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Comments
Medical student Nicholas Maselli participated in this study as part of the Senior Scholars research program at the University of Massachusetts Medical School.

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Background

Heart Failure (HF) in the setting of comorbid diabetes mellitus (DM) has been extensively examined and is associated with increased mortality. More recently, hyperglycemia independent of DM status during critical illness admissions has become recognized as an indicator of poor outcomes. Despite evolving understanding of DM in the setting of acute HF, hyperglycemia at time of admission for acute HF has not been examined with regard to in-hospital treatment and patient outcomes.

Methods

Worcester Heart Failure Study: The sample consisted of 9,748 residents of the Worcester (MA) metropolitan area hospitalized at all 11 greater Worcester medical centers for acute decompensated HF during the years 1995 - 2004 with data available on diabetic status and admission glucose measurements. Patients were stratified into three groups based on history of DM and admission hyperglycemia defined by glucose ≥200 mg/dL: 1) nondiabetic, normoglycemic (NDNG); 2) non-diabetic, hyperglycemic (NDHG) and 3) Diabetic (DM).

Results

Figure 1. Time trends according to glycemic status

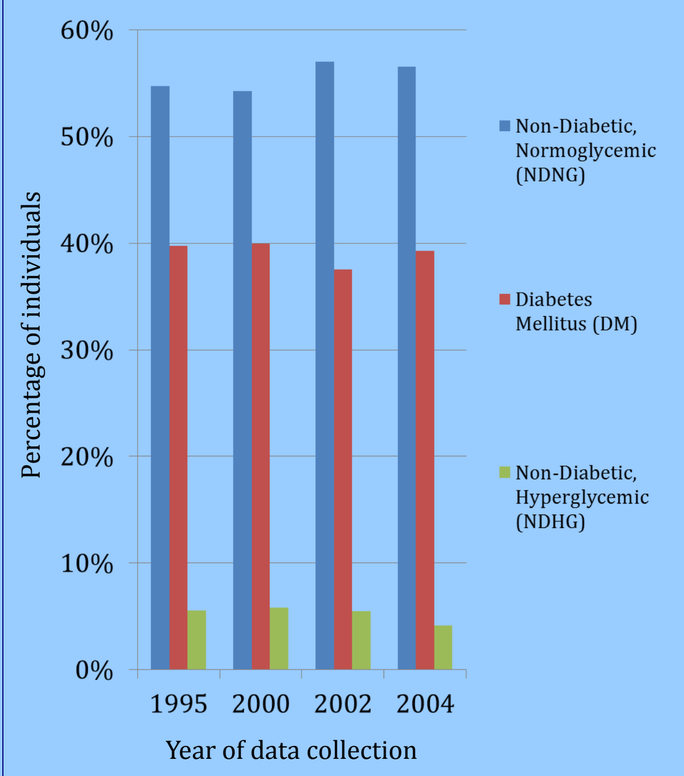

Table 1. Baseline characteristics according to glycemic status[a]

	NDNG[b] (n = 5428)	DM (n = 3807)	NDHG[c] (n = 513)
Demographics			
Age [SD] (mean, years)	78 [13]	74 [11]***	78 [12]
Male (%)	44	46	35***
Caucasian (%)	94	92***	95
Arrived by ambulance (%)	59	62**	75***
Medical History (%)			
Heart Failure (HF)	66	79***	65
Coronary Heart Disease (CHD)	50	65***	52
COPD	36	36	38
Hypertension	64	75***	67
Peripheral Vascular Disease (PVD)	15	27***	13
Renal failure/disease	21	34***	19
Stroke	12	16***	11
Clinical Admission Data			
Systolic BP (mean, mmHg)	140	146***	154***
Diastolic BP (mean, mmHg)	74	74	81***
Heart Rate (mean, bpm)	89	88***	103***
BMI (mean, kg/m2)	27	31***	27
Cholesterol (mean, mg/dL)	163	162	171
Serum glucose (mean, mg/dL)	125	197***	265***
Serum creatinine (mean, mg/dL)	1.6	1.8***	1.5
Estimated GFR (mean, ml/min/1.73 m)	56	49***	52***
Ejection Fraction (%)	46	45	44*
Length of hospitalization (mean, days)	6.4	6.0*	7.4

Table 2. Treatment and outcomes according to glycemic status[a]

	NDNG[b] (n = 5428)	DM (n = 3807)	NDHG[c] (n = 513)
Medications Received (%)			
ACE inhibitor	48	56***	53
ARB	6	7*	4
Aspirin	52	60***	58**
β-blocker	53	58***	58
Calcium channel blocker	30	36***	32
Lipid lowering agent	22	36***	21
Digoxin	43	44	45
Diuretic	97	97	98
Nitrate	52	64***	66***
Treatment Recommendations (%)			
Low-fat diet	62	66***	60
Fluid restriction	14	18***	14
Increased physical activity	41	42	48**
Reduce alcohol intake	1	1	1
Rehabilitation	11	12	14*
Salt restriction	76	78*	73
Smoking cessation	2	2	3
Procedures Received (%)			
Cardiac catheterization	6	6	7
PTCA	5	6***	8***
CABG	1	1	2**
Survival (%)			
Discharge	93	94	90*

[a] All P-values reflect comparisons to the NDNG group; [b] Admission serum glucose <200 mg/dL and no history of diabetes; [c] Admission serum glucose ≥200 mg/dL and no history of diabetes
* P-value <0.05; **P-value <0.01; ***P-value <0.001

- The average age of the study sample was 76.2 years, 43.9% were male, and 93.3% were Caucasian.
- Between 1995 and 2004, 56% of patients (n = 5428) were admitted in the NDNG group, 39% of patients (n = 3807) were in the DM group, and 5% of patients (n=513) were in the NDHG group.
- The proportion of hospitalized patients with heart failure in the three glycemic groups remained relatively stable over the study period (1995-2004). (Figure 1)
- Non-diabetic, normoglycemic patients were similar to NDHG patients with respect to age and medical history. (Table 1)
- Non-diabetic, normoglycemic patients were significantly older and less likely to have a history of various comorbid conditions such as hypertension, stroke and renal disease when compared to diabetics. (Table 1)
- Diabetics and NDHG patients received significantly more cardiac medications and procedures than NDNG patients. (Table 2)
- Diabetics had significantly more lifestyle recommendations prescribed at discharge than both non-diabetic groups. (Table 2)
- The NDHG group had significantly higher in-hospital mortality than both the NDNG and DM groups. (Table 2)

Conclusions

The results of our population-based investigation demonstrate that non-diabetic patients hospitalized for acute HF who are hyperglycemic at the time of admission represent a vulnerable group of patients at risk for increased mortality during hospitalization. Hyperglycemia ≥200 mg/dL during acute HF hospitalization should be taken into account when providing in-hospital management for HF with additional consideration given to ascertainment of diabetic status and glycemic control.

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