



Beyond Fundamentals –Pattern Management Gone Crazy – Part II

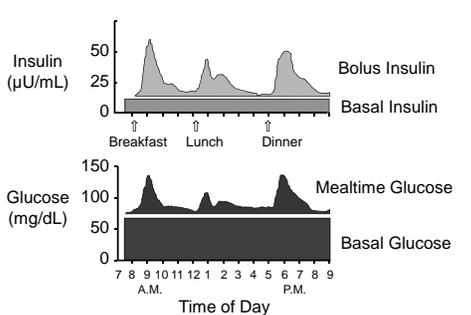
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Pattern Management Gone Crazy

- ▶ Incorporating national guidelines into practice
- ▶ Explore the importance of patient assessment in determining a realistic dosing strategy.
- ▶ Discuss strategies to initiate and modify insulin therapy with a focus on safety.
- ▶ List strategies on adjusting bolus and basal insulin to achieve glucose control.
- ▶ Glucose patterns and adjustment strategies

Physiologic Insulin Secretion: 24-Hour Profile



Poll question 1

- ▶ Which of the following are bolus insulins?
 - a. Lantus, Levemir
 - b. Novolog, Humalog, NPH
 - c. Reg, Novolog, Afrezza
 - d. Insulin pens
 - e. not sure



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Insulin Action Teams

- ▶ Bolus: lowers after meal glucose levels
 - ▶ Rapid Acting
 - ▶ Aspart, Lispro, Glulisine, Afrezza
 - ▶ Short Acting
 - ▶ Regular
- ▶ Basal: controls glucose between meals, hs
 - ▶ Intermediate
 - ▶ NPH
 - ▶ Long Acting
 - ▶ Detemir (Levemir)
 - ▶ Glargine (Lantus)



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Insulin Efficacy

- ▶ How is the effectiveness of bolus insulin determined?
 - ▶ 2 hour post meal (if you can get it)
 - ▶ Target < 180
 - ▶ Before next meal blood glucose
 - ▶ Target 80-130
- ▶ How is the effectiveness of basal insulin determined?
 - ▶ Fasting blood glucose
 - ▶ Target 80-130



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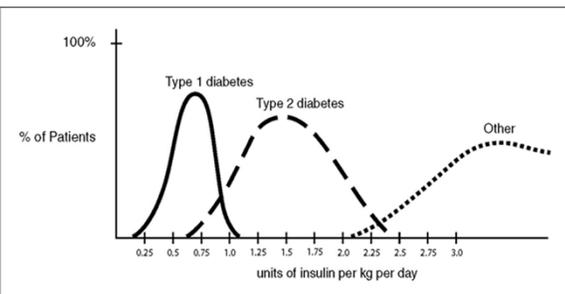
Approach Depends on Patient

- Insulin dosing is relative to body weight
- Kidney function
- Other meds
- Activity level
- Social support
- Goals of care
- Patients ability



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Insulin Dosing Type 1 & 2



U-500 Insulin: When More With Less Yields Success: *Diabetes Spectrum* March 20, 2009 vol. 22 no. 2 116-122



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Poll question 2

- ▶ What best describes inhaled insulin?
 - a. Liquid insulin that is aerosolized.
 - b. Powdered long acting insulin.
 - c. Insulin that is inhaled via a pipe.
 - d. Regular insulin in powdered form.



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Afrezza – Inhaled Insulin – Approved 2014 – Type 1 or 2

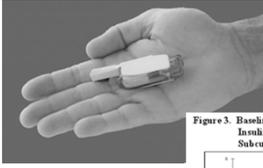
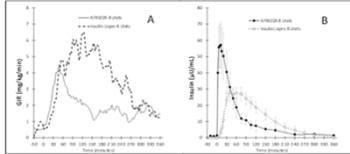


Figure 3. Baseline-Corrected Glucose Infusion Rate (A) and Baseline-Corrected Serum Insulin Concentrations (B) after Administration of AFREZZA or Subcutaneous Insulin Lispro in Type 1 Diabetes Patients*



* Despite the faster absorption of insulin (FI) from Afrezza, the onset of activity (OT) was comparable to insulin lispro.

