Original Research Article

A comparative study of glycemic control of continuous insulin infusion versus single dose sub cutaneous insulin glargine injection in the patients admitted to ICU

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Abstract

Background: Diabetes is increasing at an alarming rate affecting more than 371 million people worldwide. Recent estimates report a 5 million increase in prevalence from 2011 to 2012, with many more undiagnosed. **Aims and Objectives:** To study glycemic control of continuous insulin infusion versus single dose sub cutaneous insulin glargine injection in the patients admitted to ICU. **Methodology:** After approval from institutional ethical committee a cross-sectional study was carried out in the patients with diabetes admitted to ICU in the department of Medicine of a tertiary health care centre during the one year period i.e. January 2016 to January 2017. After the written explained consent the patients were randomly allotted to the different treatment group i.e. Group A (continuous insulin infusion) and Group B (single dose sub-cutaneous insulin glargine injection).The statistical analysis was done by Chi-square test, unpaired t-test calculated by SPSS 19 version software. **Result:** In our study we have seen The patients in the Group A and Group B were comparable with each other with respect to Age (X^2=0.8461, df=4, p>0.05). The patients in the Group A and Group B were comparable with each other with respect to Sex (X^2=0.3472, df=1,p>0.05) The Mean time averaged AUC of blood glucose level (mg/dl) ±SD for Group A was 152 ± 13.43 and for Group B 154 ± 12.54 was comparable with each other (p>0.05). The outcome in the patients like improvement was comparable in both the group (X^2=0.72, df=1, p>0.05), The average hospital stay was also comparable in both the groups (p>0.05) and also with respect to APACHE II Score (p>0.05). **Conclusion:** It can be concluded from our study that glycemic control of continuous insulin infusion versus single dose sub cutaneous insulin glargine injection in the patients admitted to ICU was comparable to each other so single dose sub cutaneous insulin glargine injection should be preferred as it is having the same effect of continuous insulin infusion.

Key Words: Continuous insulin infusion, cutaneous insulin glargine injection, APACHE II Score.

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INTRODUCTION

Diabetes is increasing at an alarming rate affecting more than 371 million people worldwide.[1] Recent estimates report a 5 million increase in prevalence from 2011 to 2012, with many more undiagnosed. As a condition that persists throughout a patient's lifespan with progressively increasing complications, diabetes decreases the quality of life, increases economic burden on the individual, their family and society. It is associated with significant morbidity and mortality with an estimated 4.8 million deaths caused due to diabetes in 2012.[1] The increase in burden is due to the progressive nature of type [2] diabetes mellitus (T2DM) in existing patients and addition of newly diagnosed cases, which increases the number of people requiring insulin.[2] The estimated proportion of people with diabetes (T1DM or T2DM) in US taking insulin or insulin with OADs is 12% and 14%,

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respectively.[3] Approximately one in four patients admitted to a hospital has a known diagnosis of diabetes,[4] and about 30% of patients with diabetes require two or more hospitalisations in any given year.[5] Hyperglycaemia in in-patients can have three possible causes which include existing recognised diabetes, existing but unrecognised diabetes and hospital associated diabetes which can be iatrogenic or stress induced.[6,7] Stress hyperglycaemia may occur during an acute illness and usually gets resolved with illness. The association between hyperglycaemia in hospitalized patients (with or without diabetes) and increased risk for complications and mortality is well established.[4,8,9] A retrospective analysis of patient records (during 2007) from a tertiary care hospital in India reported that diabetes contributed to 8.2% hospitalisations and 15.6% in-patient deaths. This corresponds to mortality rates of 48.3/1000 and 23.4/1000 admissions for patients with and without diabetes, respectively.[10] Control of hyperglycaemia among non-critically ill patients admitted to general medicine and surgery services is important, as it is linked to adverse clinical outcomes like infections, prolonged stay in hospital and more disability after institutional discharge and death.[6,8,11]

MATERIAL AND METHODS

After approval from institutional ethical committee a cross-sectional study was carried out in the patients with diabetes admitted to ICU in the department of Medicine of a tertiary health care centre during the one year period i.e. January 2016 to January 2017. After the written explained consent the patients were randomly allotted to the different treatment group i.e. Group A (continuous insulin infusion) and Group B (single dose sub-cutaneous insulin glargine injection). All details of the information like age, sex, Mean time averaged AUC of blood glucose level (mg/dl) ±SD, Outcome, Average hospital stay, APACHE II Score etc. was recorded. The statistical analysis was done by Chi-square test, unpaired t-test calculated by SPSS 19 version software.

