



Assessment and Management of Diabetes

Ava Mitchell DNP-FNP-BC
Pediatric Endocrinology

Objectives

Recognize

Recognize signs and symptoms of type 1 and type 2 diabetes



Demonstrate

Demonstrate treatment plan for prescribing insulin



Recognize

Recognize the association of Diabetes with other autoimmune disorders



Describe

Describe Pathophysiology of type 1 and type 2 diabetes



Develop

Develop a plan for patient-centered care coordination and communication in the management of pediatric patients with diabetes.

Growing Problem

Estimated 7%
population is
diabetic

Twice that
many have
pre-diabetes

21% of adults
over 60 have
diabetes

45% new
diagnosis
diabetes made
in children and
adoloscents

Epidemiology

01

Prevalence 1:300

02

Peak age
diagnosis 11-
13yrs

03

Risk for sibling
6%

04

Risk for
monozygotic
twin: 50%

05

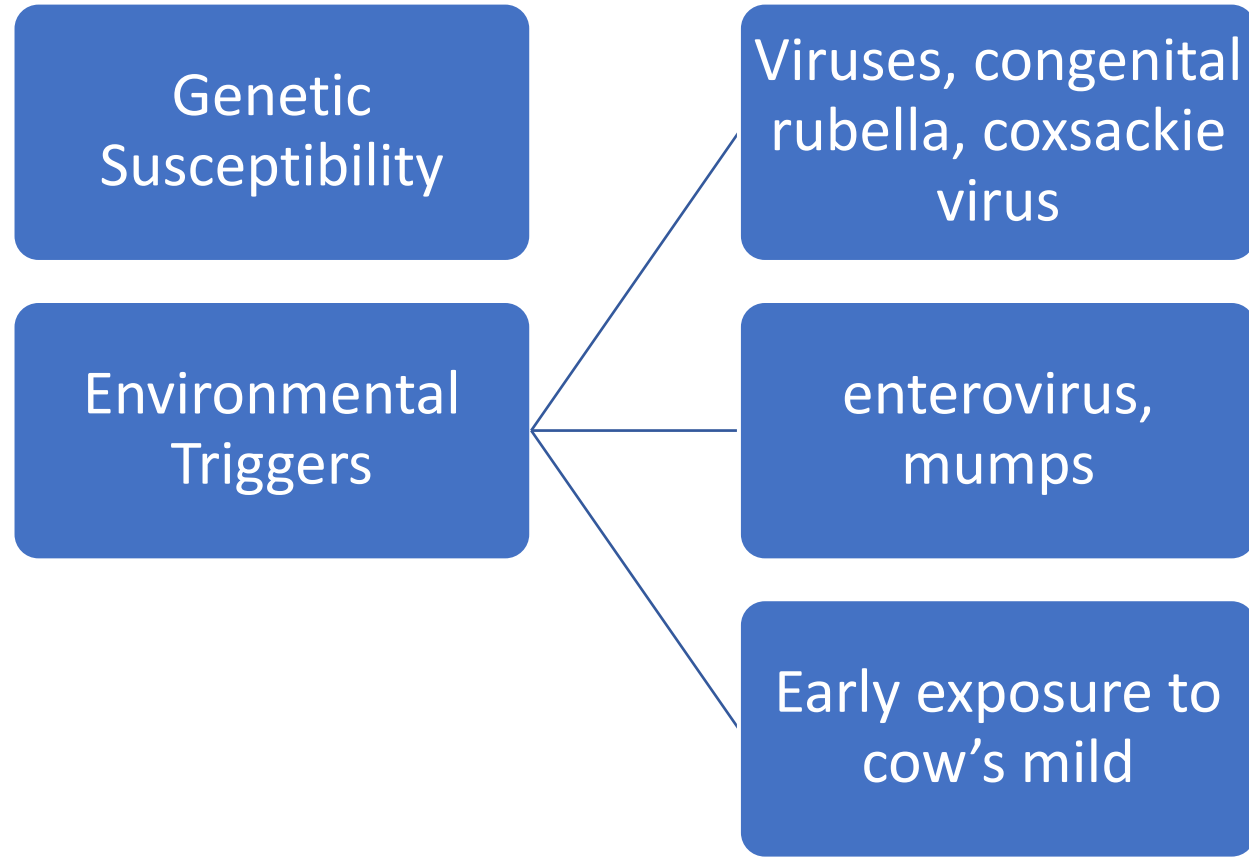
Risk for offspring
2-10%; higher if
father has
diabetes

