

How Sweet It Is! Management of Diabetes: Injectable Medications

Mary Lynn McPherson, PharmD, MA, BCPS, CPE

Home Study Webcast

4 Slides Per Page



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ACTIVITY DESCRIPTION

Pharmacy practitioners are drug experts, including the selection, dosing and titration of injectable antidiabetes and hypoglycemic agents. Many new antidiabetes medications have been introduced to the market in recent years, and pharmacist needs to be aware about best practices in the use of these medications.

TARGET AUDIENCE

The target audience for this activity is **pharmacists, pharmacy technicians and nurses** in hospital, community, and retail pharmacy settings.

LEARNING OBJECTIVES

After completing this activity, the **pharmacist** will be able to:

- Describe the mechanism of action of each injectable medication used to treat type 1 or type 2 diabetes.
- Describe the adverse effects of each injectable medication used to treat type 1 or type 2 diabetes.
- Describe the role of each injectable medication used to treat diabetes in the overall treatment approach for diabetes.
- Explain dosing and titration strategies for injectable medications used to treat diabetes.
- List important counseling points for patients receiving injectable diabetes medications.

After completing this activity, the **pharmacy technician** will be able to:

- Gain overall knowledge of injectable diabetes medications used in type 1 or type 2 diabetes
- Outline the most common adverse effects of injectable medications used in type 1 or type 2 diabetes
- Outline dosing and titration strategies for injectable medications used in type 1 or type 2 diabetes

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ACTIVITY TYPE

Knowledge-Based Home Study Webcast

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ABOUT THE AUTHOR

Mary Lynn McPherson, Pharm.D., MA, MDE, BCPS,CPE, is Professor and Executive Director, Advanced Post-Graduate Education in Palliative Care in the Department of Pharmacy Practice and Science at the University of Maryland School of Pharmacy in Baltimore. She also serves as the Program Director for the international Online Master of Science and Graduate Certificate Program in Palliative Care through the University of Maryland, Baltimore. Dr. McPherson has a master's degree in Instructional Systems Development, and a second master's degree in Distance Education and e-Learning.

Dr. McPherson has maintained a practice in hospice and palliative care (local and national) and ambulatory care her entire career. At present, Dr. McPherson is the Director of Pharmacotherapy Services at UniversityCare Heritage Crossing in Baltimore where she works primarily with chronic pain patients and patients with diabetes mellitus. Dr. McPherson teaches extensively in the Doctor of Pharmacy curriculum on pain management and end of life care, including didactic and experiential content. She also developed one of the first and few palliative care pharmacy residencies in the U.S.

Dr. McPherson serves on the Board of the Hospice Network of Maryland, and was founding president of the American Society of Pain Educators. McPherson is a Fellow in the American Society of Health-Systems Pharmacists, the American Pharmacists Association, the American Society of Consultant Pharmacists and the American Society of Pain Educators. She is Board Certified in Pharmacotherapy, a Certified Diabetes Educator and a Certified Pain Educator. She has received many honors for her work, including the American Pharmacists Association Distinguished Achievement Award in Specialized Practice, the Maryland Pharmacists Association Innovative Practice Award, and the Maryland Society of Health-Systems Pharmacists W. Purdum Lifetime Achievement Award. Dr. McPherson has received many awards for teaching including the Presidential Citation from the Hospice and Palliative Nurses Association, Professor of the Year many times from the School of Pharmacy, University of Maryland Baltimore Founder's Week Teacher of the Year and the Robert Chalmers Distinguished Educator Award from the American Association of Colleges of Pharmacy. She has written four books, including "Demystifying Opioid Conversion Calculations: A Guide for Effective Dosing," and many book chapters and peer-reviewed articles on pain management, palliative care, and other topics.