RESULT

Table 1: Distribution of the patients as per the age

Age	Group A	Group B	Total
20-30	4 (16%)	5(20%)	9(18%)
30-40	5 (20%)	7(28%)	12(24%)
40-50	9(36%)	8(32%)	17(34%)
50-60	4(16%)	3(12%)	7(14%)
>60	3(12%)	2(8%)	5(10%)
Total	**25(100%)**	**25(100%)**	**50 (100)**

(X^2=0.8461, df=4, p>0.05)

The patients in the Group A and Group B were comparable with each other with respect to Age (X^2=0.8461, df=4, p>0.05)

Table 2: Distribution of the patients as per the sex

Sex	Group A	Group B	Total
Male	15 (60%)	17 (68%)	32 (64%)
Female	10(40%)	8 (32%)	28 (56%)
Total	**25 (100%)**	**25 (100%)**	**50 (100%)**

(X^2=0.3472, df=1, p>0.05)

The patients in the Group A and Group B were comparable with each other with respect to Sex (X^2=0.3472, df=1, p>0.05)

Table 3: Comparison of Group A and Group B with respect to different parameters

	Group A	Group B	p-value
Mean time averaged AUC of blood glucose level (mg/dl) ±SD	152 ± 13.43	154 ± 12.54	p>0.05
Outcome			
Improved	17 (68%)	18(72%)	X^2=0.72,df=1,
Not-improved	8 (32%)	7(28%)	p>0.05
Average hospital stay	6 ± 2.34	7 ± 3.42	p>0.05
APACHE II Score	16 ± 3.43	18± 4.53	p>0.05

The Mean time averaged AUC of blood glucose level (mg/dl) ±SD for Group A was 152 ± 13.43 and for Group B 154 ± 12.54 was comparable with each other (p>0.05). The outcome in the patients like improvement was comparable in both the group (X^2=0.72, df=1, p>0.05), The average hospital stay was also comparable in both the groups (p>0.05) and also with respect to APACHE II Score (p>0.05).

DISCUSSION

Stress-induced hyperglycemia in the critically ill patient is a common metabolic disturbance which is associated with Intensive Care Unit (ICU) morbidity and mortality.[12,13,14] The incidence of this glycemic disorder is approximately 30%–60% which depends on the definition and diagnosis criteria in several critically ill settings.[15,16,17] Alteration of gluconeogenesis and insulin receptor sensitivity are among the common pathophysiologies of stress-induced hyperglycemia.[18] Furthermore, certain ICU management strategies, including highly concentrated glucose intravenous fluid, catecholamine infusion, renal replacement therapy, and several medications, also carry the risk of developing hyperglycemia.[17] Glycemic control in the critically ill patient is generally recommended in standard ICU care. From a recent study and recommendation, a blood glucose level between 140 and180 mg/dL is strongly recommended in all patients who develop acute hyperglycemia with a blood glucose level >200 mg/dL during ICU admission.[18] The standard management protocol, including continuous regular insulin infusion with a glycemic control protocol, has demonstrated the

most suitable method for blood glucose control in the ICU.[19] Insulin glargine is an insulin analog that is long acting and "peakless" which was introduced into clinical practice several years ago for blood glucose control in the outpatient setting.[20] This specific type of insulin requires only a single daily dose of subcutaneous injection which is more convenient and requires fewer devices. Several studies demonstrated optimal blood glucose control with the use of insulin glargine without hypoglycemic complications, particularly in outpatients with both type-1 and type-2 diabetes mellitus (DM).[21] In our study we have seen The patients in the Group A and Group B were comparable with each other with respect to Age (X^2=0.8461,df=4, p>0.05). The patients in the Group A and Group B were comparable with each other with respect to Sex (X^2=0.3472, df=1,p>0.05) The Mean time averaged AUC of blood glucose level (mg/dl) ±SD for Group A was 152 ± 13.43 and for Group B 154 ± 12.54 was comparable with each other (p>0.05). The outcome in the patients like improvement was comparable in both the group (X^2=0.72, df=1, p>0.05), The average hospital stay was also comparable in both the groups (p>0.05) and also with respect to APACHE II Score (p>0.05). These findings are similar to Rungsun Bhurayanontachai [22] *et al* they found Single-dose subcutaneous insulin glargine injection was feasibly applied for glycemic control in medical critically ill patients. The glycemic control in the critically ill patients by a single dose of subcutaneous insulin glargine was comparable to standard intravenous regular insulin infusion. A conversion dose of 100% of the daily requirement of regular insulin is suggested.

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