Advanced Practice Protocol for
Treatment of Trauma Patients with Hyperglycemia
In Critically Ill or Injured Patients

In accordance with the Division of Trauma Practice Guidelines Manual and
the Practice Guidelines for Acute Care Nurse Practitioners

I. Definition
   A. Hyperglycemia is defined as a blood sugar (accucheck or laboratory) >
      180 mg/dl.
   B. Critically ill patients are defined as patients with significant hyperglycemia
      (> 250 mg/dl), with indications for tight control (ie. Closed Head Injury) and
      who require large volume resuscitation.
   C. The goal for glucose control in patients beyond the initial resuscitation
      phase is 100-150.

II. Subjective Data
   A. Past medical history: for presence of diabetes mellitus, medications used
      to control blood sugar, medications which would increase blood sugar (ie.
      Steroids).

III. Objective Data
   A. Blood Glucose levels
   B. Onset of elevation / previous treatment (ie. SQ sliding scale)
   C. Presence of TPN / Tube feedings

IV. Assessment
   A. Presence of adequate glucose supply (either PO or D5 solutions)
   B. Vital Signs / I&O
   C. Signs and symptoms of hypoglycemia
   D. Signs and symptoms of sepsis

V. PLAN
   A. The NP will implement the normo-glycemic protocol
   B. Moribund patients excluded from glycemic control protocol.
   C. Background: The tight glucose control in intensive care study (Van den
      maintenance of normoglycemia (80-110 mg/dl) during critical illness
      independently improved morbidity and mortality. During critical illness,
      glycemic control with supplemental insulin requires continuous evaluation
      and adjustment. This simple maneuver appears to be as important as
      optimizing traditional vital signs in improving patient outcome.
   D. Studies regarding hyperglycemia demonstrate significant influences on
      infection rate and outcome for even single values greater than 200. (OR
E. Initial Blood Glucose Measurement: (per accucheck by standard finger stick; RN may take drop of blood from admission lab draw to run on accucheck machine; do not draw and waste blood for accucheck only) on admission and Q 6h (default)

1. Blood glucose < 60 mg/dl?
   a. administer ½ ampule iv Dextrose (50%)
   b. contact ICU Resident
   c. re-check accucheck Q 15 min after iv dextrose therapy and reassess
   d. review home medications and premorbid conditions that predispose hypoglycemia; correct cause if possible

2. Blood glucose 61 – 79 mg/dl?
   a. Re-check accucheck Q 1h x 2 to confirm stable blood glucose
   b. If stable, blood glucose monitoring (per accucheck) Q 6h x 24 hrs
   c. RN may d/c accuchecks if normoglycemia (61 – 110 mg/dl) is maintained x 24 hrs

3. Blood glucose 80 – 110 mg/dl?
   a. Blood glucose monitoring (per accucheck) Q 6h x 24 hrs
   b. RN may d/c accuchecks if normoglycemia (61 – 140 mg/dl) is maintained x 24 hrs

4. Blood glucose > 111 mg/dl?
   a. Yes – choose patient Category below and continue

Category 1
Non-critically injured patients
Non-mechanically ventilated patients
No pre-morbid history of diabetes mellitus, no active steroid use, no active infection.

1. Blood glucose 111 – 250 mg/dl, begin Subcutaneous Insulin Therapy
2. Blood glucose > 250 mg/dl, begin Continuous Insulin Infusion Therapy
3. Begin home antihyperglycemic therapy as soon as possible (if applicable); contact MD for orders

Category 2
Critically injured patient requiring intensive resuscitative measures.
Mechanically ventilated
Intravenous steroid therapy
   - Known or suspected adrenal insufficiency
   - Spinal cord injury
   - History of chronic steroid use Known or suspected active infection

F. Premorbid history of diabetes mellitus
1. Blood glucose > 111 mg/dl, begin Continuous Insulin Infusion Therapy
2. Blood glucose < 110 mg/dl; see Initial Blood Glucose Measurement section

G. Continuous Insulin Infusion Therapy
1. Regular insulin 0.9% sodium chloride (1 U/ml) given through large-bore peripheral or central venous access.
2. Initial insulin infusion rate:

<table>
<thead>
<tr>
<th>Blood glucose level (mg/dl)</th>
<th>Initial Insulin Infusion (U/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;351</td>
<td>14 (plus 0.1 U/kg iv bolus)</td>
</tr>
<tr>
<td>280-350</td>
<td>10</td>
</tr>
<tr>
<td>240-279</td>
<td>8</td>
</tr>
<tr>
<td>200-239</td>
<td>6</td>
</tr>
<tr>
<td>170-199</td>
<td>4</td>
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<tr>
<td>140-169</td>
<td>3</td>
</tr>
<tr>
<td>111-139</td>
<td>2</td>
</tr>
</tbody>
</table>

3. Notify ICU resident for initial glucose greater than 240.

H. Adjust insulin infusion based on Q 2h accuchecks to maintain blood glucose 80-110 mg/dl
1. Tritration guidelines:
   a. If blood glucose unchanged or greater, increase infusion by 25-40% of previous rate.
   b. If blood glucose decreased by 25% or greater, decrease infusion rate by ~ percent of decrease (ie 200-150 = 25% decrease).
   c. If blood glucose <80 mg/dl, stop insulin infusion. Recheck glucose q 1 hr until stable and within normal limits.
   d. Blood Glucose < 60 mg/dl, stop insulin infusion, give ½ amp D50W by IV push, notify ICU resident
2. Hold insulin infusion and recheck glucose Q 1 hr when:
   a. Tube feeds, TPN, or glucose acutely discontinued
   b. Travel off the unit
3. Consider changing to Subcutaneous regimen at Q 4hr intervals if:
   a. insulin requirements are stable
   b. Critical illness resolved, subcutaneous absorption appropriate, and without new clinical deterioration
   c. Minimal insulin requirements for 24 hours

I. Category 1 – Non-critically ill patients:
1. Blood glucose > 250mg/dl, begin Continuous Insulin Infusion Therapy
   a. Initiate and titrate as per guideline for Category 2 above
2. Blood glucose 111-250 mg/dl, begin Subcutaneous Insulin Therapy
   a. Q 4 hr accuchecks and dosing
   b. Subcutaneous Insulin dose (units of regular insulin) calculated as:
      \[
      \text{Subcutaneous Insulin dose} = \left\lfloor \frac{\text{blood glucose (mg/dl)} - 100}{10} \right\rfloor
      \]
3. Adjust insulin dosing (number divided by) as needed to reach target of 80-110 mg/dl
4. Notify ICU resident if questions

J. Consider initiating home antihyperglycemic regimen if adequate oral intake and mobility is present; contact MD for orders

K. The Nurse Practitioner will notify the attending physician if a ‘satellite’ patient requires an insulin infusion, and will notify the R4 if a patient on 10 North requires an insulin infusion, and if the glucose level remains difficult to control.

Reference:
Vanderbilt University Medical Center, Division of Trauma. (2004). Practice Guidelines Manual.