Inpatient Glycemic Management 201

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Dr. Desemone has no financial disclosures nor conflicts of interest to declare

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Inpatient Glycemic Management 101

RECAP

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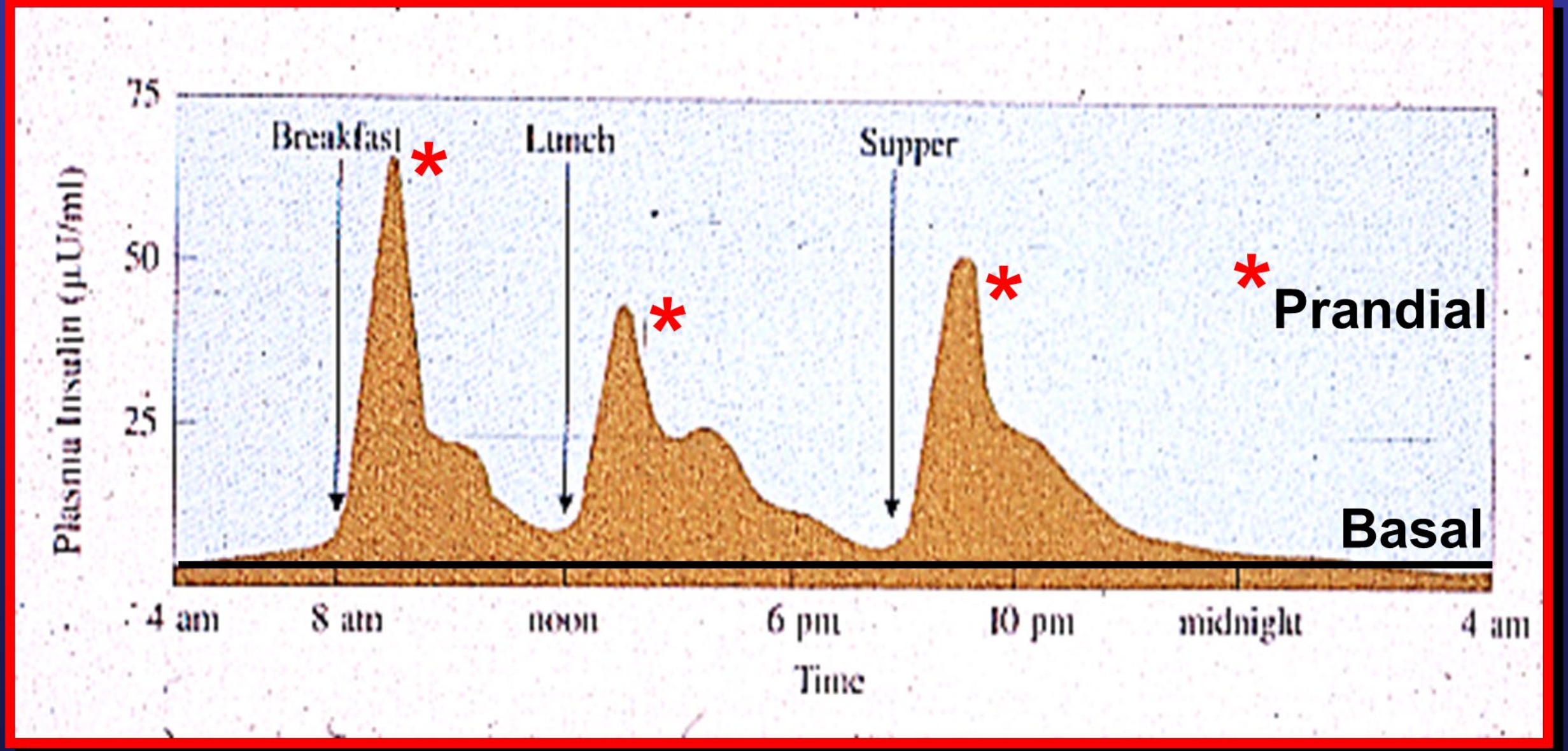
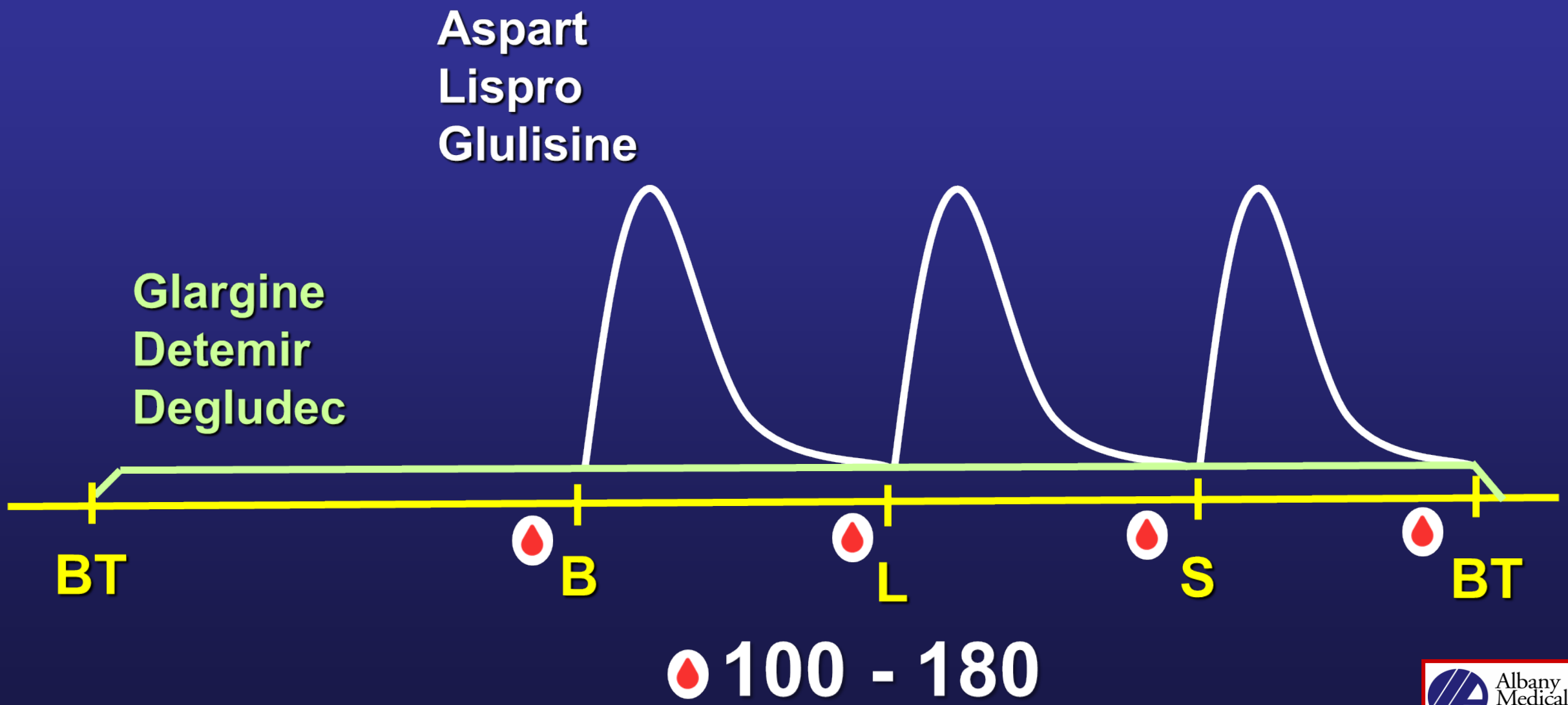
Insulin Levels in People without Diabetes



