Type I Diabetes Mellitus

Insulin Dependent

Management of Diabetes Mellitus Type I

Type I Diabetes

- Autoimmune disease
- Autoimmune destruction of the beta cells of the islets of Langerhans which are the regions of the pancreas that contain its endocrine cells (i.e., hormone-producing cells).
- Blood glucose level management:

  ✓ Diet management

  +

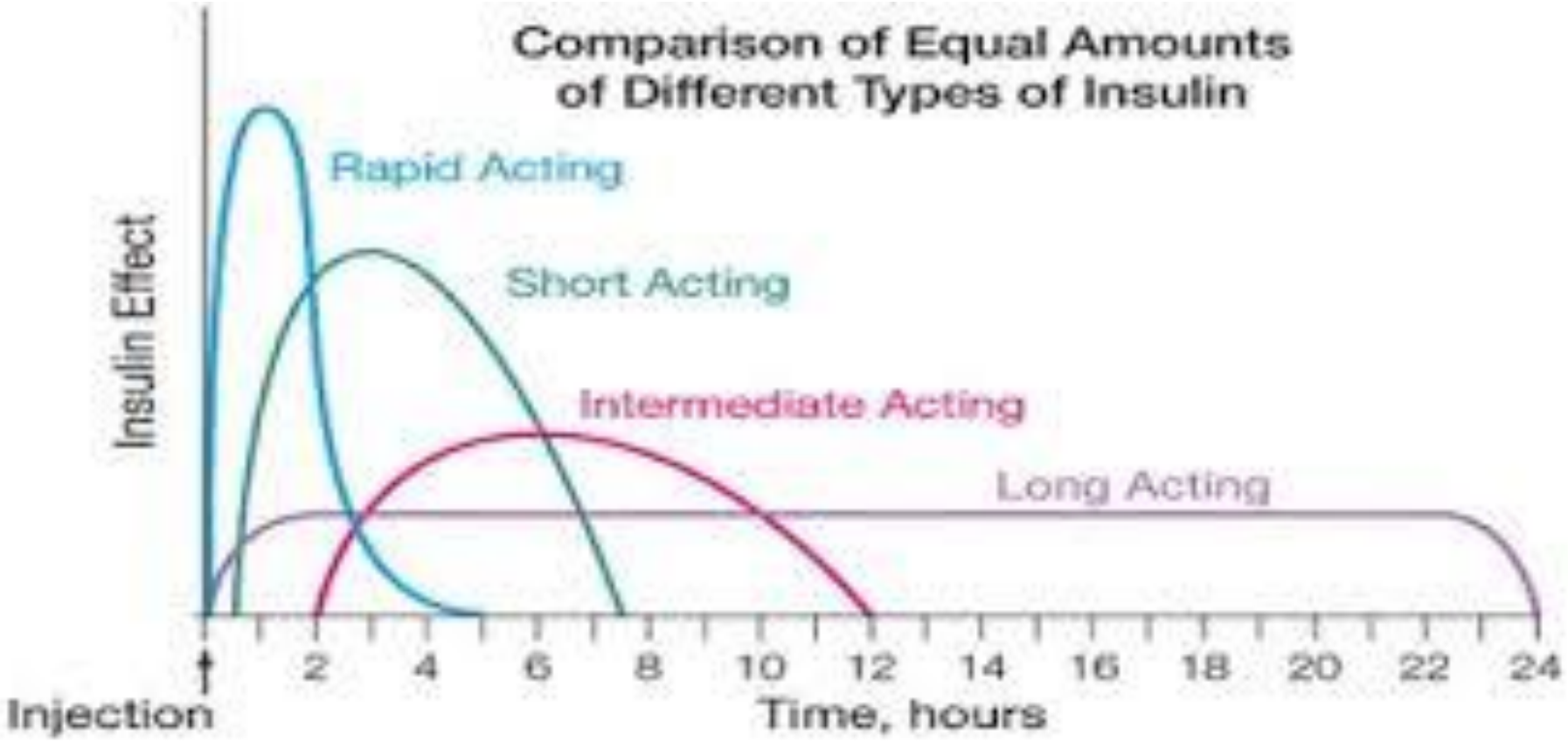
  ✓ Insulin injections

Insulin Preparations

Type of Insulin	Onset of Action	Peak of Action	Duration of Action	Examples Brand Names
1) Rapid-acting	• 15 min after injection ○ 20 min after injection	0.5-2.5 hrs. after injection 1-3 hrs. after injection	3-5 hrs. 3-5 hrs.	• Humalog (lispro); ultra rapid ○ NovoLog (aspart); rapid
2) Regular Short-acting Used in Palestine; given ½ hour before meal	Within 30 minutes of injection	1-3 hrs. after injection	6-8 hrs.	1. Humulin R 2. Novolin R

Insulin Preparations Cont'd.