PATHOPHYSIOLOGY

Autoimmune destruction of
pancreatic B-cell

Antibodies:

- Islet Cell
- Insulin
- Anti-glutamic acid decarboxylase 65- (GAD)
- T-cell mediated
- Lymphocytic infiltration



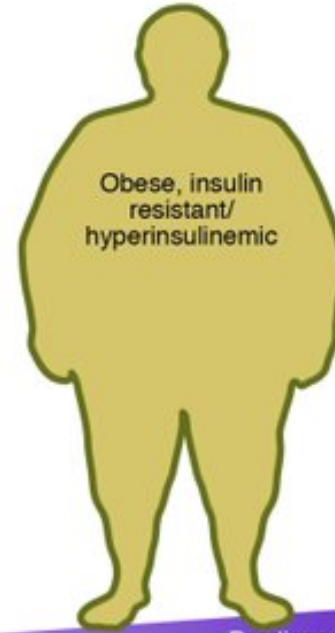
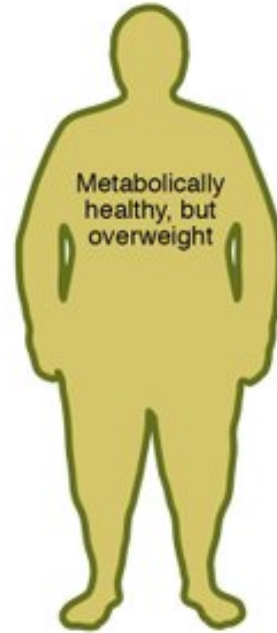
Pathophysiology

Pathophysiology Type 2 Diabetes



- Decreased Insulin Production
 - Decreased Sensitivity
 - Insulin Resistance

Overnutrition, inactivity, environmental factors



Predisposition to hyperinsulinemia, insulin resistance



Pancreatic islets



β cell compensation
NGT



β cell dysfunction
IGT



β cell failure
T2D

Predisposition to β cell failure/time



Risk Factors for Type 2 Diabetes

Overweight or Obese (BMI $\geq 85\%$)

26.7 % of preschool children (2-5 yrs)
32.6% of school-aged children (6-11 yrs)
33.6% of adolescents (12-19 yrs)

Obese (BMI $\geq 95\%$)

12.1 % of preschool children
18% of school-aged children
18.4% of adolescents

Severe Obesity (BMI $\geq 97\%$)

9.7% of preschool children
13% of school-aged children
13 % of adolescents

Obesity

Acanthosis Nigricans



Insulin Resistance/ Metabolic Syndrome

African American (70-75%) and
Hispanic Populations (1/3-2/3 of
children in south California/Texas)

Female > Male (1.5/1)

Increased Visceral Adiposity (more
adipokines which increase insulin
resistance)

Metabolic Syndrome

- Abdominal obesity
- Disturbed glucose regulation
- Dyslipidemia
- hypertension

Diagnosing Type 2 Diabetes

Fasting Plasma Glucose ≥ 126 mg/dL

Symptoms of hyperglycemia and a random venous plasma glucose of ≥ 200 mg/dL

Abnormal OGTT

- Plasma glucose ≥ 200 mg/dL at 2 hours after an oral glucose load of 1.75 g/kg (max dose 75 g)

