Prognostic Impact of Plasma Glucose on Cardiogenic Shock Patients With or Without Diabetes Mellitus: SMART RESCUE Trial

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Disclosure

- The Authors and the presenter have no conflict of interest to declare

Discussion Points

- Does hypergylcemic status influence In-Hospital Mortality in Cardiogenic shock patients?
- Should higher cut-off value be applied to DM patients in Cardiogenic shock patients?

Stress Hypergylcemia in Critically ill Paitents

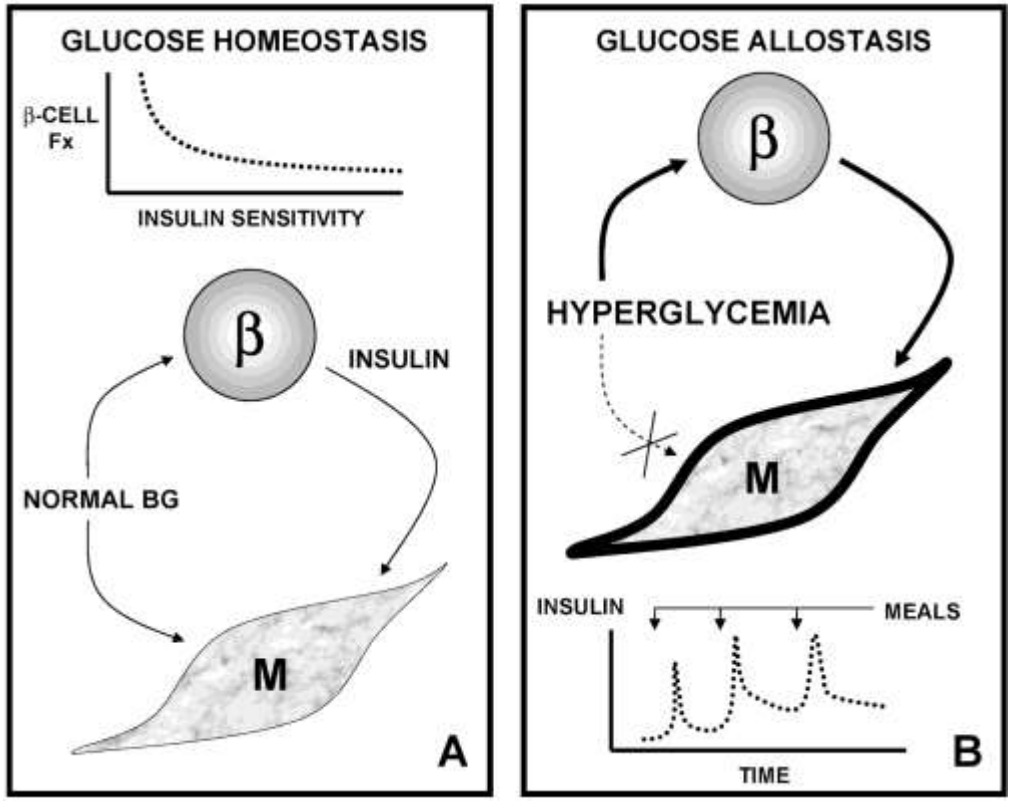
- Critically ill patients frequently experience hyperclycemia regardless of having Diabetes Melitus

- This phenomenon is referred to as ‘Stress Hyperglycemia’

