Advanced Concepts: Diabetes, Pumps and Monitors - Oh My!

Katherine Beben, MD, FAAFP

FMX

ACTIVITY DISCLAIMER

FMX

DISCLOSURE

It is the policy of the AAFP that all individuals in a position to control content disclose any relationships with commercial interests upon nomination/invitation of participation. Disclosure documents are reviewed for potential conflict of interest (COI), and if identified, conflicts are resolved prior to confirmation of participation. Only those participants who had no conflict of interest or who agreed to an identified resolution process prior to their participation were involved in this CME activity.

All individuals in a position to control content for this session have indicated they have no relevant financial relationships to disclose.

The content of my material/presentation in this CME activity will not include discussion of unapproved or investigational uses of products or devices.

FMX

Katherine Beben, MD, FAAFP

Associate Program Director, Prisma Health–Upstate/University of South Carolina School of Medicine Greenville/Family Medicine Residency Program (Oconee)

Dr. Beben earned undergraduate degrees in molecular biology and Spanish language and literature at Tulane University, New Orleans, Louisiana. She earned her medical degree at the University of Connecticut School of Medicine, Farmington, and completed a family medicine residency at the AnMed Health Family Medicine Residency Program in Anderson, South Carolina. After graduation, she fulfilled her National Health Service Corps (NHSC) obligation in rural El Dorado Springs, Missouri, practicing full-spectrum family medicine. She and her family returned to South Carolina, where she practiced for seven years and became an instructor of family medicine for the AnMed program. Recently, Dr. Beben joined the Oconee Family Medicine Residency Program to serve as associate program director.

FMX

Learning Objectives

1. Demonstrate understanding of available technology for monitoring and treating Type 1 Diabetes.

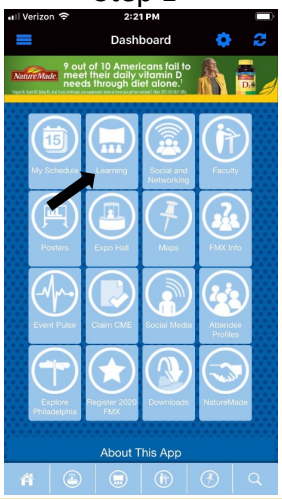
2. Interpret glycemic variability given a continuous glucose monitor (CGM) report.

3. Evaluate patients' and families' coping skills and adherence who use technology to manage Type 1 Diabetes.

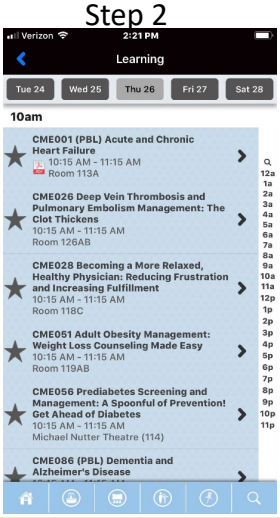
FMX

Audience Engagement System

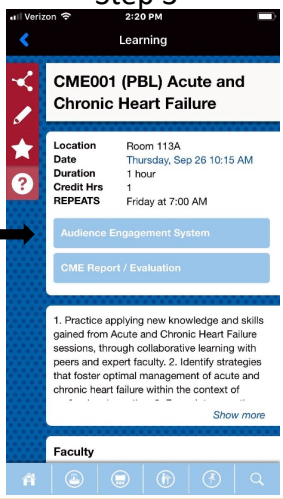
Step 1



Step 2



Step 3



FMX

Insulin Administration and Monitoring

	Glucometer	Continuous Glucose Monitor
MDI		
Infusion pump		

- Mutually exclusive events for managing Type 1
- You can pick your preferred method of insulin administration and preferred method of monitoring
- Pros and Cons to each