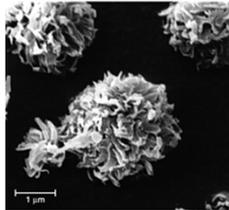
Only studied in adults over 18
Not indicated for pregnancy, while breastfeeding



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Steps, Cost, Terms

- ▶ 1st step – FDA approved. Will take time to produce, market and distribute
- ▶ Pricing – similar pricing as pens ~ \$300 a month
- ▶ Afrezza is regular human insulin in powder form using Technosphere technology.
- ▶ Referred to as TI in papers – “Technosphere Insulin”



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Afrezza Dosing and Considerations

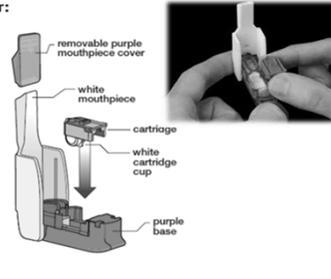
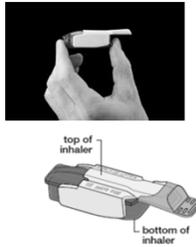
- ▶ Bolus regular insulin – inhaled before meals
- ▶ Dosing: 4 and 8 unit cartridges
 - ▶ Convert with 1:1 ratio to existing insulin dose
- ▶ Lung function test before start (FEV1)
 - ▶ Not for pts w/ chronic lung issues
 - ▶ Asthma, COPD, history of lung cancer, smokers
 - ▶ Can cause acute bronchospasm – Black box warning
- ▶ Side effects:
 - ▶ Hypoglycemia, sore throat, cough
 - ▶ Less hypoglycemia than injected insulin



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Afrezza Inhaler

Know your AFREZZA® inhaler:



Replace inhaler every 15 days –
Do not wash

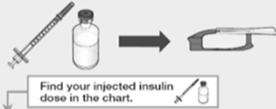


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If you cannot find your injected dose in the chart below, you must talk to a healthcare provider before using AFREZZA®.

Afrezza – Combos to get right dose

To switch from injected mealtime insulin to AFREZZA®...



Injected Mealtime Insulin Dose	AFREZZA® Dose	# of 4 unit (pink) cartridges needed	# of 8 unit (green) cartridges needed
up to 4 units	4 units	1	0
5-8 units	8 units	0	1
9-12 units	12 units	1	1
13-16 units	16 units	2	0
17-20 units	20 units	2	1
21-24 units	24 units	3	0

Example:
If you need to take 12 units of AFREZZA® you can use...
1 blue (4 unit) cartridge + 1 green (8 unit) cartridge

Find the correct dose of AFREZZA®.



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Sample situations - Pt on....

- ▶ 7 units Humalog at meals, 20 u Lantus at hs
- ▶ 5 units regular break, dinner, 10 units detemir
- ▶ 10 units aspart at meals, 30 Lantus
- ▶ Carb counts – 1:15 .. Had 75 gms
 - ▶ Type 1
 - ▶ Type 2
 - ▶ BG before meal 67
 - ▶ BG before meal 170



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Sample situations - Pt on....

- ▶ 7 units Humalog at meals, 20 u Lantus at hs
 - ▶ Type 1 or 2 - 8 units Afrezza.
 - ▶ BG 67 – reduce to 4 units? BG 170 – 8 units ok
- ▶ 5 units regular break, dinner, 10 units detemir
 - ▶ Type 1 – 4 units, Type 2 - 8 units?
 - ▶ BG 67 – 4 units. BG 170 – Type 1, 4 units. Type 2, 8 units?
- ▶ 10 units aspart at meals, 30 Lantus
 - ▶ Type 1, 8 or 12 units? Type 2, 12 units.
 - ▶ BG 170 – 12 units both. BG 67, 8 units both
- ▶ BG 140 - Carb counts – 1:15 .. Had 75 gms carb
 - ▶ Type 1, 4 units (ck in 2 hrs, give more?). Type 2, 8 units?



