

Diabetes in children and adolescents

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FACE**



Case 2.

- A 12 year old girl with type 1 diabetes for 3 years. She is on mixtard twice daily and actrapid at lunch time. Her family came complaining that their daughter was having recurrent hypoglycemia several times /day but this was not documented. She gave her self insulin injections the family was not sure of the dose. She was refusing to check her sugars. In the clinic her blood sugar was 529 mg/dl and her Hba1c was 14 %. She was also refusing to go to school because she didn't feel well.

Case 3.

- A 12 yr. old boy with diabetes for 5 years was brought to the clinic because of high sugars for the last few months. He had been admitted to the hospital 4 times with diabetic ketoacidosis within the last 2 months and in between his admissions his blood sugars were always high. HIS DOSE OF INSULIN WAS NEVER CHANGED. He was told to stop eating almost everything except salad on his last admission and was told that his dose was calculated according to his weight. His blood sugar was hi on measurement in the clinic and his Hba1c was 15 %.

Introduction

- Type 1 diabetes is the most common chronic illness in childhood.
- Differentiates from adult care.
- Differences in size of the pts, unpredictability of toddler's dietary intake and activity level
- Increased risk of hypoglycemia and DKA.

Goals

- **Successful management of children with diabetes includes the following.**
 1. **Balancing strict glycemic control which reduces the risk of long term sequelae, and avoidance of severe hypoglycemia.**
 2. **Setting realistic roles and goals for each child and family.**
 3. **Maintaining normal growth, development and emotional maturation.**
 4. **Training the patient and family to provide appropriate daily diabetes care in order to attain glucose control and to recognize and treat hypoglycemia.**

Training and care of the patient

- **Initial phase**

Begins at time of diagnosis. In the first few days, the family begins to understand the disease process and is trained to successfully administer insulin, check blood glucose concentrations, check for ketonuria and recognize and treat hypoglycemia.

- **Basic understanding**
- **Insulin administration**
- **Blood glucose monitoring**
- **Ketonuria**
- **Hypoglycemia**

Families are instructed to recognize the signs and symptoms of hypoglycemia, this is particularly difficult in the non-verbal young child and infant in whom the signs of hypoglycemia are nonspecific.

- **Ongoing phase**

After the initial phase the diabetes team continues to provide care, teaching and support to the child and family.

- 1. Concepts that are required for glycemic control are stressed including the interaction of insulin, diet and exercise on blood glucose concentrations.**
- 2. As the child grows older the education and training are directed toward self management for the patient.**

Age based care

■ Infants

1. Infants younger than 1 yr of age are at highest risk of severe hypoglycemia.
2. Hypoglycemia is difficult to detect
3. Hypoglycemia can also lead to neurological complications.
4. The frequent feeding schedule of infancy makes it challenging to develop a management plan that avoids episodes of hypoglycemia but provides sufficient glycemic control.

Toddlers

- The issues surrounding the care of toddlers 1-3yrs of age are similar to those in infants.
- The parents must learn to recognize episodes of hypoglycemia.
- Hypoglycemia is a constant concern because of the erratic food intake and activity levels of toddlers.
- It may also be difficult to differentiate between a temper tantrum and hypoglycemia.

Preschool and early school-aged children

- 3-7 years
- The patient may start participating in their own care by testing their blood glucose or preparing materials.
- Childcare providers need to be educated regarding diabetes care.

School aged children

- 8-11 years
- They can assume more of the management of their diabetes with adult supervision and support.
- Can administer insulin but it should be under supervision.
- The disease has a psychological impact and they may develop anxiety and depression.
- They need to attend school regularly.

Adolescents

- They can be responsible for the daily management of their diabetes but if they have no adult supervision they have poor glycemic control.
- There is a lot of parent-child conflict over daily management and this leads also to poor control.
- Shared management between the adolescent and parents has been associated with better results.
- Adolescents start driving
- Smoking
- Psychiatric issues; a 3 fold increase in depression and eating disorders.

