



**Welcome to Diabetes
MiniSeries – Class 3**

Beverly Dyck Thomassian, RN, MPH, BC-ADM, CDE
President, Diabetes Education Services

© Copyright 1999-2014, Diabetes Education Services, All Rights Reserved. 

Diabetes MiniSeries – Class 3

- ▶ Using basal/bolus insulin therapy to improve glucose control from hospital to home
- ▶ Incorporating national guidelines into practice
- ▶ Glucose patterns and adjustment strategies

Glucose Management and Hospitalized Patients



▶ In hospitalized patients with critical illness, hyperglycemia is a signal that warrants our attention.

Hospitals and Hyperglycemia – What’s the Big Deal?

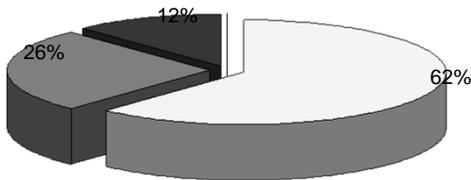
- ▶ Hyperglycemia is associated with increased morbidity and mortality in hospital settings.
- ▶ Acute Myocardial Infarction
- ▶ Stroke
- ▶ Cardiac Surgery
- ▶ Infection
- ▶ Longer lengths of stay



Diabetes Education SERVICES

Hyperglycemia*: A Common Comorbidity in Medical-Surgical Patients in a Community Hospital

Umipierrez G et al. J Clin Endocrinol Metabol 87:978, 2002

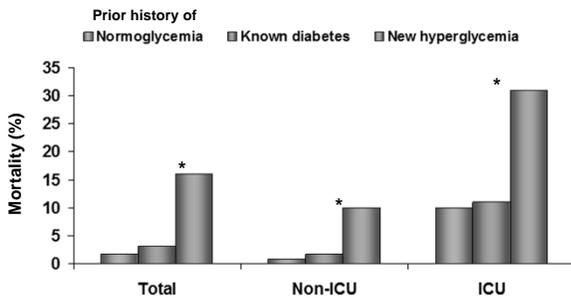


- Normoglycemia
 - Known Diabetes
 - New Hyperglycemia
- n = 2,020
- * Hyperglycemia: Fasting BG \geq 126 mg/dl or Random BG \geq 200 mg/dl X 2



Diabetes Education SERVICES

Effect of Hyperglycemia on Hospital Mortality



*P<.01 compared with normoglycemia and known diabetes.
Umipierrez GE et al. J Clin Endocrinol Metab. 2002;87:978-982.



Diabetes Education SERVICES

BG Above Normal = Trouble

▶ Pre Diabetes

- ▶ Fasting Glucose = 100-125mg/dl
- ▶ A1c 5.7 – 6.4%

▶ Diabetes

- ▶ Fasting Glucose = 126 mg/dl +
- ▶ Random Glucose = 200 mg/dl +
- ▶ A1c 6.5% +



- ▶ Any blood glucose above 140 requires treatment

Umpierrez et al



Diabetes Education SERVICES

WHAT SHOULD WE AIM FOR?

Critically Ill pts

- BG > 180- Start insulin
- BG goal 140-180



Non Critically Ill patients BG Goals

- Premeal <140
- Post meal <180
- Insulin therapy preferred treatment

Consensus: Inpt Hyperglycemia, Endocr Pract. 2009;15 (No.4)



Diabetes Education SERVICES

Management of Hyperglycemia and Diabetes

- ▶ Stop oral agents (ie) metformin & sulfonylurea on admission
- ▶ “The sole use of Sliding Scale insulin is discouraged” – ADA 2014
- ▶ For discharge, oral meds can be resumed

Start Basal/bolus therapy

- ▶ NPH and Regular insulin
- ▶ Long-acting and rapid-acting insulin
- ▶ Premixed insulin



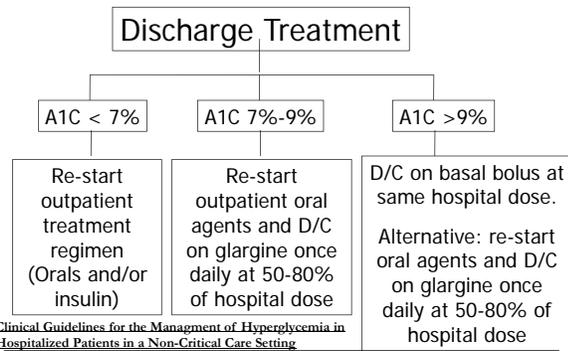
Diabetes Education SERVICES

**In Patient Strategies – Start Early,
Focus on Survival Skills**



Diabetes Education SERVICES

Discharge insulin Algorithm



Clinical Guidelines for the Management of Hyperglycemia in Hospitalized Patients in a Non-Critical Care Setting



Diabetes Education SERVICES

Now What?