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Pattern Management



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Poll Question - 3

- ▶ When looking at glucose patterns, which problem do you fix first?
 - a. Hyperglycemia
 - b. Hypoglycemia
 - c. non-compliance
 - d. legible writing
 - e. not sure



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Pattern Management

- ▶ Safety 1st!! - Evaluate 3 day patterns
- ▶ **Hypo:** eval 1st and fix:
 - ▶ If possible, decrease medication dose
 - ▶ Timing of meals, exercise, medications
- ▶ **Hyperglycemia:** evaluate 2nd
 - ▶ Identify patterns
 - ▶ Before increase insulin, make sure not missing something (carbs, exercise, omission)



Case Study

- ▶ 68 yr old, avid walker
- ▶ BMI 24, Weighs 90kg
- ▶ A1c – 9.6%, BG 270s during day for past mos
- ▶ Insulin – 40 units Lantus
- ▶ Oral Meds: glyburide, metformin
 - ▶ What medication changes?
 - ▶ What insulin changes?
 - ▶ Big insurance copay



Type 2, 90kg – A1c 9.6% Pt on Metformin, Glyburide- Max dose- Lantus started

	Break	Lunch	Dinner	HS
Mo 1	190s			298 10uLan
Mo 2	180s			233 20uLan
Mo 3	160s			216 30uLan
Mo 4	130s	278	184	209 40u Lan

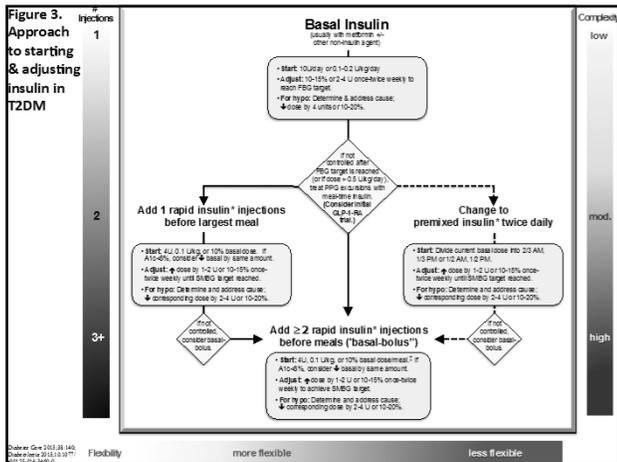


Next Step - Insulin

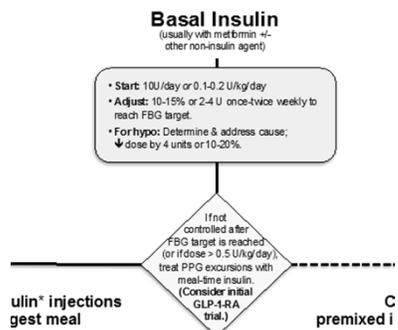
- ▶ Add GLP1 Agonist? No
- ▶ Add a SGLT-2 Inhibitor? no
- ▶ DPP-IV? No due to \$\$
- ▶ Stop Glyburide (not indicated if on insulin. Increase risk for hypo and mortality)
- ▶ Need to improve insulin therapy
 - ▶ Look at eating patterns
 - ▶ Refer to RD, Education
 - ▶ Great support system



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When is it Too much basal insulin?



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Next steps



- ▶ Insulin – Max basal dose is 45 units (90kg x 0.5). At 40 units now.
- ▶ Next step – Add bolus insulin or switch to 70/30.
- ▶ After discussing with patient, decide to add regular* insulin to largest meal.
- ▶ Dose – 4 units or 10% of basal (40 x 10% = 4 units).
- ▶ When is largest meal (most carbs)?

*Cheapest



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Cost Per Vial in Northern CA

Per vial cost	Walmart	Walgreens	Costco
Regular Insulin	\$25*	\$92	\$99
NPH	\$25*	\$92	\$99
70/30	\$25*	\$92	\$101
Humalog	\$200	\$220	\$178
Novolog	\$197	\$217	\$178
Apidra	\$180	\$246	\$178
Levemir	\$300	\$300	\$300
Lantus	\$226	\$221	\$206



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Food diary – Finding Biggest Meal