Poll Question #1

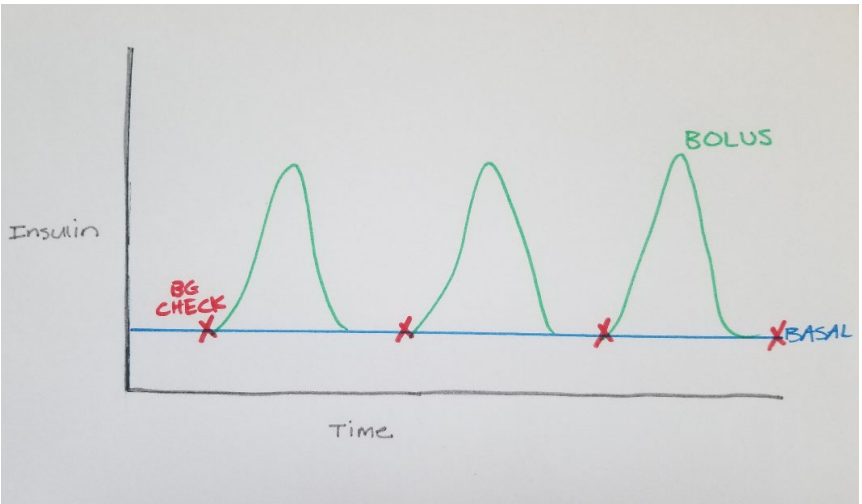
The preferred initial insulin regimen for the management of Type 1 Diabetes in children is:

A. Regular insulin with NPH
B. Premixed insulin (i.e. 70/30)
C. Long-acting basal with rapid-acting bolus
D. Rapid-acting boluses

Insulin Regimens

- Conventional: regular insulin with NPH
- Intensive: rapid-acting and long-acting
  - Multiple daily injections (MDI)
  - Continuous infusion pump

Multiple Daily Injections



Multiple Daily Injections

- Basal injections once a day lasting 24 hours
- Bolus injections with every meal and before snacks
- Bolus before bedtime
- Bolus to correct for hyperglycemia

Multiple Daily Injections

- Lower mean fasting
- Lower pre- and post-breakfast
- Lower pre- and post-lunch
- Lower incidence of nocturnal hypoglycemia

Murphy NP, Keane SM, Ong KK, et al. Randomized cross-over trial of insulin glargine plus lispro or NPH insulin plus regular human insulin in adolescents with type 1 diabetes on intensive insulin regimens. Diabetes Care 2003; 26:799.

Continuous Infusion Pumps

Poll Question #2

How often does the insulin and infusion site need to be changed when using continuous infusion pumps?

A. Every day
B. Every 2-3 days
C. Once a week
D. Once a month

Continuous Infusion Pumps-What

- Subcutaneous cannula that is replaced every 2-3 days
- Site rotation to prevent lipohypertrophy
- Use rapid or short-acting insulin
- Need to keep emergency kit for MDI in case of pump failure

Continuous Infusion Pumps-Who

- Recurrent severe hypoglycemia
- Wide fluctuations in blood glucose levels regardless of A1C
- Suboptimal diabetes control
- Microvascular complications and/or risk factors for macrovascular complications
- Good metabolic control, but insulin regimen that compromises lifestyle

Phillip M, Battelino T, Rodriguez H, et al. Use of insulin pump therapy in the pediatric age-group: consensus statement from the European Society for Paediatric Endocrinology, the Lawson Wilkins Pediatric Endocrine Society, and the International Society for Pediatric and Adolescent Diabetes, endorsed by the American Diabetes Association and the European Association for the Study of Diabetes. Diabetes Care 2007; 30:1653.

Continuous Infusion Pumps-Pros

- Pre-programmed by endocrinology with carb ratios, sensitivity factors, basal rates
- Can suspend insulin delivery
- Can program alarms/reminders
- Better than MDI for glycemic control and avoiding hypoglycemia with less total daily insulin

Weintrob N, Benzaquen H, Galatzer A, et al. Comparison of continuous subcutaneous insulin infusion and multiple daily injection regimens in children with type 1 diabetes: a randomized open crossover trial. Pediatrics 2003; 112:559.

Continuous Infusion Pumps-Cons

- Cost
- Pump failure
  - Rapid rise in BG can lead to DKA
  - Back-up supplies
- Superficial infection risk at infusion site

Continuous Infusion Pumps

Continuous Glucose Monitors

Poll Question #3

Where would be an appropriate site to place a continuous glucose monitor (CGM)?