Mechanism of Stress Hyperglycemia

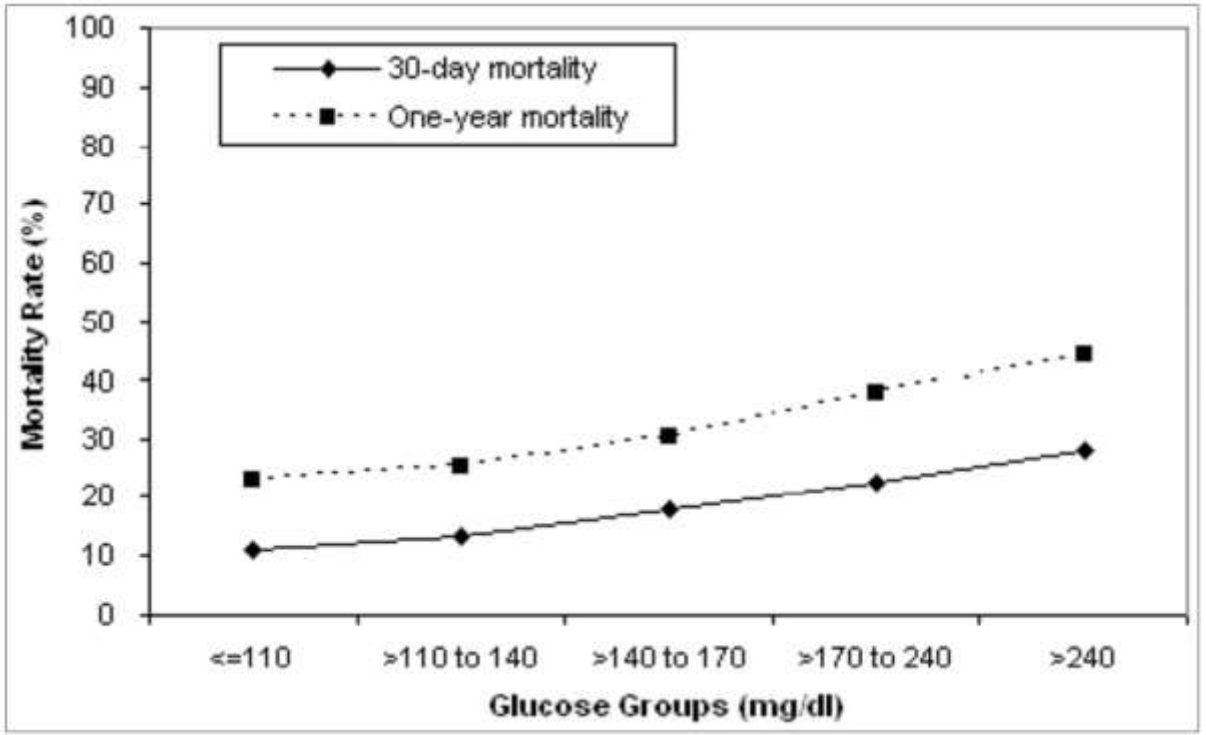
- Neuroendocrinologic alterations-> decreased glucose disposal + increased insulin resistance-> hyperglycemia

- A: Homeostasis, insulin sensitivity and pancreatic B-cell function are directly related which maintains blood glucose in the normal range
- B: Allostasis, B-cell insulin secretion increases to compensate for insulin resistance. However, complete correction is avoided for meal response

