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Implications of Blood Glucose Management with Heart Failure Patients with Type 2 Diabetes in an Acute Care Setting

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Background
Heart failure and diabetes are both lifestyle diseases that currently represent a significant financial strain at $245 Billion and $31 Billion respectively (Heidenreich, et al, 2013). Research indicates that the two diseases potentially exacerbate each other when comorbid. Early research indicates that lowering average blood sugar over time (1% A1c reduction) improves functional status, kidney function, and reduces Renin Angiotensin Aldosterone System activity in patients also suffering from CHF, changes that are also shown to improve management of heart failure (Lapina, et al, 2008.)

Little data was found to demonstrate short term efficacy of reducing average blood sugar in the inpatient population during exacerbation of either comorbidity. It is known that patients with diabetes have a considerably higher likelihood of comorbid heart failure when compared with those without (Wang, et al, 2015.) both of which are of clinical significance in the inpatient population.

Purpose
This observational and retrospective study was conducted to elicit relevant data from known participants admitted for heart failure with comorbid data to identify opportunities to improve patient outcomes such as adherence to treatment regimens, patient satisfaction, renal function and length of stay. This study took place at Providence St. Vincent Medical Center’s 4th floor Cardiology B unit.

Methods
This was an Institutional Review Board approved observational and retrospective study. Potential participants were identified during their admission on the inpatient Cardiology B unit by charge nurses, investigators, and floor nurses. At the time of discharge, these participants were invited to complete a five question survey asking about the their diabetes and inpatient experience. This survey identified participant satisfaction with blood sugar management, whether improved sugar control would be preferable, their difficulty adhering to the fluid restriction, and whether they utilized oral glycemic agents at home. The first four items were addressed with a 5-point Likert scale. The oral agents item response choices were Yes and No. Investigators then collected clinical data by reviewing electronic medical records, specifically gathering data about diagnosis, length of stay, creatinine, capillary blood glucose, hgba1c, and nutrition profile.

Results
This study included 7 participants who fit the research criteria. The patients’ lengths of stay averaged 8.7 ± 2.1 days and ranged from 2-28 days. Blood sugars averaged 164 ± 51 and ranged from 80 to 374. The participants’ laboratory A1c averaged 7.6 ± 2.1 and ranged from 5.1 to 11.8, while A1c calculated from median blood sugar was 7.1 ± 0.9 and ranged from 6.9 to 8.2. The participants’ average inpatient blood sugars translate to an A1c of 7.5 ± 0.4, excluding one value for one patient who had 4 of 5 values nearly identical, the average adjusted inpatient blood sugars translate to an A1c of 7.3, reflecting tighter blood sugar control as seen in figure 1.

Creatinine averaged 2.1 ± 1.0 from 1.3 to 4.0.

All 7 patients completed the survey where 5 was the highest score on each Likert scale question. A total of 5 (71%) patients reported taking oral diabetes medication at home.

In survey responses, participants expressed a positive view of their blood sugar management with 6 (86%) responding they were somewhat satisfied or satisfied with their blood sugar management with the average being 4.2 out of 5 on the Likert Scale.

Discussion/Conclusions
All participants’ median blood sugars after admission reflected a median A1c of less than 8.2. Participants’ A1c calculated from mean blood sugar averaged 7.6% lower than laboratory and change from laboratory to A1c calculated from median blood sugars was -11%. As 5 of the 7 patients reported taking oral diabetes medication at home, and sliding scale subcutaneous insulin was the treatment while inpatient, this change in regimen with a sliding scale blood sugars readings per day did result in increased control. However, both laboratory and inpatient blood sugar data reflects sub-optimal blood sugar control according to the American Diabetes Association (ADA).

This may imply the participant plays a larger role in blood sugar management than the regimen itself. Dietary and lifestyle modifications may demonstrate greater efficacy than medication regimen, even while in-patient.

Participant laboratory values of A1c reflecting glucose control prior to admission and creatinine level were the greatest correlator of length of stay. This finding is expected as poor blood sugar control is known to have a causal relationship with impaired renal function, as reflected by increased creatinine. Impaired renal function has been shown to decrease the efficacy of diuretics, which would in turn increase length of stay.

There was some correlation between increased blood sugars while inpatient and difficulty abiding fluid restriction as well as an increase in number of denied fluid requests. This is consistent with polydipsia from hyperglycemia making fluid restriction compliance difficult, leading to increased fluid intake and increased difficulty abiding a fluid restriction. While the strengths of these correlations is weak, it does imply that improved inpatient blood sugar control may improve participant satisfaction.

Future investigations would benefit from larger participant groups. Understanding the scope of service may account for the low study sample, as St. Vincent has increased telemetry capacity, and treatment of heart failure populations have been redistributed across multiple units outside cardiology.

In addition, some attitudes reflect poor insight into diabetes control including the clustering of responses around improved blood sugar control. Only one participant answered that improved blood sugar control would benefit inpatient experience “a great amount” and none answered “a great amount.” This is despite the mean and median blood sugar being 164 and 156 respectively, with the American Diabetes Association guidelines indicating 130 as the target blood sugar two hours after eating.

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References