Basal-Bolus Therapy



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Inpatient Glycemic Management 101

What to Remember About Insulin Replacement

1. **Basal Estimate**
   - 1 unit per hour
     - lower for liver failure and renal failure
2. **Prandial Estimate**
   - 1:10 Insulin:CHO Ratio
3. **Target**
   - 100 – 180

Estimates and Target apply to all environments: ✓

Critical Care, Med-Surg, Ambulatory, Acute, and Chronic

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1. Basal Estimate
   - 1 unit per hour
     - lower for liver failure and renal failure
2. Prandial Estimate
   - 1:10 Insulin:CHO Ratio
3. Correction

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Learning Objectives

1. State the definition of the “insulin sensitivity” when correcting for hyperglycemia
2. Describe how to write an ideal rapid-acting insulin analog order
3. Describe the treatment and prevention of Severe Hypoglycemia
4. Describe how to convert from IV to SQ insulin replacement

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Correcting for Hyperglycemia

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64 yo ♂ Retired Accountant
s/p Motorcycle MVA
Type 2 Diabetes for 10 years
BMI 39
Glipizide, Metformin

21:00 Arrived @ ED

22:00 VBG 350

Scheduled for ORIF @ 0700

64 yo ♂ Retired Accountant

22:00

350

Dilemma:

- **BG too high to for the OR**
- **There are 9 hours to achieve an acceptable BG**
  - **What is the target?**

How to chose a dose of a rapid insulin analog?

ORIF **07:00**

150

64 yo ♂ Retired Accountant

22:00

350

Definition of Insulin Sensitivity:

The number of points 1 unit of insulin decreases the glucose

Estimate: 40

07:00 ORIF

150

64 yo ♂ Retired Accountant

22:00

Delta

200

÷

Sensitivity

40

= 5 units

350

150

07:00 ORIF

64 yo ♂ Retired Accountant

22:00

5 units lispro

350

Sensitivity

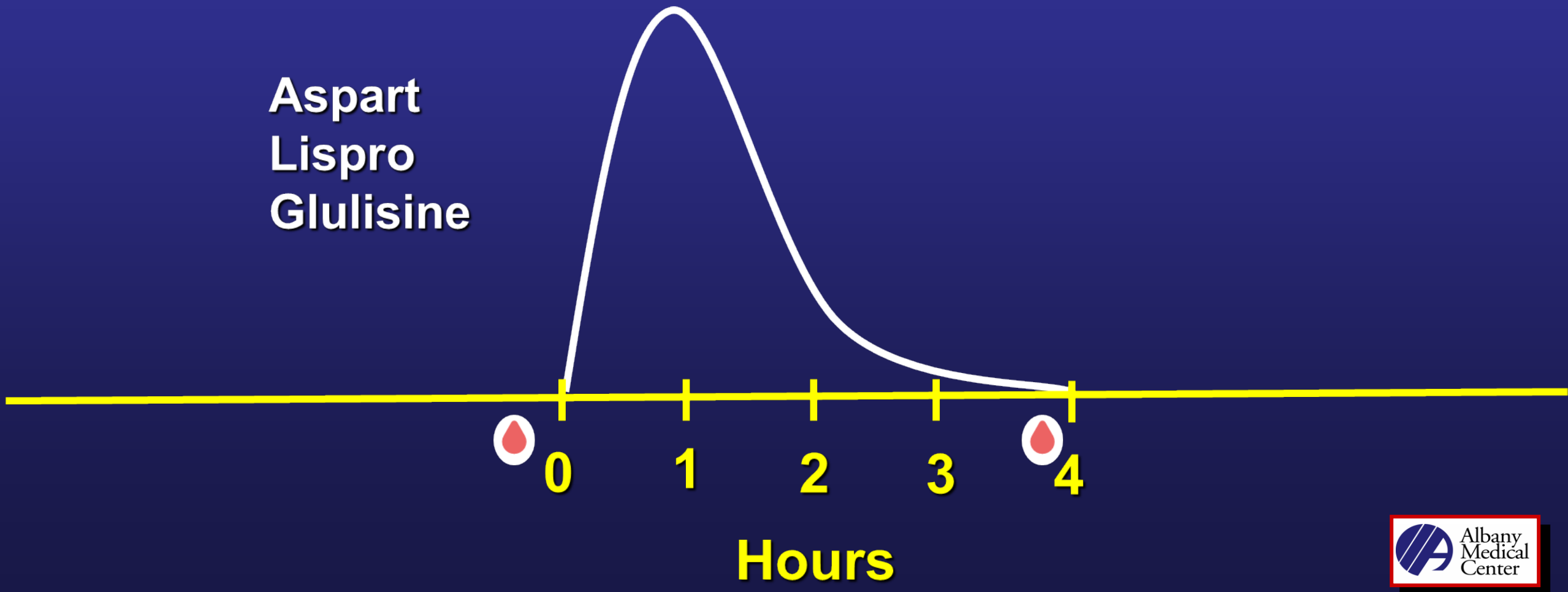
40

07:00

ORIF

150

Onset, Peak, and Duration of Rapid Insulin Analogs



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64 yo ♂ Retired Accountant

22:00 — 5 units lispro

350

Delta
50

300

02:00

Delta
150

5 units lispro

÷

x units lispro

Sensitivity
10

150

07:00 — ORIF

Sensitivity:
The number of points 1 unit of insulin decreases the glucose

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1. Basal Estimate
   - 1 unit per hour
     - lower for liver failure and renal failure
2. Prandial Estimate
   - 1:10 Insulin:CHO Ratio ÷4 ✓
3. Correction Estimate
   - Sensitivity: 1 unit lowers the BG by 40 points

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1. Basal Estimate
   - 1 unit per hour
     - lower for liver failure and renal failure
2. Prandial Estimate
   - 1:10 Insulin:CHO Ratio
3. Correction Estimate
   - Sensitivity: 1 unit lowers the BG by 40 points