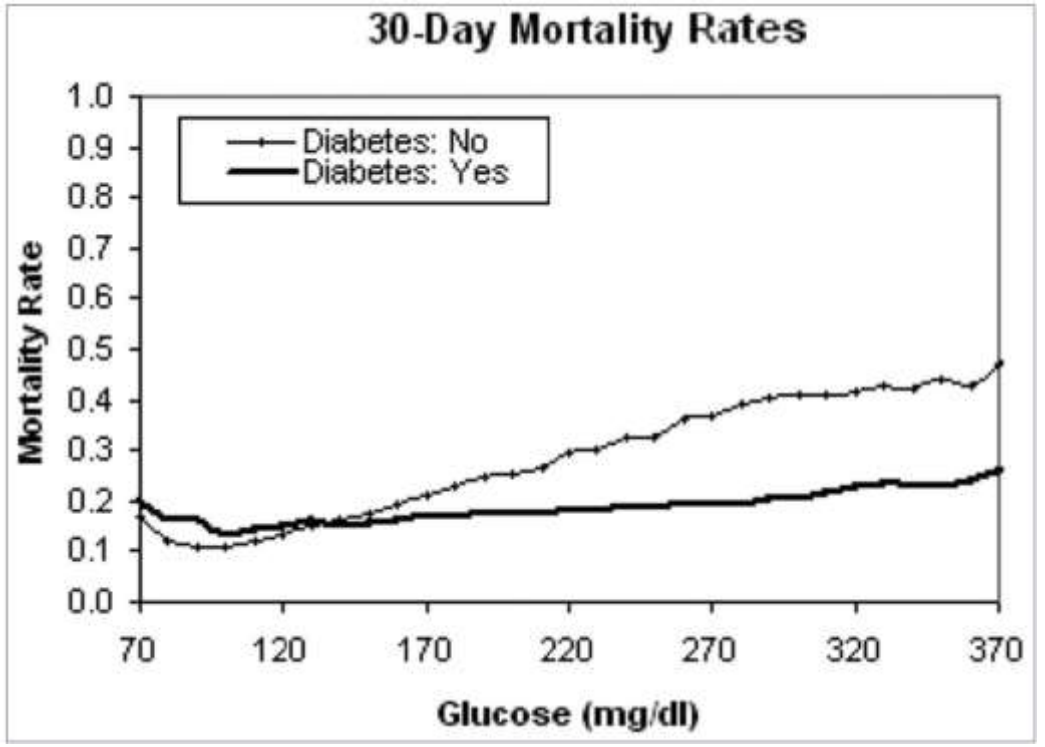


J Parenter Enteral Nutr, Volume: 30,01 March 2006

Hyperglycemia and Acute Coronary Syndrome



Mortality by admission glucose level



Mortality by admission glucose levels with or without DM

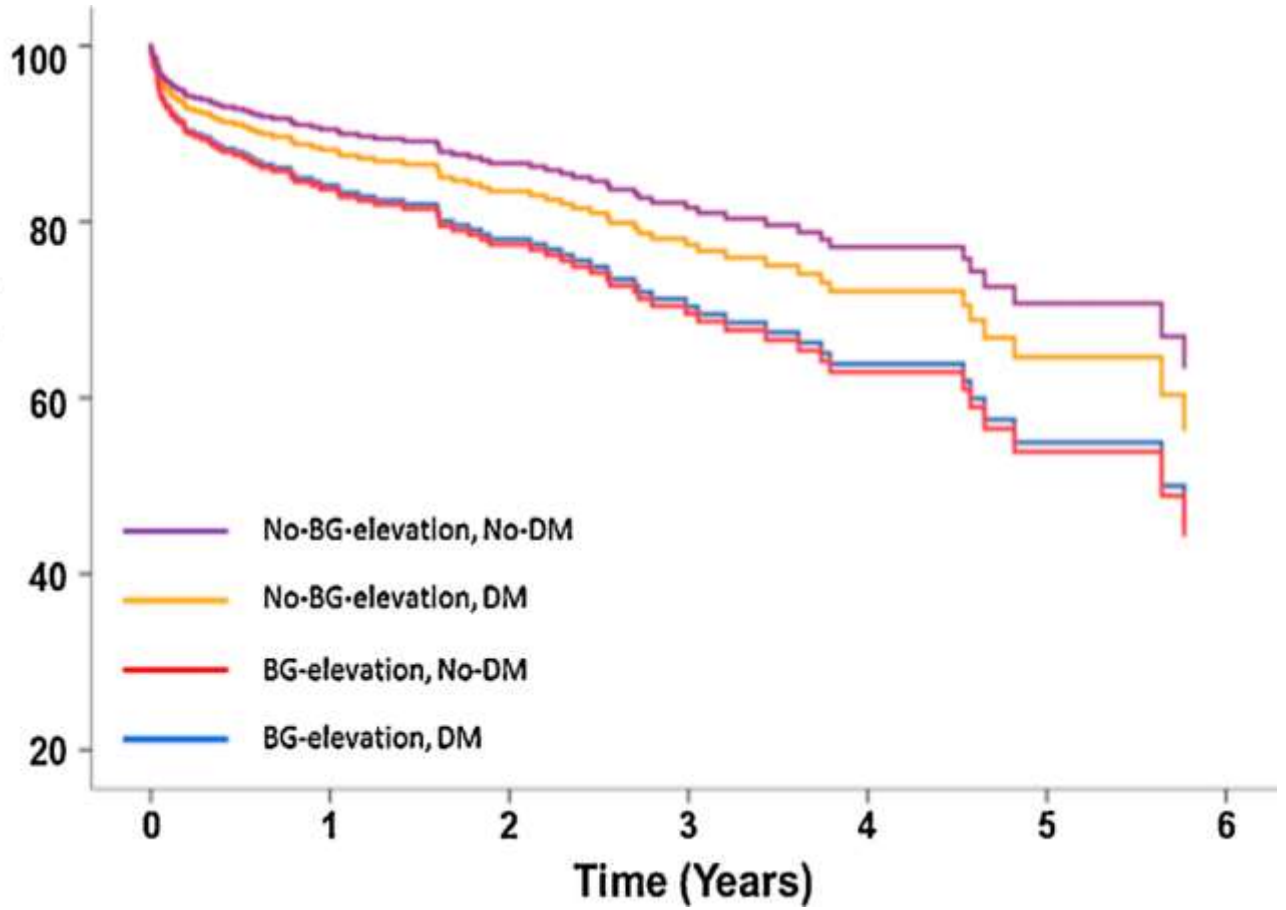
AHA SCIENTIFIC STATEMENT, March 2008

Hyperglycemia on admission in Acute Decompensated Heart Failure

Clinical parameters	HR (95%CI)	p-Value
Age	1.01 (0.99–1.03)	0.272
BMI	0.97 (0.91–1.03)	0.254
Current smokers	1.33 (0.85–2.09)	0.216
History of HF	1.31 (0.82–2.09)	0.259
Ischemic heart disease	1.25 (0.80–1.97)	0.328
Atrial fibrillation	1.68 (1.01–2.81)	0.046
Chronic obstructive pulmonary disease	2.27 (1.00–5.11)	0.048
Systolic BP	0.99 (0.98–0.99)	0.001
Hemoglobin	0.86 (0.77–0.95)	0.004
eGFR	1.00 (0.99–1.01)	0.651
Sodium	0.98 (0.93–1.03)	0.405
C-reactive protein[a]	1.10 (0.95–1.28)	0.188
BNP[a]	1.02 (0.81–1.27)	0.879
Diuretics	1.83 (1.13–2.95)	0.014
No-BG elevation, No-DM	1.00 (Reference)	
No-BG elevation, DM	1.26 (0.59–2.67)	0.546
BG elevation, no-DM	1.79 (1.02–3.12)	0.042
BG elevation, DM	1.73 (1.01–2.98)	0.048

BG, blood glucose; BMI, body mass index; BNP, B-type natriuretic peptide; BP, blood pressure; DM, diabetes mellitus; eGFR, estimated glomerular filtration rate; HF, heart failure; HR, hazard ratio.
[a] Natural log-transformed values were used for analysis.