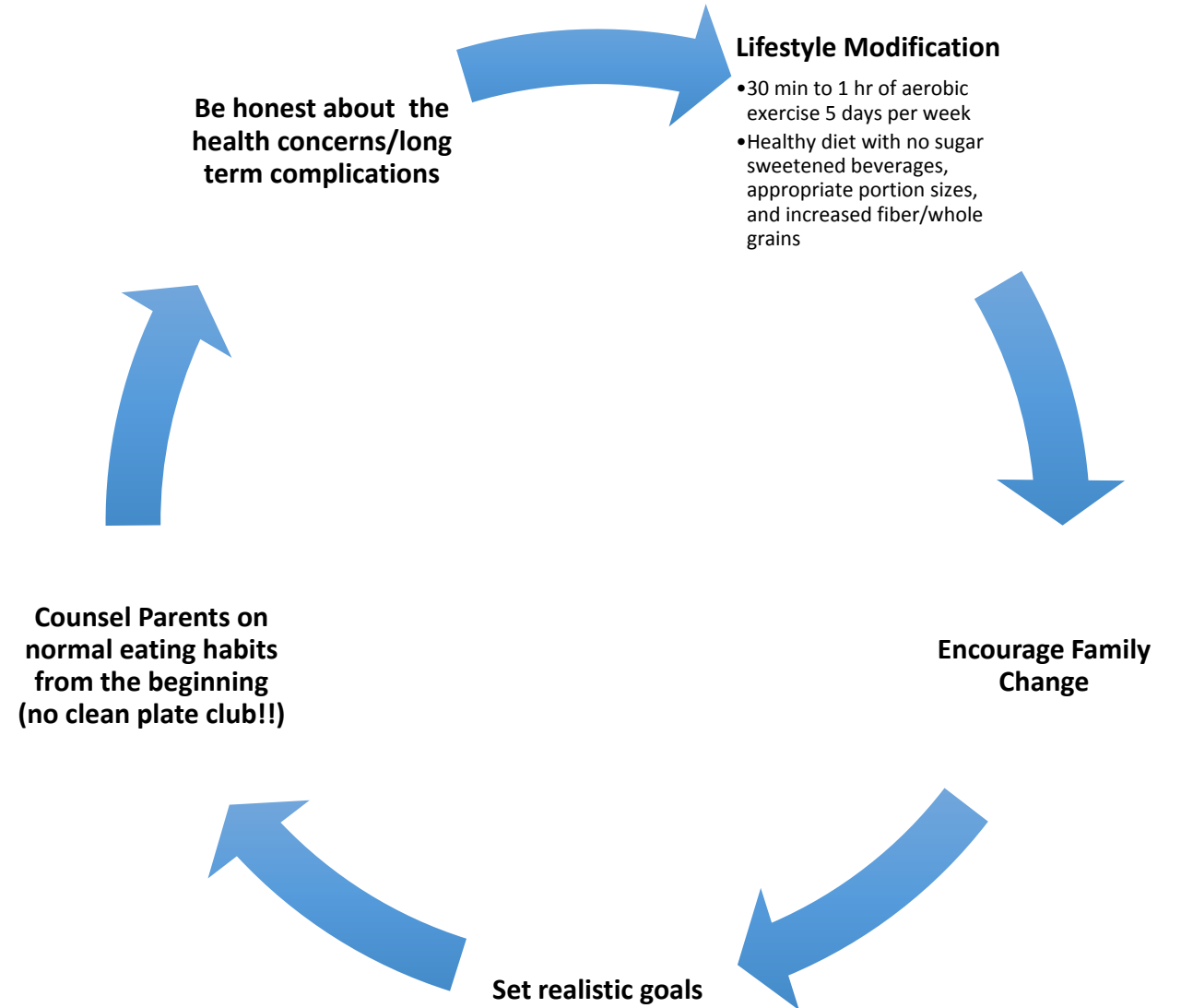
Hgb A1C ≥ 6.5 %

Screenings for T2DM



- Annual vision screening
- Urine microalbumin/creatinine ratio
- Blood pressure at every visit
- Sleep apnea
- Menstrual irregularities in females
- Lipids annually
- NAFLD screen annually

Management of Type 2 DM



Signs and Symptoms

- Polyuria
- Polydipsia
- Polyphagia
- Fatigue
- Weight loss
- DKA:
 - Tachypnea (Kussmaul Respirations)
 - Dehydration
 - Abdominal Pain, Nausea, Vomiting
 - Altered Mental Status
 - Blurred Vision
 - Ketotic Odor

Honeymoon Phase

- Definition: A patient with type 1 diabetes requiring < 0.5 units/kg/day of insulin associated with good metabolic control (near normal HgbA1C levels)
- Can occur from the first weeks up to roughly 2 years of diagnosis
- *Only after patient is on insulin

Sick Day Guidelines

- Never stop basal insulin even if the child cannot eat.
- Most illness results in hyperglycemia and more ketogenesis
- Occasionally recurrent vomiting may result in hypoglycemia
- Correction factor insulin doses may be given as often as every 2-3 hrs as needed

Complications

Acute: hypoglycemia, hyperglycemia, DKA

Chronic: growth issues, skin problems, hypertension, cardiovascular disease, renal disease, retinopathy, neuropathy, wounds, vascular insufficiency, and gastro paresis

