

## Diabetes Care at School

Dr. Stephen Tiff M.D.  
Faye Fittery RN, MSN, CDE

## Supplies needed at school

### All kids:

meter with strip  
lancets  
urine ketone strips  
alcohol wipes  
Glucagon  
CARB snack

### Pumpers:

Insulin vial (Rapid-acting)  
Syringes/needles  
Copy basals/bolus settings  
Non-pumpers:  
Insulin vial  
Needles/syringes or pen

## Cases:

P.J. is an 8 year old female who is using an insulin pen and is due to run a mile for gym class.

Her BG is 300mg/dl. What would you do?

Her BG is 70mg/dl. What would you do?

J.T. is a 7 year old male who has had a pump for 1 year. He presents to the office shaky and sweaty after gym class. What would you do?

J.R. is an 11 year old male who presents to your office for a pre lunch BG. He has been on the pump for 3 months. His BG is 390mg/dl. What would you do?

P.L. is a 9 year old girl with a pump who is found in the bathroom unconscious. What would you do?

C.J. comes to your office prior to lunch with a blood sugar of 250mg/dl. He is unsure what he will eat for lunch, but he is hungry and usually eats 75 grams of carbohydrate. How should you manage this?

## Type 2 diabetes in children

### Causes:

Genetics

Lifestyle

### Management:

Nutrition

Exercise

Medication:

Metformin usually first choice

Insulin

BG monitoring

## INSULIN PUMP INCLUDES:

- INSULIN CARTRIDGE
- PROGRAMMABLE CONTROLS
- BATTERIES
- INFUSION SET CONNECTS PUMP TO BODY:
  - CANNULA
  - DISCONNECTABLE HUB TAPED TO SKIN
  - PLASTIC TUBING CONNECTED FROM CARTRIDGE TO HUB
  - INTRODUCER NEEDLE GUIDES CANNULA INTO SKIN – NEEDLE REMOVED AND CANNULA STAYS IN PLACE FOR A MAXIMUM OF THREE DAYS



SOME PUMPS HAVE METERS THAT TRANSMIT BG TO PUMP AUTOMATICALLY. PUMP WILL USE PROGRAMMED INFORMATION TO CALCULATE RECOMMENDED BG BOLUS.

## HOW A PUMP DELIVERS INSULIN

- Basal – slow, steady insulin delivery with preset amounts of rapid-acting insulin at regular intervals. ie. 12A = 1.8, 3A = 2.1, 5A = 2.3, 8A = 1.8, 11A = 1.3
- Bolus – amount of insulin taken prior to a meal based on amount of carbohydrates and/or correction for elevated BG

## BOLUS DOSE

Based on:

- Grams of carbohydrate eaten
- Insulin/carbohydrate ratio (ex. 1 unit for every 15gm CHO)
- Blood glucose level
- Insulin sensitivity factor (ISF) (ex. 1 unit for every 50mg/dl >120mg/dl)
- Timing of last bolus (Insulin on board)
- Recent or planned activity

## BOLUS DOSE

To calculate a BG bolus:

$$\frac{\text{current BG} - \text{target BG}}{\text{ISF}} = \# \text{ units for BG bolus}$$

To calculate a carbohydrate bolus:

$$\frac{\text{grams carbohydrate eaten}}{x} = \# \text{ units for CHO bolus}$$

(x = carbohydrate ratio)

Add the BG bolus and CHO bolus = total # units of bolus

## CALCULATING BOLUS

### EXAMPLE

Current BG = 350mg/dl  
 Target BG = 120mg/dl  
 Insulin Sensitivity Factor = 50 mg/dl

$$\frac{350 - 120}{50} = 4.6 \text{ units for BG bolus}$$

Carbohydrates eaten = 75gm  
 Insulin/carb ratio = 1:15

$$\frac{75\text{gm}}{15\text{gm}} = 5 \text{ units for Carb bolus}$$

Total bolus is 4.6 units + 5 units = 9.6 units

## CARBOHYDRATE COUNTING

Essential for achieving better glucose control.

Helps match insulin with food choices.

Allows for greater freedom and flexibility in food choices.

"A carbohydrate is a carbohydrate, is a carbohydrate" (No difference in absorption of a sugar as compared to a starchy carbohydrate)

What is important is:

1. How much CHO eaten
2. When CHO is eaten
3. With what the CHO is eaten
4. If adequate insulin activity is available

NOTE: 1 serving of CHO is 15gms.

## Approaches to Meal Planning

- Constant (Consistent) carbohydrate counting: (consistent amount of CARBS eaten at meals/snacks) ie. 45-60 gms. per meal and 15 gms. per snacks
- Carbohydrate counting: use CARB/insulin ratio (match insulin to gms. of CARB eaten); more flexibility.

## Exercise

- Check BG before, during, and after exercise
- Eat before heavy exercise
- Extra snacks available during exercise including those to treat hypoglycemia
- May need to reduce insulin dose prior to exercise
- Keep hydrated
- No exercise if ketones present
- Be aware of possible delayed hypoglycemia
- Learn from past experiences.

## HYPOGLYCEMIA

Often less severe and less frequent low BG's on a pump.

Treatment: Take 15gm rapid-acting CHO

Wait 15 minutes

Recheck BG

If less than 70mg/dl, repeat above

When BG 70mg/dl or greater, follow with protein/carb snack or meal

Avoid overtreatment.

May disconnect /suspend for short time if very low BG

## PUMP PROBLEMS

- Leak in infusion set
- Infection at infusion site
- Pump out of insulin
- Technical problem with pump
- Air bubbles in tubing
- Clogged catheter
- Kinked catheter

Can lead to hyperglycemia/ketoacidosis quickly!

## HYPERGLYCEMIA

**BG can rise quickly without any long-acting insulin "on board".**

**Any interruption of the insulin flow can increase BG quickly.**

**If BG > 300 mg/dl:**

- Check infusion set, site, pump
- Check urine ketones.

If moderate to large ketones, will necessitate an injection of rapid-acting insulin with a syringe. Call parents immediately. Needs to drink sugar free fluids (1 oz. per year of age) every hour.

## "Smart" pumps

- Help calculate the bolus amount of insulin (Carb/insulin ratio, sensitivity factor, target.)
- Fine tune bolus dosage by adjusting for insulin which could be active in body. (insulin on board/active insulin which is set for # hours.)

## Active insulin/insulin on board (IOB)

- Insulin which has been delivered but not yet used by body.
- Reduces "stacking" of insulin.
- Usually set between 2 ½ to 5 hours

## Continuous Glucose Monitoring (CGM)

Measures glucose level in interstitial fluid using a sensor inserted subcutaneously.

Glucose information transmitted to wireless monitor.

Interstitial fluid glucose lags behind BG levels by about 10 minutes; is usually within 20% of BG level unless BG level rapidly rising or falling.

Does not replace BG monitoring.

## Indications for CGM

- Wide fluctuations in BG levels.
- Severe hypoglycemia or hypoglycemia unawareness.
- Periods of stress/growth/menstruation.
- During sports season.
- Lack of correlation of BG values and A1C.
- When basal testing or other insulin changes.

## Three components of CGM

Sensor

Transmitter

Receiver (Paradigm RealTime uses pump as receiver)