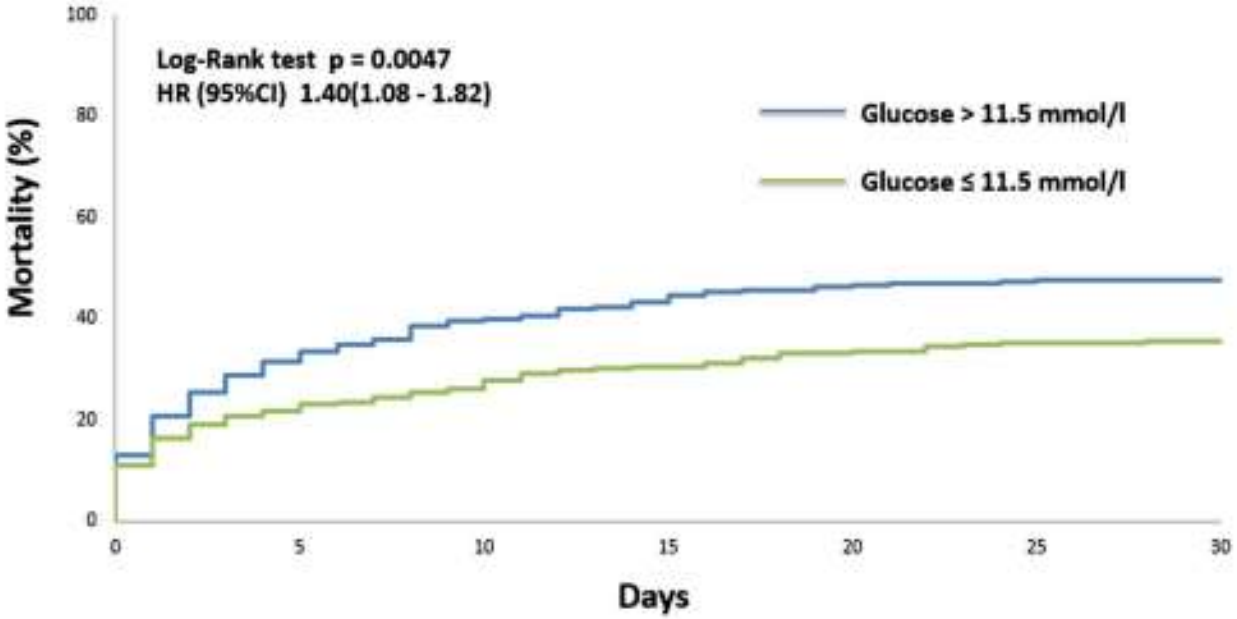
Multivariate hazard ratio for mortality rate



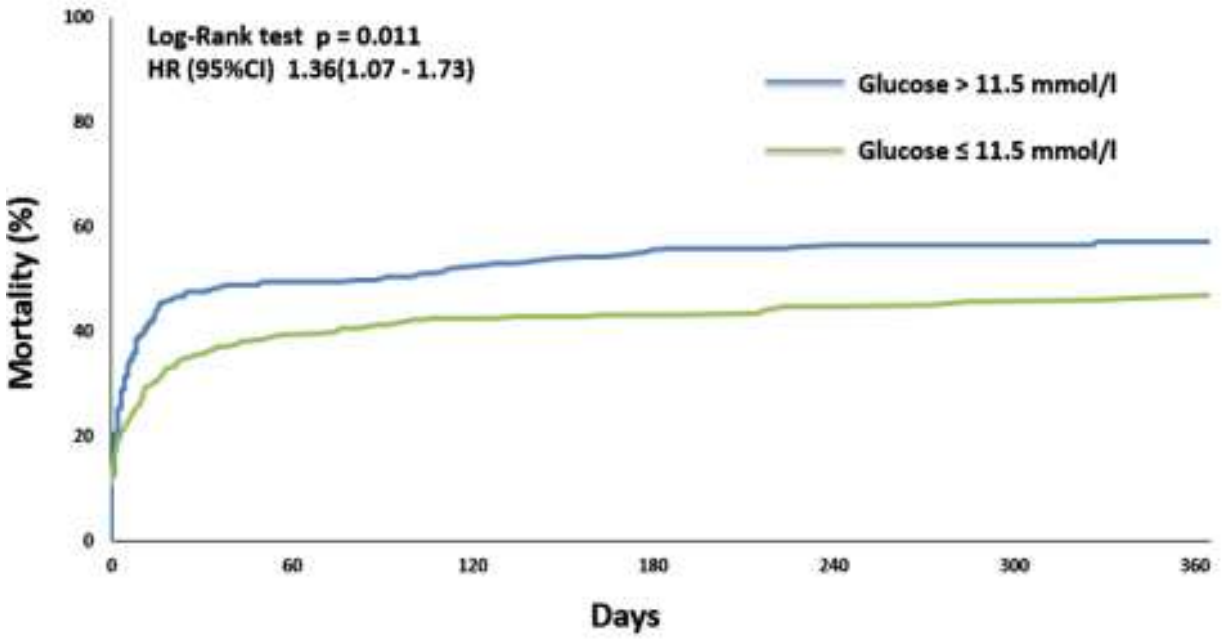
Multivariate Cox proportional hazard survival plot

