MUSC Health
MEDICAL UNIVERSITY of SOUTH CAROLINA

SOUTH CAROLINA COLLEGE OF PHARMACY

Glycemic Control in Critically Ill Patients

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Stress Hyperglycemia

- Stress causes reprioritization of metabolic reactions, especially in the liver, muscles, gut and kidneys
- Increased production of insulin, cytokines, and counter-regulatory hormones
- Glucose homeostasis is dysregulated and results in hyperglycemia

Crit Care Med 2003;31(2):634-5
Crit Care Clin 2001;17:107-24

Mechanism

- Peripheral insulin resistance occurs by:
  - Hyperinsulinemia
  - Failure of gluconeogenesis suppression
  - Impaired peripheral insulin-mediated glucose uptake
- Hyperglycemia and risk of morbidity and mortality have a direct relationship

Chest 2007;132:268-78

Treatment

- Conventional (BG 180-200 mg/dL or insulin infusion if >215 mg/dL)
- Intensive (BG 80-110 mg/dL)
  - ARR 3-4% in hospital death with intensive insulin therapy
  - ARR ~8% if treated for at least 3 days
- Higher risk of hypoglycemia or death?

Chest 2007;132:268-78
Crit Care Med 2003;31:359-66
N Engl J Med 2001;345:1359-67

Purpose

- Quality improvement project
- Assess the performance of the MUSC-MC Surgical Trauma Intensive Care Unit (STICU) Glucose Management Protocol

Objectives

- Primary outcome
  - ICU length of stay (LOS)
- Secondary outcomes
  - Hospital LOS
  - Ventilator days
  - Infectious complications
  - Mortality

Methods

- Retrospective review of patients managed by the Surgical Critical Care Service using the STICU glucose management protocol
- Outcomes assessed at different glucose targets (80-110 mg/dL and 80-140 mg/dL)
- A total of 86 patients in each group to detect a 1.3 day decrease in ICU LOS

Methods

- Inclusion criteria
  - Surgical and trauma patients managed by MUSC Surgical Critical Care Services
  - STICU admission orders initiating glucose management protocol
- Exclusion criteria
  - Critically ill for <24 hours
  - Transferred to another Critical Care Service
  - Receiving end-of-life care

Statistical Methods

- T-test to account for differences in continuous variables
- Chi-square test to examine categorical variables
- Multivariate regression analysis to control for confounding variables

Baseline Characteristics 80-110 mg/dL

Characteristic		Number (n)	Percent (%)
Gender	Male	39	75
	Female	13	25
Race	Caucasian	25	48.1
	African American	21	40.4
	Hispanic	2	3.9
	Asian	4	7.7
Admitting Dx	MVA	25	48.1
	GSW	4	7.7
	Stabbing	2	3.9
	Blunt trauma	0	0
	Fall	1	1.9
	Vascular surgery	0	0
	GI surgery	13	25
	Surgical oncology	2	3.9
	Other	5	9.6
Diabetes	None	43	82.7
	Type I	2	3.9
	Type II	7	13.5

Baseline Characteristics 80-110 mg/dL

Characteristic		Median	Interquartile Range
Age (yr)		48	31 - 62
BMI (kg/m^2)		26.8	23.3 - 31
HbA1c	Total	5.6	5.3 - 5.9
	No DM	5.6	5.3 - 5.8
	DM I	6.3	N/A
	DM II	6.6	6 - 6.8
APACHE II		19	14 - 22.3

Results

Outcome	Median	Interquartile Range
ICU LOS (days)	7	4 - 16
Hospital LOS (days)	16.5	9 - 34.3
Ventilator Days (days)	5.5	3 - 13

Results

Outcome		n	%
Infectious Complications	Bacteremia	13	27.1
	Pneumonia	21	42
	Sepsis	11	22.5
	Severe sepsis	8	16.3
	Wound infection	4	8.3
Mortality		7	14.3

- Hypoglycemic events:
  - BG <70 mg/dL: 10.7% of patient days
  - BG <50 mg/dL: 1% of patient days

Conclusions

- Data collection and analysis are ongoing
- Not enough data to support/refute the primary outcome
- Expect to reach power by the end of May

Limitations

- Retrospective study design
- One-tailed analysis
- Patient population
  - Fluid resuscitation
  - Multiple trips to operating room or radiology
  - Interruption of nutrition
- Managing an intensive insulin protocol

Protocol Implementation

- Barriers
  - Increased nursing workload
  - Nursing and physician education
    - Protocol
    - Insulin infusion calculator
- Beneficial future developments
  - Accurate, continuous BG monitoring devices
  - Closed-loop, computer-assisted BG control

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