✓

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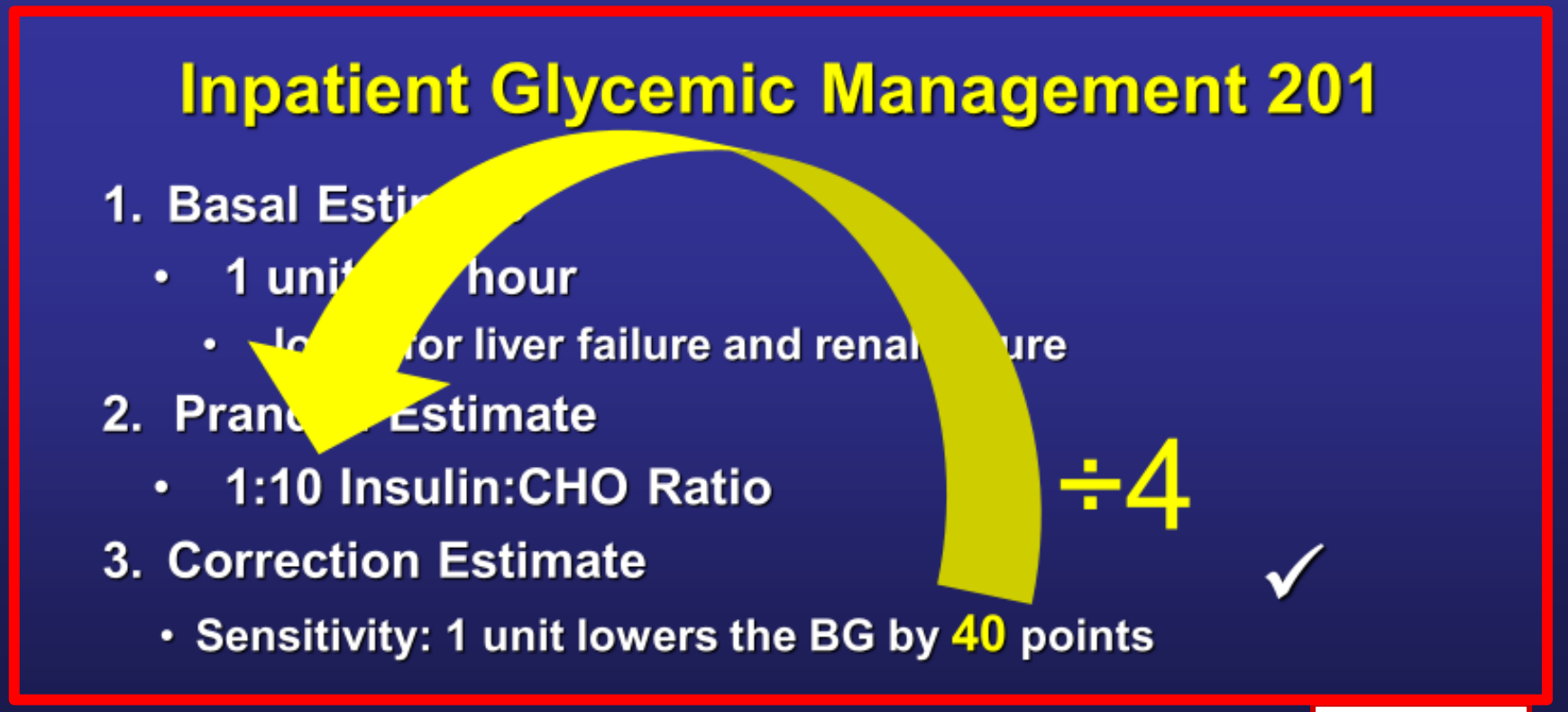
Changing from Sliding Scale to Basal-Bolus

Start from Scratch

(or 1800 rule)



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Changing from Sliding Scale to Basal-Bolus

1800 rule

1800 ÷ [TDD] = Sensitivity

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1. Basal Estimate
   - 1 unit per hour
     - lower for liver failure and renal failure
2. Prandial Estimate
   - 1:10 Insulin:CHO Ratio
3. Correction Estimate ✓
   - Sensitivity: 1 unit lowers the BG by 40 points

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Diabetes Management Caveats

Fingersticks are not very accurate

It's tough to inject insulin and insulin analogs

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Accuracy is ~20%

Most Accurate:

Fingertips

Toe tips

Ear lobes

FSBG falsely elevated when “Milking”

FSBG is falsely elevated in anemia

diathrive.com
Murray-Bachmann, *et al*, Journal of Clinical & Translational Endocrinology
25 (2021) Northwell – Lenox Hill


diathrive.com

Mealtime Rapid Insulin Analog Order

- INSULIN LISPRO 10 UNITS SUBCUTANEOUSLY **WITH** MEALS. BEST IF GIVEN WITH FIRST BITE OF MEAL, BUT MAY BE GIVEN UP TO 20 MINUTES AFTER THE FIRST BITE IF 50% OF THE MEAL IS EATEN. PLEASE HOLD IN PATIENT FOR 10 SECONDS.

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How to Inject Insulin and Analogs

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Hypoglycemia

"suffer the harm of a severe hypoglycemic event"

CMS Measure ID	CMS816v2
Short Name	HH-01
NQF Number	3503e

1. A blood glucose result less than 40 mg/dL

AND

2. A hypoglycemic medication administered within 24 hours prior to the start of the severe hypoglycemic event

When low blood sugar isn't treated and you need someone to help you recover, it is considered a severe event. diabetes.org accessed 2022-05-17

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Hypoglycemia

(from the perspective of people who live with diabetes)

1. Daily hypoglycemia is a prerequisite for achieving an acceptable A1c
2. The antidote is a treat!

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Transitioning from IV to SQ Insulin Replacement

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53 yo ♂ Medical Van Driver

Disability-Retired Secondary to Auto Accident 5 years ago

Ketosis-Prone DM1 for 23 years

- Hypoglycemic seizure while tilling vegetable garden
  - Glargine 27 hs
  - Aspart 1:12 I:CHO ratio
- Did not wake up with IV dextrose
- Admitted to Neuro ICU
- A1c 9.0%

