Diabetes Meds Objectives

- Explain the action of the various types of insulin currently available
- Identify the relationship between insulin peak and risk for hypoglycemia
- Discuss rationale for different insulin treatment strategies
- Differentiate mechanism of action, SE, and nursing considerations among various classes of oral antihyperglycemics.

Diabetes Type 1 and Type 2

- 1: 4 patients in the hospital have DM
- Most insulin is made currently with Recombinant DNA technology.
  - Chemically equivalent to human insulin
  - 2005 Eli Lilly D/C Pork, Ultralente, Humulin Lente
- Most insulin is U-100 insulin
  - Must use U100 syringe!
- U-500 insulin is made and used by some
  - Only as regular insulin.

Insulin Dynamics

- Onset
- Peak
- Duration

Four dynamics:
- Rapid, Short, Intermediate, and Long acting

Insulin is all about timing!

- Realize that it is important to time administration of insulin dose so that the insulin is at peak when the blood glucose level peaks after eating.
- Insulin poses the greatest risk to patients when it is peaking!!

Rapid acting insulin

- lispro (Humalog) 5-15m 30-90 ~5hrs
- aspart (Novolog) 10-20 30-90 ~3-5hrs
- glulisine (Apridra) 5-15 30-90 ~5hrs
Short (Regular)  
**O**   **P**   **D**  
- Humulin R  \~30min  2-4hrs  \~12hrs  
- Novolin R  

When does your blood sugar level peak after eating?  
What are the signs and symptoms of hypoglycemia?  

Signs and Symptoms of Hypoglycemia  
- Shakes  
- Sweats  
- Hunger  
- Irritability  
- Pallor  
- Tachycardia  

Intermediate NPH  
**O**   **P**   **D**  
- Humulin N  \~2hrs  4-10hrs  \~16hrs  
- Novolin N  90min  4-12hrs  \~24hrs  

Long Acting  
**O**   **P**   **D**  
- glargine (Lantus)  2-4hrs  no peak  \~24hrs  
- detemir (Levemir)  2-4hr  no peak  \~24hrs  

Fixed mixture insulin formulations  
- NPH insulin is stable in mixtures with Regular insulin  
  - 70/30  50/50  
- The key component in NPH is protamine  
- Fixed mix insulin is typically used in Type 2 diabetes to simplify the regimen and give a predictable response pattern.  

Special Circumstances  
- As a general rule the nurse should not withhold an insulin dose.  
- But! if a patient is on a mixture insulin then they might ask a MD for only an NPH dose  
- NPH will accommodate the patient’s basal insulin needs  


**Injection Sites for Insulin**

- Most times it is given SC
  - Regular insulin can be given IM when faster absorption is needed (DKA)
  - Regular is the only IV insulin
- May be given IV bolus and Drip
  - Coat the tubing by priming the tubing ~50ml
  - Half life is 5min in the blood
- Long acting insulin should be given 4hrs prior to stopping the continuous insulin drip

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**Inulin Dosing Schedules**

- Depends on the Type of Diabetes and the patient's level of DM control
- Usually Type 1 will need more injections.

- Physiologic Insulin Release
  - Continuously in very small amounts (Basal RESPONSE)

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**Conventional Insulin Therapy**

- Twice daily dosing with a combination of rapid and intermediate acting insulin (spit/mixed therapy)
- Diabetes Control and Complications Trial (DCCT): better control was possible with intensive insulin treatment (DCCT Research Group, 1993)

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**Intensive Insulin Therapy**

- Defined: management with three or more injections daily
- Or: Insulin delivery by way of an external insulin pump.

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**Basal Bolus Principle**

- About half of the patient’s total daily dose is delivered as the basal dose
- The other half is given as meal-time dosing in divided doses.
- Basal dose: intermediate acting insulin given in twice a day or with long acting insulin once or twice daily

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**Basal Dose Purpose**

- Provide a consistent amount of insulin that is strong enough to prevent nocturnal hyperglycemia and DKA
- Hopefully not to strong that it causes hypoglycemia.
- We get a good idea by looking at the Fasting Blood sugars for the patient.
Insulin Pumps
- Pumps programmed with basal dose
  - i.e. 0.5 units per hour
- Patient then calculates the bolus doses with meals.
- Catheter tubing and syringe reservoir changed q2-3 days.