Journal of Cardiology. 2017 Apr

Hyperglycemia In Cardiogenic Shock complicating AMI ; IABP-SHOCK II-trial



KM curve for 30 day mortality



KM curve for 1 year mortality

Clinical Research in Cardiology 2018

Purpose

- Despite the abundance of studies regarding hyperglycemia and its prognostic impact in cardiovascular patients, the results do not share concrete coherence due to diverse disease entity spectrum and distinctive clinical settings
- Our aim was to evaluate the prognostic value of admission glucose level regardless of having DM in cardiogenic shock patients

Study Population

- A total of 1,177consecutive cardiogenic shock patients were enrolled from January 2014 to December of 2018 at 12 hospitals in South Korea.
- Patients were divided into four groups according to their initial plasma glucose level (guideline from glucose management of critically ill patients)

Glucose management in critically ill adults and children. Lancet Diabetes Endocrinology. 2015

- Diabetes patients (n=752) and non-diabetes patients (n=425) ;

  Group 1 (≤8 mmol/L),

  Group 2 (8-12 mmol/L),

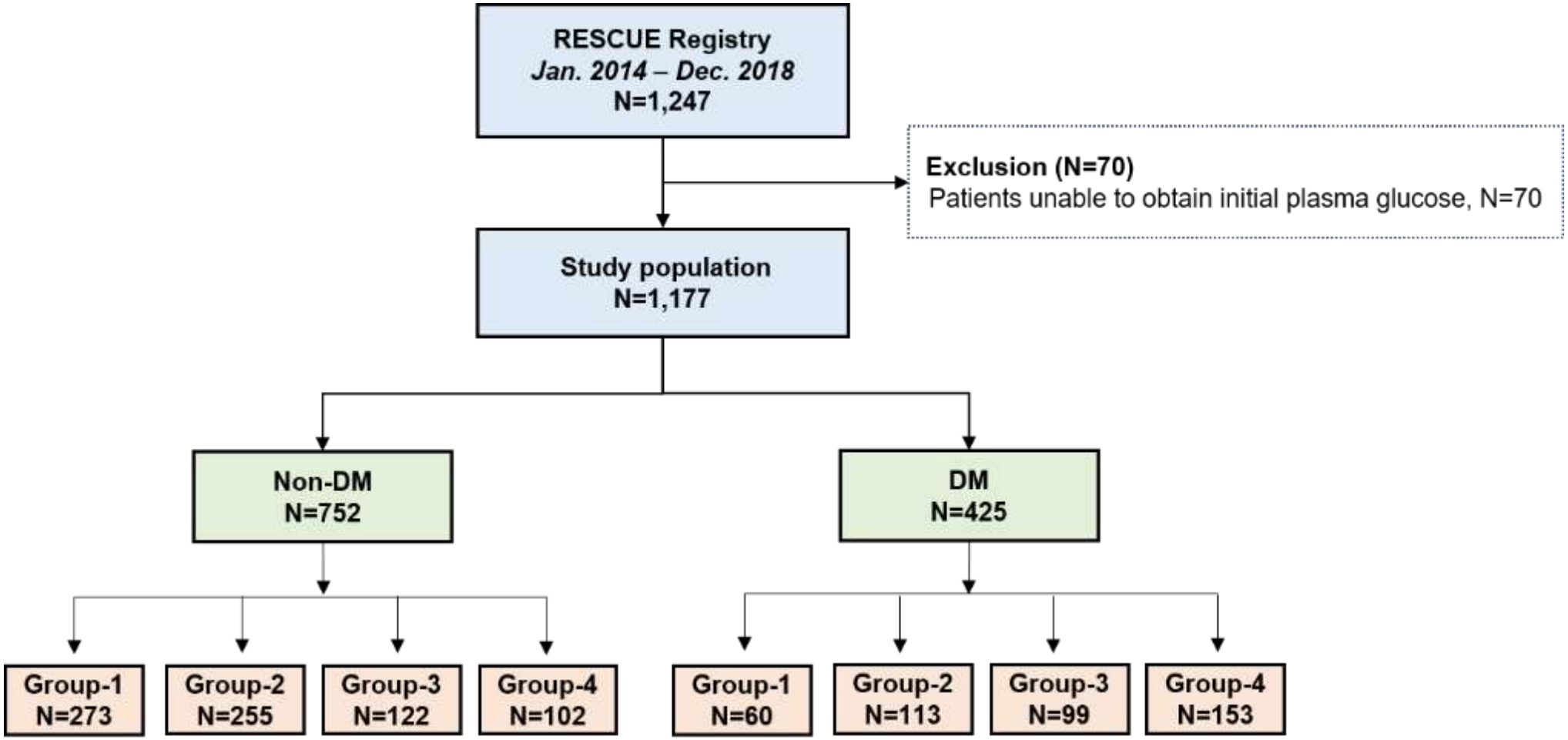
  Group 3 (12-16mmol/L)