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53 yo ♂ Medical Van Driver

Disability-Retired Secondary to Auto Accident 5 years ago

Ketosis-Prone DM1 for 23 years

- Fibresource HN @ 57 ml/hr
- On IV insulin @ 4 units/hr
  - Dedicated line

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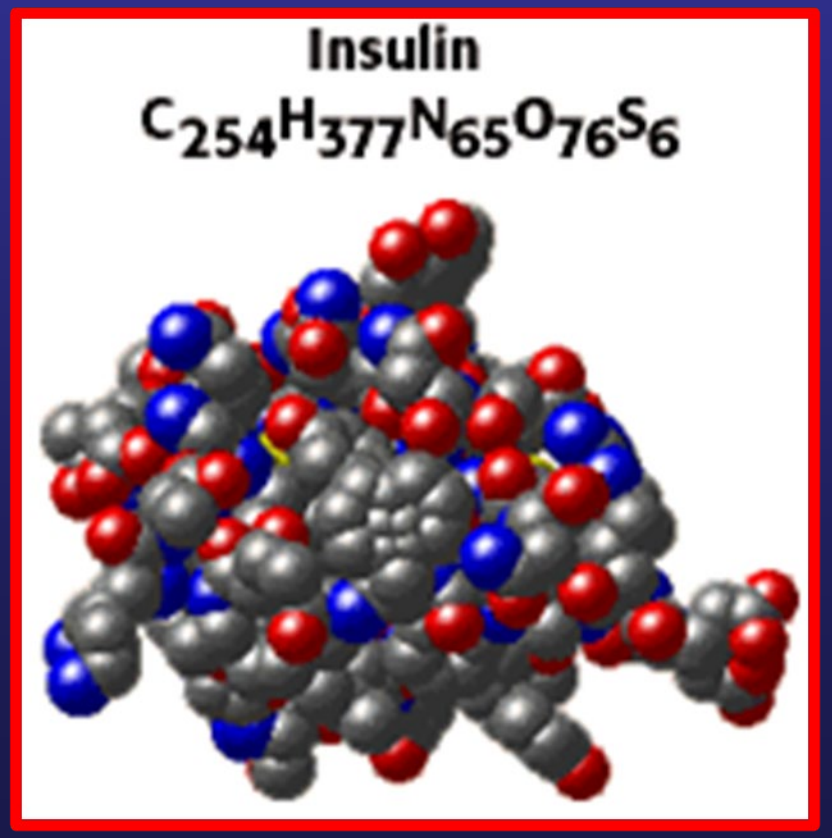
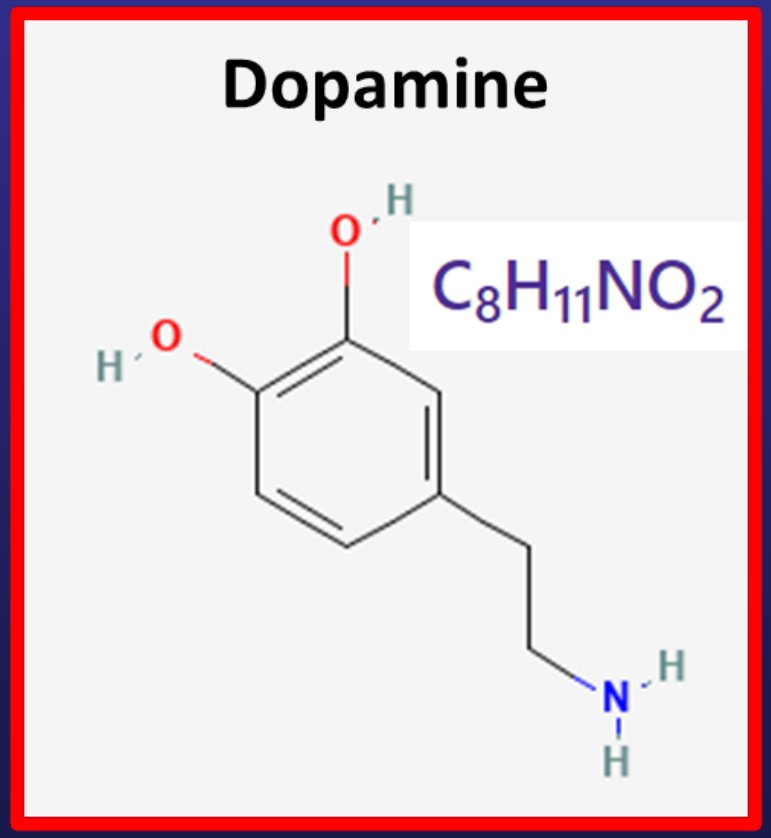
Infusing IV Insulin

Best with a Dedicated Line





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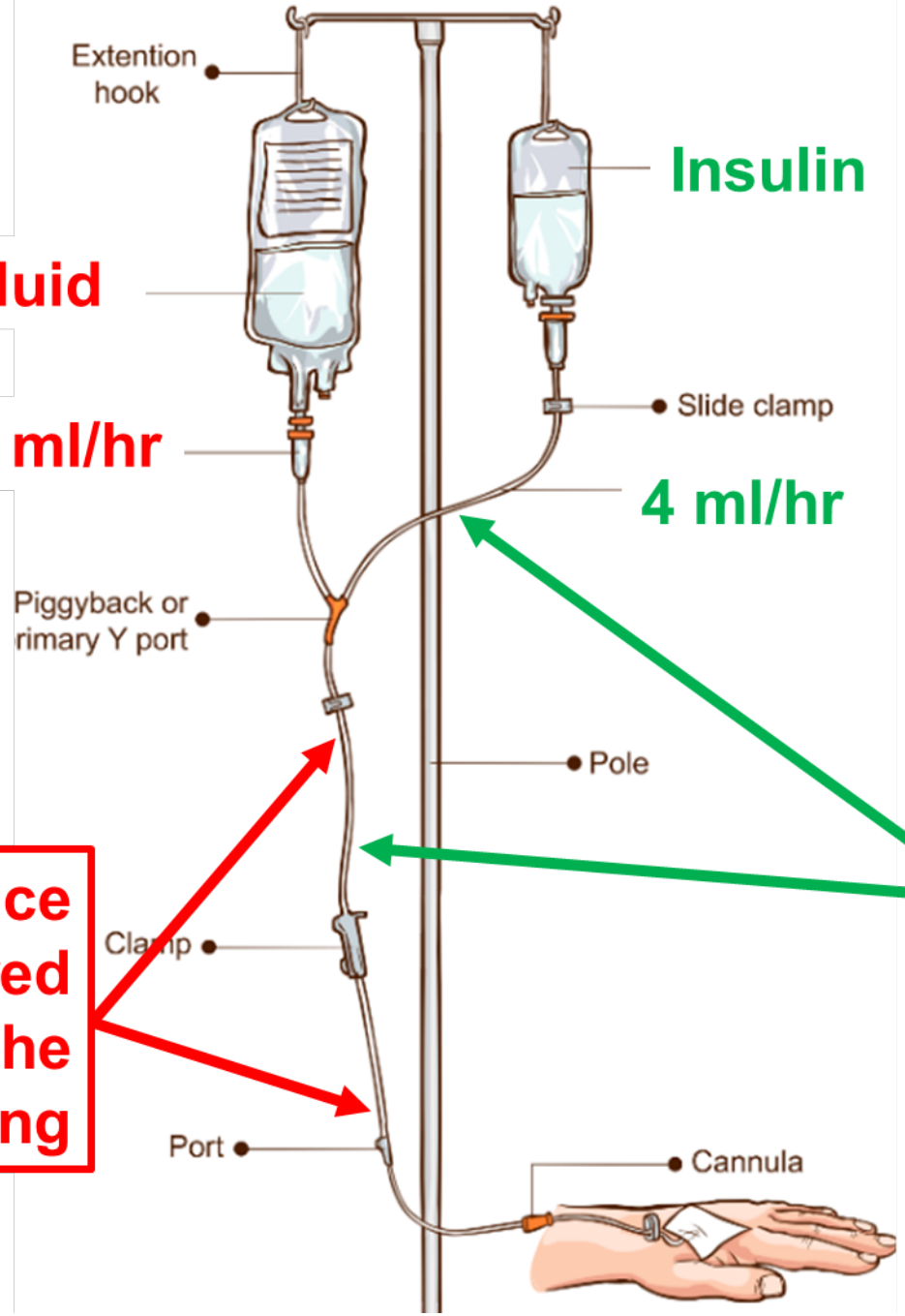

Rapid flow of maintenance fluid removes denatured insulin coating inside of the IV tubing

Inside of IV tubing coated with denatured insulin

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Converting IV Insulin to SQ Insulin

Dedicated Line!!!

