Special Situations
Outline

• Continuous Nutrition
  – Tube feeds
  – TPN
• Steroids
• Pumps
• Perioperative BG Control
Patient receiving continuous TF or TPN

Continuous nutrition coverage options:
- Analog q4hr
- Regular q6hr
- Intermediate q12hr
- Long acting q12-24hr
Tube Feeding and TPN

• “Super Nutrition”

• Often requires higher ratio of nutritional insulin compared to basal given continuous exposure to high levels of carbohydrates

• Can be as much as 40:60, 30:70 or even 20:80 ratio of basal:nutrition
Tube Feeding and TPN: Insulin Strategies

• Several options to cover *nutritional* component
  • Analog q4hr
  • Regular q6hr
  • Intermediate q12hr
  • Long acting q12-24hr
  • For TPN- regular insulin can be added to TPN

• Choice should be uniform across institution

• Indication and holding parameters should be included in every single nutritional insulin order so RN knows when to give and when to hold

• Be careful not to increase basal insulin too much in case nutrition is interrupted
Interruption in Nutrition

• Unexpected
  – Pt on continuous TF pulls keofeed
    • Middle of the night?
    • 1 hour after nutritional insulin given?
    • 5 hours after nutritional insulin given?
• Expected
  – Pt on continuous TF going to Radiology
    • 1 hr for CT?
    • 6 hrs for procedure?

• HAVE A PLAN!!
Patient receiving continuous TF or TPN

Continuous nutrition coverage options:
- Analog q4hr
- Regular q6hr
- Intermediate q12hr
- Long acting q12-24hr
1 Hour After Nutritional Insulin Given
5 Hours After Nutritional Insulin Given
1. Check BG q1-2hrs until insulin action complete

2. Start D10 @ TF rate if BG trending <100 mg/dL and insulin action not complete
Question 1

A 58 y/o man with DM2 is intubated in the burn ICU after he is injured in an electrical fire. He is receiving tube feeds at 70 cc/hr through a keofeed. His blood glucoses have been well controlled on a regimen of Lantus 30u QHS and regular insulin 10u Q6h. At 3pm the patient pulls his keofeed tube and there is great difficulty getting it back down. The next dose of regular is not due until 6pm, what do you do in the meantime?

A. Continue insulin as scheduled and consider adjusting the regimen if it can’t be replaced in the next 4 hours.
B. Increase frequency of BG checks and if trending low start D10 at 70 cc/hr until next dose of regular can be held.
C. Hold both Lantus and regular insulin until the keofeed is replaced.
D. Hold both Lantus and regular insulin and start D10 at 70 cc/hr until keofeed replaced.
Steroids

- Steroids are commonly prescribed in the hospital
  - COPD and asthma exacerbations
  - Transplant patients
  - Anti-emetic for chemotherapy
  - Post-operatively, orthopedics

- Steroids cause general insulin resistance w/ much less effect on gluconeogenesis

- Glucose elevation is predominantly postprandial hyperglycemia with a relative lack of fasting hyperglycemia
8am Once Daily Dosed Steroid

Steroid Effect
Steroid Use

[Graph and data table]

HOSPITALISTS. TRANSFORMING HEALTHCARE. REVOLUTIONIZING PATIENT CARE.
Relative Potencies of Systemic Glucocorticoids

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<th>CORTICOSTEROID</th>
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Equivalent Physiologic Replacement Doses for Reference:
- Dexamethasone: 0.8-1.2 mg
- Prednisone: 5-7.5 mg
- Hydrocortisone: 20-30 mg
Treatment of Steroid Induced Hyperglycemia

• Insulin dosing depends on frequency/timing of steroid administration (eg once daily, BID, TID, QID)

• Treatment often consists of :
  – Large doses of a rapid-acting insulin before meals +/- basal insulin

  OR

  – NPH in addition to the usual basal/bolus regimen

• Significant increases in basal insulin should be avoided in once daily dosing, as overnight hypoglycemia may be induced

• Insulin doses should be titrated simultaneously with the steroid dose changes
Downside of using basal heavy regimen to cover BID-QID steroids is that when steroid tapered to once daily → sig risk hypoglycemia...need to titrate insulin simultaneously with steroids!!

### Glucose (mg/dl)

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Titrating Down Steroids

- Decrease your nutritional insulin dose OR NPH dose as you titrate down on steroids

- Be sure to address basal insulin dose if dose was increased to cover BID-QID dosed steroids
Question 2

A 45 y/o female with obesity and HTN is admitted with COPD exacerbation and started on prednisone 60mg qam. Glucose on routine labs is 180 mg/dL, what should you do next?

