

Diabetes Pharmacology

Visions Symposium 2016

Amanda Williams, RN BSN
Diabetes Nurse Educator
The University of Kansas Health System

Objectives

- Understand current medication therapies to treat diabetes and hyperglycemia
- Learn about new technologies in the treatment of diabetes

Current Therapies used in the Treatment of Hyperglycemia

Causes for Hyperglycemia

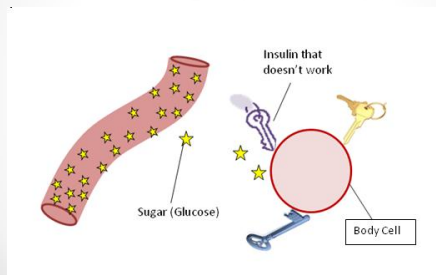
- Diabetes
 - Type 1
 - Type 2
- Surgery
- Trauma
- Steroid Treatment
- Nutritional Support
 - TPN/ Tube Feedings



Oral Therapy

...
Type 2 Diabetes

Type 2 Diabetes Pathophysiology



Biguanides

Glucophage (Metformin)

- Mechanism of Action
 - Improves Insulin Sensitivity
 - Does not affect insulin output
 - Decreases Hepatic Glucose Production
 - Decreases Glucose Absorption
- Benefits:
 - Proven to have Cardiovascular Benefits
 - Promotes Weight loss
 - Low Instance of Hypoglycemia
 - Decrease A1c 1%-2%
- Side Effects:
 - Diarrhea: Should Subside in 2 weeks
- Contraindications:
 - Elevated Creatinine

Sulfonylureas

Amaryl (glimepiride), Glucotrol (glipizide), Diabeta (glyburide)

- Increases Insulin Output
- Best Results in 1st year of use
 - Decreases by 50% in 2nd year of use
- Benefit
 - 1%-2% Reduction in HgA1c
- Side Effects
 - Hypoglycemia
 - Weight Gain
- Contraindication
 - Elderly- Due to Hypoglycemia



DPP-4 Inhibitors

Januvia (Sitagliptin), Onglyza (Saxagliptin), Tradjenta (linagliptin)

- Mechanism of Action
 - Blocks Action of DPP-4
 - Causes Pancreas to Release more Insulin
 - Decreases Glucagon Levels
 - Promote Satiety
- Pros:
 - Works well as monotherapy
- Cons:
 - Expensive
 - May not produce better results than Metformin and a Sulfonylurea

Thiazolidinediones (TZD's)

Actos (pioglitazone), Avandia (rosiglitazone)

- Improves Insulin Sensitivity
- Benefit
 - Decrease A1c 1%-2%
 - Low Instance of Hypoglycemia
- Contraindications:
 - Heart Failure
 - Liver Function Impairment
- Side Effects
 - Weight Gain
 - Fluid Retention

Meglitinides

Starlix (nateglinide), Prandin (repaglinide)

- Rapid –Acting Insulin Secretagogues
- Take 15 minutes Before Meal
 - Helps prevent post meal glucose elevation
- Side Effects
 - Weight Gain
 - Hypoglycemia-less common than Sulfonylureas

SGLT-2 Inhibitors

Invokana (canagliflozin), Farziga (dapagliflozin), Jardiance
(empagliflozin)

- Stops Reabsorption of Glucose in Kidneys
 - Glucose is Excreted in Urine, will have Positive Urine Glucose
- Contraindications:
 - Renal Impairment
- Side Effects:
 - Yeast Infection
 - UTI
 - Does Not Increase Incidence of DKA

Alpha-Glucosidase Inhibitors

Precose (acarbose), Glyset (migitol)

- Delays Glucose Absorption from the GI Tract
- Taken with 1st Bite of Food, Typically 3 x Day
- Side Effects:
 - Gas
 - Diarrhea
 - Abdominal Pain/ Cramping
- Benefit
 - Decrease A1c 0.5%-1%

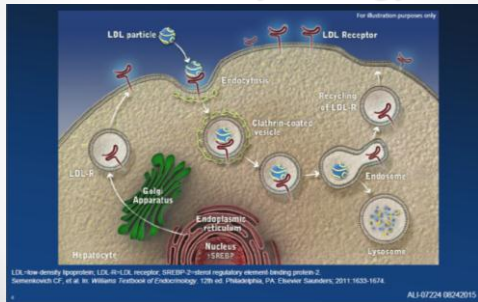
Combination Medications

- Indication
 - Baseline HgA1c of > 7.5%-9.0%
- Benefits
 - Decrease Number of Pills
 - Work Better Together
- Glucovance
 - (Glyburide + Metformin)
- Avandamet
 - (Rosiglitazone + Metformin)
- Metaglip
 - (Metformin + Glipizide)
- Avandaryl
 - (Amaryl + Rosiglitazone)
- Actoplus
 - (Pioglitazone + Metformin)
- Duetact
 - (pioglitazone + Glimepiride)

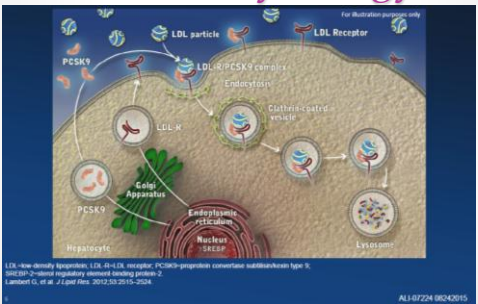
Lipid Impact on Type 2 Diabetes

...