(Total Daily Dose [TDD] of IV Insulin) x 0.8

=

Total Daily Dose of SQ Insulin

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IV to SQ Insulin Conversion

IV:

4 units per hour

24 hours per day

TDD of IV insulin = 96 units

x 0.8 = 77 units SQ

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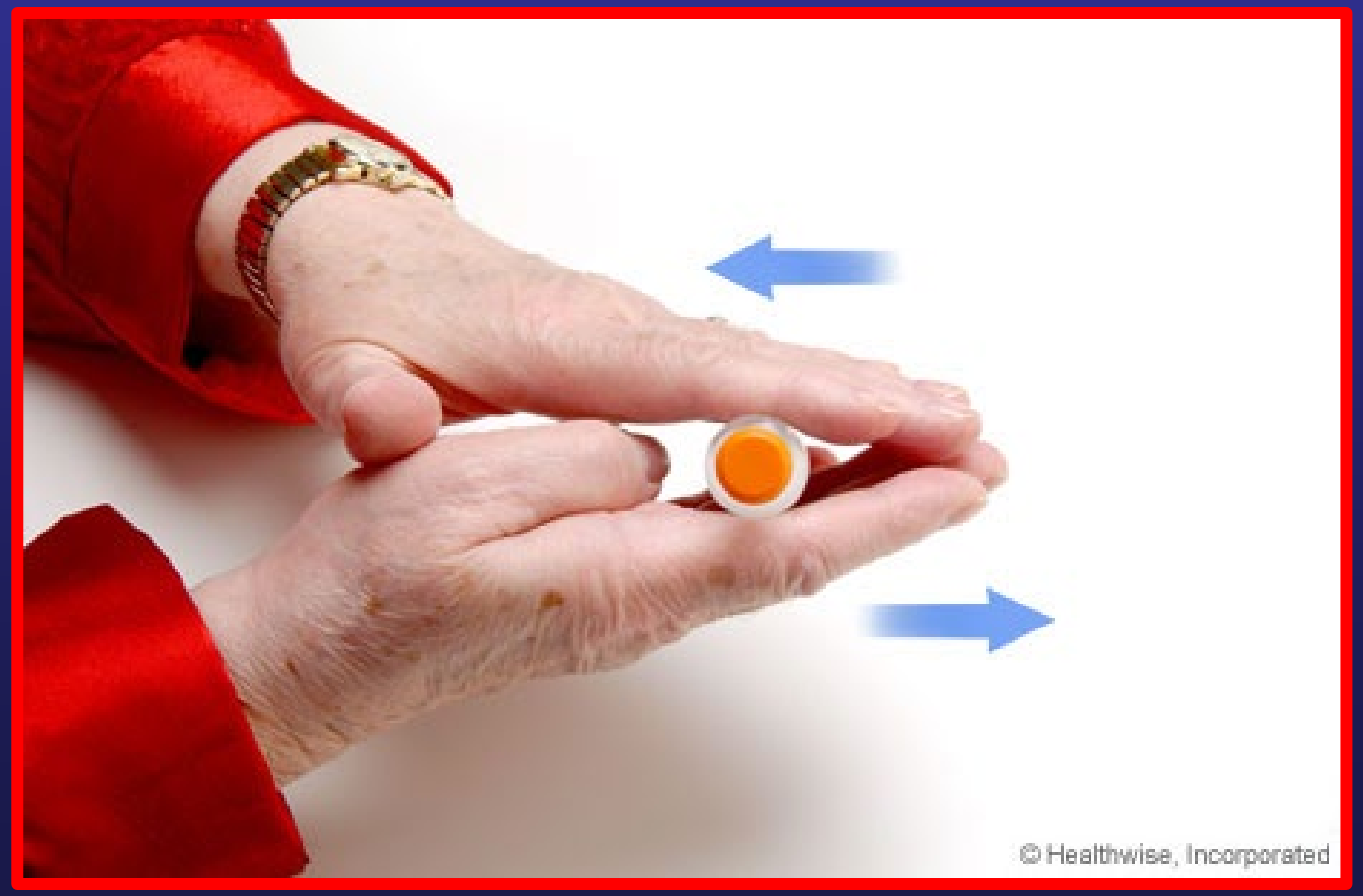
Choice of SQ Insulin Replacement for People on Constant Delivery of CHO (Parenteral or Enteral)



NPH

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Calculated Dose of SQ Insulin = 77

1. Round up from 77 to 80 units daily
2. NPH 40 units SQ Q12H
   - Tube Feeds: 09:00 and 21:00
   - TPN: 18:00 and 06:00
     - bags switched @ 18:00
3. Check FSBG Q6H
4. No sliding scale

What is the target BG?

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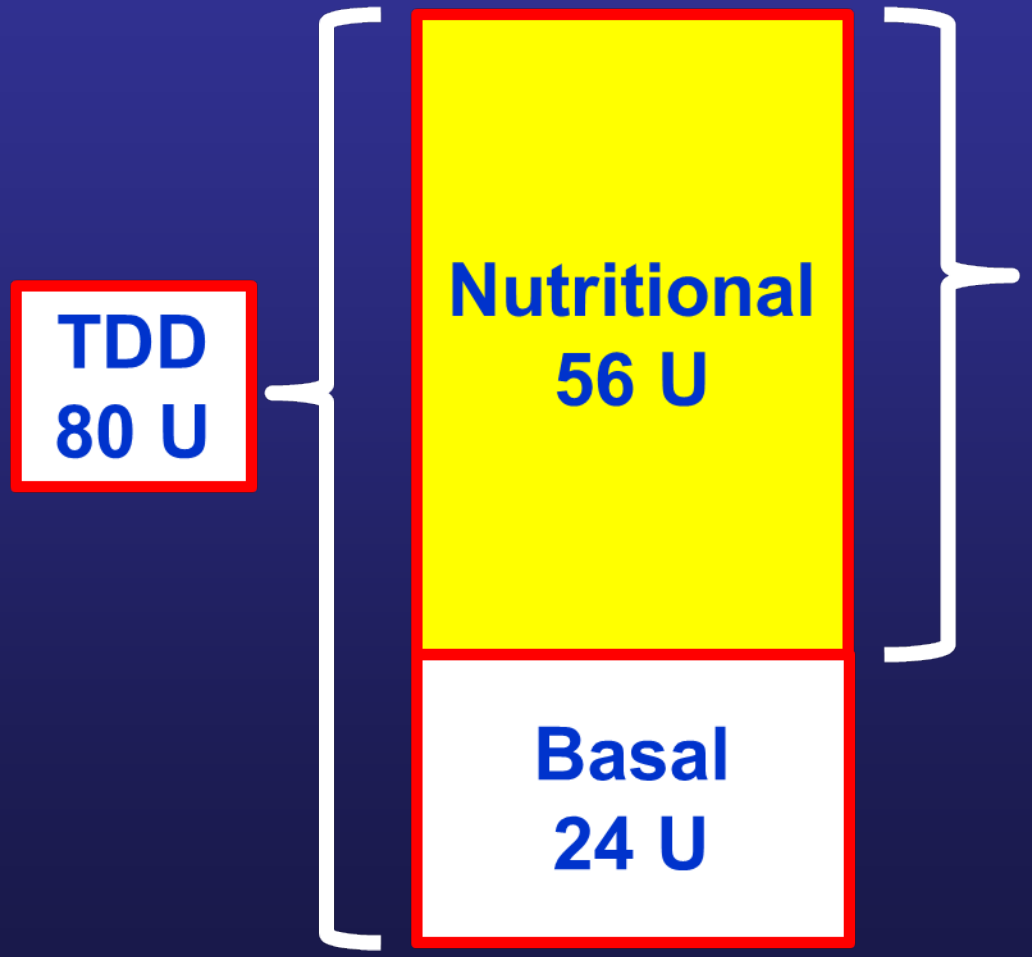
Calculating the I:CHO Ratio