A. Upper arm
B. Abdomen
C. Thigh
D. Buttock
E. All of the above

Continuous Glucose Monitors-What

- Subcutaneous microfilament reads interstitial glucose concentrations every 5 minutes
- Usually place on abdomen or arm
- Variable need to calibrate with traditional fingerstick

Continuous Glucose Monitors-Who

- Poorly controlled A1C
- Wide fluctuations in blood glucose levels
- Non-adherence with traditional glucometer use

Continuous Glucose Monitors-Pros

- Fewer fingersticks
- Waterproof
- ONSET Study:
  - Lower glycemic variability
  - No severe hypoglycemia

Kordonouri O, Pankowska E, Rami B, et al. Sensor-augmented pump therapy from the diagnosis of childhood type 1 diabetes: results of the Paediatric Onset Study (ONSET) after 12 months of treatment. Diabetologia 2010; 53:2487.

Continuous Glucose Monitors-Cons

- Cost
- Skin reaction to adhesive
- Adhesive augmentation with swimming

Continuous Glucose Monitors

Pump with CGM

- Partially closed-loop: suspends insulin delivery if senses low or rapidly dropping BG
- Hybrid closed-loop: + auto-adjusts basal rates
- Complete closed-loop: + auto boluses for correction

Pump with CGM

- More likely to achieve goal A1C
- Fewer hyperglycemic episodes
- Lower glycemic variability
- 2-fold reduction in hypoglycemic events

Slover RH, Welsh JB, Criego A, et al. Effectiveness of sensor-augmented pump therapy in children and adolescents with type 1 diabetes in the STAR 3 study. Pediatr Diabetes 2012; 13:6.
Abraham MB, Nicholas JA, Smith GJ, et al. Reduction in Hypoglycemia With the Predictive Low-Glucose Management System: A Long-term Randomized Controlled Trial in Adolescents With Type 1 Diabetes. Diabetes Care 2018; 41:303.