- ▶ Breakfast
 - ▶ Bowl of oatmeal with walnuts, banana, coffee
- ▶ Lunch
 - ▶ Sandwich and piece of fruit
 - ▶ A few cookies around 3pm
- ▶ Dinner
 - ▶ Big salad, BBQ meat, dinner roll, glass of wine
- ▶ Late night snacking
 - ▶ Peanut butter on celery, nuts, cheese



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Pt on Metformin, Lantus 40
Type 2, 90kg – A1c 9.6%

	Break	Lunch	Dinner	HS
Wk 1	130s 4u R	190	160	180 40uLan
Wk 2	120s 5u R	170	150	170 40uLan
Wk 3	100s 6 uR	150	150	170s 40uLan
Wk 4	80s 7uR	130s	140s	160s 35u Lan



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Intensive Diabetes Therapy Insulin Dosing Strategy

50/50 Rule

▶ 0.5-1.0 units/kg day
(.5 units/kg most common)

- ▶ Basal = 50% of total
 - Glargine Q day
 - NPH or Detemir BID

- Bolus = 50% of total
 - usually divided into 3 meals

Example

▶ Wt 90kg x 0.5 = 45 units of insulin/day

- ▶ Basal dose: 23 units
 - Glargine 23 units Q day
 - NPH/Detemir 12u BID

- ▶ Bolus dose: 22 units
 - ▶ 7 units NovoLog, Apidra, Reg, Humalog each meal



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Pt on Metformin, Lantus 40
Type 2, 90kg – A1c 7.6%

	Break	Lunch	Dinner	HS
Wk 1	130s 7u R	130 4uR	130	160 25uLan
Wk 2	120s 7u R	120 4uR	130	150 25uLan
Wk 3	100s 7 uR	110 4uR	120s	140s 25uLan
Wk 4	100s 7uR	110 4uR	120s	140s 25u Lan



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Intensive Diabetes Therapy Insulin Dosing Strategy

50/50 Rule

- ▶ 0.3-1.0 units/kg day
(.5 units/kg most common)

- ▶ Basal = 50% of total
 - Glargine Q day
 - NPH or Detemir BID

- Bolus = 50% of total
 - usually divided into 3 meals

Example – You Try

- ▶ Wt 80 kg x 0.5 = ____ units of insulin/day

- ▶ Basal dose: ____ units
 - Glargine ____ units QD
 - NPH/Detemir ____ BID

- ▶ Bolus dose: ____ units
____ units NovoLog, Apidra
Humalog each meal



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Poll Question - 4

- ▶ What is the bolus dose each meal?
 - a. 5 units
 - b. 8 units
 - c. 6-7 units
 - d. Not sure



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Nancy - 78 yr old on 4 injections a day

- ▶ A1c 9.3%, BMI 24 – Wt 70kg
- ▶ BG levels consistently above 200
- ▶ Checks BG 3-4 xs a day, keeps log.
- ▶ Pt starting to have dementia, husband primary care giver
- ▶ Insulin dose:
 - ▶ 5 units Apidra at each meal
 - ▶ 6 units Lantus at bedtime



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Based on Body Wt of 70 kg

- ▶ Calculate insulin needs
 - ▶ $70 \times 0.5 = 35$ units a day
 - ▶ $\frac{1}{2}$ Basal = 18 units
 - ▶ $\frac{1}{2}$ bolus = 17 / 3 meals – 6 break 6 lunch 5 dinner
- ▶ Other issues
 - ▶ In am, pt injects insulin at 6am and eats at 8am
 - ▶ Rest of day, pt takes insulin after meals
 - ▶ Husband needs to assist with all BG checks, logs and insulin administration
 - ▶ Husband tells you, BG is often above 200 and I don't know how to adjust insulin. MD just says to increase.



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Assessment



- ▶ Given situation, is this a realistic plan or is it too intensive?
- ▶ Keep things safe and don't make too many changes at once.
- ▶ Pt's husband needs framework to adjust insulin based on BG levels.
- ▶ When leaving, husband mentions that the Apidra and Lantus are very expensive. They are having difficulty affording it.
- ▶ Husband is getting tired.