Addresses the CHO in the Tube Feeds

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How Many Grams CHO in Daily Tube Feeds?

Product	Fibersource® HN	Osmolite® 1.2 Cal	Isosource® 1.5 Cal	Replete® Fiber
Description	Moderate Protein with Fiber	Moderate Protein, Fiber Free	Moderate Protein w Fiber, Concentrated	High Protein w Fiber
Kcal/mL	1.2	1.2	1.5	1.0
Protein (g / % of kcal)	54 / 18%	56 / 18.5%	68 / 19%	64 / 25%
Protein Sources	Soy Protein Isolate, Sodium Caseinate (Milk), Calcium Caseinate (Milk)	Sodium Caseinate, Calcium Caseinate	Sodium Caseinate (Milk), Soy Protein Isolate, Calcium Caseinate (Milk)	Soy Protein Isolate, Sodium Caseinate (Milk), Calcium Caseinate (Milk)
Total Carbohydrates (g / % of kcal)	164 / 52%	158 / 52.5%	176 / 45%	124 / 45%
Carb Sources	Glucose Syrup, Maltodextrin	Corn Maltodextrin	Glucose Syrup, Maltodextrin	Corn Syrup, Maltodextrin
Total Fat (g / % of kcal)	40 / 30%	39 / 29%	59 / 36%	34 / 30%
Fat Sources	Canola Oil, Medium Chain Triglycerides	High Oleic Safflower Oil, Canola Oil, Medium-Chain Triglycerides	Canola Oil, Medium Chain Triglycerides	Canola Oil, Medium Chain Triglycerides
Osmolality (mOsm/kg water)	480	360	650	330
Dietary Fiber (g)	15	---	15	12
Fiber Sources	Pea Fiber, FOS,	---	Pea Fiber, FOS,	Pea Fiber, FOS,

How Many Grams CHO in Daily Tube Feeds?

- **Fibresource HN**

  164 gm CHO per liter

  57 ml/hr = 1.37 liter/day

  = 224 gm CHO per day

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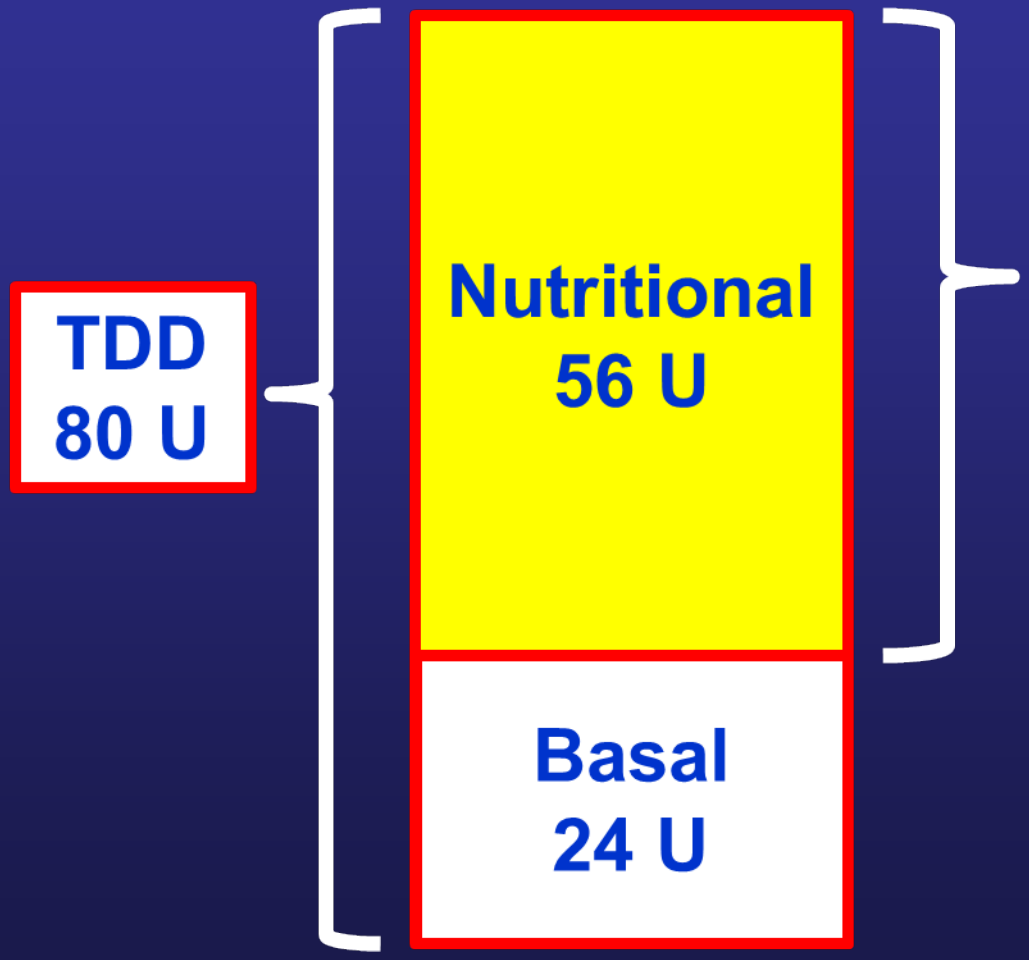
Calculating the I:CHO Ratio



Addresses the CHO in the Tube Feeds

56 U Nutritional Insulin per day
224 gm CHO per day

I:CHO = 1:4

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53 yo ♂ Medical Van Driver

Disability-Retired Secondary to Auto Accident 5 years ago

Ketosis-Prone DM1 for 23 years

- Hypoglycemic seizure while tilling vegetable garden
  - Glargine 27 hs
  - Aspart 1:12 I:CHO ratio
- Did not wake up with IV dextrose
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Now:
I:CHO = 1:4