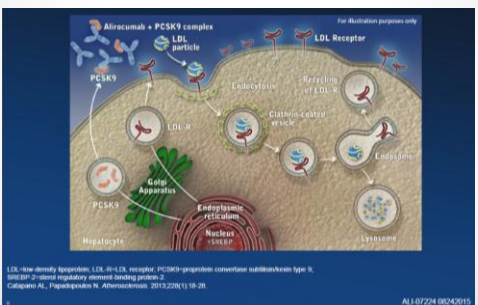
PCSK9 Physiology



PCSK9 Physiology



PSK9- Inhibitor

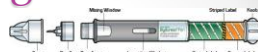


Non Insulin Injectables

...

GLP1- Agonists

- Mechanism of Action
 - Slows Gastric Emptying and Break Down of Carbohydrates
 - Suppresses Glucagon Production
 - Causes Pancreas to Release more Insulin
 - May Decrease Appetite
- Benefits
 - Weight Loss
 - Less Likely to Cause Low Blood Sugar
- Side Effects
 - Nausea
- Contraindications
 - Renal Impairment



Bydureon: Taken Once Weekly



Byetta: Taken BID



Victoza: Once Daily



Trulicity: Once Weekly



Tanzeum: Once Weekly

Amylinomimetic

Symlin (pramlintide)

- Improves Gastric Emptying
- Reduces Post Meal Glucagon Levels
- Benefit
 - Reduces HgA1c 0.5%-1%
- Side Effects
 - Nausea



Insulin Therapy

...

We do not Give Food to Treat Insulin,
We Give Insulin to Treat Food

Insulin Therapy

- 20%-30% of Type 2 Diabetics, will require Insulin Therapy
 - Loss of β -Cells
- Insulin is Preferred to Oral Therapy in Patients with $HgA1c > 8.5$
- Therapy must be Matched to Patient's Diet, Activity Level and Glucose Trends



Insulin Drip

- Used for Treatment of:
 - Hyperglycemia
 - DKA
 - Post Cardiac Surgery
- Transitioning Off IV Insulin
 - Give Basal Insulin 2 hours before Stopping Drip



Subcutaneous Insulin Therapy

- Basal Insulin

Insulin Type	Brand Name (Generic Name)	Starts to Work	Maximum Effect	Lasts	Comments	Graph of Insulin Action
Basal (Background)	Levemir (detemir) Lantus (glargine) Toujeo (U-300 glargine)	1 – 4 hours	8-10 hours or no peak	18-24 hours	<ul style="list-style-type: none"> Take only one time per day within an hour of the same time If you forget a dose, do NOT take an extra dose Make sure to eat consistent meals during the day to avoid low blood sugar 	
Basal (Background)	Novolin N (NPH) Humulin N (NPH)	2 – 4 hours	4 – 10 hours	12 – 20 hours	<ul style="list-style-type: none"> Take twice per day within an hour of the same time Make sure to eat consistent meals during the day to avoid low blood sugar 	

Subcutaneous Insulin Therapy

- Bolus Insulin

Insulin Type	Brand Name (Generic Name)	Starts to Work	Maximum Effect	Lasts	Comments	Graph of Insulin Action
Rapid-Acting	Novolog (Aspart) Apidra (Gulisine) Humalog (Lispro)	10-15 minutes	1-2 hours	4-6 hours	<ul style="list-style-type: none"> Take within 15 minutes of eating Dose can be adjusted based on carbohydrate intake (using insulin-to-carb ratio) or to bring down high blood sugars (using a correction factor) 	
Short-Acting	Novolin R (regular) Humulin R (regular)	30 – 60 minutes	2 – 4 hours	6 – 8 hours	<ul style="list-style-type: none"> Take 30 minutes before eating a meal Dose can be adjusted based on carbohydrate intake (using insulin-to-carb ratio) or to bring down high blood sugars (using a correction factor) 	

Emerging Insulins and Biosimilars

- 2016 Insulin Patents Expire

Lilly	Sanofi	Novo Nordisk
Humalog	Apidra	Novolog
	Lantus	Levemir

Insulin Pump Therapy

- Used to Treat
 - Type 1, Type 2, and CFRD
- Benefits
 - Fewer Injections
 - Continuous Infusion
 - Easy Bolusing
 - Continuous Glucose Monitoring Available
- Complications
 - Compromised Site
- Consider Discontinuing
 - Cognitive Impairment



Future: Insulin Patches and Implantable Devices

- Smart Insulin Patch
- Developed at The University of North Carolina and NC State
- Detects Increase in Blood Glucose and Secretes Doses of Insulin into the Bloodstream



Smart Insulin Patch

Questions?

Thank You!

• References

- Unger, J. (2007). *Diabetes Management in Primary Care*. Philadelphia, PA: Walters Kluwer.
- <http://news.unchealthcare.org/news/2015/june/smart-insulin-patch-could-replace-painful-injections-for-diabetes>
- ADA. 13. Diabetes Care in the Hospital, Nursing Home, and Skilled Nursing Facility. *Diabetes Care* 2015;38(suppl 1):S80
