HIGHLAND HOSPITAL CLINICAL PROTOCOL

Perioperative Glucose Control

Perioperative is defined as the period from pre-op (SDSU) through discharge from PACU.

These are guidelines for the following patients:

- All diabetic patients presenting for surgery and who will be admitted post-operatively.
- For patients without known diabetes who are at risk of hyperglycemia in the perioperative period because their fasting blood glucose (BG) the day of surgery is >100.

These guidelines are not intended for pregnant patients.

RECOMMENDATIONS

Preoperative General Considerations:

- Schedule a diabetic patient's surgery early in the day (preferably before noon)
- At pretesting:
    - Document the type of diabetes the patient has (Type 1 or 2) and their diabetic status (see Table 2: diet only, oral diabetes medications, insulin, pump, U500)
    - Check blood glucose and A1c (if no A1c in last 30 days)
    - Document frequency of hypoglycemia
    - If A1c >9% consider postponing surgery and obtaining endocrine referral or med adjustments by primary doctor.
    - If a patient has diabetes confirm the plan regarding diabetes medications the day before and day of surgery (**Table 1)**

Day of Surgery Glucose Monitoring:

- Check fasting BG in all patients presenting for surgery who will be admitted. If >100 see **Table 2**
- **In Patients with Diabetes:**
    - Glucose target 140-180 mg/dl
    - Confirm diabetes status (Type 1 or 2)
    - Document last dose (date/time) of diabetic meds taken w/in prior 24 hrs.
    - If fasting BG day of surgery >100 see **Table 2**
    - Check BG intra-op every 2-3 hrs based on patient's condition
    - If BG<70 see hypoglycemia protocol below
    - Patients on long acting insulin (LAI) other than Glargine (Lantus) will be given a comparable dose of Glargine if LAI necessary during the perioperative period (see * Table 2).
    - Sliding scale insulin (Table 3) should not be given more frequently then q4 hours to avoid stacking
    - Do not give Lantus to patients going home the same day as surgery.

- **In Patients Without Diabetes:**
    - Glucose target 140-180 mg/dl
    - Check fasting BG upon arrival, if BG >100 see Table 2
    - If insulin given recheck intra-op every 2-3 hrs based on patient's condition
    - Sliding scale insulin (Table 3) should not be given more frequently then q4 hours to avoid stacking

Postoperative Monitoring and Orders for Transfer to the Floor:

- Document the time last dose of insulin was given and the type of insulin.
- BG checks q2-3 hrs
- Insulin is only given q4 hours to prevent stacking and hypoglycemia
- If BG is <70 follow hypoglycemia protocol
- Order BG checks for transfer to floor
    - QAC/HS and 3am BG if ordered for a diet
    - Q6 hrs if NPO
    - Low dose lispro sliding scale should be ordered
- Nursing handoff to the floor should include:
    - Notifying floor nurse that patient is on the peri-op glucose protocol
    - Last BG check and when next BG check should be
    - Last dose and time of insulin administration in perioperative period
    - If the patient was treated per the hypoglycemia protocol

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Table 1
Instructions for Pre-operative Management of Diabetic Patients