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Plan

- ▶ What A1c and BG targets are realistic?
 - ▶ A1c < 8% (now 9.3%).. Want to drop BG by 40 points
 - ▶ BG premeal 100-140, post meal <180
- ▶ Keep checking BG 3-4 times a day
- ▶ Give Apidra 5 units plus supplemental scale BEFORE each meal
- ▶ TIE – Test, Inject and Eat within 5 mins of injecting insulin
- ▶ Continue 6 units Lantus at night
- ▶ Call with glucose results in one week



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Apidra Scale

Apidra
 5 units before each meal
 Eat within 5 minutes of injection
 Add additional apidra if blood
 sugar more than 150 - see scale below

Blood Sugar	Add Insulin Apidra
less than 70	No insulin. Eat sugary food
70 - 150	No added insulin
150 - 200	Add 1 unit
201 - 250	Add 2 units
251 - 300	Add 3 units
301 - 350	Add 4 units
350 - 400	Add 5 units
400 +	Add 6 units
500 +	7 units -
	60 to ER or call Doctor



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After One Week

Blood Sugar Log

Date	Goal: <input type="checkbox"/> Breakfast	Goal: <input type="checkbox"/> Afternoon	Goal: <input type="checkbox"/> Dinner	Goal: <input type="checkbox"/> Bedtime
2/17		260 5u		
2/18	219 7u	241 6u	257 (8)	
2/19	166 6u	355 10	155 (6)	141
2/20	257 (8)	425 (11)	290 (8)	220
2/21	289 (8)	220 (7)	325 (9)	131
2/22	239 (7)	254 (8)	290 (8)	220
2/23	243 (8)	203 (7)	187 (6)	140
2/24	247 (7)	198 (6)		

Lantus



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Poll question 5

What best describes 70/30 insulin?

- A. 70 percent bolus, 30 percent basal
- ▶ B. 70 percent analog, 30 percent bolus
- ▶ C. 70 percent basal, 30 percent aerosolized
- ▶ D. 70 percent basal, 30 percent bolus
- ▶ E. Not sure



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Combo Sub-Q Insulin

Insulin Type	Onset	Peak
Humalog Mix 75/25: 75% NPL, 25% lispro 50/50: 50% NPL, 50% lispro	0.25 - 0.5 hr	0.5-6.5 hrs
NovoLog Mix 70/30: 70% NPA, 30% aspart	0.25 - 0.5 hr	1 - 4 hrs
NPH + Reg Combo 70/30: 70%N /30%R 50/50: 50%N /50%R	0.5 - 1.0 hr	2 - 16 hrs

Considerations:

- Pre-mixed, difficult to fine tune therapy



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Recommendations

- ▶ Increase Apidra to 6 units at breakfast and lunch.
- ▶ Increase Lantus to 8 units at hs
- ▶ Check back in one week
- ▶ Consider changing to 70/30 insulin
- ▶ Calculating 70/30
 - ▶ Add up TOTAL insulin she takes a day ~ 30 units
 - ▶ Compare to weight calculation $70 \times 0.5 = 35$ units/day
 - ▶ Start conservative – 30 units
 - ▶ 2/3 am 20 units (14 basal + 6 bolus)
 - ▶ 1/3 before dinner 10 units (7 basal +3 bolus)
 - ▶ Gradually increase to get to target



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Type 1 for 30 Years – On injections Lantus and Humalog (6 x's a day)



- ▶ Rob weighs 80kg.
- ▶ Insulin dosing
 - ▶ Lantus 22 units AM
 - ▶ Humalog
 - ▶ Before breakfast 9-14 units
 - 2 hrs post breakfast 2 more units (based on BG)
 - ▶ Lunch 2-4 units
 - ▶ Dinner 2-6 units
 - 2 hours after lunch, 2-4 more units (based on BG)
 - ▶ Bedtime 1-2 units if > 200
- 2. Not keeping any type of log
- 3. Not counting carbs – just ballparking
- 4. A1c 6.7 – no Endo