Type of Insulin	Onset of Action	Peak of Action	Duration of Action	Examples Brand Names
3) NPH : Neutral Protamine Hagedor n insulin; Intermediate-acting	2 hours following injection	4-12 hrs. after injection	18-26 hrs.	1. Humulin N 2. Novolin N
4) Long-acting Peak-less	70 minutes	None	24 hrs.	Lantus (glargine) Aventis

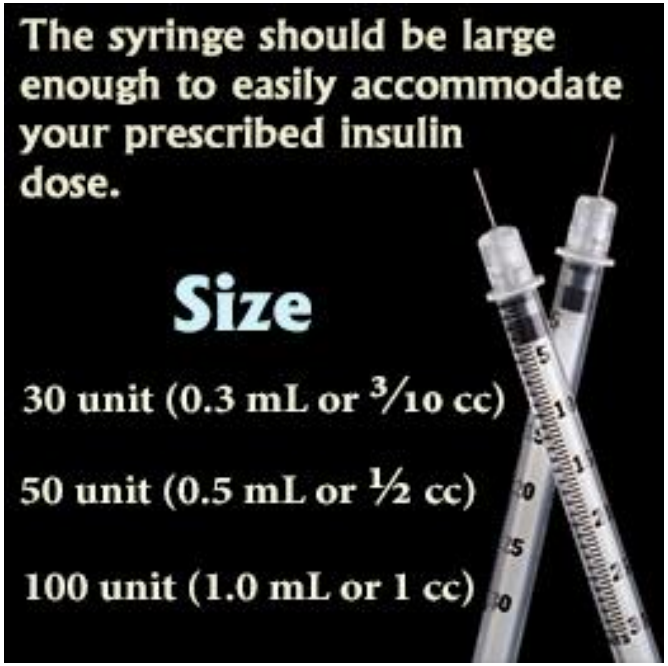


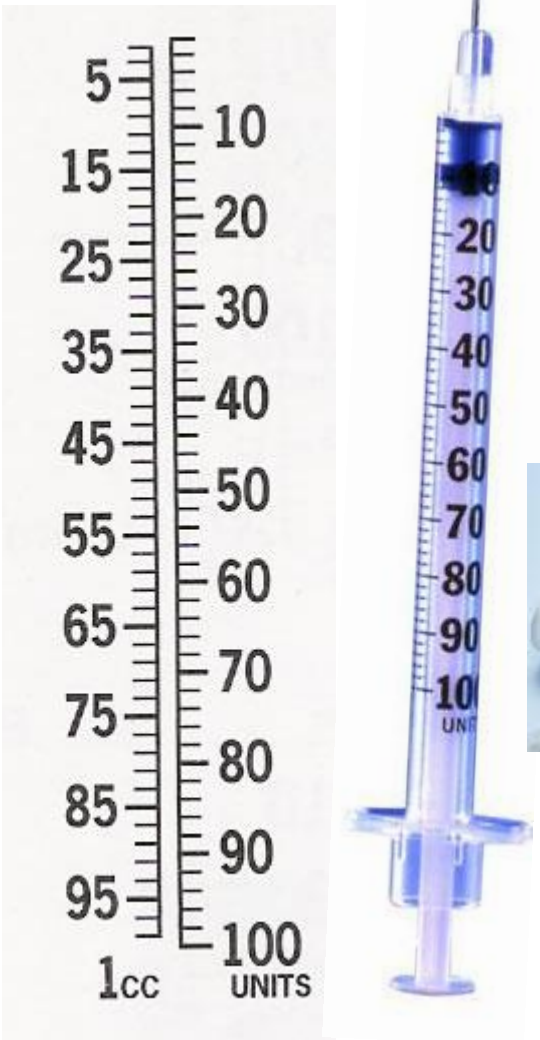
Insulin Preparations Cont'd.

Type of Insulin	Onset of Action	Peak of Action	Duration of Action	Examples
Intermediate / and short-acting (regular) mixtures Used in Palestine together with regular short acting ½ hour before lunch	The onset, peak, and duration of action of these mixtures would: • reflect a composite of the: ○ intermediate-acting + short-acting insulin used in the mixture			1. Humulin N 70/30 2. Novolin N 70/30 3. Humulin 50/50 Mixture is: • Intermediate-acting + • Short-acting Either 70/30 Or 50/50

Insulin Syringes are Marked in Insulin “Units".