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If the Blood Glucose is not 100 – 180 the I:CHO ratio must be adjusted

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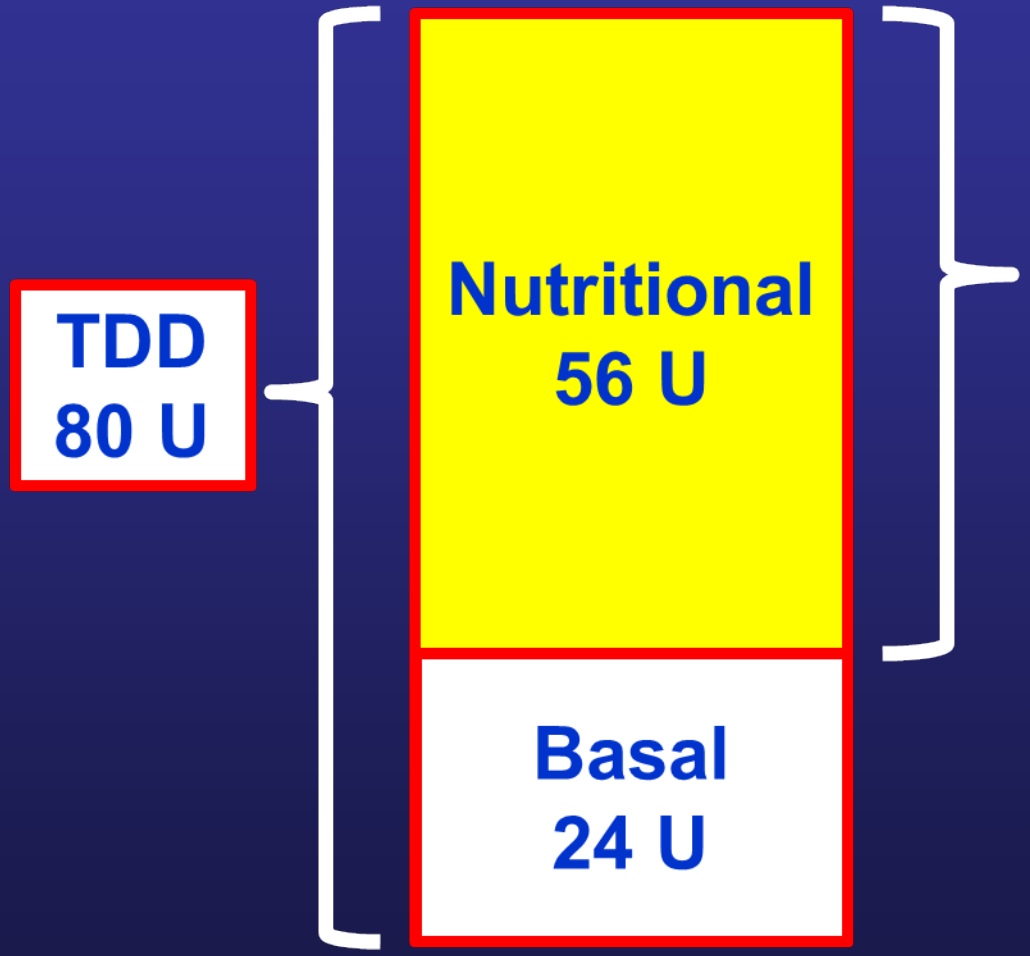
Adjusting the I:CHO Ratio



Addresses the CHO in the Tube Feeds

56 U Nutritional Insulin per day
224 gm CHO per day

I:CHO = 1:4

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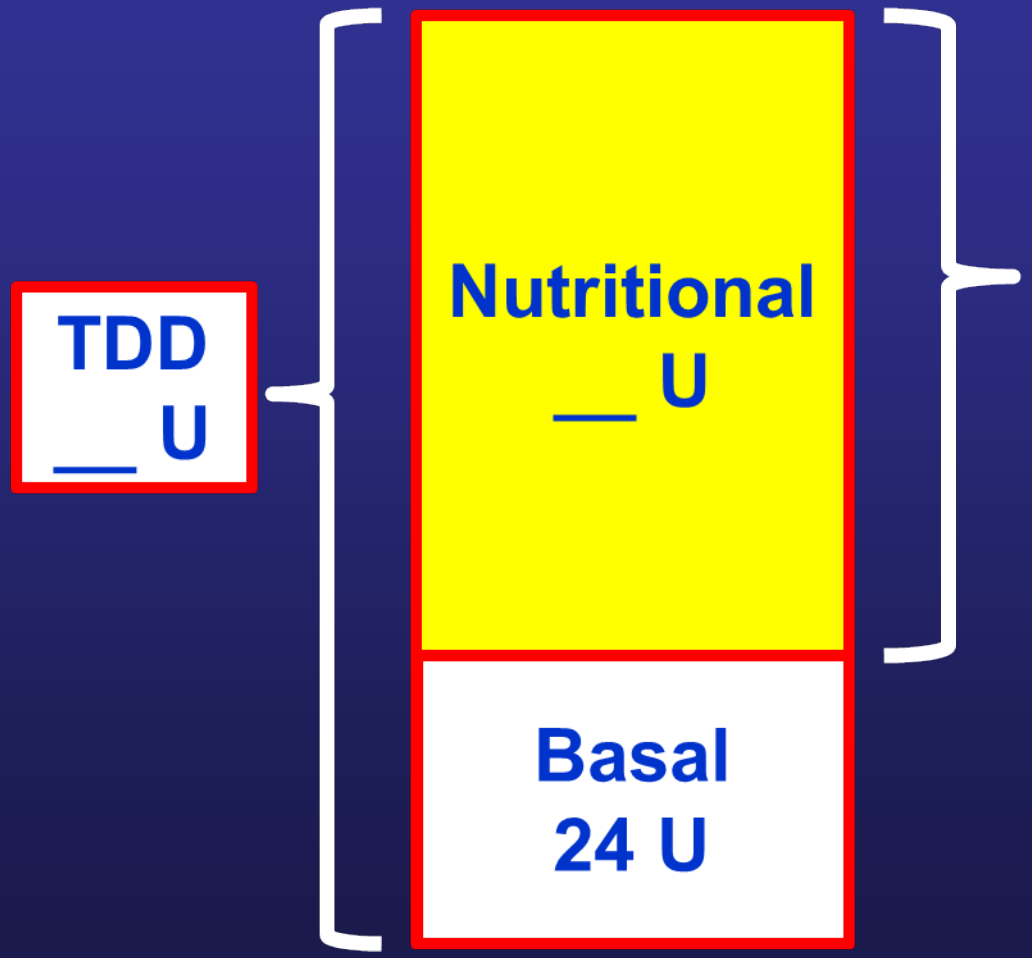
Adjusting the I:CHO Ratio