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Type 1 for 30 Years – 80kg



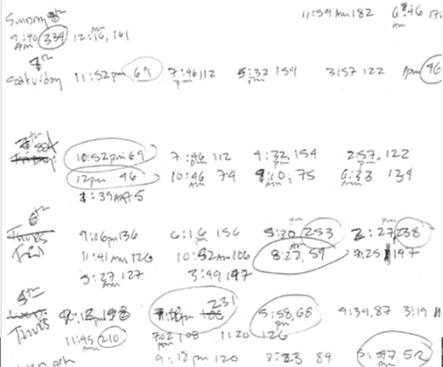
- ▶ Based on wt, dose of insulin?
- ▶ Total daily dose $-80 \times 0.5 = 40$ units/day
 - ▶ Basal dose 50% = 20 units a day
 - ▶ Bolus dose 50% = 20 units/3 meals = 7 + 6 + 6
- ▶ Current dose (total = 26) Adjusted
 - ▶ 12 breakfast + 2 = 14 10 units
 - ▶ 4 lunch 4 units
 - ▶ 4 dinner + 2 = 6 4 units

1. Stacking issue – hypo before lunch, after dinner
3. Adjusts insulin down if active at work
4. Starts to feel hypo around 60-70
5. Doesn't always have snacks



Rob – Keep BG log for 1 week

Day before appt, wife got results off of meter and wrote them down. Wife also circled numbers she was concerned about.



Plan



- ▶ Keep detailed log for one wk, include insulin dose and carbs eaten
- ▶ Decrease Lantus to 18 units in am
- ▶ Try not to stack novolog (take extra after meal)
- ▶ Try to carb count
 - ▶ Breakfast - 1 unit for every 10gm
 - ▶ Lunch – 1 unit for every 15 gms
- ▶ When BG < 70, don't wait – treat



Bolus Basics



- ▶ Carbohydrate/ Prandial Coverage
 - ▶ Match the insulin to the carbohydrates
 - ▶ 1 unit for 10 - 15 gms - Common starting point
- ▶ Correction Bolus - targets hyperglycemia
 - ▶ 1 unit for every 30-50 points over target

- ▶ Adjust ratios depending on sensitivity and response



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Adjusting Bolus and Correction Doses Carbohydrate-to-Insulin Ratio

Based on three questions before meals:



1. How much carbohydrate am I going to eat?
2. What is my insulin dose for this amount of carbohydrate?
3. Should I lower the dose because I plan to be very active or have recently been active?



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Poll question 6

- ▶ If Robs BG is 68 before eating, what is the best insulin adjustment strategy?
- ▶ A. Take bolus insulin ½ hour after eating
- ▶ B. Reduce usual bolus insulin dose by 1 unit
- ▶ C. Eat 30 gms of carb, then eat meal
- ▶ D. Decrease pm basal



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Next Steps

- ▶ Put alarm on phone to eat snack at 9am.
- ▶ If drinking, 15gms carb for every drink. May need to decrease insulin coverage (be conservative)
- ▶ Consider insulin pump and downloading glucose results
- ▶ When BG above 130 premeal, add correction based on 1700 rule – 1 unit for every 45
- ▶ Return visit in 3-6 months



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More detailed Insulin Plan – 80kg



Carb ratio:

- ▶ 1 unit for every 10 gms at breakfast
- ▶ 1 unit for every 15gm at lunch and dinner

Insulin Sensitivity Calculation:

- ▶ 1700 Rule
 - ▶ $1700 / \text{Total Daily Dose} = \text{insulin sensitivity}$
 - ▶ $1700 / 40 = 43$
 - ▶ 1 unit drops BG 45 points – “Correction”
- ▶ Carb coverage plus correction = total dose



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Correction Bolus for Rob

Analog Insulin (1 unit:45 mg/dl>130)

Less than 70 mg/dl	Subtract 1 unit
70-130 mg/dl	0 units
130-175 mg/dl	1 unit
176-220 mg/dl	2 units
221-265 mg/dl	3 units
266-310 mg/dl	4 units
311-356 mg/dl	5 units



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Adjusting Robs Bolus Insulin With Ratios

Rob plans to eat 70 gms of carbohydrate, BG before breakfast 165.

Carb coverage: $70\text{gms} / 10 = 7$ units insulin

Correction Scale - $165 - 130 = 35$ over target – 1 unit

- 7 units bolus insulin to cover carbs in meal
- 1 units bolus insulin to correct to target

Total adjusted dose: 8 units humalog insulin



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Adjusting Robs Bolus Insulin With Ratios - You Try

BG before breakfast 175, plans to eat 80 gms of carbohydrate.