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How Sweet It Is! Management of Diabetes: Injectable Medications

Faculty: Mary Lynn McPherson, PharmD, MA, BCPS, CPE



Objectives



1. Describe the mechanism of action of each injectable medication used to treat type 1 or type 2 diabetes.
2. Describe the adverse effects of each injectable medication used to treat type 1 or type 2 diabetes.
3. Describe the role of each injectable medication used to treat diabetes in the overall treatment approach for diabetes.
4. Explain dosing and titration strategies for injectable medications used to treat diabetes.
5. List important counseling points for patients receiving injectable diabetes medications.
1. Introduction to diabetes mellitus.
2. Lifestyle modification and diabetes mellitus
3. Monitoring diabetes mellitus
4. Medication management Part 1 (Oral Meds)
5. **Medication management Part 2 (Injectable Meds)**
6. Problem solving with diabetes mellitus
7. Coping with diabetes mellitus
8. Risk reduction and management of complications with diabetes mellitus Part 1
9. Risk reduction and management of complications with diabetes mellitus Part 2
10. Diabetes disease state management



So What is Diabetes Mellitus?



- "A condition characterized by hyperglycemia resulting from the body's inability to use blood glucose for energy. In Type 1 diabetes, the pancreas no longer makes insulin and therefore blood glucose cannot enter the cells to be used for energy. In Type 2 diabetes, either the pancreas does not make enough insulin or the body is unable to use insulin correctly."
- See more at: <http://www.diabetes.org/diabetes-basics/common-terms/#sthash.OlpR7p0L.dpuf>

<http://www.diabetes.org/diabetes-basics/common-terms/>



Injectable Medications for Diabetes Mellitus



- Pramlintide (SymlinPen 60 and SymlinPen 120) – amylinomimetic
 - Mimics actions of naturally occurring amylin (pancreatic hormone co-secreted with insulin)
 - Suppresses inappropriately high postprandial glucagon secretion
 - Slows gastric emptying and enhances satiety
 - Reduces postprandial glucose excursions and fluctuations through the day
 - Reduces A1c 0.4-0.6%
 - Use immediately prior to meals containing either ≥ 250 kcal or ≥ 30 g CHO
 - Type 1 and Type 2 diabetes; reduce insulin by 50%



Glucagonlike Peptide 1 Receptor Agonists



- Long-acting analogues of human glucagonlike peptide 1 (GLP-1)
 - An incretin hormone
- Mechanisms of action:
 - Augments glucose-dependent insulin secretion
 - Decreases inappropriate glucagon secretion
 - Increases β -cell growth/replication
 - Slows gastric emptying
 - Decreases food intake
- Indication – adjunct to diet and exercise to improve glycemic control in adults with type 2 diabetes mellitus
 - Liraglutide (Saxenda) – indicated for chronic weight management

GLP1 Receptor Agonists



Generic Name	Albiglutide	Dulaglutide	Exenatide	Exenatide ER	Liraglutide	Lixisenatide
Trade Name	Tanzeum	Trulicity	Byetta	Bydureon	Victoza (Saxenda)	Adlyxin
Dosage forms	Pen injector	Injection solution	Injection solution	Injection powder	Injection solution	Injection solution
Initial adult dose	30 mg SQ once weekly	0.75 mg SQ once weekly	5 mcg SQ twice daily	2 mg SQ once weekly	0.6 mg SQ once daily	10 mcg SQ once daily
Maintenance adult dose	30 to 50 SQ once weekly	0.75 to 1.5 mg SQ once weekly	10 mcg SQ twice daily	2 mg SQ once weekly	1.2 to 1.8 mg (Victoza) or 3 mg (Saxenda) SQ once daily	20 mcg SQ once daily

Facts and Comparisons

GLP1 Receptor Agonists



- Short acting agents (exenatide and lixisenatide)
 - Half-lives of 2 and 2.8 hours, respectively
 - Modest reduction in FBG (9 -11 mg/dl)
 - Post-prandial BG reduction of 35-50 mg/dl
- Long-acting agents (exenatide XR, liraglutide, albiglutide, dulaglutide)
 - Half-lives of 12 hours to 5 days
 - All once weekly (except liraglutide is once-daily)
 - Liraglutide reduced FBG and PPG; rest primarily reduce FBG
- All injected subcutaneously into abdomen, thigh or upper arms
- SA dosed within 60 minutes before meals
- LA dosed without regard to meals

