Targeting Glycemic Control in Non-Critically Ill Patients at a Tertiary Teaching Hospital

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Objectives

• Discuss rationale for the development of a glycemic control protocol for non-critically ill patients at Jackson Memorial Hospital

• Describe the glycemic control protocol and study methodology

• Assess results of the protocol on patient care based on the composite numbers of hyperglycemic and hypoglycemic events
Glucose Dysregulation

- Glucose variability is associated with increased mortality and length of stay (LOS) in the inpatient setting.

- The likelihood of experiencing a hyperglycemic episode during an inpatient admission has been reported to be as high as 46% in non-critically ill patients.

- Strict glucose control has been associated with increased morbidity and mortality due to increased hypoglycemic events.

- Many factors can contribute to a patient’s dysregulation in blood glucose during a hospital admission.
Jackson Memorial Hospital (JMH)

- JMH participates in Hospital Engagement Network to reduce hypoglycemic events in patients receiving insulin or other hypoglycemic agents
- According to Centers for Medicare and Medicaid Services (CMS) the rate of hypoglycemia and hyperglycemia must be reported
- Protocol development mandated by JMH Hypoglycemia Taskforce
- Members of taskforce active within protocol development
Objective

• To investigate if implementation of a glycemic control protocol will result in less episodes of dysglycemia
Definitions

• Basal insulin: glargine ; NPH
• Prandial insulin: lispro; regular insulin
• Correctional insulin: lispro; regular insulin
• Hyperglycemia:
  – Fasting plasma glucose (FPG)/ pre-meal > 140 mg/dL
  – Random/ 2 hours post prandial > 200 mg/dL
  – Average daily blood glucose > 200 mg/dL
• Hypoglycemia : any glucose value < 70 mg/dL
• WNL: within normal limits
• POC: point of care
• BG: blood glucose
Protocol Development

• Consultation with endocrinologist

• Evaluation of current practice

• Literature evaluation

• RABBIT Studies
  ➢ 2007
    • Medical patients
  ➢ 2011
    • Medical – surgical patients

Diabetes Care. 2007 Sep;30(9):2181-6.
Study Design

• Prospective quasi experimental pre- and post-intervention study

• Primary endpoint: composite of both hypo/hyperglycemic episodes
Secondary Endpoints

- Number of hyperglycemic episodes
- Number of hypoglycemic episodes
- Average daily blood glucose
- Infectious complications
- Length of stay
- Daily insulin requirements
- Discharge diabetic regimens
- Number of hypoglycemia rescue medications administered
- Number of patients re-admitted
- Safety analysis
Inclusion Criteria

• Internal Medicine patients

• 18 years or older

• At least 3 hyperglycemic events in a 48-hour period or an average daily BG greater than 200 mg/dL

• Patients who have at least 1 hypoglycemic event
Exclusion Criteria

• DKA on admission
• Type 1 diabetes
• Patients on hemodialysis/ CVVHHD
• Patients being treated with U 500 insulin
• Patients expected to require ICU level care
• Patients expected to require surgery during admission
Statistics

• Primary endpoint: Composite difference of dysglycemic episodes pre and post intervention
  – Wilcoxon’s signed-rank test