Insulin syringes come in several sizes to match insulin strength and dosage.





Insulin Pens: Some can be Refilled, Others are Disposable

Insulin Penfill

Press to Inject

Insulin Pumps

- Insulin pumps are small computerized devices that deliver insulin

- Pumps can be programmed:

  1) To release measured small continuous doses of slow acting insulin to cover basal needs (basal), with

  2) A rapid acting bolus dose close to mealtime to control the rise in blood glucose after a meal,

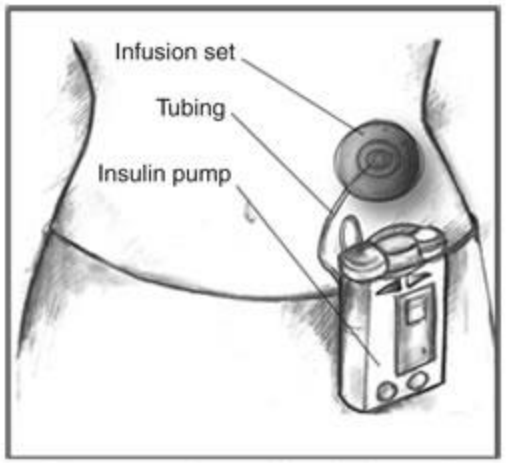
- Doses are delivered through a flexible plastic tube called a catheter.

- With the aid of a small needle, the catheter is inserted through the skin into the fatty tissue and is taped in place.

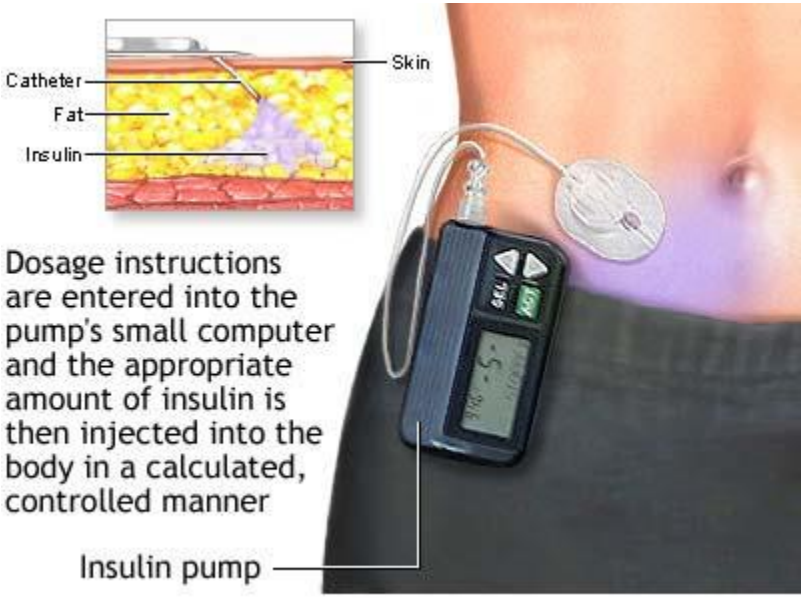
Insulin Pump Cont'd.

- The insulin pump is not an artificial pancreas (because one still has to monitor his/her blood glucose level),
- Pumps can help some people achieve better control,
- Many people prefer this continuous system of insulin delivery over injections.

Insulin Pump (Computerized Device)



An insulin pump can be worn discretely under clothing as it administers insulin to the diabetic



Insulin pumps deliver :

- slow-acting and rapid- insulin
- 24 hours a day
- through a catheter placed under the skin.

Types of Insulin Pumps

There are several models on the market separated the pumps into 4 categories:

1) Pumps that incorporate or work with a Blood Glucose Monitor (BGM) and offer Continuous Glucose Monitoring (CGM),

2) Pumps with just CGM capability,

3) Pumps with just a BGM, and

4) Standalone pumps: no BGM or CGM.

Insulin Doses

- Insulin doses are separated into:

1. Basal dose to cover 24 hour basal needs,

2. Bolus doses to cover the carbohydrate intake in each meal or snack,

3. Correction dose or supplemental dose to treat high blood glucose levels.

Basal Insulin Replacement (Dose)

- To replace insulin in the fasting state:
  - Between meals
  - Overnight
- ≈ 40-50% (≈ 45%) of the total daily insulin dose (TDID).
- Usually is constant from day to day.

