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ORIGINAL ARTICLE

Blood glucose control for patients with acute coronary syndromes in Qatar



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Abstract *Background:* Blood glucose is known to be elevated in patients presenting with acute coronary syndromes. However a gap in knowledge exists regarding effective management strategies once admitted to acute care units. It is also unknown what factors (if any) predict elevated glucose values during initial presentation. *Objectives:* Objectives of the study were to characterize blood glucose control in patients admitted to the cardiac care unit (CCU) in Qatar and to determine predictive factors associated with high glucose levels (> 10 mmol/l) on admission to the CCU. *Setting:* All data for this study were obtained from the CCU at Heart Hospital in Doha, Qatar. *Method:* A retrospective chart review was completed for patients admitted to the CCU in Qatar from October 1st, 2012 to March 31st, 2013, of which 283 were included. Baseline characteristics (age, gender, nationality, medical history, smoking status, type of acute coronary syndrome), capillary and lab blood glucose measurements, and use of insulin were extracted. Time spent in glucose ranges of <4, 4 to <8, 8 to <10, and >10 mmol/l was calculated manually. Univariate and multivariate logistic regression were performed to assess factors associated with high glucose on admission. The primary analysis was completed with capillary data and a sensitivity analysis was completed using laboratory data. *Main outcome measure:* Blood glucose values measured on admission and throughout length of stay in the CCU. *Results:* Capillary blood glucose data showed majority of time was spent in the range of >10 mmol/l (41.95%), followed by 4–8 mmol/l (35.44%), then 8–10 mmol/l (21.45%), and finally <4 mmol/l (1.16%). As a sensitivity analysis, laboratory data showed very similar findings. Diabetes, hypertension, and non-smoker status

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predicted glucose values > 10 mmol/l on admission ($p < 0.05$) in a univariate analysis but only diabetes remained significant in a multivariate model (OR 23.3; 95% CI, 11.5–47.3). *Conclusion:* Diabetes predicts high glucose values on hospital admission for patients with ACS and patients are not being adequately controlled throughout CCU stay.

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1. Introduction

Diabetes and cardiovascular disease are highly prevalent in Western societies and are rapidly becoming major health concerns within other global regions (Wild et al., 2004). Both are associated with high rates of morbidity and place significant cost and resource burdens on healthcare systems (Zhang et al., 2010). In addition to the burden on society, these diseases greatly affect patients and their caregivers. Patients commonly develop symptoms and/or complications that negatively influence their quality of life, while increasing potential for physician visits and hospitalizations (Sudore et al., 2012; Ciechanowski et al., 2003; Nishi et al., 2014).

The relationship between Acute Coronary Syndromes (ACS) and diabetes is poorly understood, however both those with and without diabetes commonly present to the hospital with elevated glucose levels upon admission for an ACS event (Kosiborod, 2009). The mechanism for serum glucose elevation in non-those without diabetes is unclear but may be a marker of undiagnosed diabetes or impaired glucose tolerance (Norhammar et al., 2002). The effect is concerning, as hyperglycemia is associated with a higher risk of mortality and complications in patients experiencing ACS (Donahoe et al., 2007; Deedwania et al., 2008). This is true for glucose levels on admission, as well as glucose levels throughout hospitalization (Kosiborod, 2009). It is speculated that abnormal glucose metabolism may have a role in left ventricular remodeling (Hofsten et al., 2009; Nicolau et al., 2007). However, this remains yet to be confirmed.

A key area of interest is determination of the most effective management strategy for ACS patients presenting with hyperglycemia on admission to the critical care unit. There is evidence that glucose normalization upon admission to a hospital setting can reduce mortality risk, without any major increases in adverse effects (Kosiborod, 2009). Moreover, greater reduction of glucose over 24 h in those without diabetes has predicted lower mortality (Goyal et al., 2009). However, large studies in critical care settings have demonstrated increased morbidity and mortality in patients who received intensive glycaemic control, likely due to hypoglycemia (Finfer et al., 2009). As such, current clinical practice guidelines recommend maintaining blood glucose in the range of 7–11 mmol/l for patients presenting with ACS (Canadian Diabetes Association Practice Guidelines Expert Committee, 2013).

In recent years, the Middle East has observed a sharp increase in the prevalence of both diabetes and cardiovascular diseases (Habibzadeh, 2012). The State of Qatar is a member state of the Gulf Cooperation Council (GCC) and is currently undergoing healthcare reform, with comprehensive strategies being implemented to develop a modernized world-class healthcare system (Supreme Council of Health, 2012). However, this system is challenged by very high rates of both

diabetes and cardiovascular disease within local populations (Supreme Council of Health, 2012; Bener et al., 2009; Almahmeed et al., 2012). There is currently a gap in knowledge regarding the presentation and management of ACS patients in Qatar, and whether or not practice trends mirror that of other international centers. Specifically, it is unknown how glucose is managed upon presentation in patients with ACS and what (if any) predictive factors are associated with high glucose levels on admission.

The primary objective of this study was to characterize capillary blood glucose control in ACS patients admitted to the cardiac care unit (CCU) in Qatar. A secondary objective was to determine predictive factors associated with high glucose levels (> 10 mmol/l) on admission to the CCU. Approval was received from the Institutional Review Boards at both Hamad Medical Corporation and Qatar University.

2. Methods

2.1. Design and patients

This study was a retrospective chart review of all patients admitted with a diagnosis of ACS to the CCU at Heart Hospital in Qatar, from October 1, 2012 to March 31, 2013. Inclusion criteria were patients admitted to the CCU at the Heart Hospital with a diagnosis of ST segment elevated myocardial infarction (STEMI), non-STEMI, or unstable angina that had at least one documented blood glucose measurement during CCU stay. Patients who were not admitted for ACS or who did not have a plasma glucose level taken at any time during admission to the CCU were excluded from the study.

2.2. Outcomes

The primary endpoint was characterization of blood glucose control in patients admitted to the CCU through determination of the time spent in blood glucose ranges of < 4 , 4 to < 8 , 8 to < 10 , and > 10 mmol/l measured through capillary mechanisms. These ranges were chosen based on institution levels of hypoglycemia (< 4) and hyperglycemia (> 10). The threshold for initiation of sliding scale insulin at the center studied is 10 mmol/l and therefore correlates to institutional definitions of control. The secondary endpoint was the determination of factors associated with initial glucose levels > 10 mmol/l on admission to the CCU.

2.3. Data collection

A standardized data extraction tool was developed for collecting patient data. Patients were identified using hospital records

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