Addresses the CHO in the Tube Feeds

__ U Nutritional Insulin per day
224 gm CHO per day

I:CHO = 1:3

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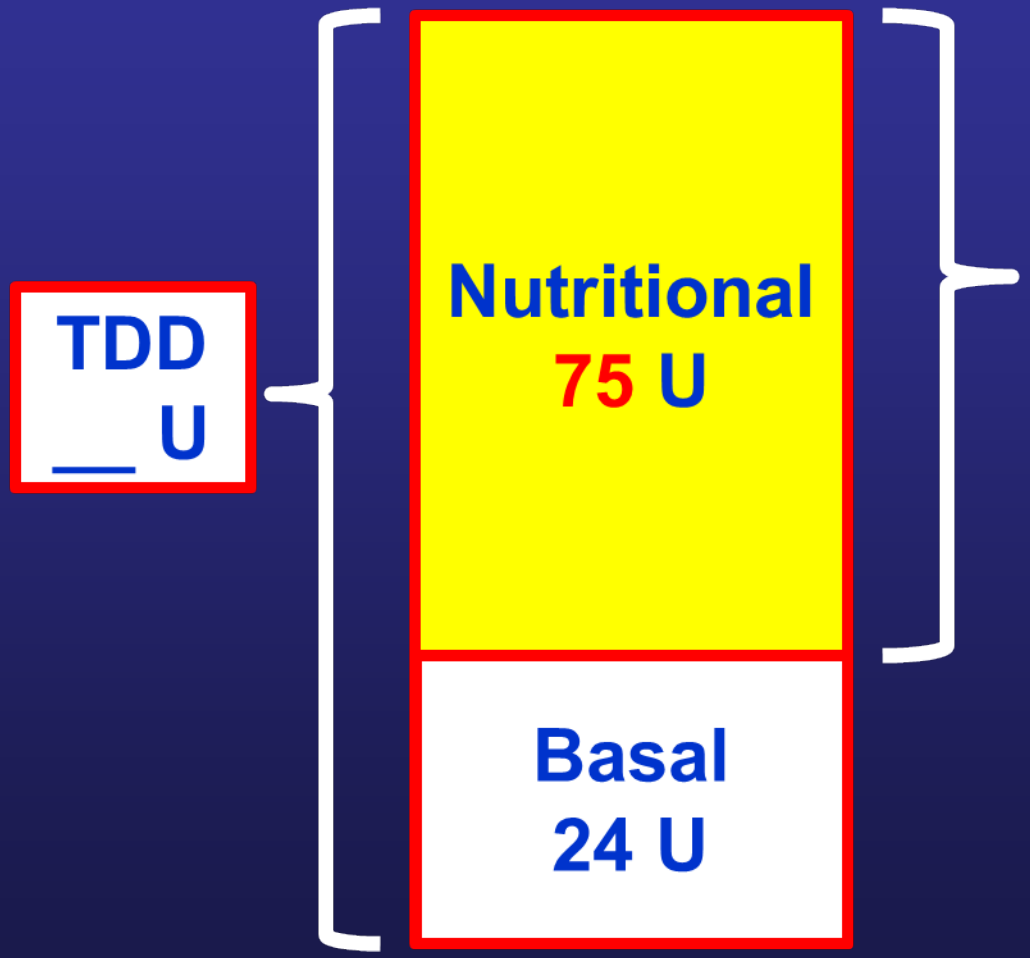
Adjusting the I:CHO Ratio



Addresses the CHO in the Tube Feeds

75 U Nutritional Insulin per day
224 gm CHO per day

I:CHO = 1:3

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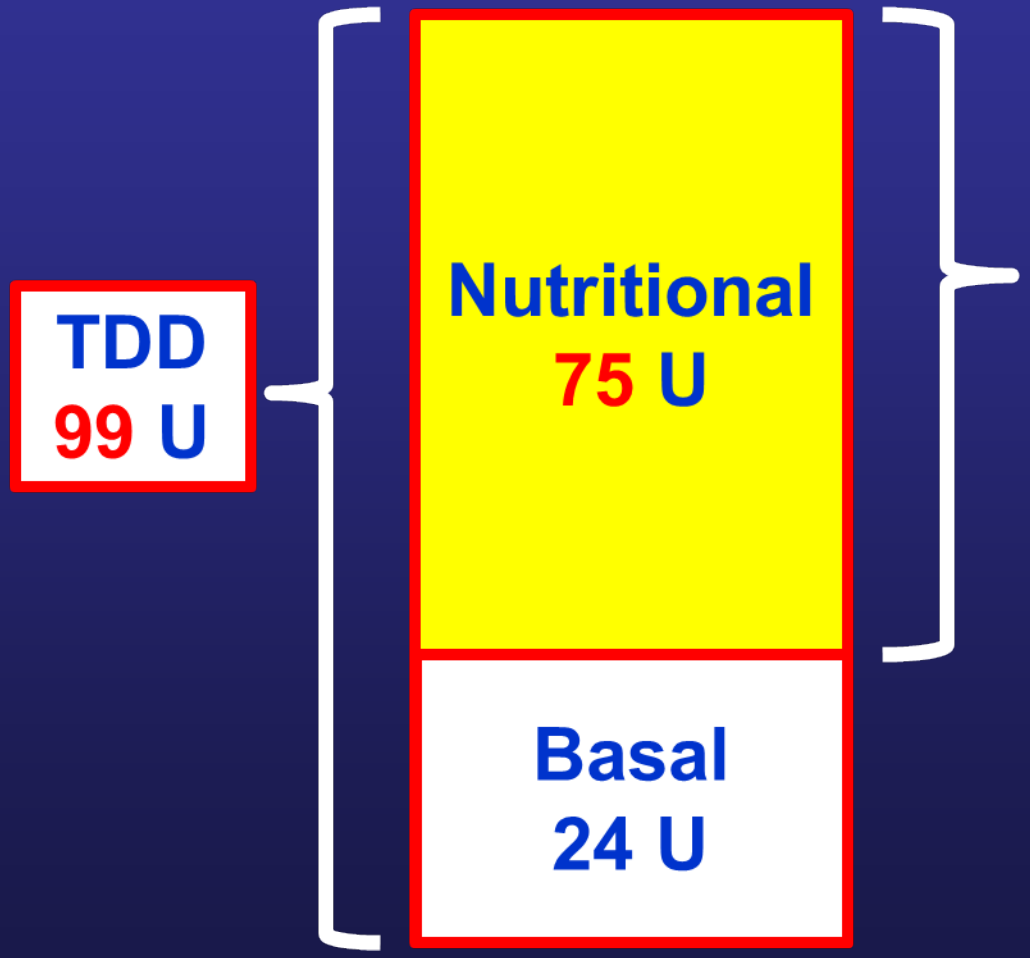
Adjusting the I:CHO Ratio



Addresses the CHO in the Tube Feeds

75 U Nutritional Insulin per day
224 gm CHO per day

I:CHO = 1:3

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New NPH Order

NPH 50 Units SQ Q12H

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