Risk for other autoimmune illnesses

- 20% thyroid disease
- 10% have celiac disease
- Increased risk of others

Lipid Goals

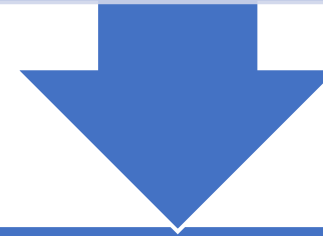
Children: LDL < 130 mg/dL, LDL of 100-129 mg/dL should recommend lifestyle modification and then treat with statins if the patient is over the age of 10 and LDL is > 130 mg/dL

Hypertriglyceridemia is more common with uncontrolled diabetes. Medication is not routinely recommended until triglycerides are > 500 mg/dL

Blood Pressure Goals

Lifestyle intervention if systolic blood pressure > 90% for age

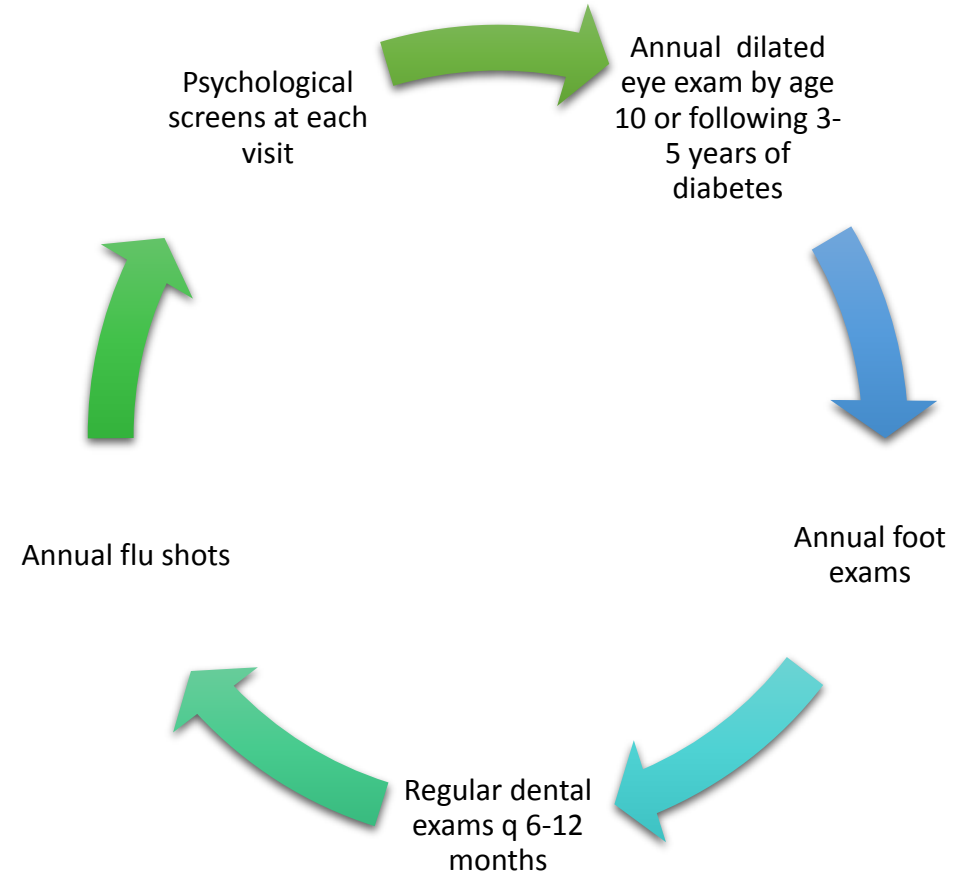
Low sodium diet and regular exercise

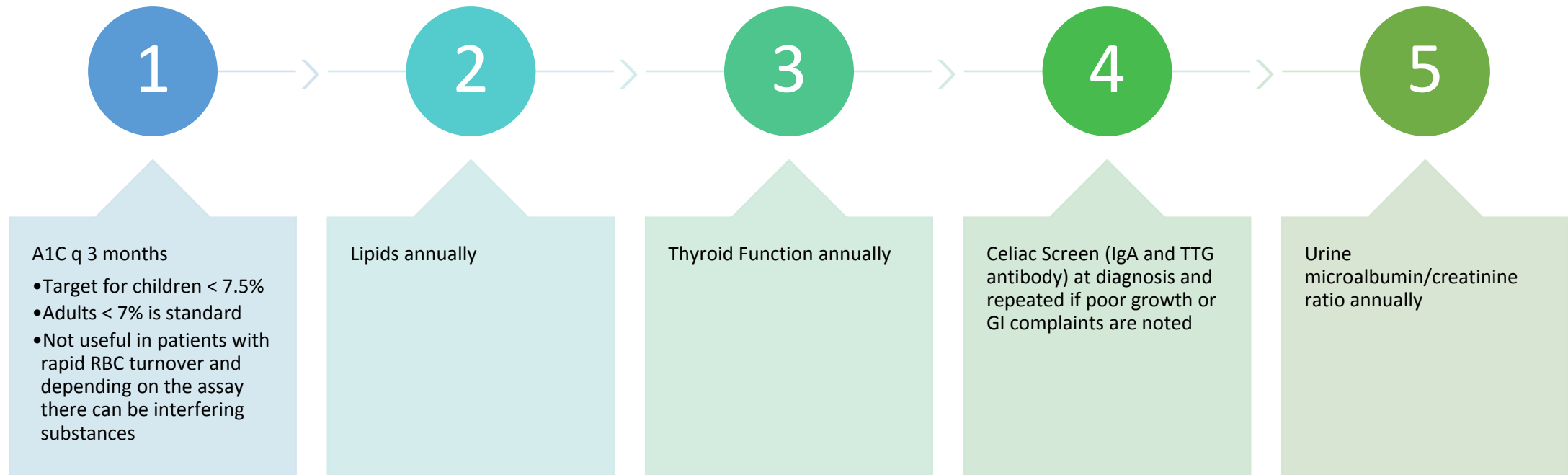


Treat if average systolic blood pressure > 95% for age

ACE inhibitors as first line

Recommended Exams





Recommended Lab Screens

Insulin

Insulin	Brand Name	Onset of Action	Peak	Duration of Action
Human Regular (IV use)	Humulin R Novolin R	0.5 hr	2.5-5 hrs	5-8 hrs
Human-NPH	Humulin N Novolin N	1-2 hr	4-14 hrs	10->24 hrs
Human Lente	Humulin L	1-3 hrs	6-16 hrs	12->24 hrs
Human Ultralente	Humulin U	4-8 hrs	10-30 hrs	18-> 36 hrs
Lispro Insulin	Humalog	<0.5 hrs	0.5-1.5 hrs	< 6 hrs
Aspart Insulin	Novolog	< 0.25 hrs	40-50 min	3-5 hrs
Insulin Glulisine	Apidra	< 0.25 hrs	55 min	< 6 hrs
Insulin Glargine	Lantus	1-2 hrs	No true peak	24 hrs
Insulin Detemir	Levemir	1-2 hrs	No true peak	24 hrs