<table>
<tr><th rowspan="2">Day</th><th colspan="2" rowspan="2">Nutrition</th><th rowspan="2">Oral and non-insulin Diabetic Meds</th><th colspan="2">-Glargine (lantus)
-Detemir(levemir)
-Toujeo ,*Tresiba *</th><th colspan="2">NPH (Novolin N, Humulin N)
70/30, 75/25, 50/50</th><th colspan="2">-Lispro (Humalog),
-Aspart (Novolog)
-glulisine (Apidra)</th><th rowspan="2">Insulin Pump</th><th rowspan="2">U500</th></tr>
<tr><th>AM Dose</th><th>PM Dose</th><th>AM Dose</th><th>PM Dose</th><th>AM Dose</th><th>PM Dose</th></tr>
<tr><td rowspan="2">Day Before Surgery</td><td colspan="2">Regular diet</td><td>Take usual meds all day</td><td>Usual dose</td><td>80% if on monotherapy</td><td>Usual dose</td><td>50% of usual dose</td><td>Usual dose</td><td>Usual dose</td><td>Usual basal rate and boluses for carbs</td><td>Usual dose</td></tr>
<tr><td colspan="2">Clear Liquid Diet:
Should include 1-2 cups of sugar containing liquid every 4 hrs until bedtime or midnight. Ex: juice, regular jello</td><td>Take usual meds all day</td><td>Usual dose</td><td>80% of usual dose</td><td>Usual dose</td><td>50% of usual dose</td><td>Usual dose with breakfast and lunch</td><td>If BG>120 take 50% usual dose w/dinner
If BG<120 DON'T take any w/ dinner or at bedtime.</td><td>Usual basal rate and boluses for carbs</td><td>Consult Endocrine for instructions</td></tr>
<tr><td rowspan="3">Day of Surgery</td><td>Check in before noon</td><td rowspan="2">Water, black coffee or tea until 1 hr prior to check-in. DO NOT EAT. Be sure to follow instructions below for hypoglycemia.</td><td rowspan="2">Do not take any non-insulin medications</td><td colspan="6">No Insulin at home on the day of surgery unless specific instructions given by your doctor.</td><td rowspan="2">Lower basal rate by 25%, No boluses</td><td rowspan="2">Consult Endocrine For Instructions</td></tr>
<tr><td>Check in after noon</td><td colspan="2">If on AM Long-acting insulin (ex: Lantus/levemir*) and BG>150
GIVE 80% OF USUAL DOSE</td><td colspan="2">If on AM NPH and BG>150
GIVE 50% OF USUAL DOSE</td><td colspan="2">IF on correctional rapid-acting insulin and blood sugar >180
GIVE USUAL SLIDING SCALE</td></tr>
<tr><td colspan="12">LOW BLOOD SUGAR INSTRUCTIONS: IF BLOOD SUGAR IS BELOW 70 TAKE 4 OZ OF JUICE (1/2 CUP) or 4 GLUCOSE TABS AND RECHECK IN 10 MINUTES. IF BLOOD SUGAR IS NOT HIGHER THAN 70 THEN REPEAT ABOVE STEPS EVERY 15 MIN UNTIL BG IS HIGHER THAN 70. NOTIFY THE STAFF WHEN YOU ARRIVE FOR SURGERY.
* Toujeo (glargine/lantus 300 units/ml) and Tresiba (degludec 200 units/ml) are concentrated long acting insulins that should be transitioned to lantus equal dosing if given pre-op</td></tr>
</table>

Special Circumstances:

- Perioperative steroids in diabetics
  - Consider endocrine consult if BGs remain elevated
- Insulin pump
  - Ok to wear insulin pump intraoperatively if surgery < 2 hrs
  - Check BG q1-2 hr intra-op
  - Consider endocrine consult
- Indications to consider insulin infusion intra-operatively
  - BG >300mg/dl
  - Surgery duration >3 hours(infusion can only be run on W5, ICU and E3 (OB))