▶ Nurse had an emergency and pt already ate lunch?

▶ Nurse administered insulin and pt only ate a few bites of turkey and drank non sugar tea?



▶ You just gave 3 units of Aspart and patient needs to go to OR NOW!

Discharge Teaching



- ▶ What supplies will she need?
- ▶ What top 5 things do we need to teach her?
- ▶ What resources can we provide?
- ▶ What referrals?



Diabetes Education SERVICES

5 Survival Skills

1. Basics of Diabetes
 2. Can patient perform self blood glucose monitoring? Do they need meter?
 3. Can pt safely take meds / insulin? Teach side effects.
 4. Meal Planning?
 5. Self Care including hypo prevent/treat
- ▶ Follow-Up plan - Does pt know who to contact when need help?
 - ▶ Diabetes Ed, PCP, Home Health



Diabetes Education SERVICES

Bottom Line

- ▶ 30-40% of hospitalized patients have diabetes
 - ▶ 10% aren't officially diagnosed
- ▶ Cardiovascular disease is the leading cause of hospitalization for people with diabetes
- ▶ Look for patients with hyperglycemia and cardiometabolic risk factors: smokers, HTN, central obesity, abnormal lipids, Acanthosis.
- ▶ Provide education and promote self-advocacy



Diabetes Education SERVICES

Summary



- ▶ Hyperglycemia is a marker of metabolic dysregulation and deserves our attention.
- ▶ Glucose control improves outcomes.
- ▶ Insulin drips and basal bolus regimes are two strategies to improve glucose.
- ▶ Inpatient glucose control is cost effective.
- ▶ We can make a difference.



Diabetes Education SERVICES

Insulin Therapy From Ants to Analogs:

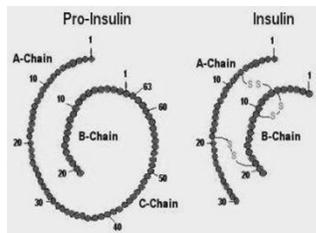


Diabetes Education SERVICES

Insulin – the Ultimate Hormone Replacement Therapy

Objectives:

- Discuss the actions of different insulins
- Describe using pattern management as an insulin adjustment tool.



Diabetes Education SERVICES

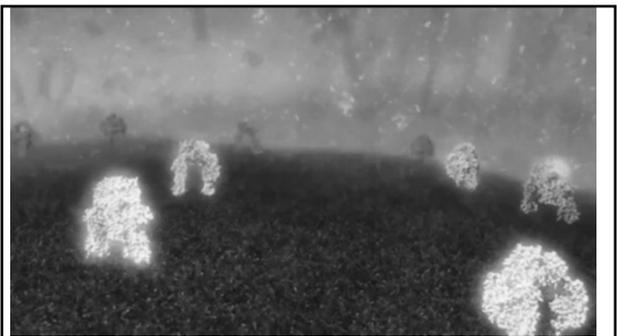
The Nobel Prize in Physiology or Medicine 1923



Frederick G. Banting

Born: 14 November 1891, Alliston, Canada
Died: 21 February 1941, Newfoundland, Canada
Affiliation at the time of the award: University of Toronto, Toronto, Canada
Prize motivation: "for the discovery of insulin"
Field: endocrinology, metabolism





Images shows insulin (blue) molecules binding with insulin receptors (yellow) Jan 2013

The international research team was led by scientists from the Walter and Eliza Hall Institute (WEHI) in Melbourne, with collaborators from La Trobe University, the University of Melbourne, Case Western Reserve University, the University of Chicago, the University of York and the Institute of Organic Chemistry and Biochemistry in Prague.



Psychological Insulin Resistance (PIR)

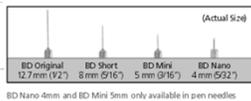


- ▶ 50% of providers in study threatened pts "with the needle".
- ▶ Less than 50% of providers realized insulins' positive effect on type 2 dm
- ▶ Most pts don't believe that insulin would "better help them manage their diabetes".
- ▶ Solutions: Find the root of PIR and address it, use more insulin pens

Diabetes Attitudes, Wishes, Needs Study - Rubin



Needle Size often a Barrier Size *Does* Matter

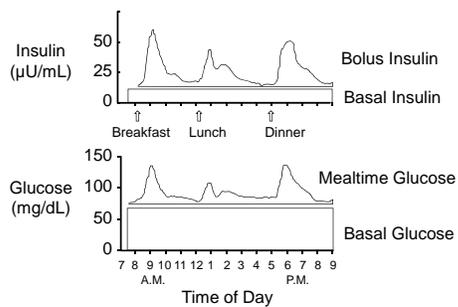


- ▶ Use more short needles – 4 mm
- ▶ Effective for pts with BMI of 24- 49
- ▶ Keeps it subq
- ▶ If pt thin, inject at angle
- ▶ To avoid leakage, count to 10 before withdrawing needle
- ▶ ½ the patients who could benefit from insulin are not using it due to needle phobias



