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Research Paper

Echocardiographic Findings and Outcome of Hyperglycemia in Medical ICU

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ABSTRACT
Background and aim: Hyperglycemia in critical illness hasbeen found to be associated with increased risk of heart failure. The present study evaluated echo findings and outcome of hyperglycemia in medical ICU. Methods: It was a hospital-based observational study conducted in thedepartment of medicine of Dr. Rajendra Prasad Government Medical College andHospital, Kangra (at Tanda) a tertiary care referral hospital.All patients above the age of 18 years with hyperglycemia during hospitalstay in Medical ICU setting and willing to participate in this study wereincluded. In hospital hyperglycemia was defined as any glucosevalue >7.8 mmol/l (140 mg/dl).Patients were labeled based on their glycemic status on admissionto Medicine ICU as admission hyperglycemia or having any RBS value>140mg/dl during ICU stay. Results: 45 were investigated by 2D Echocardiogram. Abnormal Echo results were seen in 41 patients (91%) whereas 4 patients (9%) had a normal echocardiogram. Out of these 45 patients, RWMA was present in 14 patients (31%). Global hypokinesia in 8 patients (18%) and concentric LVH in 7 patients (15%). Of the 45 patients, 35.5% had ejection fraction of <40%(reduced EF), 26.7% had ejection fraction of 40 – 50% (mild range EF) and remaining 37.8% had >50% VEF(preserved EF). Mortality was seen in 26.7%. Conclusion: Hyperglycemia in critically ill is associated with increased risk of heart failure and mortality.

Key words: *Hyperglycemia, ICU, Echocardiography*

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I. Introduction

Perioperative hyperglycemia frequently develops in critically ill patients and has been associated with adverse outcome. Carbohydrate metabolism is regulated by insulin, glucagon, cortisol, growth hormone, and epinephrine, the concentrations of which are often perturbed in critical care patients.

In 2001, Van Den Berghe[1] published a randomized controlled trial of critically ill patients showing that intensive insulin therapy to maintain blood glucose at or below 110 mg per deciliter reduces mortality among critically ill patients in the intensive care unit by one third. The results of this trial were enthusiastically received and rapidly incorporated into guidelines, which have led to worldwide adoption of tight glucose control in critically ill patients. Tight glucose control for patients treated in intensive care units (ICUs) has been recommended by many professional organizations.[2]

Epidemiological observations suggest a causal relation between hyperglycemia and the development and progression of heart failure (HF).[3]

Over the years, numerous studies have shown that acute hyperglycemia has many harmful effects on the cardiovascular system. It causes insufficiency, dysregulation and overall endothelial dysfunction[4] and reduces collateral circulation[5], spontaneous reperfusion in patients with acute myocardial infarction (AMI) with ST-segment elevation[6] and it deepens the QT.[7] In addition, some studies have shown that, during AMI, acute hyperglycemia is associated with impaired function (dysfunction) of the left ventricle (LV).[8,9]

The present study evaluated echocardiographic findings and outcome of hyperglycemia in ICU.

II. Methods

It was a hospital-based observational study conducted in the departmentof medicine of Dr. Rajendra Prasad Government Medical College andHospital, Kangra (at Tanda) a tertiary care referral hospital.All patients above the age of 18 years with hyperglycemia during hospitalstay in Medical ICU setting and willing to participate in this study wereincluded. Patients with hemoglobinopathies, on hemodialysis, blood transfusions andiron deficiency anaemia or chronic kidney disease, and/or who did not consent to be the part of this study wereexcluded.

In hospital hyperglycemia was defined as any glucose value >7.8 mmol/l (140 mg/dl). Patients were labeled based on their glycemic status on admission to Medicine ICU as admission hyperglycemia or having any RBS value>140mg/dl during ICU stay.

Patients were further categorized as follows based on diabetic status andHbA1c levels:
1) If patient was a known diabetic:
- Well controlled diabetic if HbA1c ≤7%
- Uncontrolled diabetic if HbA1c >7%

2). If patient had no prior history of diabetes mellitus:
- Stress-induced hyperglycemia if HbA1c <6.5%
- Newly diagnosed diabetes mellitus if HbA1c >6.5%