GLP1 Receptor Agonists



- Both LA and SA GLP-1 RA associated with significant weight loss in patients with T2DM and obesity
 - Total body fat, especially trunk or visceral fat
 - Liraglutide seems to be preferred agent if weight loss is desired goal
- Common adverse effects in $\geq 10\%$
 - Nausea (tolerates develops), vomiting
 - Upper respiratory infection
 - Infection-site bruising and SQ nodule formation
 - Diarrhea, constipation, UTIs

GLP-1 RA	A1c Reduction
Exenatide	0.8-1.5
Exenatide XR	1.3-1.9
Liraglutide	1.1-1.6
Albiglutide	0.78-1.55
Dulaglutide	0.7-1.6
Lixisenatide	0.7-0.9

GLP1 Receptor Agonists



- Incretin mimetics association with C cell hyperplasia/medullary thyroid tumors in animals
 - Boxed warning, but relevance in humans unknown
 - Contraindicated in patients with personal or family history of medullary thyroid carcinoma
- As a class, incretin mimetics associated with acute pancreatitis
 - Use with caution in patients with a history of pancreatitis
- Low risk of hypoglycemia (0-14.5%), risk increases when used in combination with insulin/insulin secretagogues



GLP1 Receptor Agonists



- How do you pick a GLP-1 RA?
- Frequency of administration, type of required glucose control (FBG, PPG), adverse effects, patient-related variables, patient's ability to use administration devices
- Higher A1c, required FBG reduction, consider LA agents (exenatide XR, liraglutide, dulaglutide, albiglutide)
- Require PPG reduction, consider SA exenatide or lixisenatide
- Both FBG and PPG reduction and weight loss desired, liraglutide is optimal
- Good choices for patients with frequent hypoglycemia



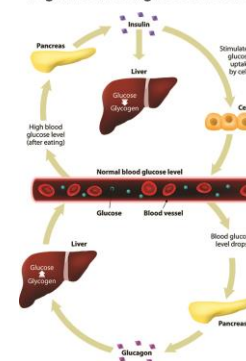
GLP1 Receptor Agonists



- Role in therapy – when to use them
- American Diabetes Association
 - If A1c not achieved after ~ 3 months, considering adding a second agent (GLP-1 RA is one option)
 - Consider using two agents if A1c $\geq$ 9% (GLP-1 RA is one option)
 - As a third agent, more severe diabetes
- AACE/ACE guidelines
 - Monotherapy with entry A1c < 7.5%
 - In combination with second agent with entry A1c $\geq$ 7.5%
 - Part of triple therapy with entry A1c $\geq$ 9%

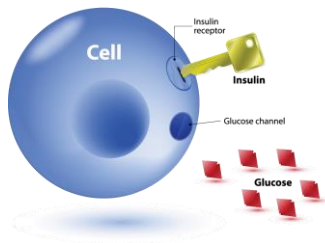


INSULIN AND GLUCAGON regulate blood glucose levels

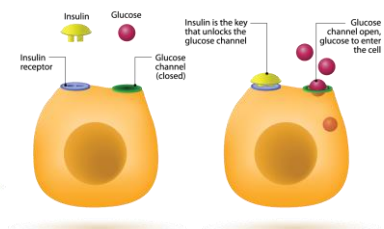


A Closer Look At Insulin

IMPORTANCE OF INSULIN



HOW DOES INSULIN WORK?

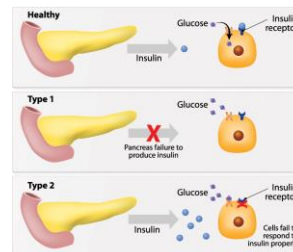


For more information - <https://www.youtube.com/watch?v=QIHx8gWfMgw>



What's Your Type?