Bolus Insulin Replacement (Dose)

- Is for:

  - Carbohydrate intake coverage (food), and
  - High blood sugar correction.

- Makes up the other 50-60% (≈ 55%) of the total daily insulin dose (TDID)

(Bolus Dose) Cont'd.
Carbohydrate Intake Coverage Dose

- Is to cover CHO intake at a meal.

- Is calculated based on the amount of CHO eaten at a meal divided by the insulin/CHO ratio.

- Insulin/CHO ratio represents:
  - # grams of CHO covered or disposed of by 1 unit of insulin.

Insulin/CHO Ratio

- Generally
  - ➢ 1 unit of insulin will dispose of 12-15 grams of carbohydrate.
    - ✓ Range can vary from 4-30 grams or more of carbohydrate depending on an individual's sensitivity to insulin
    - ✓ Insulin sensitivity can vary:
      - o From person to person,
      - o According to the time of day, and
      - o Is affected by physical activity, and
      - o Stress.

Carbohydrate Intake Coverage Dose Cont'd.

Example: 60 grams of CHO in a meal:

- Your Insulin/CHO ratio is for example 1:12
- CHO insulin dose = 60 g ÷ 12 = 5 units

You will need 5 units of insulin to cover the carbohydrate you eat at the meal.

High Blood Sugar Correction Dose

Generally:

- 1 unit of insulin is needed to drop the blood glucose by 45 mg/dl.

- So the correction dose is 1 unit of insulin for every 45 mg/dl of blood glucose above the target level.

❖ Correction dose can range from 30-100 mg/dl or more, depending on individual insulin sensitivity, and other circumstances.

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Correction Insulin Dose Cont'd.

Example

- Your actual pre-meal blood sugar is:
  - 210 mg/dl.

- Pre-meal blood sugar target is:
  - 120 mg/dl.

- Difference is:
  - 90 mg/dl

- Correction insulin dose is:
  - 90/45 = 2 units

Total Mealtime Dose

- Total meal insulin dose =
  - CHO intake insulin dose, +
  - High blood sugar correction dose

Example:

- CHO coverage dose (5 units)
- + high sugar correction dose (2 units)
- total meal dose (7 units)

- The TOTAL MEALTIME INSULIN DOSE is 7 units of insulin.

Total Daily Insulin Requirement
Total Daily Insulin Dose (TDID)

General calculation:

Total Daily Insulin Requirement (in units of insulin) =

- 0.55 x Weight in kilograms

Or

- Weight in Pounds ÷ 4

Total Daily Insulin Dose (TDID) Cont'd.

Example:

- Weight: 73 kg
  - ➢ 73 kg x 0.55 = 40 unit of insulin/day

- Weight: 160 lb.
  - ➢ 160/4 = 40 units of insulin/day

✓ Insulin dose may be ↑ or ↓ depending on body's reaction whether resistant or sensitive to insulin.

❖ Individual needs are best assessed by physician.

Basal Insulin Dose

40-50% (≈ 45%) of TDID (Total Daily Insulin Dose)

For someone whose weight is 160 lbs.

- TDID = 160 lbs. ÷ 4 = 40 units.
- TDID = 73 kg x 0.55 = 40 unit.

- Basal insulin dose (if we use the 45% level) =
  - 45% of TDID (40 units) = 18 units
  - 40 – 18 = 22 units to cover meals and correction dose.

bolus

Insulin/CHO Ratio

Rule of 500: used to calculate Insulin/CHO ratio

- 500 ÷ TDID (Total Daily Insulin Dose) = grams of CHO covered by 1 unit of insulin = insulin/CHO ratio

- Carbohydrate coverage ratio =
  - 500 ÷ TDID (40 units) =
  - 1unit insulin / 12.5 g CHO

- The Insulin/CHO ratio may vary during the day.

High Blood Sugar
Correction Factor

Rule of "1800": used to calculate correction factor

Correction Factor =

- 1800 ÷ TDID (Total Daily Insulin Dose) = the drop in blood glucose that occurs by using by 1 unit of insulin.

Correction Factor = 1800 ÷ TDID (40 units) = 1 unit of insulin will reduce the blood sugar level by 45 mg/dl.

High Blood Sugar
Correction Factor Cont'd.

Rule of "1800":

Another example,

If the TDID = 60 units of insulin, then correction factor would be:

1800 ÷ 60 units = 30 = 1 unit of insulin will reduce the blood sugar level by 30 mg/dl.