FULL LENGTH ARTICLE

The prognostic impact of hyperglycemiaon clinical outcomes of acute heart failure patients: Insights from the heart function assessment registry trial in Saudi Arabia registry

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Background: **The prognostic impact of hyperglycemia (HG) in acute heart failure (AHF) is controversial. Our aim is to examine the impact of HG on short- and long-term survival in AHF patients.**

Methods: **Data from the Heart Function Assessment Registry Trial in Saudi Arabia (HEARTS) for patients who had available random blood sugar (RBS) were analyzed. The enrollment period was from October 2009 to December 2010. Comparisons were performed according to the RBS levels on admission as either <11.1 mmol/L or ≥11.1 mmol/L. Primary outcomes were hospital adverse events and short- and long-term mortality rates.**

Results: **A total of 2511 patients were analyzed. Of those, 728 (29%) had HG. Compared with patients with normoglycemia (NG), HG patients had higher rates of hospital, 30-day, and 1-year mortality rates (8.8% vs. 5.6%; $p = 0.003$, 10.4% vs. 7.2%; $p = 0.007$, and 21.8% vs. 18.4%; $p = 0.04$, respectively). There were no differences between the two groups in 2- or 3-year mortality rates. After adjustment for relevant confounders, HG remained an independent predictor for hospital and 30-day mortality [odds ratio (OR) = 1.6; 95% confidence interval (CI) 1.07–2.42; $p = 0.021$, and OR = 1.55; 95% CI 1.07–2.25; $p = 0.02$, respectively].**

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Conclusion: **HG on admission is independently associated with hospital and short-term mortality in AHF patients. Future research should focus on examining the impact of tight glycemic control on outcomes of AHF patients.**

Keywords: Acute heart failure, HEARTS, Hyperglycemia, Mortality, Random blood glucose

1. Introduction

Acute heart failure (AHF) continues to be a burdensome problem to healthcare systems and is a leading cause of frequent hospitalizations and long-term medical care [1]. Multiple illnesses coexist with HF and influence its prognosis [2–4]. Diabetes mellitus (DM) is known as one of the most commonly associated comorbidities in HF patients with a prevalence ranging from 25% to 40% [5,6]. Data from major HF registries indicate that DM worsens hospital outcomes and increases short-term mortality rates [6–11]. Although the impact of DM on HF outcomes is known, the role of hyperglycemia (HG), either new-onset or in the context of preexisting DM, remains controversial [12–20]. Several reports have suggested a negative impact of HG on AHF mainly affecting hospital outcomes and overall survival [12–18], yet others have not shown similar findings [19,20].

HG in acute coronary syndromes (ACS) has been widely investigated. The DIGAMI trial showed a survival benefit in ACS patients with tight glycemic control [21]. This was later confirmed in other major trials [22–24]. Currently, the 2013 American Heart Association/American College of Cardiology guidelines recommend targeting sugar levels <180 mg/dL [25]. Glycemic control has become an integral part of the standard management of ACS, however the impact of extrapolating this evidence across the spectrum of all cardiovascular diseases is yet to be determined.

We sought to determine the relationship between HG and hospital adverse outcomes, as well as short- and long-term mortality rates in AHF patients using data from the Heart Function Assessment Registry Trial in Saudi Arabia (HEARTS).

Abbreviations

ACS	Acute Coronary Syndrome
AHF	Acute Heart Failure
BMI	Body Mass Index
DBP	Diastolic Blood Pressure
DLD	Dyslipidemia
DM	Diabetes Mellitus
EF	Ejection Fraction
eGFR	Estimated Glomerular Filtration Rate
HEARTS	Heart Function Assessment Registry Trial In Saudi Arabia
HG	Hyperglycemia
HR	Heart Rate
HTN	Hypertension
IHD	Ischemic Heart Disease
IQR	Interquartile Range
RBS	Random Blood Sugar
SBP	Systolic Blood Pressure
SD	Standard Deviation

2. Materials and methods

HEARTS protocol has been described previously [26,27]. Briefly, HEARTS is a prospective registry that enrolled 2609 consecutive patients with a primary admission diagnosis of AHF. Eighteen tertiary care centers in different regions of Saudi Arabia participated in this registry. Enrollment took place between October 2009 and December 2010, with clinical follow-up until January 2013. The definition of HF was according to the European Society of Cardiology guidelines for the diagnosis and treatment of acute and chronic HF [28]. The study was approved by the institutional review board at each participating hospital and complied with the Declaration of Helsinki.

Patients were eligible for this analysis if baseline random blood sugar (RBS) values were available. The diagnosis of DM was based on medical records documentation, patient self-reporting, or if the patient was taking diabetic medications. Patients were labeled as having HG if their RBS was ≥11.1 mmol/L, according to the American Diabetes Association guidelines [29]. We described patients' baseline characteristics, therapies, hospital course, and hospital mortality rates. Additionally, we obtained the vital status after 30 days, 1 year, 2 years, and 3 years following hospi-

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