November 2014 to February 2015.

Inclusion criteria: Patients admitted to the Medical ICU of Government Medical College, Kozhikode. Irrespective of age and gender willing to give consent

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Exclusion criteria: Those who were not willing to give consent
Methodology
Study was conducted among the patients admitted to the Medical ICU through the OP Department and casualty.
Detailed history and physical examination along with relevant investigations were done after getting written, informed consent
A proper proforma was set up emphasizing history, physical findings, and investigations.

- The medical records of 144 patients admitted to Medical ICU were verified
- Patients were categorized according to gender and age
- Gender distribution was in to two groups as male and female
- Patients were categorized in to 6 age groups from 13 years onwards
- All the patients were grouped into diagnostic categories according to comorbid illnesses.
- The patients who had 2 or more glucose measurements made were divided into 3 study groups
- A normoglycemic group - Those patients with normal plasma glucose and no previous history of Diabetes

- Patients with hyperglycemia were subdivided between those with a previous history of diabetes (known diabetics) and those without a previous history of diabetes (new hyperglycemia)
- Hyperglycemia was defined as in-hospital Random Blood Glucose level of 200 mg/dl or more on 2 or more occasions
- Comparison of morbidity and mortality among the glycemic groups was done as per gender, age, comorbidities
- Final outcome of the patients was studied- whether the patients was discharged to the ward or expired while in MICU.
- Functional outcome of the patients was assessed according to Karnofsky performance scale.
- Out come and functional outcome among the different groups were compared and evaluated.
- The primary end point of the study is In-hospital mortality
- Secondary end points include treatment of hyperglycemia and patient disposition at discharge.

Statistical analysis: Analysis was done after entering the data into Microsoft Excel and analyzing the same using SPSS.
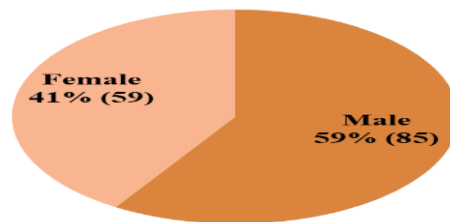
Results

Fig 1: Gender distribution

Figure 1 shows the study was male preponderance having 59% of males as study participants.

Table 1: Age wise distribution of study participants

Age group	Frequency	Percentage
13-22	25	17.36
23-32	34	23.61
33-42	21	14.58
43-52	26	18.05
53-62	20	13.89
>62	18	12.50

Table 1 suggest patients were divided into six groups according to their age.The maximum number of patients was between the age 23 and32 and those above 62were the least.According to table 2 out of the total 144 patients 27 (18.75%) were found hyperglycemic with a history of Diabetes Mellitus and 20 (13.88%) were hyperglycemic

without a history of DM.Rest of them i.e 97patients (67.36%) were found to be normoglycemic.Out of the 47 patients who were detected to have hyperglycemia 45 were treated with Insulin and two patients were treated with oral hypoglycemicagent, Metformin.The set wo were already on OHA at the time of admission.

Table 2:Categorization of participant with treatment plan

Hyperglycemic Group	Treated with Insulin	Treated with OHA
47	45	2

Table 3: Glycemic status in different age groups

GlycemicGroup	13-22	23-32	33-42	43-52	53-62	>62
Normoglycemia	25	32	17	11	09	03
Hyperglycemia With DM	00	00	00	07	09	11
Hyperglycemia Without DM	00	02	04	08	02	04

As per table 3 those patients who remained to be normglycemic in MICU were with maximum distribution in age group 23-32 years (32 patients -22.22%) and next was with 25patients (17.36%)in the age group13-22.Occurrence of hyperglycemia was maximum and equal in age groups 43-52 and >62 ,15 each (10.42%).But the incidence of hyperglycemia without DM was maximum in 43-52 age group(8

patients-5.55%).In the age group13-22 no patients developed hyperglycemia. Least number who developed hyperglycemia werein 23-32 and 53-62 age groups(2patients each-1.39%).Same was the frequency in those who were with hyperglycemia without history of DM. The findings are statistically significant with P valueof 0.000

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Table 4: Glycemic status as per Gender distribution

	Normoglycemia	Hyperglycemia With DM	Hyperglycemia Without DM
Male	63(65.9%)	14(51.9%)	8(40%)
Female	34(34.1%)	13(48.1%)	12(60%)
Total	97(67.36%)	27(18.75%)	20(13.89%)

As per table 4 those who developed hyperglycemia with a history of DM amounts to18.75% of total among whom majority are males. Among the group who developed hyperglycemia without a previous history of DM were 20 in number. Out of these 20 majority are females.

Table 5:Comparison of mortality in gender groups based on glycemic status

Died	Normoglycemic	Hyperglycemia with DM	Hyperglycemia Without DM
Male	11	05	03
Female	10	06	05
Total	21	11	08

As per table 5 in the normoglycemic group mortality was little higher in males.In hyperglycemia with DM death in females were little higher.But in the hyperglycemic group without DM mortality was comparatively higher in females.