Diabetes Education SERVICES

Physiologic Insulin Secretion: 24-Hour Profile



Diabetes Education SERVICES

Insulin Action Teams

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



Diabetes Education SERVICES

Cost Per Insulin 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



Diabetes Education SERVICES

Bolus Insulins (½ of total daily dose ÷ meals)

Name	Onset	Peak Action
▶ Lispro (Humalog)	15-30 min	1-1.5 hrs
▶ Aspart (NovoLog)		
▶ Glulisine (Apidra)		
▶ Regular	30 mins	2-4 hrs



Diabetes Education SERVICES

Bolus Insulin Summary

- ▶ Regular, Novolog, Humalog, Apidra,
- ▶ Starts working fast (15-30 mins)
- ▶ Gets out fast (3-6 hours)
- ▶ Post meal BG reflects effectiveness
- ▶ Should comprise about ½ total daily dose
- ▶ Covers food or hyperglycemia.
- ▶ 1 unit
 - ▶ Covers ≈ 10 -15 gms of carb
 - ▶ Lowers BG ≈ 30 – 50 points



Diabetes Education SERVICES

Bolus Insulin Timing

- ▶ How is the effectiveness of bolus insulin determined?
 - ▶ 2 hour post meal (if you can get it)
 - ▶ Before next meal blood glucose
- ▶ Glucose goals (ADA) – may be modified by provider/pt
 - ▶ 1-2 hours post meal <180
 - ▶ Before next meal – 70 - 130



Diabetes Education SERVICES

Bolus – Insulin Sliding Scale

Starts at 150, 2 units for every 50 mg/dl >150

	Break	Lunch	Dinner	HS
Day 1	94 no insulin	212 4 uR	148 no insulin	254 6 uR
Day 2	243 4uR	254 6 uR	201 4uR	199 no insulin
Day 3	189 2uR	243 4uR	162 2uR	244 4uR
Day 4	66 No insulin	287 6uR	144 none	272 6uR



Diabetes Education SERVICES

Basal Insulins

(½ of total daily dose)

Intermediate Acting Peak Action Duration

- ▶ NPH 4-12 hrs 12-24

Long Acting Peak Action Duration

- ▶ Detemir (Levemir) peakless 20 hrs
- ▶ Glargine (Lantus) No peak 24 hrs

Fasting BG reflects efficacy of basal



Diabetes Education SERVICES

Basal Insulin Summary

- ▶ NPH, Levemir, Lantus
- ▶ Covers in between meals, through night
- ▶ Starts working slow (4 hours)
- ▶ Stays in long (12-24 hours)
 - ▶ NPH/ Lente 12 hrs
 - ▶ Levemir, Lantus 20-24 hrs
- ▶ Fasting blood glucose reflects effectiveness



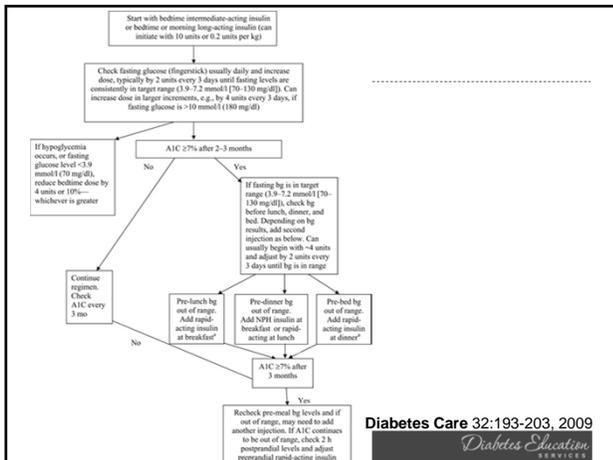
Diabetes Education SERVICES

Basal Only Type 2, 60kg – A1c 8.7%

	Break	Lunch	Dinner	HS
Mo 1	170s			298 10uLan
Mo 2	160s			233 20uLan
Mo 3	140s	283	265	206 30uLan



Diabetes Education SERVICES



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



10u 70/30 BID

Patterns? Changes needed?

	Break	Lunch	Dinner	HS
Day 1	102	63	92	181
Day 2	112	67	106	195
Day 3	98	56	112	201
Day 4	99	71	132	211



Pattern Management



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)



Type 2 – Amaryl 4mg AM, 10u Lantus pm

	Break	Lunch	Dinner	HS
Day 1	164	94	66	162
Day 2	169		59	195
Day 3		84	81	242
Day 4	159		43	211



Basal Bolus – What Adjustments?