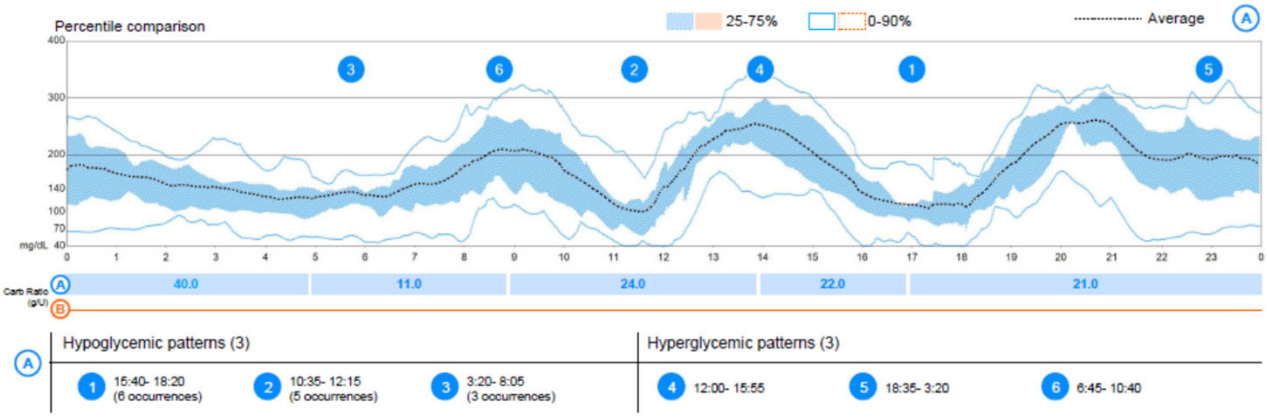
Objectives

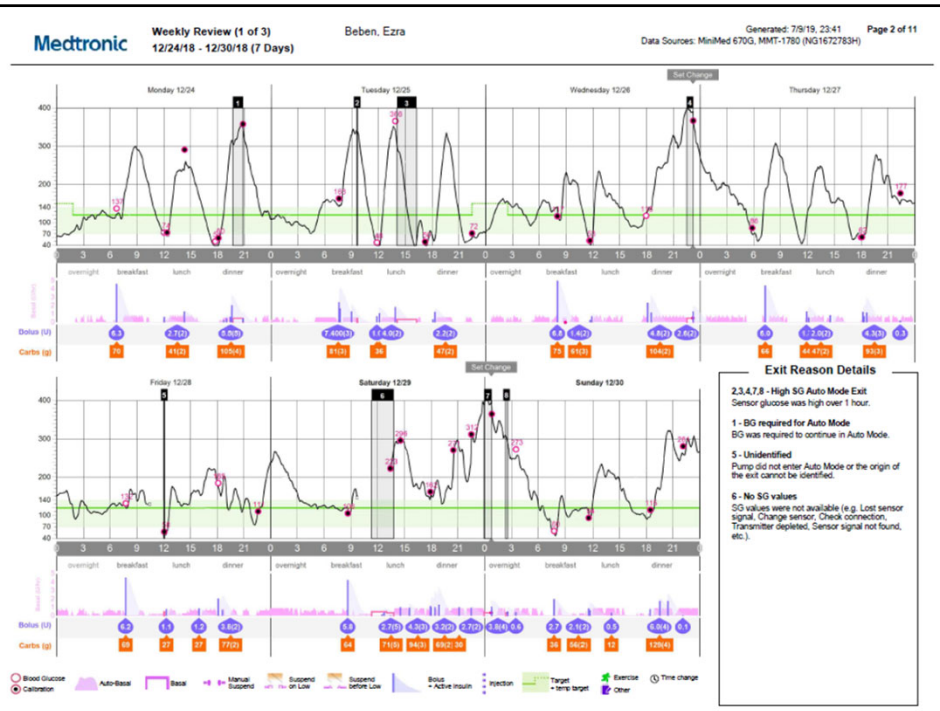
- Demonstrate understanding of available technology for treating and monitoring Type 1 Diabetes.
- Interpret glycemic variability given a continuous glucose monitor (CGM) report.
- Evaluate patients' and families' coping skills and adherence when using technology to manage Type 1 Diabetes.

Poll Question #4

What kind of information can you get from looking at a continuous glucose monitor report?

A. How often they check their blood sugar
B. What type of insulin is in use
C. If/when the patient disconnects his/her pump
D. When the patient is exercising


Percentile comparison
25-75%
0-90%
Average
mg/dL
Carb Ratio (g/U)
40.0
11.0
24.0
22.0
21.0
Hypoglycemic patterns (3)
1 15:40- 18:20 (6 occurrences)
2 10:35- 12:15 (5 occurrences)
3 3:20- 8:05 (3 occurrences)
Hyperglycemic patterns (3)
4 12:00- 15:55
5 18:35- 3:20
6 6:45- 10:40


Medtronic
Weekly Review (1 of 3)
12/24/18 - 12/30/18 (7 Days)
Beben, Ezra
Generated: 7/9/19, 23:41
Page 2 of 11
Data Sources: MiniMed 670G, MMT-1780 (NG1672783H)
Monday 12/24
Tuesday 12/25
Wednesday 12/26
Thursday 12/27
Friday 12/28
Saturday 12/29
Sunday 12/30
Set Change
Bolus (U)
Carbs (g)
Exit Reason Details
2,3,4,7,8 - High SG Auto Mode Exit
Sensor glucose was high over 1 hour.
1 - BG required for Auto Mode
BG was required to continue in Auto Mode.
5 - Unidentified
Pump did not enter Auto Mode or the origin of the exit cannot be identified.
6 - No SG values
SG values were not available (e.g. Lost sensor signal, Change sensor, Check connection, Transmitter depleted, Sensor signal not found, etc.).

Objectives

- Demonstrate understanding of available technology for treating and monitoring Type 1 Diabetes.
- Interpret glycemic variability given a continuous glucose monitor (CGM) report.
- Evaluate patients' and families' coping skills and adherence when using technology to manage Type 1 Diabetes.

Evaluating Adherence

- Ask patients about pump and CGM use
- Ask if they download their data
- Ask how often they're seeing endocrinology
- Ask about their latest A1C

Evaluating Coping Skills

- Ask patient and/or family to show you where sites are and what they're using
- Ask about triumphs and struggles
- Determine insight by asking about reasons why sugars are high or low
- Who do they call for help?

Practice Recommendations

- Ask patients and families what technology they are using to manage their Type 1 Diabetes.
- Offer support for lifestyle interventions to help manage glycemic variability.
- Know who to contact to help patients and families troubleshoot any technologic difficulties.

Contact Information

Email: Kati.beben@prismahealth.org
Phone: (864) 482-3491
Twitter: @BebenKati

Questions

FMX