Table 6:Diagnosis and outcome

Diagnosis	Total	Discharged	Died	Mortality%
Infections	52	45	07	13.46
Cardiovascular diseases	07	03	04	57.14
GIT-Hepatobiliary	07	05	02	28.57
CVA	13	06	07	53.85
Respiratory diseases	10	06	04	40
Malignancy	09	06	03	33.33
Snake bite	12	10	02	16.67
Poisoning-others	07	04	03	42.86
Renal diseases	03	00	03	100
Others	24	19	05	20.83

As per table 6 in general mortality is highest among Renal diseases. Second and third in order come Cardiovascular and Cerebro vascular diseases. Least mortality is in patients with infections. Next in order are patients with snake bite and other non-categorized diseases.These observations are statistically significant with P-value of.005.

Table 7: Glycemic status with Outcome

Glycemicstatus	Discharged	Died	Mortality%
Normoglycemia	76	21	27
Hyperglycemia withDM	16	11	40.7
HyperglycemiaWithout DM	12	08	40

The mortality percentage among normoglycemic is only 27%compared to 40.7 in hyperglycemics with DM and 40 in hyperglycemics without DM.The difference in mortality in the two hyperglycemic groups is significantly less.

Discussion

In this study 144 patients admitted to the Medical ICU of Government Medical College Hospital, Kozhikode for four months consecutive period from November 2013 to February 2015were subjected to observation. Detailed elicitation of history and thorough clinical examination were done in each case, as per the proforma. Three consecutive blood samples for Random Blood Sugar (RBS) were sent for analysis. Those patients whose RBS was reported >200mg/dl at least on two samples out of these were categorized as Hyperglycemics and all others with normal RBS values were put together as Normoglycemics. The Hyperglycemics were further subdivided into two categories as Hyperglycemics with history of Diabetes Mellitus Hyperglycemics without history of DM. The patients were admitted with various illnesses and were with diverse comorbidities. Study revealed that 67.36% of patients remained normoglycemic after admission to MICU.Out of the rest 18.75% were hyperglycemic and they had history of Diabetes Mellitus in the past.13.88% patients were newlydetected to be hyperglycemic (without history of Diabetes Mellitus).From these observations it is assumed that admission hyperglycemia occurs in patients admitted to MICU with significant frequency.Those with no previous history of Diabetes Mellitus are prone to develop hyperglycemia depending upon other comorbid illnesses.Similar observations were obtained in previous studies[9].The outcome of patients were broadly categorized into two, discharged to ward or Died.Out of the 144 patients included in the study 72.2% were discharged to medical wards and the rest 27.8 expired while in the MICU.Analyzing the performance scale 27.7% were under the scale 0(Died). 21.52% were under scale 90 and 15.97% with scale 80.These two scales comprise most of the patients assessed. The least number of patients were with scale 10.These findings were comparable with the observations in previous studies.[7]Those patients who remained to be normoglycemic in MICU were with maximum distribution in age group 23-32 years (22.22%) and next were with 17.36% in the age group13-22. Occurrence of hyperglycemia was maximum and equal in age groups 43-52 and>62,15 (10.42%).But theincidence of hyperglycemia without DM was maximum in43-52 agegroup (8 patients-5.55%). In the age group13-22no patients developed hyperglycemia. Least number who developed hyperglycemia were in 23-32 and 53-62 age groups (1.39%). Same was the frequency in those who were with hyperglycemia without history of DM. These observations denotes the tendency for those in the middle-age group to develop hyperglycemia even without history of DM.Younger age groups tends to remain normoglycemic in MICU.

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The effect of glycemic status on sex groups regarding mortality was compared in the normoglycemic group mortality was little higher in males. In hyperglycemia with DM death in females were little higher. But in the hyperglycemic group without DM mortality was comparatively higher in females.Majority among the normoglycemic patients have functional outcome score within the scales 100 and 80.56.70%fall in this range,with more patients in 90-80 group . Among the hyperglycemic groups the frequency is gradually increasing from the best outcome(100) to the worst (0). 40.42% hyperglycemics fall in the group of patients expired or a score of zero. Both groups of hyperglycemia have maximum patients in the worst outcome or scale 0.So as in the case of final outcome functional outcome is seen to be worse in the hyperglycemic groups there is no added risk for morbidity or mortality in the new glycemics.[12]In general mortality is highest among those with Renal diseases. Second and third inorderare Cardiovascular and Cerebrovascular diseases. Least mortality is in patients with infections. Next in order arepatients with snake bite and other non-categorized diseases Most of the patients admitted with infections were without significant other comorbid illnesses.[10]Patients with illnesses leading to better outcome (Infections and snake bite) are found to have majority with normoglycemic status. It can be assumed that other comorbid illnesses can lead to hyperglycemia.[11] The mortality percentage among normoglycemic is only 27% compared to 40.7 in hyperglycemics with DM and 40 in hyperglycemics without DM. The difference in mortality in the two hyperglycemic groups is significantly less. There is increased mortality in hyperglycemic patients.

Conclusion

Female patients without H/o DM have more chance to develop hyperglycemia in critical illness. Hyperglycemia seen with an increasing trend in the older age groups. Younger age groups, especially below 40 tends to remain Normoglycemic in critical illnesses. Patients admitted with Infections and Poisoning have a higher chance to remain normoglycemic Patients with Cardiovascular diseases are prone to become hyperglycemic. Snake bite and other poisonings have lesser chance to develop hyperglycemia. Hyperglycemia in general leads a poor functional outcome. Treatment with Insulin does not cause any significant variation in the mortality rate of the glycemic group when compared to the normoglycemics. Hyperglycemia can lead to increased mortality. Known diabetics and new hyperglycemics have equal mortality rate.

Conflict of Interest: Nil
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