  Group 4 (≥16mmol/L)

Inclusion/Exclusion Criteria

- Inclusion Criteria
  - 1) Systolic blood pressure <90mmHg for >30min or catecholamine or vasopressor required to maintain pressure above 90mmHg during systole
  - 2) Clinical signs of pulmonary congestion and signs of impaired organ perfusion with at least one of the following criteria:
    - ❖ Altered mental status;
    - ❖ Cold, clammy skin and extremities;
    - ❖ Oiguria with urine output< 0.5 mL/Kg/h for the first 6 hours of admission
    - ❖ Serum lactate > 2.0mmol/L
- Exclusion Criteria
  - 1) Out-of-hospital cardiac arrest
  - 2) Septic or hypovolemic shock.

Study Design and Flow Chart



RESULT

Baseline Characteristics

Baseline charactersistics	Non DM					DM				
	Group-1(273)	Group-2(255)	Group-3(122)	Group-4(102)	p-value	Group-1(60)	Group-2(113)	Group-3(99)	Group-4(153)	p-value
Age(years)	62.36 ± 15.90	65.19 ± 14.84	66.69 ± 12.75	60.84 ± 12.86	< 0.01	71.30 ± 10.40	68.83 ± 10.52	69.22 ± 11.62	67.75 ± 12.21	0.23
BMI(kg/m^2)	23.50 + 3.78	22.95 + 3.35	23.36 + 4.19	23.54 + 3.21	0.31	23.14 + 4.00	23.93 + 3.24	23.76 + 3.64	23.26 + 3.37	0.32
Gender, female	88(32.2%)	81(33.9%)	32(26.2%)	29(28.4%)	0.61	24(40%)	31(27.4%)	21(21.2%)	54(35.3%)	0.03
HTN, n (%)	111(40.7%)	103(40.4%)	52(42.6%)	42(41.2%)	0.98	41(68.3%)	87(77.0%)	75(75.8%)	16(69.3%)	0.39
Dyslipidemia n (%)	53(19.4%)	50(19.6%)	37(30.3%)	21(20.6%)	0.07	17(28.3%)	38(33.6%)	45(45.5%)	58(37.9%)	0.14
Smoking	83(30.4%)	73(28.6%)	45(36.9%)	49(48%)	< 0.01	9(15.0%)	28(24.8%)	22(22.2%)	33(21.6%)	0.53
CKD	16(5.9%)	8(3.1%)	11(9.0%)	5(4.9%)	0.11	13(21.7%)	24(21.2%)	19(19.2%)	24(15.7%)	0.63
PAOD	9(3.3%)	5(2%)	5(4.1%)	1(1%)	0.39	3(5.0%)	7(6.2%)	10(10.1%)	10(6.5%)	0.57
previous MI	28(10.3%)	27(10.6%)	15(12.3%)	5(4.9%)	0.29	9(15.0%)	17(15.0%)	31(22.8%)	15(10.8%)	0.06
previous CVA	26(9.8%)	17(6.7%)	10(8.2%)	2(2%)	0.08	7(11.7%)	15(13.3%)	17(17.2%)	17(11.1%)	0.56
Etiology of shock					0.04					< 0.01
Ischemic cardiomyopathy	194(71.1%)	199(78%)	102(83.6%)	78(76.5%)		42(70.0%)	86(76.1%)	85(85.9%)	133(86.9%)	
Non ischemic cardiomyopathy	79(28.9%)	56(22%)	20(16.4%)	24(23.5%)		18(30.0%)	27(23.9%)	14(14.1%)	20(13.1%)	
APACHE II score	4.77 ± 3.32	5.03 ± 3.04	5.52 ± 3.09	5.97 ± 3.15	< 0.01	5.42 ± 3.67	5.30 ± 3.38	5.59 ± 3.35	6.07 ± 3.18	0.27
LVEF (%)	38.99 ± 16.82	38.54 ± 16.19	39.32 ± 16.22	35.03 ± 18.11	0.27	36.62 ± 16.24	37.78 ± 14.67	37.57 ± 15.13	31.28 ± 14.65	< 0.01