A. Nothing, no BG checks necessary as patient does not have history of diabetes
B. Start BG checks qac/qhs with correction scale for possible steroid induced hyperglycemia
C. Start basal bolus insulin at 2 units/kg to cover steroid induced hyperglycemia
D. Check A1C as patient could have undiagnosed diabetes
Insulin Pumps

• In order to use an insulin pump in the hospital, a patient must:
  • Be at baseline mental status with fully functional pump and adequate supplies
  • Be able to demonstrate operational features of his/her pump

• Orderset for “patient’s own pump” should include:
  • Order for using the pump
  • Order for insulin if needed
  • Patient’s signed consent
  • Flow sheet for patient to document all settings and boluses

• Provider knowledgeable in insulin pumps should follow all patients on an insulin pump.
Patient’s Own Insulin Pump: Competency Must Be Evaluated

Vs.

Safety Issues

Patient’s Own Glucose Meter?

Patient’s Own Insulin?

Drip vs. Pump in ICU?

Nursing Documentation
A 25 y/o female with uncontrolled DM1 on insulin pump therapy at home admitted to the ICU with severe DKA. How would you manage her BG’s upon admission?

A. Have her continue insulin pump after changing out the infusion set, reservoir and insulin
B. Treat initially with IVFs and IV insulin bolus and then continue insulin pump at increased settings after changing out the infusion set, reservoir and insulin
C. Discontinue insulin pump and start insulin infusion while she is in the ICU
Perioperative Glycemic Control

• Mounting evidence that perioperative hyperglycemia is associated with worse outcomes
  – Malglycemia causes oxidative stress
  – Increased risk of inflammation and infection
  – Increased risk of thrombosis

• Association between hyperglycemia in the postoperative period and adverse outcomes, including infections, arrhythmias and renal impairment

• Published studies show that intervention to improve glucose levels reduce the risk of these complications

Akhtar Anesth Analg 2010, Diabetes Care 2009
Standards of Care

• **A1c value should be obtained preoperatively** for those with diabetes or diabetes risk factors, with appropriate adjustment in the outpatient regimen prior to surgery.

• **Use intravenous insulin infusions** in patients with type 1 or type 2 diabetes treated with insulin and undergoing **major surgical procedures**, with target glucose between **120 and 180 mg/dL**.

• Administer **subcutaneous correction dose insulin or an intravenous insulin infusion** during **minor or short surgical procedures**, with target glucose between **140 and 180 mg/dL**, and monitoring every 1 – 2 hours, depending on insulin used and type of surgery.

• Anesthesiologist and OR team should make sure that:
  – Glucose levels are monitored at least every hour for patients on infusion.
  – If using insulin during surgery, potassium levels are measured every 4 to 6 hours during surgery.
  – Glucose is measured in the recovery room immediately after surgery.

Baseline

• Determine what is currently happening perioperatively in your facility
  – How is the patient educated?
  – Is A1C being obtained?
  – When is BG being checked / how often?
  – Is there intervention for malglycemia?
  – Are there perioperative glycemic targets?
Standardize

• Develop recommendations/protocols/order sets to address:
  – Pre-operative A1C check for all patients with diabetes and risk factors
  – Standardized guidelines for medication adjustments pre-operatively with clear patient instructions
  – Recommendations for BG checks pre/intra/post operatively
  – Protocols for the use of insulin peri-operatively
  – Include hypoglycemia protocol
  – Clear documentation and hand-offs between pre/intra/post op teams
  – Plan for transition home or to hospital unit
Patient Education

- Medications to take the day before surgery
- Medications to take the morning of surgery
- Medications to take after returning home or to the hospital unit

- A handout for the patient may be beneficial
- How will patient get this information?
Set Targets and Make a Plan

• How often will you be checking blood sugars?
  – Will you use meter? ABG? Other?
• What is your target glucose range?
• What is the plan for hyperglycemia?
  – Will you use IV or subcutaneous insulin?
  – Create a protocol
• What is the plan for hypoglycemia?
  – Create a protocol
Transitions

• Very important
• Place where many errors occur
• Home to pre-op or hospital room to pre-op
• Pre-op to surgery
• Surgery to recovery
• Recovery to hospital unit or home
• Hand-Off will be key, clear and timely communication
Question 4

A 65 y/o male with obesity, T2DM, HTN and hyperlipidemia is admitted with chest pain and found to have 3 vessel disease in need of a CABG. BG have been well controlled in the hospital with basal insulin 30 units and 10 units rapid acting insulin with meals, but he is now NPO going to the OR for CABG. BG on morning of surgery is 220 mg/dL, what should you do next?

A. Cancel surgery
B. Give rapid acting insulin correction scale subcutaneously
C. Start insulin infusion
D. Delay surgery until BG is < 180 mg/dL
Thank you