DIABETES MELLITUS



TYPES OF DIABETES

Type I diabetes



Type II diabetes



● Glucose ● Glut-4 ● Insulin ● Insulin receptor



Role of Insulin

- Type 1 – insulin production stops completely
 - Insulin is necessary to maintain life and regular BG level; for rest of life
- Type 2 – continual decline in the amount of insulin produced
 - Most people with T2DM may reach the point where their pancreas cannot make enough insulin to meet their need
 - May be short-term (extreme HG at diagnosis, hospitalization, severe illness, pregnancy)
 - May be instituted as basal insulin
 - May progress to basal plus bolus insulin (bolus to cover meals)
- Insulin available as injection or inhaled
 - Oral insulin destroyed by gastric juices



Insulin

- Source – made in laboratory using special gene technology
 - Chemical structure same as endogenous human insulin
 - In the past, bovine and porcine insulin was chemically modified to mimic human insulin
- Indication – treatment of T1DM and T2DM to improve glycemic control; treatment of insulin resistance
 - Off-label – gestational diabetes mellitus, diabetic ketoacidosis, hyperglycemic during critical illness



Injectable Insulins



Generic Name	Trade Name	Compatibility	Administration
Rapid Acting			
Insulin aspart	NovoLog	May be mixed with NPH for SQ injection May be given IV (NS, D5, D10)	SQ, IV, pump Administer within 5-10 minutes before a meal.
Insulin glulisine	Apidra	May be mixed with NPH for SQ injection May be given IV (NS)	SQ, IV, pump Administer 15 minutes before a meal or within 20 minutes after starting meal
Insulin lispro	Humalog	May be mixed with NPH for SQ injection May be given IV (NS)	SQ, IV pump Administer within 15 minutes before or immediately after eating if dosed as a meal-time insulin
Short Acting			
Regular	Humulin R Novolin R	May be mixed with longer-acting insulin for SQ (not conc) May be given IV (NS) (not conc)	Humulin R, Novolin R – IV (not conc) Humulin R, Humulin R (conc), Novolin R – SQ Administer 30-45 minutes before meal

Risks and Complications



Injectable Insulins



Generic Name	Trade Name	Compatibility	Administration
Intermediate Acting			
Insulin isophane (NPH)	Humulin N Novolin N	May be mixed with regular or insulin lispro (not Novolin N)	SQ Typically administered within 30 minutes of a meal; typically given twice daily
Long Acting / Ultra Long Acting			
Insulin degludec	Tresiba	Do not mix or dilute with any other insulin or solution	Once daily dosing, can be administered at any time of the day, at the same time every day
Insulin detemir	Levemir	Do not mix or dilute with any other insulin or solution	Once daily, with evening meal or bedtime. Twice daily dosing – evening dose with evening meal, at bedtime, or 12 hours after morning dose
Insulin glargine	Lantus, Toujeo, Basaglar	Do not mix or dilute with any other insulin or solution	Once daily dosing can be administered at any time of the day, at the same time every day

Risks and Complications



Administration



- Cold injections should be avoided
- Rotate administration sites to prevent lipodystrophy
- General rule – do not administer within 1 inch of the same site for 1 month
- Fastest absorption in abdomen (up to 50% faster), then upper arm, thigh, then buttocks
- May be preferable to use same site, but rotate within site



Routes of Administration



- Continuous Subcutaneous Insulin Infusion (CSII)
 - Insulin aspart, insulin glulisine, insulin lispro U 100 may be administered by CSII by an external insulin pump
- Intravenous
 - Regular insulin U100, insulin apart, insulin glulisine, insulin lispro U100 can be administered IV with close monitoring
- Inhalation
 - Afrezza is for oral inhalation only
 - Administer at the beginning of the meal; allow cartridges to come to room temperature
 - Replace inhaler every 15 days to maintain accurate drug delivery