Pt weighs 80kg

	Break	Lunch	Dinner	HS
Day 1	69 7H	79 5H	245 8H	190 22u Det
Day 2	81 7H	87 5H	170 8H	133 22u Det
Day 3	73 7H	94 5H	194 8H	110 22u Det
Day 4	62 7H	83 5H	211 8H	127 22u Det



Intensive Diabetes Therapy
Insulin Dosing Strategy

50/50 Rule

- ▶ 0.5-1.0 units/kg day
- ▶ Basal = 50% of total
 - Glargine QD
 - NPH or Detemir BID
- Bolus = 50% of total
 - usually divided into 3 meals

Example

- ▶ Wt 50kg x 0.5 = 25 units of insulin/day
- ▶ Basal dose: 13 units
 - Glargine 13 units QD
 - NPH/Detemir 6u BID
- ▶ Bolus dose: 12 units
 - ▶ 4 units NovoLog, Apidra Humalog, Regular each meal



Diabetes Education SERVICES

Intensive Diabetes Therapy
Insulin Dosing Strategy

50/50 Rule

- ▶ 0.5-1.0 units/kg day
- ▶ Basal = 50% of total
 - Glargine QD
 - NPH or Detemir BID
- Bolus = 50% of total
 - usually divided into 3 meals

Example – You Try

- ▶ Wt 60 kg x 0.5 = ____ units of insulin/day
- ▶ Basal dose: ____ units
 - Glargine ____ QD
 - NPH/Detemir ____ BID
- ▶ Bolus dose: ____ units
 - ____ units NovoLog, Apidra Humalog, Reg each meal



Diabetes Education SERVICES

Intensive Diabetes Therapy
Insulin Dosing Strategy

50/50 Rule

- ▶ 0.5-1.0 units/kg day
- ▶ Basal = 50% of total
 - Glargine QD
 - NPH or Detemir BID
- Bolus = 50% of total
 - usually divided into 3 meals

Example – You Try

- ▶ Wt 60kg x 0.5 = 30 units of insulin/day
- ▶ Basal dose: 15 units
 - Glargine 15 QD or
 - NPH/Detemir 7u BID
- ▶ Bolus dose: 15 units
 - ▶ 5 NovoLog, Apidra, Humalog, Reg each meal



Diabetes Education SERVICES

Basal Bolus – Using 50/50 Rule - Pt weighs 80kg

	Break	Lunch	Dinner	HS
Day 1	84 6H	89 7H	145 7H	190 20 u Det
Day 2	81 6H	97 7H	107 7H	133 20u Det
Day 3	79 6H	104 7H	124 7H	110 20u Det
Day 4	69 6H	103 7H	208 7H	193 20u Det



Diabetes Education SERVICES

Insulin Teaching Keys

- ▶ Bolus insulin with meals
- ▶ Basal 1-2xs daily
- ▶ Abdomen preferred injection site
- ▶ Stay 1" away from previous site
- ▶ Don't re-use ultra fine syringes
- ▶ Keep unopened insulin in refrigerator
- ▶ Toss opened insulin vial after 28 days
- ▶ Proper disposal
- ▶ Review patients ability to withdraw and inject.
- ▶ Side effects include hypoglycemia/wt gain
- ▶ Insulin pens –
 - ▶ Prime needle to assure accurate insulin dose given
 - ▶ Hold needle in for 5 seconds after injection
 - ▶ Roll 70/30 pens



Diabetes Education SERVICES

Sharps Disposal: Product and Info

- ▶ Look in the Government section white pages for a household hazardous waste listing for your city or county.
- ▶ Call 1-800-CLEANUP (1-800-253-2687)
- ▶ Search for collection centers on the California Integrated Waste Management Board (CIWMB) Web site:
<http://www.ciwmb.ca.gov/HHW/HealthCare/Collection/>



Diabetes Education SERVICES

DiaBingo - I

- I Injected hormone that is an analog of amylin
- I Glargine, Detemir, NPH are types of
- I Breakdown of glycogen into glucose
- I Anabolic hormone
- I Insulin is released when glucose levels are low
- I Once opened, insulin vials are good for one _____
- I Elevated post-prandial glucose indicate need for pre-meal
- I Epinephrine increases insulin resistance
- I Creation of glucose from amino acids and lactate
- I Decreasing renal function for people on insulin can cause
- I Bolus insulins
- I A hormone that increases blood glucose levels



Diabetes Education SERVICES

Thank You



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



Diabetes Education SERVICES