Type 2 Diabetes
- Is a progressive disease involving
  - insulin resistance
  - gradual loss of beta cell function
- Most pts will need insulin therapy as some point
- Fasting hyperglycemia is a sign that oral agents alone are no longer effective

Type II
- If the FBS is high then the MD may give a once a day dose of intermediate acting insulin (NPH) or long acting glargine (Lantus), detemir (Levemir)

Insulin Therapy
- Medication therapy for all pt’s with type 1 and many pt’s with type II

Insulin Storage
- Insulin is a protein
  - damaged by exposure to extremes in temperature
- Insulin is stable for 28 days at room temp when opened
- Insulin detemir is stable for 42 days

Mixing Insulin’s
- Rapid and intermediate acting insulin’s can be mixed together in the same syringe
- (NEVER mix Lantus or LEVEMIR with any other type of insulin)
Intermediate Insulin

- Settles out of suspension easily
  - gently rolls the vial 20 times between hands to suspend properly
  - (NO vigorous shaking)

Correct Mixing Directions

- 1. inject air into the bottle of cloudy insulin (intermediate)
- 2. Inject air into the bottle of clear (Regular or rapid) insulin.
- 3. Withdraw the correct dose of clear insulin, making sure to eliminate all bubbles.
- Withdraw the correct dose of cloudy insulin. Do NOT push insulin back into vial.

Sites of Injection and speed of absorption

- fastest : abdomen
- medium speed: Upper arm
- Slows speed: thigh and buttock areas.
- Patients at home should rotate sites every 10days to 2wks.
- Varies depending on the amount of subcutaneous fat.

Injection Sites

- Some patients will rotate depending on the time of day.
  - Abdomen in the morning when insulin resistance is highest and at dinner time with largest meal.
  - Lunch in the arm
- Slower absorption of leg and hip helps to maximize the use of intermediate insulin given at bedtime

Complications of Insulin Injects

- Lipodystrophy (atrophy or hypertrophy at injection sites)
- Appears as a lump
- Lumps are usually painless when injected
  - unpredictable absorption

More injection tips

- 29 gauge ½” or 5/16”
- 90 degrees for thick adipose tissue
- 45 degrees for thin patients
- Aspiration before insulin injection is no longer recommended
Timing with meals

- Regular: given 30 min before meals
- Rapid acting analogs: lispro (Humalog), aspart (Novolog), glulisine (Apidra) 5-15min before meals.

Oral Antihyperglycemic Medications

- Type II diabetes
  - insulin resistance
  - progressive beta cell exhaustion
- Factors affects drug choice
  - age
  - level of hyperglycemia
  - stage of diabetes
  - presence of comorbid conditions (obesity, HTN, abnormal lipid metabolism)
  - MD preference and cost

Oral Antihyperglycemic Medications

- Insulin Secretagogues
  - they increase pancreatic secretion of insulin.
  - Sulfonylureas
  - Glinides

Sulfonylurea

- Drug Actions
- Contra-I
  - glyburide Insulin secretion Type1 DM
  - glipizide "" DKA
  - glimeperide "" Hypersen
  - renal failure

Glinides (meglitinides)

- drug action
- Contra-I
  - Repaglinide insulin Type I
  - Nateglinide secretion DKA
  - Hyper-sensitivity Renal Failure
  - rapid acting should be given with meals repaglinide (Prandin)
  - nateglinide (Starlix)
### Glucosidase Inhibitors:

- delay absorption of carbohydrates
  - acarbose (Precose)
  - miglitol (Glyset)

### Advantages
- Contra-I
  - Hypersensitivity
  - DKA
  - Inflammatory or other bowel disease

### Metformin
- reduces hepatic release of glucose
  - does not cause hypoglycemia
  - can lead to wt loss in some pts.
  - 1st line drug of choice for type II overweight pts with BS levels under 200mg/dl
  - improve insulin sensitivity in muscle and fat cells

### Metformin
- Risks
  - lactic acidosis
  - liver disease
  - impaired kidney function
  - CHF
  - Sepsis

### Metformin and Contrast (iodine)
- D/C to contrast diagnostic tests
  - D/c on the day of or just prior to the procedure and be withheld for 48 hours or until renal function can be verified as normal.

