Hot Topics: The Future of Diabetes Management
Cutting Edge Medication and Technology-Based Care

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Hot Topics: Diabetes
Glycemic Management: Inpatient

The glucose was what!?
Hyperglycemia 3 Ways

Secondary to diagnosis of Diabetes

Pre-Diabetes Prior to admission (IFG, IGT)

Stress Induced Diabetes (Hyperglycemia)

* Prior to 2001, hyperglycemia in the hospital setting was tolerated, not well treated
Illness Leads to Stress Hyperglycemia

- Illness
- ↑ Stress Hormones: cortisol, epinephrine
- ↑ Glucose Production
- ↑ Glucose
- ↑ Fatty Acids
- ↓ Glucose Uptake
- ↑ Lipolysis
- FFAs
Effects of Hyperglycemia during acute Illness

Hyperglycemia is pro-inflammatory, pro-oxidative, and pro-coagulant

This affects Morbidity and Mortality during acute Illness.

Thrombus formation is increased

Thrombus breakdown is inhibited
Increased Mortality/Morbidity in Critically ill Patients

- Hyperactive inflammatory response
- Increased oxidative stress
- Impaired endothelial function
- Increased coagulation response
- Increased free fatty acids
- Poor tissue perfusion
- Autonomic dysfunction
- Increased risk of infections or poor response to anti-infective agents
Is Hypoglycemia Life Threatening?
Hypoglycemia Is Associated With Cardiovascular Complications

Tachycardia and high blood pressure

Myocardial ischemia
  • Silent ischemia, angina, infarction

Cardiac arrhythmias
  • Transiently prolonged corrected QT interval
  • Increased QT dispersion

Sudden death

Common Features Increasing Risk of Hypoglycemia in an Inpatient Setting

- Advanced age
- Decreased oral intake
- Chronic renal failure
- Liver disease
- Beta-blockers
Triggers for Hypoglycemia

Transportation off ward causing meal delay

New NPO status

Interruption of any of the following:

- Intravenous dextrose
- TPN
- Enteral feedings
- Continuous renal replacement therapy
AACE/ADA Glucose Targets in Non-ICU Adult Inpatients

- Premeal glucose targets <140 mg/dL
- Random BG <180 mg/dL
- To avoid hypoglycemia, reassess insulin regimen if BG levels fall below 100 mg/dL
- Occasionally patients may be maintained with a glucose range below and/or above these cut-points

Hypoglycemia = BG <70 mg/dL

Severe hypoglycemia = BG <50 mg/dL
Hot Topics Diabetes: Medications
Oral & Non-Insulin Injectables

Pharmacologic Maze
Medication Management
Diabetes Medications: Oral Classifications

- **Sulfonylureas (secretagogues)**
  - Glyburide, glipizide, glimepiride, nateglinide, repaglinide
- **Biguanides**
  - metformin
- **Thiazolidinedione aka TZDs**
  - Pioglitazone, rosiglitazone
- **DPP-4 Inhibitors**
  - Sitagliptin, saxagliptin, linagliptin, alogliptin
- **SGLT2 Inhibitors**
  - Dapagliflozin, canagliflozin
- **Alpha-glucosidase Inhibitors**
  - Acarbose, miglitol
- **Bile Acid Sequestrants**
  - Colesevelam
Diabetes Medications: Non-Insulin Injected

• GLP-1 Inhibitors
  – Exenatide, liraglutide, dulaglutide
• Amylin synthetic
  – pramlintide
Sites of Action in Type 2 Diabetes

**Insulin secretion**
- Sulfonyureas
- Meglitinides
- Incretins

**Glucagon secretion**
- Incretins
- Amylin

**Appetite control**
- Incretins
- Amylin

**GI**
- Incretins
- α-glucosidase inhibitors
- Amylin
- Bile acid sequestrant

**Hepatic glucose output**
- Metformin
- Thiazolidinediones

**Lipotoxicity**
- Thiazolidinediones
- Salicylates

**Glucose uptake and utilization**
- Thiazolidinediones
- Metformin

**Glucose reabsorption**
- SGLT2 inhibitors
Incretin Mimetics
Hot Topics: Insulin
Basal-Bolus Therapies

Rabbits & Turtles
Insulin Dosing

How Much Insulin?

Home

Hospital
Response of Blood Glucose, Insulin, Glucagon to a Meal

The blood glucose starts to rise in 15-30 minutes, peaks at 1 hour, and remains elevated for about 2 hours after a meal in non-diabetes.
Pharmacokinetics of Insulin Products

Figure 2. Approximate Pharmacokinetic Profiles of Human Insulin and Insulin Analogues.
The relative duration of action of the various forms of insulin is shown. The duration will vary widely both between and within persons.

Basal-Nutritional (Bolus) Therapy

Basal insulin for fasting & nutritional insulin for meals

<table>
<thead>
<tr>
<th>Insulin</th>
<th>Onset</th>
<th>Peak</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lispro/aspart/glulisine (Humalog/Novolog/Apidra)</td>
<td>5–15 min</td>
<td>1–2 h</td>
<td>2–4 h</td>
</tr>
<tr>
<td>Regular</td>
<td>30–60 min</td>
<td>3–4 h</td>
<td>4–8 h</td>
</tr>
<tr>
<td>NPH (N)</td>
<td>1–2 h</td>
<td>4–12 h</td>
<td>14–18 h</td>
</tr>
<tr>
<td>Detemir/Glargine (Levemir/Lantus/Toujeo)</td>
<td>1–2 h</td>
<td>Relatively Peakless</td>
<td>Up to 24 h</td>
</tr>
</tbody>
</table>
Basal-Bolus Insulin Therapy

Select most appropriate nutrition source
- NPO or only carbohydrate source is IVF (D5, D10) or PPN (Procalamine)
- Oral diet or bolus tube feeding TID qAC
- Continuous nutrition (continuous TPN or tube feeding)
- Other (overnight cyclic tube feeding, or bolus feeding other than TID)

Creatinine Clearance [Estimated (Cockcroft-Gault)]
- Creatinine (mg/dl)
  - 1
- Creat Clear [est]
  - 101.8
- Actual
- Estimated
- Normal CrCl > 50?
  - Yes or unknown
- No

Correctional Insulin Frequency
- 3 times a day WITH meals

Glucose Monitoring Frequency
- 4 times a day (AC & QHS)

Select Insulin Sensitivity
- Sensitive (0.15 - 0.3 units/Kg/day - Type I DM, pre-diabetes, or non-diabetic hyperglycemia)
- Standard (0.2 - 0.4 units/Kg/day - Type II DM)
- Resistant (0.25 - 0.5 units/Kg/day - avoid if NPO or CrCl < 50)

Dither if CrCl <= 50

CLICK HERE to Calculate Dose
Basal-Bolus Insulin Therapy

| Basal-Bolus Insulin Therapy | MLM 3.2: Oral diet / Bolus |

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Regular & Lispro mutually exclusive; link QHS item

Match selection of type of insulin in each grid
Hot Topics: Insulin Delivery And Glucose Monitoring

Today & Tomorrow
Insulin Delivery

Insulin delivery options

- vial and syringe
- insulin pen devices
- insulin pump
Present Pumps
Future Pumps

An automated artificial pancreas uses input data from the sensor of an insulin-dependent diabetes patient, analyzes it and commands the pump to deliver the correct dose of insulin at the right time.
Home Glucose Monitoring Devices
Continuous Glucose Monitoring (CGM)
Future Monitoring Devices