Data are presented as mean±standard deviation or number (%)

Organ Support Modality

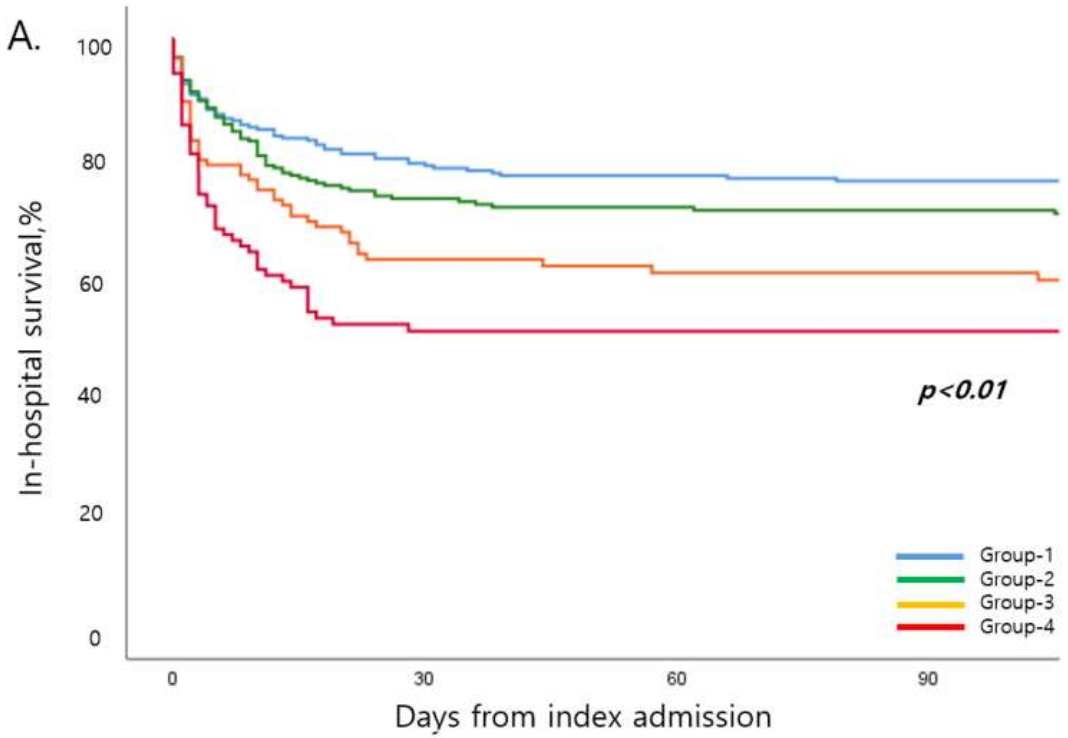
Modality of organ support	Group-1	Group-2	Group-3	Group-4	P value
Non DM					
Mechanical ventilator	124 (45.4%)	125 (49%)	82 (67.2%)	84 (82.4%)	< 0.01
CRRT	47 (17.2%)	43 (16.9%)	31 (25.4%)	33 (32.4%)	< 0.01
ECMO	92 (33.7%)	96 (37.6%)	49 (40.2%)	60 (58.8%)	< 0.01
IABP	55 (20.1%)	59 (23.1%)	48 (39.3%)	26 (25.5%)	< 0.01
Vasoactive inotropic score	62.66 ± 118.61	65.21 ± 108.92	99.86 ± 212.13	135.60 ± 145.14	< 0.01
DM					
Mechanical ventilator	29 (48.3%)	60 (53.1%)	64 (64.6%)	108 (70.6%)	< 0.01
CRRT	14 (23.3%)	30 (26.5%)	28 (28.3%)	43 (28.1%)	0.89
ECMO	24 (40.0%)	38 (33.6%)	33 (33.3%)	73 (47.7%)	0.06
IABP	16 (26.7%)	31 (27.4%)	26 (26.3%)	44 (28.8%)	0.98
Vasoactive inotropic score	60.03 ± 113.84	62.13 ± 109.84	77.86 ± 214.69	67.05 ± 87.98	0.82

Data are presented as mean±standard deviation or number (%); CRRT= continuous renal replacement therapy, ECMO=extracorporeal membrane oxygenation, IABP= intra-aortic balloon pump.

