**PURPOSE**
To provide guidelines for the perioperative management of blood glucose levels in known diabetic non-cardiac surgery patients. There is substantial evidence linking hyperglycemia in hospitalized patients (with or without diabetes) to poor outcomes. Studies have suggested that intensive treatment of hyperglycemia improves hospital outcomes.

These instructions do not take the place of clinical judgment on the part of the medical staff nor do they replace physician judgment based on the physician-patient relationship.

**SCOPE**
All patients receiving anesthesia in the Main OR or Ambulatory Surgery Center with a history of diabetes mellitus except for patients having cardiac surgery.

**DEFINITION:**
**Perioperative Period**: time from when patient arrives in pre-op holding or the operating room (if direct admit) until patient leaves PACU or transfers from OR to an ICU.
PREOPERATIVE INSTRUCTIONS

If an endocrinologist or other medical physician has agreed to manage the patient, then follow their recommendations.

If there are no specific instructions from the patient’s physician, then follow the preoperative instructions as listed below:

1. NIGHT BEFORE PROCEDURE: instruct patient to take their prescribed medications as follows:

<table>
<thead>
<tr>
<th>Medication</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>Do NOT take the evening before procedure.</td>
</tr>
<tr>
<td>Other Non-Insulin Diabetic Medications</td>
<td>Take as prescribed.</td>
</tr>
<tr>
<td>Insulin Pump</td>
<td>Continue at basal rate.</td>
</tr>
<tr>
<td>Basal Insulins</td>
<td></td>
</tr>
<tr>
<td>NPH/Detemir (Levimir)/Glargine (Lantus)</td>
<td>Usual evening dose.</td>
</tr>
<tr>
<td>Mixed Insulins - (70/30, 75/25, etc.)</td>
<td>Snack. E.g. ½ sandwich, fruit before midnight.</td>
</tr>
<tr>
<td>Short Acting Insulins –</td>
<td>Do NOT take.</td>
</tr>
<tr>
<td>(Novolog, Humalog, Apidra, regular)</td>
<td></td>
</tr>
</tbody>
</table>

2 MORNING OF PROCEDURE:

a) Have patient test a.m. blood sugar (BS) at home. If ≤ 70 have patient call pre-op RN.

b) If patient has symptoms of hypoglycemia, they should drink a clear liquid with sugar and call pre-op RN.

c) If BS > 70, instruct them to take their prescribed medications as follows:

<table>
<thead>
<tr>
<th>Medication</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Insulin Diabetic Medications</td>
<td>Do NOT take.</td>
</tr>
<tr>
<td>Insulin Pump</td>
<td>Continue at basal rate.</td>
</tr>
<tr>
<td>Basal Insulins</td>
<td></td>
</tr>
<tr>
<td>NPH</td>
<td>Take ½ usual morning dose.</td>
</tr>
<tr>
<td>Detemir (Levimir)/Glargine (Lantus)</td>
<td>Take 7580% usual morning dose.</td>
</tr>
<tr>
<td>Mixed Insulins - (70/30, 75/25, etc.)</td>
<td>Do NOT take. Take 1/3 usual morning dose</td>
</tr>
<tr>
<td>Short Acting Insulins –</td>
<td>Do NOT take.</td>
</tr>
<tr>
<td>(Novolog, Humalog, Apidra, regular)</td>
<td></td>
</tr>
</tbody>
</table>
Protocol

Perioperative Management of Diabetes Mellitus in Non-Cardiac Surgery Patients

Document Owner: Robert Padilla

Approver(s): Dascenzo, Douglas; Davies, Eric; Hakim, Joffer; Hannawa, Tana

Date Created: 11/30/2016

Date Approved: Not Approved Yet
PRE-OPERATIVE MANAGEMENT

1. Check BS using glucometer.
2. If BS ≥ 180:
   a. Notify attending anesthesiologist.
   b. Regulate BS according to appropriate algorithm (document dose, route, site in MAR)
      i. Diabetics NOT ON INSULIN use **Low Dose Algorithm**.
      ii. Diabetics ON INSULIN use appropriate algorithm (Low, Medium or High Dose).
   c. All Insulin given in the perioperative period should be given subcutaneously (SQ) in abdomen (more reliable absorption) using an insulin syringe.
3. If BS ≤ 70:
   a. Notify attending anesthesiologist.
   b. follow the **HYPOGLYCEMIC ALGORITHM**.
4. If BS < 100 but > 70 and Novolog has been given in the perioperative period:
   a. Notify attending anesthesiologist.
   b. Begin D5/.45% saline at 100 ml/hour.
5. Continue checking BS every two hours if the patient is prescribed or treated with any diabetic medication.
INTRA-OPERATIVE MANAGEMENT