3). Patients with Pre-Diabetes
- HbA1c 5.7 to 6.4%

Data analysis
Data were presented as frequency, and percentage

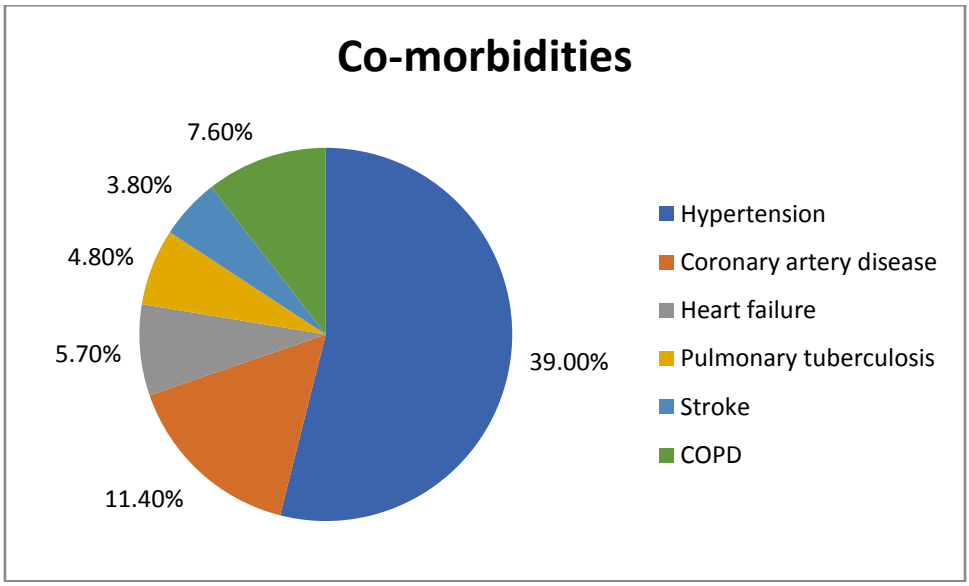
III. Results

General characteristics
Table 1 shows general characteristics. A total of 105 patients were included in this study. Mean age of the patients was 60.33 ± 15.2 years. Sixty-two percent of the patients aged above 60 years. 50.5% were males. 37.14% were smokers, 36.19% were alcoholics, and 9.5% were vegetarian.

Table 1: General characteristics

	Frequency	**Percentage**
Age (Years)		
≤40	10	9.52%
41-50	16	15.24%
51-60	15	14.29%
61-70	41	39.05%
>70	23	21.90%
Gender		
Male	53	50.5%
Female	52	49.5%
Smokers	39	37.14%
Alcoholics	38	36.19%
Diet		
Veg	10	9.5%
Mixed	95	90.5%

Co-morbidities
Hypertension was the most common co-morbidity (39%) followed by coronary artery disease (11.4%), and COPD (7.6%) (Figure 1).



Echo findings

Out of the total 105 patients, 45 were investigated by 2D Echocardiogram. Abnormal Echo results were seen in 41 patients (91%) whereas 4 patients (9%) had a normal echocardiogram. Out of these 45 patients, RWMA was present in 14 patients (31%). Global hypokinesia in 8 patients (18%) and concentric LVH in 7 patients (15%).

Table 2: frequency of 2d-echo parameters

2D ECHO	Frequency	Percentage
Normal	4	8.89%
RWMA	14	31.11%
Global hypokinesia	8	17.78%
ConcentricLVH	7	15.56%
LVSD	4	8.89%
LVDD	4	8.89%
Pericardial Effusion	2	4.44%
RA/ RV Dilated/ PAH, TR	2	4.44%

Ventricular ejection fraction

Out of 105 patients, ventricular ejection fraction was seen of 45 patients who were investigated by echocardiogram. Of the 45 patients, 35.5% had ejection fraction of <40%, 26.7% had ejection fraction of 40 – 50% and remaining 37.8% had >50% VEF.

Table: 3 Distribution of VEF

VEF%	Frequency	Percentage
<40%	16	35.50%
40-50%	12	26.70%
>50%	17	37.80%

Patient outcome

About 63.8% of patients were shifted to the general ward. Mortality was seen in 26.7% and the remaining 9.5% of patients were discharged/referred to higher centre.

Table 4: Outcome

Outcome	Frequency	Percentage
Shifted to general ward	67	63.80%
Discharged/referred	10	9.50%
Mortality	28	26.70%

IV. Discussion

In our study, Of the total cases in this study, 45 were investigated by 2D Echocardiogram.Abnormal ECHO results were seen in 91% patients. Out of these 45 patients, 31%patients had RWMA on echocardiogram whereas 18% had global HK and 9% hadLVSD and LVDD each. Bogdanović et al found that both groups of diabeticpatients, with poor and good metabolic control (both groups A and B), have similarchanges in E velocity and E/A ratio implying the presence of diastolic dysfunction(regardless of HbA1c level) in comparison to healthy controls.[10]

In our study, of 105 patients, ventricular ejection fraction was seen of 45 patients who were investigated by echocardiogram. Of the 45 patients, 35.5% had ejection fraction of <40%, 26.7% had ejection fraction of 40 – 50% and remaining 37.8% had >50% VEF.

In our study, the ICU mortality was 26.7%. A recent study revealed thathyperglycemia was not only an independent marker of in-hospital mortality in ICUbut also in patients admitted to general hospital wards.[11] In this study, investigatorsdivided patients into three groups: those with a known history of diabetes, thosewith new hyperglycemia and those with normoglycemia. Total mortality wassignificantly higher in patients with new hyperglycemia (16%) than in diabeticpatients (3%) and normoglycemic patients (1.7%). Dhakal et al reported that out of66 patients with hyperglycemia in ICU, 42 expired.[12]

V. Conclusion

Hyperglycemic patients in ICU have a higher prevalence of heart diseases and hyperglycemia is linked to a higher mortality incritically ill patients regardless of their diagnosis or severity of disease.

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