### Metformin
- Can cause GI upset: titrate dose
- Will not cause hypoglycemia when monotherapy
- Used in combo drugs
  - with glipizide (Metaglip)
  - with glyburide (GlucoVance)
  - with rosiglitazone (Avandamet)

### Biguanides:
- reduces production of glucose by they liver
  - metformin (glucophage)

### Contra
- Hypersensitivity
- liver disease
- ETOH abuse
- kidney impairment
- heart failure
- Use of tests with iodine contrast
- sepsis
- age older than 80 years.
<table>
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<td>- Contra-I</td>
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<td>- rosiglitazone (Avandia)</td>
<td>- hypersensitivity</td>
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<td>- Advantages</td>
<td>- Heart failure</td>
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<td>- improve lipid status reducing cardiac risks</td>
<td>- Active liver disease</td>
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Advantages:
- improve lipid status reducing cardiac risks
- no risk of hypoglycemia with monotherapy

S.E:
- fluid retention and weight gain
- troglitazone 1st (liver failure) off market
- Check baseline liver enzymes.

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<tr>
<td>- glucagon-like peptide 1 (GLP-1) analogs</td>
<td>- Restores first phase insulin release</td>
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<tr>
<td>use for Type 2 diabetes</td>
<td>increases beta cell mass</td>
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<tr>
<td>- Works:</td>
<td>promotes weight loss in Type 2</td>
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<td>- stimulates insulin release and inhibits postprandial endogenous glucagon secretion in response to blood glucose levels.</td>
<td>This can be beneficial before starting insulin therapy.</td>
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Works:
- stimulates insulin release and inhibits postprandial endogenous glucagon secretion in response to blood glucose levels.
- slows gastric emptying and decreases appetite
- for use with pts not gaining control of BS with metaformin, sulfonylureas

S.E:
- nausea (diminishes over time)
- greater risk of Hypoglycemia with combination use of a sulfonylurea

Available injection only.
- administered in the 60 minutes prior to both the morning and evening meals.

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**Amylin Analogs**
pramlintide acetate (Symlin)

- Reduce insulin by 50% when therapy is initiated
- S.E.
  - nausea (most common)
  - HA, anorexia, vomiting, dizziness, tiredness, stomach pain, and indigestion.

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**Inhaled Insulin powder**
Exubera

- Rapid acting insulin
  - Onset in 10 minutes
  - Peak in 30-120 minutes
  - Duration 2 hours
- Contra-I
  - asthma, bronchitis, smoking hx within six months
  - Pregnancy

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**Inhaled Insulin powder**
Exubera

- Used only as a bolus
- Adm within 10 minutes of starting meals
- In place of mealtime injectable insulin
- Ordered in mg. 1mg and 3mg blister packs
  - 1mg = 3 units of insulin
  - 3mg = 8 units of s/c insulin

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**Hypoglycemia**

- BS less than 70mg/dL
  - Shakes
  - Sweats
  - Hunger
  - Irritability
  - Pallor
  - Tachycardia
**Glucagon**

- Substance produced by pancreatic alpha cells to counteract the effects of insulin
- Raises glucose levels
- Injectable that needs to be reconstituted.
- SC or IM injection

**Glucagon**

- Used for pts with moderate to severe symptoms.
- Rapid response in 5-15 minutes
- Failure suggests a lack of available hepatic glycogen which will require IV administration of dextrose 50%
- Dextrose is very hypertonic.