1. Review handoff sheet for preoperative management.
2. Consult with preoperative nurse for additional questions.
3. Continue checking BS every two hours if the patient is prescribed or treated with any diabetic medication.
4. If BS ≥ 180:
   a. Notify attending anesthesiologist.
   b. Regulate BS according to appropriate algorithm (document dose, route, site in MAR)
      i. Diabetics NOT ON INSULIN use Low Dose Algorithm.
      ii. Diabetics ON INSULIN use appropriate algorithm (Low, Medium or High Dose).
   c. All Insulin given in the perioperative period should be given subcutaneously (SQ) in abdomen (more reliable absorption) using an insulin syringe.
5. If BS ≤ 70:
   a. Notify attending anesthesiologist.
   b. follow the HYPOGLYCEMIC ALGORITHM.
6. If BS < 100 but > 70 and Novolog has been given in the perioperative period:
   a. Notify attending anesthesiologist.
   b. Begin D5/.45% saline at 100 ml/hour.
7. Provide report of BS measurements and treatment when handing off care (change of anesthesia provider, PACU nurse, ICU nurse)
POST ANESTHESIA CARE UNIT MANAGEMENT

1. PACU RN will take report of BS’s and treatment from anesthesia personnel.
2. Continue checking BS every two hours if treated with any diabetic medication.
3. If BS ≥ 180:
   a. Notify attending anesthesiologist.
   b. Regulate BS according to appropriate algorithm (document dose, route, site in MAR)
      i. Diabetics NOT ON INSULIN use Low Dose Algorithm.
      ii. Diabetics ON INSULIN use appropriate algorithm (Low, Medium or High Dose).
   c. All Insulin given in the perioperative period should be given subcutaneously (SQ) in abdomen (more reliable absorption) using an insulin syringe.
4. If BS ≤ 70:
   a. Notify attending anesthesiologist.
   b. follow the HYPOGLYCEMIC ALGORITHM.
5. If BS < 100 but > 70 and Novolog has been given in the perioperative period:
   a. Notify attending anesthesiologist.
   b. Begin D5/.45% saline at 100 ml/hour.
6. Discharge from PACU when routine discharge criteria are met.
   a. Inpatients:
      i. PACU RN will report BS’s and treatment to unit RN and discharge to floor.
      ii. If insulin has been given within 2 hours of discharge, an order will be placed to obtain at least one BS 2 hours after the last dose of insulin.
      iii. Surgical staff will order BS to be checked at 0600 on post op day #1.
      iv. All BS’s drawn after the perioperative period are to be reported to house staff or attending surgeon.
   b. Outpatients:
      i. Eating without nausea – Instruct patient to take their next usual nutritional (pre-meal) dose of insulin and resume next scheduled dose of diabetic medication.
      ii. Nauseous or Unable to eat – Instruct patient to use their correctional sliding scale to cover meals. Resume usual dose of diabetic medication the next day.
      iii. Patients should not be discharged within two hours of receiving Insulin without the order of an Anesthesiologist.
ALGORITHMS

Hypoglycemic – For any BS < 70 mg/dl
1. Call the anesthesiologist.
2. Stop insulin pump, Stop IV insulin infusion.
3. Give 25 ml 50% dextrose IV bolus.
4. Recheck BS in 15 minutes, then hourly.

Hyperglycemic

Low Dose – Pts requiring <40 units of insulin/day

<table>
<thead>
<tr>
<th>BS</th>
<th>NovoLog (Insulin aspart)</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-249</td>
<td>3 units SQ</td>
</tr>
<tr>
<td>250-299</td>
<td>4 units SQ</td>
</tr>
<tr>
<td>300-349</td>
<td>5 units SQ</td>
</tr>
<tr>
<td>&gt;349</td>
<td>6 units SQ</td>
</tr>
</tbody>
</table>

Medium Dose – Pts requiring 40 - 80 units of insulin/day

<table>
<thead>
<tr>
<th>BS</th>
<th>NovoLog (Insulin aspart)</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-249</td>
<td>4 units SQ</td>
</tr>
<tr>
<td>250-299</td>
<td>6 units SQ</td>
</tr>
<tr>
<td>300-349</td>
<td>8 units SQ</td>
</tr>
<tr>
<td>&gt;349</td>
<td>9 units SQ</td>
</tr>
</tbody>
</table>

High Dose – Pts requiring > 80 units of insulin/day

<table>
<thead>
<tr>
<th>BS</th>
<th>NovoLog (Insulin aspart)</th>
</tr>
</thead>
<tbody>
<tr>
<td>180-249</td>
<td>5 units SQ</td>
</tr>
<tr>
<td>250-299</td>
<td>8 units SQ</td>
</tr>
<tr>
<td>300-349</td>
<td>11 units SQ</td>
</tr>
<tr>
<td>&gt;349</td>
<td>13 units SQ</td>
</tr>
</tbody>
</table>
REFERENCES


3. Intravenous Intra-Operative Insulin Protocol, Cardiac Anesthesia Manual, St Joseph Mercy Oakland Hospital

4. Standards of Medical Care in Diabetes – 2013, *Diabetes Care* 2013 January; v 36, supplement 1


7. Diabetes Care 2012 January; v 35, Supplement 1 s11-s63 Table 10 Noninsulin therapies for hyperglycemia in type 2 diabetes: properties of selected glucose-lowering drugs that may guide individualization of therapy

8. Personal Communication-March, 2013, Sachin Kheterpal M.D.- Department of Anesthesiology, University of Michigan, Ann Arbor, Guidelines for Preoperative and Perioperative Management of Adult Diabetes Mellitus