2 shots per day

- Using NPH and Regular insulin mixes

3 shots per day

- Using NPH and Rapid Analog

Basal-Bolus (MDI)

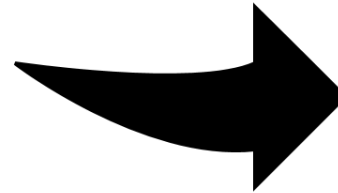
- Long acting insulin+ rapid analog (usually 4+ shots per day)

Insulin Pumps

- Rapid analog alone

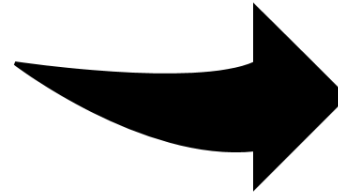
Management Strategies

Insulin Dose Calculations



- Total Daily Dose (TDD)
 - 0.5-1 units/kg/day
- Basal Insulin
 - 50% of the TDD
- Meal Dose-(If using set doses)
 - (50% of the TDD)/3
- Carbohydrate Ratio
 - $500/\text{TDD} = x$
 - 1 unit of insulin: x grams of carbs in a meal/snack
- Correction Factor
 - $(\text{BS-target})/(\text{Insulin Sensitivity Factor})$
 - Target is 180 for toddlers, 150 for children up to 12, and 120 for most patients
 - Insulin Sensitivity Factor = $1500/\text{TDD}$

Dosing Example



- 30 kg child with glucose of 400 mg/dL eating a 60 g carbohydrate meal
- Total Daily Dose (TDD)= 30kg * 0.8= 24 units
- Basal=0.5*TDD=0.5*24=12 units of long acting insulin
 - For a pump 12 units/24 hours=0.5 units/hr of rapid acting insulin
- Set dose= (0.5*TDD)/3=(0.5*24)/3=4 units=
 - 4 units with meals
- Carbohydrate Ratio= 500/TDD=500/20=20.8
 - 1 unit: 20 g carbohydrates
 - 60g/20g= 3 units for the carbohydrates
- Correction Factor= Glucose-150/ISF=(BG-150)/75
 - Insulin sensitivity factor = 1500/20=75
 - 400-150/75=3.33 units of correction