____ - 130 = ____ over target, ____ / 45 = ____ units

____ gms / ____ = ____ units ins for carbs

- ____ units insulin to correct for hyperglycemia
- ____ units insulin to cover carbs in meal

Total adjusted dose: ____ units humalog insulin



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Adjusting Robs Bolus Insulin With Ratios - Answers

BG before breakfast 175, plans to eat 80 gms of carbohydrate.

$175 - 130 = 45$ over target, $45 / 45 = 1$ units

80 gms / $10 = 8$ units for carbs

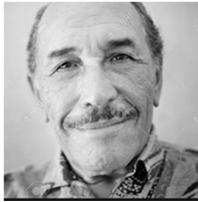
- 1 units insulin to correct hyperglycemia
- 8 units insulin to cover carbs in meal

Total adjusted dose: 9 units humalog insulin



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Based on Mr R's clinical picture – In hospital
How Much Insulin Needed?



- ▶ Creatinine 1.6
- ▶ 76 years old
- ▶ Not very hungry
- ▶ BMI 21
- ▶ Weighs 80kg
- ▶ Glucotrol 5mg at home
- ▶ A1c 7.2%



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Calculate Daily Insulin Needs



▶ Based on unique characteristics of pt, where would you start?

- ▶ Body wt in Kg x _____ = total daily dose
- ▶ May need more or less based on clinical presentation

←—————→
Less 0.3 u/kg 0.5u/kg More 1.0 u/kg

Thin, elderly, ↑ creat Heavy, infection, steroids



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Calculate Insulin Needs Basal/ insulin carb/ correct



- ▶ Body wt in Kg x 0.3
- ▶ 80kg x 0.3 = 24 units daily

- ▶ Basal = 12 units
- ▶ Bolus = 12 units / 3 meals = 4 units each meal
- ▶ What if he is nauseated?



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More than 200 units a day?

Medscape



Source: Am J Health-Syst Pharm © 2010 American Society of Health-System Pharmacists

Consider u-500

- ▶ Consider U-500 (5 x's more potent)
 - ▶ 1 unit on U-100 syringe = 5 units insulin
 - ▶ Dosing – take total daily needs and split into two doses
 - ▶ 60% am / 40% pm
 - ▶ 500 units per mL – 20 units a vial = 10,000 units per vial
 - ▶ Costs ~ \$400 per vial
 - ▶ No basal insulin needed, because U-500 has bolus and basal action
 - ▶ Needs careful monitoring/ education

U-500 Insulin: When More With Less Yields Success: *Diabetes Spectrum* March 20, 2009 vol. 22 no. 2 116-122

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U-500 Dose

U-100 syringe
and TB Syringe

If this is your dose of Humulin R U-500	Fill a U-100 insulin syringe up to this marking	Fill a tuberculin syringe up to this marking
25	5	0.05
50	10	0.1
75	15	0.15
100	20	0.2
125	25	0.25
150	30	0.3
175	35	0.35
200	40	0.4
225	45	0.45
250	50	0.5
275	55	0.55
300	60	0.6
325	65	0.65
350	70	0.7
375	75	0.75
400	80	0.8
425	85	0.85
450	90	0.9
475	95	0.95
500	100	1.0

Convert Pt from u-100 to u-500

- ▶ Pt currently on a total dose of 250 units a day
 - ▶ $250 / 5 = 50$ units a day
 - ▶ 2/3 in am = 30 units u500
 - ▶ 1/3 in pm = 20 units u500
- ▶ Pt currently on a total dose of 300 units a day
 - ▶ $300 / 5 =$
 - ▶ 2/3 in am =
 - ▶ 1/3 in pm =



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Poll question 7

- ▶ Pt on 300 units of u-100 insulin a day. Which is an accurate conversion to u-500.
- ▶ A. Take 50 units daily
- ▶ B. Take 30 units daily
- ▶ C. Take 36 units am and pm
- ▶ D. Take 36 units am and 24 units pm



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Thank You



- ▶ Questions?
- ▶ Email bev@diabetesed.net
- ▶ Web www.diabetesed.net



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