Warnings/Precautions



- Chronic lung disease – inhalation only
- Most common adverse effect is hypoglycemia
- Insulin causes shift of potassium from extracellular space to intracellular space, possibly producing hypokalemia
- Caution with insulin and TZDs – may cause dose-related fluid retention and lead to or exacerbate heart failure, especially in combination with insulin
- U-500 regular insulin – use in patients receiving > 200 mg QD
 - Caution if using a U-100 syringe
 - BD has introduced a U-500 syringe



Storage



- Unopened, unused vials of insulin should be kept refrigerated and protected from light
 - Refrigerated, unopened vials of insulin can be used until the printed expiration date
- If the unopened, unused vial of insulin is kept at room temperature, it must be discarded after one month
- Opened vial or pen device in use at home or traveling, store at room temperature (most good for up to 30 days; discard after 30 days)
- Ok to keep current vial or pen in refrigerator; allow to warm before injection
- Never freeze insulin (or boil it!)



When to Inject, How it Affects BG



- Rapid acting insulin
 - Intended to control BG rise that happens after a meal
 - Enters bloodstream within 5-15 minutes after injection
 - Patient should eat within 15 minutes of injecting rapid acting insulin
 - Acts for 1-2 hours after injection (wears off 4-6 hours)
 - If you inject rapid acting insulin before breakfast, it will peak at the same time breakfast raises your glucose level
 - Same with lunch, same with dinner
- Short acting insulin
 - Intended to control BG rise that happens after a meal, but there's a lag time
 - Inject 30-45 minutes before eating
 - Onset 30-60 minutes, acts for 2-4 hours, dissipates 6-10 hours



When to Inject, How it Affects BG



- Intermediate acting insulin
 - Cloudy because it's has slowed action
 - MUST gently and thoroughly mix insulin before preparing injection
 - Intended to impact BG that rises many hours after injection
 - Enters blood stream in 1-2 hours, peaks 4-8 hours after injection, dissipates in 10-18 hours
 - Inject before breakfast, peaks around the same time lunch raises your BG
 - Inject before dinner, peaks and controls BG overnight (peaks in middle of night). May require bedtime snack
- Long acting insulin
 - Basal, 24-hour release



Combination Insulins

- Humulin 70/30, Novolin 70/30, Relion/Novolin 70/30 =
 - 70% intermediate acting insulin (NPH) +
 - 30% short acting regular insulin
- Humalog 75/25 =
 - 75% intermediate acting insulin (NPL) +
 - 25% Humalog (lispro) insulin
- Novolog Mix 70/30 =
 - 70% intermediate acting insulin (NPA) +
 - 30% Novolog (aspart) insulin



Insulin Action Profiles

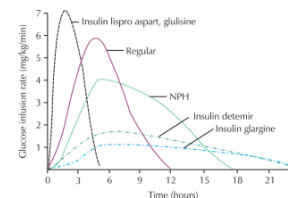


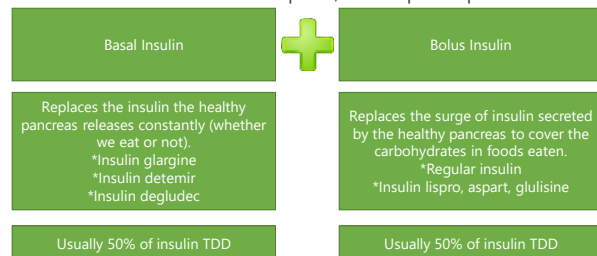
Fig. 1. Activity profiles of different types of insulin. Reprinted with permission from diabetes education online, diabetes teaching center. NPH: neutral protamine hagedom. Copyright © 2009 The Regents of the University of California, all rights reserved, www.deo.ucsf.edu.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3431894/>



Crafting Insulin Regimens – Type 1 DM

- Patients with T1DM are insulinopenic, and require replacement of BOTH:



TDD = total daily dose
<http://www.jalmed.com/insulin-dosing-made-easier/>



Let's Look at an Example T1DM

- Laura – 17 year old diagnosed with Type 1 DM
- TDD for most patients with T1DM is 0.5-1 unit/kg/day
- Laura weighs 60 kg → (60 kg)(0.5 units/kg) = 30 units TDD
- Half of TDD is basal → 15 units insulin glargine in the evening
- Half of TDD is bolus → divide between three meals to start
 - 5 units insulin lispro before each meal
- Laura's initial insulin order is:
 - Insulin glargine 15 units every evening
 - Insulin lispro 5 units 15 minutes before breakfast, lunch and dinner



Let's meet Trent Jamison

- Trent Jamison is 11 years old
- He is 4'7", 78 pounds (usually)
- His mother brings him in to see the pediatrician with complaints of bed-wetting, general lethargy, and a recent 5 pound weight loss.
- On questioning Trent says he's been drinking a lot of Gatorade because he's been thirsty.
- No family history of diabetes.



Trent Jamison

- 78 pounds = 35.5 kg
- 0.5-1 unit/kg ~ 17.5 to 35 units insulin TDD
- Basal – 9 units insulin glargine (or detemir or degludec)
- Bolus – 3 units insulin lispro (or aspart or glulisine) before each meal



Injecting Insulin

1. Wash your hands
2. Be sure to clean your skin before each injection
3. Insulin needles recommended for one-time use
4. Do not attempt to clean needle by wiping with alcohol (strips off silicone coating, making future injections more painful)
5. Room temperature insulin less likely to hurt
6. Using alcohol, clean the rubber top of the insulin vial
7. Draw air into the syringe (= to insulin dose)
8. With the vial upright, stick the needle into the rubber top of the vial; inject the air.

AADE Module 4: Taking Medications



Injecting Insulin

9. Holding the vial and syringe firmly together as a unit, turn it upside down.
10. Slowly draw the insulin into the syringe.
11. If you see air bubbles, slowly inject back into the vial and re-draw. Tap side of the syringe to help bubbles rise to the top. Repeat until no bubbles seen.
12. Make sure top of black rubber stopper is aligned with the measuring line on the syringe for the dose you want
13. Remove needle from vial
14. Gently pinch up a layer of fat; quickly insert needle into the skin; inject
15. After a few seconds, remove needle. Do not massage skin after injection.

AADE Module 4: Taking Medications



Insulin and Monitoring BG



Insulin	Time Injected	Period of Insulin Activity	SMBG Reflecting Insulin Action
Rapid-acting (lispro, aspart, glulisine)	Before a meal	Covers meal (acts to reduced post-prandial BG)	2 hour post-prandial (also pre-prandial value before next meal, or bedtime)
Short acting (regular)	Before a meal	Between that meal and either the subsequent meal, or the bedtime snack (if insulin is taken before dinner)	Both after the meal which insulin is injected and before next meal or bedtime snack (if insulin is taken before dinner)
Intermediate acting (NPH)	Before breakfast	Between lunch and dinner	Before dinner
Intermediate acting (NPH)	Before dinner or bedtime	Overnight	Before breakfast
Long acting (glargine, detemir, degludec)	Before breakfast or before dinner or half dose at each time	Mostly overnight because short acting insulin overrides its effect during the day	Before breakfast

There's More Than One Way to Pluck a Chicken



When this glucose is out of range	Adjust this insulin
Fasting	Intermediate or long-acting administered with dinner or bedtime (e.g., glargine, detemir, degludec, or NPH)
Post-breakfast or pre-lunch	Breakfast bolus or rapid or short acting
Post-lunch or pre-dinner	Lunch bolus of rapid or short acting, OR NPH before breakfast
Post-dinner or bedtime	Dinner bolus of rapid or short acting

Trent



- Trent has been injecting the prescribed regimen:
 - 9 units glargine every evening
 - 3 units insulin lispro before each meal
- His diet is appropriate, and his AVERAGE BG values are as follows:
 - Pre-breakfast 160 mg/dl
 - Pre-lunch 130 mg/dl
 - Pre-dinner 110 mg/dl
 - Bedtime 100 mg/dl
- How do you adjust his insulin regimen?