Medications



- Medications
 - **Exogenous Insulin**
 - Biguanides:
 - Increase Insulin Sensitivity and Decrease Hepatic Glucose Production
 - **Metformin** 500-1000 mg po BID
 - Sulfonylureas or Meglitinides: Increase Insulin Secretion
 - Alpha-glucosidase inhibitors or lipase inhibitors
 - DPP-IV Inhibitors: Increase insulin production and decrease hepatic glucose production
 - GLP-1 agonists: Increase insulin production and decrease hepatic glucose production, reduction of post prandial glucagon and food intake (byetta, victoza, Trulicity)
 - Amalyn analogs: (Pramlintide) Delay gastric emptying and suppress glucagon secretion
 - SGLT-2 inhibitors: Canagliflozin, Empagliflozin, Ertugliflozin, and Dapagliflozin: Lower the renal glucose threshold resulting in increased glucosuria and decreased serum glucose

Continuous Subcutaneous Insulin infusion



Intensive insulin therapy using subcutaneous delivery of insulin via pump

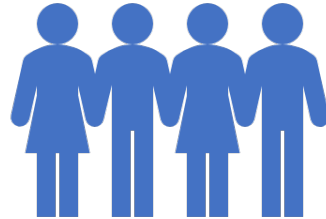


Designed to more closely mimic the pancreas with basal-bolus dosing of insulin



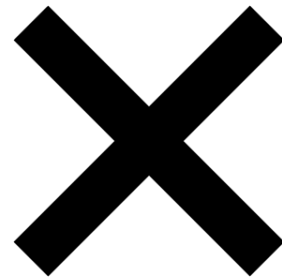
Only uses rapid acting insulin (Aspart, Lispro, Glulisine, or Regular)

Patient Selection



- Are they technically able to operate the pump?
- Are they motivated?
- Do they have a support system in place?
- Are they responsible about their diabetes care?
- Is it cost effective for your patient?
- What is the education level of the patient? Are they willing and able to learn?
- Do they test blood sugars 4-5 times a day?
- Can they recognize and deal with pump malfunction?

Common Misconceptions of Insulin Pump



- The site/needle is surgically implanted
- The pump is for very poorly controlled diabetics
- If the patient is sick or not eating the pump infusion should be discontinued

01

Delivers small doses of insulin every 3-10 minutes

02

Attempts to mimics normal pancreatic function.

03

Most new pumps can be dosed in 0.005-0.05 unit intervals

04

Pt may vary this at different hours of the day based on their particular needs

Basal Rate

Bolus



Patient can enter boluses with meals and snacks



Many pumps also calculate for correction factor based on pts insulin sensitivity and can add this to the mealtime bolus



Calculates time of last bolus to avoid stacking insulin



Boluses may be entered in 0.1 unit intervals

Example 0.3 units to cover milk in coffee

Common Problems

- Infusion site infection
- Prevention:
 - Clean the area before inserting new site
 - Change site every 2-3 days
 - Frequent site inspection
 - Respond to pain or local irritation



What if Pump Breaks?



- Pump repair or replacement within 24 hours with most companies
- Always have a backup plan
- Pump holiday with long acting and rapid acting insulin injections

DKA / Pump

Pump uses only rapid acting insulin

If malfunction occurs the user has no insulin in their system within 1-2 hours

Pt must remember to check BS 1-2 hours after inserting a new site

Also remember that the pump holds up to 3 mL of insulin (300 units) and if exposed to extreme heat (hot tub, etc) the insulin may be denatured

Pack	Always pack extra supplies
Get	Get a letter from your Provider for flights, especially international
Bring	Always bring Lantus as a backup
Have	Have backup syringes on hand
Take	Take advantage of the variable basal capabilities

Travel Tips

Alabama Medicaid Coverage

1. They must complete an education program and have been on MDI therapy for at least 6 months with 4 times daily blood glucose checks for 2 months plus:

2. patient has been on a pump prior to Medicare enrollment and has documented blood sugar checks for 1 month before

HbA1C > 7

Recurrent hypoglycemia

Widely fluctuating blood sugars

- QUESTIONS?