• Secondary endpoints: Wilcoxon’s signed-rank test and student t-test

• Baseline demographics: Student’s t-test

• Power = 80% ; α = 0.05

• Sample size: 500 total dysglycemic events
  – Difference to detect = 0.252 x σ
### Demographics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-Protocol n=55 (%)</th>
<th>Post-Protocol n=55 (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>52.3%</td>
<td>54.5%</td>
<td>0.98</td>
</tr>
<tr>
<td>Average Age</td>
<td>65 (42-86)</td>
<td>60 (45-79)</td>
<td>0.89</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>32.7%</td>
<td>20%</td>
<td>0.23</td>
</tr>
<tr>
<td>Hispanic</td>
<td>30.9%</td>
<td>38.1%</td>
<td>0.76</td>
</tr>
<tr>
<td>AA</td>
<td>30.9%</td>
<td>38.1%</td>
<td>0.57</td>
</tr>
<tr>
<td>Other</td>
<td>5.4%</td>
<td>2%</td>
<td>1.0</td>
</tr>
<tr>
<td>LOS (mean days)</td>
<td>5.2</td>
<td>5.1</td>
<td>1.0</td>
</tr>
<tr>
<td>ICU Transfers</td>
<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>ED Admission/ Direct Admission</td>
<td>55/0</td>
<td>55/0</td>
<td>1.0</td>
</tr>
<tr>
<td>A1C (mean) on admission</td>
<td>7.31*</td>
<td>7.34**</td>
<td>0.99</td>
</tr>
</tbody>
</table>

*10 pre-protocol study participants no A1c ordered during admission
**9 study participants ordered A1c during admission at suggestion of intervening pharmacist
Dysglycemic Events

- Pre-Protocol: 285
- Protocol Group: 222

p = 0.78
Hyperglycemic Events

Pre-Protocol Group: 277
Protocol Group: 217

p = 0.52
Hypoglycemic Events

Pre-Protocol Group: 8
Protocol Group: 5
p = 0.89
## Secondary Endpoints

<table>
<thead>
<tr>
<th>Blood Glucose Level (mg/dL) (mean)</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Daily Blood Glucose (95% CI)</td>
<td>193 (126 – 236)</td>
<td>178 (134 – 216)</td>
<td>0.01</td>
</tr>
<tr>
<td>Morning Blood Glucose (95% CI)</td>
<td>119 (92 – 133)</td>
<td>108 (89 – 125)</td>
<td>0.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Insulin Units Administered (mean)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid/Regular Insulin Units/day</td>
<td>18</td>
<td>15</td>
<td>0.64</td>
</tr>
<tr>
<td>Glargine Insulin Units/day</td>
<td>11</td>
<td>18</td>
<td>0.03</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Corticosteroids/ Octreotide/ D50/ Glucagon</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Patients Receiving Corticosteroids</td>
<td>5</td>
<td>9</td>
<td>0.89</td>
</tr>
<tr>
<td>Patients Receiving Octreotide</td>
<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>D50 Doses Given</td>
<td>0</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Glucagon Doses Given</td>
<td>0</td>
<td>0</td>
<td>1.0</td>
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<table>
<thead>
<tr>
<th>Infections</th>
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<tbody>
<tr>
<td>Patients Who Developed Infections as Defined by New Onset Abx Initiation</td>
<td>12</td>
<td>12</td>
<td>1.0</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Endocrine</th>
<th></th>
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<tbody>
<tr>
<td>Consults</td>
<td>0</td>
<td>0</td>
<td>1.0</td>
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<table>
<thead>
<tr>
<th>Readmissions</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Within 30 days</td>
<td>9 (16.3)</td>
<td>6 (10.9)</td>
<td>0.22</td>
</tr>
</tbody>
</table>
Study Limitations

- Unblinded/non-randomized
- Disease state variability
- Point of care optimization
- Seasonal variations in patients being admitted
- Assumption that patients are strictly abiding to food preparations provided by staff
Conclusions

• The use of a glycemic control protocol was not statistically significant in reducing the composite number of dysglycemic events

• Average daily blood glucose values and average AM blood glucose values were lower in the protocol group

• The utilization of long acting insulin glargine was statistically higher in the protocol group

• There were positive trends in number of hypo/hyperglycemic events and number of patients re-admitted within 30 days in favor of the protocol group
Action Plan

- Operationalize the glycemic control protocol at JMH
- Perform a DUE on protocol utility after 3 months
- Implement protocol in patient care units with the highest dysglycemia rates
- Educate patients and health care providers on protocol utility and purpose
Learning Assessment

• True/False: Hyperglycemia is associated with poor patient outcomes

• True/False: CMS monitors the rates of hyperglycemia and hypoglycemia

• True/False: Many factors contribute to dysglycemia
References


References


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