Rules, Rules, Rules!



- Fine-tuning the insulin regimen – carbohydrate counting
- Rule of 500 – calculate how many grams of carbohydrate each unit of rapid acting insulin will cover
- $500/\text{TDD} = \text{number of carbs covered by one unit of RA insulin}$
- Trent now on insulin glargine 10 units in evening, and 9 units RA
- $500/19 = 26.3$
 - Each unit of insulin lispro "covers" about 26 grams of carbohydrate

Carbohydrate Counting



- Trent's Mom is serving spaghetti with meatballs for dinner
- Trent has begged her to fix Texas Toast – a real favorite – (and he knows he's going to eat two pieces) ~ 30 g CHO
- Trent's rule of 500 is 26 g CHO is covered by one unit of insulin, so he should increase his RA insulin by one unit

<https://www.niddk.nih.gov/health-information/diabetes/overview/diet-eating-physical-activity/carbohydrate-counting>

1 serving of carbohydrate (15 grams):

One slice of bread
One 6" tortilla
1/3 cup pasta
1/3 cup rice
1/2 cup canned or fresh fruit or fruit juice or one small piece of fresh fruit, such as a small apple or orange
1/2 cup of pinto beans
1/2 cup of starchy vegetables such as mashed potatoes, cooked corn, peas, or lima beans
3/4 cup of dry cereal or 1/2 cup cooked cereal
1 tablespoon of jelly



Correction Factor – Rule of 1800



- To correct a blood glucose that is higher than expected/desired
- 1800/TDD tells you how far the BG will drop with each unit of RA insulin
- Trent – $1800/19 = 94.7$ units
- Trent went to a birthday party and went a little nuts with the cake and ice cream. His pre-dinner BG was 400 mg/dl.
- Trent should administer two extra units of RA insulin to realign his party-induced hyperglycemia (in addition to his planned dose)



Insulin pump therapy



- Small device (size of a beeper)
- Provides continuous infusion (basal insulin dose) – may vary rate
- Allows for bolus doses to be programmed
- Minimed 670G – a hybrid closed loop insulin delivery system
 - Approved for patients ≥ 14 years old
 - System uses an algorithm to automatically adjust basal insulin doses based on readings from a continuous glucose monitor
 - Does require some action from patient (it's a "hybrid" not a true "artificial pancreas")
 - Patient must manually enter the estimated amount of CHO to be consumed during a meal and accept bolus prandial dose suggested by system



Initiating Basal Insulin in T2DM



- May be a reasonable option early after diagnosis, if A1c $> 9\%$
- Start 10 units/day or 0.1-0.2 units/kg/day
- Adjust 10-15% or 2-4 units once-twice weekly to reach FBG target
- For hypoglycemia, determine and address cause; reduce dose by 4 units or 10-20%
- If not controlled after FBG target is reached (or at dose > 0.5 units/kg/day), treat PPG excursions with mealtime insulin, or GLP-1 RA trial)



Let's meet Sofía Hernandez



- Sofía is 42 years old; she was born in Puerto Rico but has lived in Maryland for over 20 years
- Sofía is 5'4" and weighs 375 pounds
- LOVES regular soda and apple juice
- Wondering if there's a problem – feels fatigued, not sleeping well, nocturia x 3
- BP 148/94 mmHg (145/92 on repeat)
- Lipid panel: TC 220 mg/dl, TG 260 mg/dl, HDL 28 mg/dl, LDL 140 mg/dl
- Fasting plasma glucose 185 mg/dl
- Started on lifestyle modification and metformin
- She BEGGED not to have to start insulin



What now Sofía?