Table 2
Admission Perioperative Blood Glucose Management Grid

Diabetic Status	Home Insulin	Admission Blood Glucose		
		100-140	141-180	>180
Diet Only	None	Monitor	SSI Lispro[1]	SSI Lispro[1]
Oral Meds Only	None	Monitor[3]	Glargine 0.15 u/kg[3] (DOSA and SSTY patients only)	Glargine 0.15 u/kg + SSI Lispro[1,3] (DOSA and SSTY patients only)
Type 1 or 2 DM on Insulin	Glargine or LAI * PM Dosing Only	Ensure last pm dose LAI (If none taken give 50% pm dose as Glargine) [3]	Ensure last pm dose LAI (If none taken give 50% pm dose as Glargine) + SSI Lispro[1,3]	Ensure last pm dose LAI (If none taken give 50% pm dose as Glargine) + SSI Lispro[1,3]
	Glargine AM Dosing Only	Glargine § 80% AM Dose[3]	Glargine § 80% AM Dose + SSI Lispro[1,3]	Glargine § 100% AM Dose + SSI Lispro[1,3]
	Glargine AM & PM (bid) Dosing	Glargine § 80% AM Dose[3]	Glargine § 80% AM Dose + SSI Lispro[1, 3]	Glargine § 100% AM Dose + SSI Lispro[1, 3]
	NPH, 70/30, 75/25	Give 50% of usual dose as Lantus[3]	Give 50% of usual dose as Lantus + SSI Lispro[1, 3]	Give 50% of usual dose as Lantus + SSI Lispro[1, 3]
No Known Diabetes - hyperglycemia		Monitor[4]	Monitor[4]	SSI Lispro[2, 4]

***** LAI (Long acting insulin): Glargine (Lantus), Detemir (Levemir), Degludec (Tresiba), Glargine (Toujeo 300 units/ml).

§ If on a LAI other than Lantus will get converted to Lantus pre-op at 80%-100% usual dose of LAI

[1] Follow table 3 for correction dosing in Pre-Op

[2] Follow table 4 for correction dosing in Pre-Op

[3] Follow table 3 for correction dosing in PACU

[4] Follow table 4 for correction dosing in PACU

Table 3
SSI Correctional Doses - Diabetics

Table 3: SSI Correctional Doses (subcutaneous lispro insulin)	
Blood Glucose	**Lispro Insulin (units)**
≤ 140	**0**
141-200	**2**
201-250	**4**
251-300	**6**
301-350	**8**
351-400	**10**
> 400	**12 STOP and ‡ r/o DKA**
‡ Rule out DKA with serum basic metabolic profile and serum ketones looking for anion gap and positive ketones. Post pone surgery if DKA and consult Endocrinology.	

Table 4
SSI Correctional Doses - Nondiabetics

Table 4: SSI Correctional Doses for nondiabetics (subcutaneous lispro insulin)	
Blood Glucose	**Lispro Insulin (units)**
<180	**0**
181-220	**2**
221-260	**4**
261-300	**6**
301-340	**8**
341-400	**10**
> 400	**12 STOP and ‡ r/o DKA**
‡ Rule out DKA with serum basic metabolic profile and serum ketones looking for anion gap and positive ketones. Post pone surgery if DKA and consult Endocrinology.	

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Hypoglycemia Protocol: for patients on insulin or oral hypoglycemic agents and BG is <70mg/dl.

- If BG <70 mg/dl, give 25 ml of D50 solution IV.
- If there is no IV access, glucagon 1mg IM/SQ can be used once.
- Recheck BG 10 minutes after treating.
- If needed, treat again & recheck in another 10 minutes.

For patients receiving insulin per protocol and BG 70 - 100

- Begin dextrose containing IV fluid at discretion of anesthesiologist

REFERENCES

- Moghissi ES, et al. American Association of Clinical Endocrinologists; American Diabetes Association. American Association of Clinical Endocrinologists and American Diabetes Association consensus statement on in patient glycemic control. Diabetes Care.2009;32(6):1111
- Umpierrez GE, et al. Management of hyperglycemia in hospitalized patients in noncritical care setting: an endocrine society clinical practice guideline. J Clin Endocrinol Metab2012;97(1):16
- Standards of Medical Care in Diabetes-2016. American Diabetes Association. Diabetes Care. 2016;39:S99-104

HISTORY

6/2008 Approved: Clinical Council & Surgical Space Infection Prevention Committee
12/2012 Approved: Clinical Council
2/2015 Revised: Peri-operative CSQC
10/2015 Approved: SSI Task Force and Clinical Council
1/2017 Revised and Approved: Peri-operative CSQC
2/2017 Approved: Clinical Council