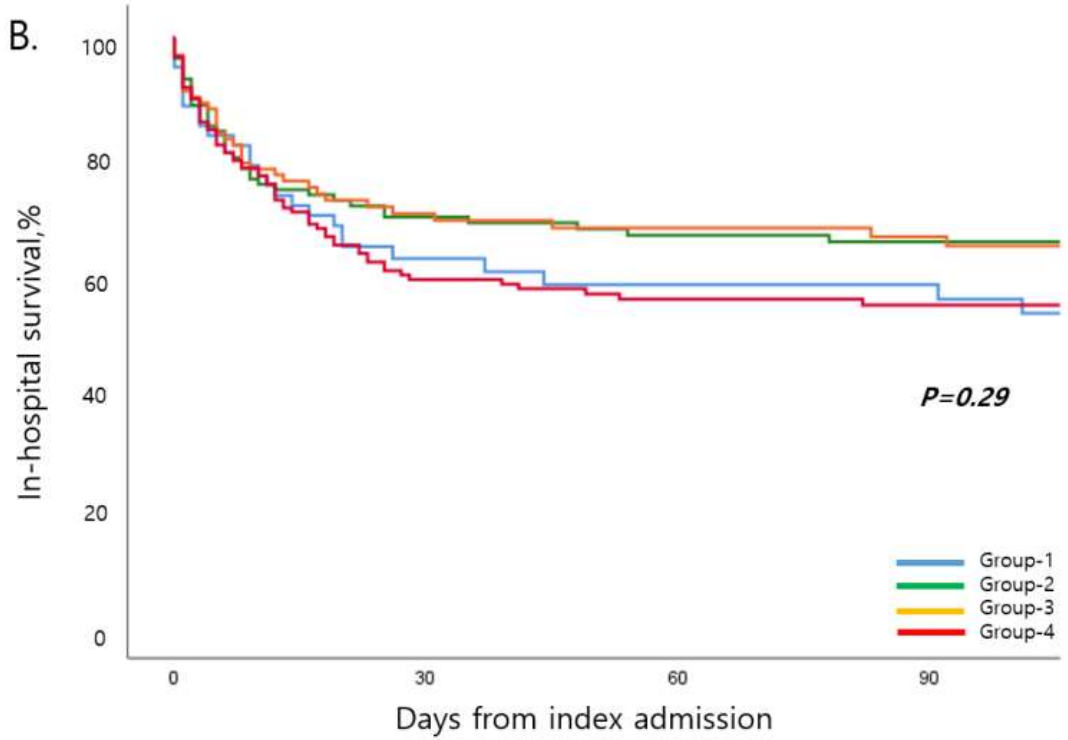
Uni & Multivariate Cox regression

Non DM							DM						
Variables	**Univariate**			**Multivariate**			**Variables**	**Univariate**			**Multivariate**		
	HR	95% CI	p-value	HR	95% CI	p-value		HR	95% CI	p-value	HR	95% CI	p-value
Age, per year	1.022	1.012-1.032	<0.001	1.031	1.018-1.043	<0.01	Age, per year	1.018	1.004-1.033	0.012	1.022	1.007-1.038	<0.01
HTN	1.236	0.957-1.597	0.105				HTN	1.082	0.766-1.527	0.655			
Dyslipidemia	0.682	0.484-0.962	0.029	0.629	0.417-0.950	0.028	Dyslipidemia	1.098	0.803-1.501	0.558			
CKD	2.018	1.313-3.104	0.001				CKD	1.397	0.979-1.994	0.065			
Smoking	0.718	0.539-0.956	0.023	0.649	0.442-0.955	0.028	Smoking	0.771	0.519-1.146	0.198			
LVEF, per unit	0.973	0.964-0.983	<0.001	0.969	0.959-0.979	<0.01	LVEF, per unit	0.961	0.949-0.974	<0.001	0.959	0.946-0.972	<0.01
APACHE II score, per score	1.125	1.085-1.167	<0.001	1.094	1.046-1.146	<0.01	APACHE II score, per score	1.075	1.027-1.124	0.002			
Serum creatinine, per unit	1.094	1.025-1.168	0.007				Serum creatinine, per unit	1.082	1.008-1.161	0.029			
Serum Glucose, per unit	1.003	1.002-1.004	<0.001	1.003	1.002-1.004	<0.01	Serum Glucose, per unit	1.001	1.000-1.002	0.065			

In-Hospital Mortality



No. at risk				
Group-1	273	194	166	163
Group-2	255	156	137	128
Group-3	122	61	50	50
Group-4	102	43	41	40



No. at risk				
Group-1	60	29	24	23
Group-2	113	72	62	59
Group-3	99	61	46	43
Group-4	153	80	57	53

A: Non-DM patients

B: DM patients

Conclusion

- In non-DM patients, mechanical organ support such as ECMO, mechanical ventilation and CRRT showed incremental propensity in concordance with their serum glucose level.
- In non-DM patients, in-hospital mortality increased as admission glucose level increased.
- DM patients are exposed to chronic hyperglycemia therefore higher cut-off value for ‘Stress hyperglycemia’ is warranted