- Concerned about her A1c (9.6%)
- You are leaning toward basal insulin, but she starts to cry and begs, please don't make me take insulin
- You are instead thinking a GLP-1 RA
 - Liraglutide 0.6 mg once daily, increase weekly as tolerated up to 1.8 mg qd
 - Great choice because she has both FBG and PPG elevation, and weight loss is imperative
 - She refuses daily injection
 - Exenatide Extended Release
 - 2 mg once weekly (SQ)



What now Sofía?



- Three months later, the patient's weight has fallen from 368 to 340 pounds
- A1c reduced from 9.6% to 8.3%. What now?



Fears of Injecting Insulin in T2DM



- Psychological and financial factors
 - Inappropriate perceptions about insulin therapy, including its benefits, side effects, indications and contraindications and how insulin affects ADLs
 - Financial barriers related to cost of insulin and accessibility issues in obtaining supplies
- Fear of injection
 - Past experiences – personal observation, interactions with health care professionals, interactions with significant others
 - Insufficient knowledge on – insulin pens, benefits of insulin, insulin's side effects, progressive nature of T2DM
 - Misconceptions about insulin – insulin is the source of hypoglycemia, insulin is harmful
 - Misconceptions about injections – injections are painful, insulin therapy indicates a personal failure in managing diabetes, insulin therapy restricts life

http://www.thejournalofdiabetesnursing.co.uk/media/content/_master/4819/files/pdf/dn21-3_91-5.pdf



What Now Sofía?



- You have a LONG talk with the patient, and she finally agrees to daily basal insulin (insulin glargine) 10 units every evening
- Her FBG target is 80-130 mg/dl

Date	FBG	Action
Week 1	240 mg/dl	Start insulin glargine 10 units every evening
Week 2	180 mg/dl	Increase insulin glargine to 12 units every evening
Week 3	160 mg/dl	Increase insulin glargine to 15 units every evening
Week 4	130 mg/dl	Continue with insulin glargine 15 units every evening

Exam Questions

1. Which of the following is a mechanism of action of pramlintide?
 - a. Suppresses inappropriately high postprandial glucagon secretion
 - b. Slows gastric emptying
 - c. Enhances satiety
 - d. All of the above

2. Which of the following are CORRECT about liraglutide?
 - a. It is injected once a week
 - b. Reduced hepatic glucose production
 - c. Slows gastric emptying
 - d. Increases urinary excretion of glucose

3. Which GLP1 receptor agonist is also approved for weight loss?
 - a. Albiglutide
 - b. Dulaglutide
 - c. Exenatide XR
 - d. Liraglutide
 - e. Lixisenatide

4. What is the predominant adverse effect associated with GLP1 RA therapy?
 - a. Constipation
 - b. Fungal genital infections
 - c. Nausea
 - d. Chronic cough

5. Which of the following insulins regimens seems the most reasonable?
 - a. Insulin aspart before each meal and insulin degludec each evening
 - b. Insulin aspart before each meal and 2 hours after each meal
 - c. Insulin lispro before each meal and regular insulin at bedtime
 - d. Insulin glargine in the morning daily and insulin detemir in the evening daily

6. Which of the following is CORRECT about insulin therapy?
 - a. Cold insulin is less painful
 - b. Injections in the flank are the most rapidly absorbed

- c. Patients should stay 1" away from an injection site for a month
- d. Most patients should slant the needle at a 45 degree angle when injecting

7. What is the biggest concern about inhaled insulin?

- a. Chronic lung disease
- b. Hypokalemia
- c. Heart failure
- d. Urinary tract infections

8. Insulin aspart is injected before lunch; when should the patient check their blood glucose to assess the effectiveness of that dose?

- a. Before breakfast
- b. Before lunch
- c. 2 hours after lunch
- d. Bedtime

9. What is the dose of insulin for a patient newly diagnosed with type 1 diabetes?

- a. 0.5 – 1 unit/kg/day
- b. 1 – 2 units/kg/day
- c. 2-4 units/kg/day
- d. Always start with 10 units at bedtime

10. How many carbohydrates grams are in one slice of bread?

- a. 10 grams
- b. 15 grams
- c. 30 grams
- d. 45 grams