Glycemic control

- **Both in children and adults, the goal of management is to maintain glucose control as near to normal as safely possible. The targeted goal of this glycemic balance varies based upon the risk of hypoglycemia which is age dependent.**
- **In adults an A1c value of 7 percent or less is the targeted goal.**
- **Long term complications**
- **DCCT which demonstrated that strict glycemic control delayed the onset of microvascular disease (retinopathy, nephropathy, and neuropathy), slowed progression of already present microvascular disease, and decreased the incidence of cardiovascular disease**
- **Hypoglycemia the DCCT showed that as HbA1c decreased the incidence of hypoglycemia increased.**

Good Glycemic Control

Reduces Complications

	<u>DCCT</u>	<u>Kumamoto</u>	<u>UKPDS</u>
HbA _{1c}	9 → 7%	9 → 7%	8 → 7%
Retinopathy	63%	69%	17-21%
Nephropathy	54%	70%	24-33%
Neuropathy	60%	—	—
Macrovascular disease	41%*	—	16%*

* not statistically significant

Diabetes Control and Complications Trial (DCCT) Research Group. *N Engl J Med.* 1993;329:977-986.

Ohkubo Y et al. *Diabetes Res Clin Pract.* 1995;28:103-117.

UK Prospective Diabetes Study Group (UKPDS) 33. *Lancet.* 1998;352:837-853.

Age specific goals

- **Age specific ADA A1c goals**
 1. < 6 yrs -7.5-8.5 %
 2. 6-12 yrs <8 %
 3. 13-17 yrs <7.5%
- **Age specific blood glucose levels**
 1. **Bedtime goals**
 - < 6yrs 110-200 mg/dl
 - 6-12 yrs 100-180 mg /dl
 - 13-19 yrs 90-150 mg/dl
 2. **Before meals**
 - < 6 yrs 100-180 mg/dl
 - 6-12 yrs 90-180 mg/dl
 - 13-19 yrs 90-130 mg/dl

Blood glucose monitoring

- Frequent monitoring has been shown to improve glycemic control in children and decrease the frequency of severe hypoglycemic episodes.
- The ADA recommends testing of blood glucose at least 4 times /day.
- Some children need more frequent monitoring.
- This is especially true for small children who are at increased risk for severe hypoglycemia. And in pts who are treated with intensive therapy who have multiple meals snacks per day and require blood glucose checks prior to administration of a premeal bolus of insulin.
- Blood glucose meters and continuous glucose monitoring are available.





Insulin

- There are many different types of insulins and delivery systems available.
- The selected regimen should be individualized for the child and family to fit their lifestyle and optimize compliance.
- Preparations
 1. Rapid-acting and short acting
 2. Intermediate NPH
 3. Long-acting

Administration

- Needle and syringe (NPH and rapid insulin can be mixed in one syringe)
- Pens
- Pumps

Regimen choices

- **Conventional regimen Intermediate insulin twice daily with a rapid acting insulin 2-3 times /day**
For this regimen the daily schedule should be fixed.
- **Intensive regimens (basal insulin with premeal boluses of a rapid acting insulin. These boluses are adjusted according to the carb content of the meal in addition the current blood sugar reading**
- **The intensive regimen allows more flexibility than the conventional regimen in terms of timing and carb content of meals.**

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- Premeal and presnack bolus does are based upon
 1. Premeal blood glucose level
 2. Estimated amount of carbohydrates to be consumed
 3. Expected level of exercise after the meal

Intensive therapy

- **Insulin glargine + rapid acting insulin bolus**
- **Insulin pump should be considered for patients with one or more of the following characteristics**
 1. **Wide fluctuations in blood glucose levels**
 2. **Suboptimal diabetes control**
 3. **Microvascular complications and or risk for macrovascular complications**
 4. **Good metabolic control but insulin regimen that compromises lifestyle.**





Insulin dosing in children

- **Insulin requirement is based upon body wt, age and pubertal stage of the child**
- **Usually the initial dose is 0.5-1 unit/kg.**
- **Prepubertal children usually require lower doses.**
- **Higher doses are needed in pubertal children, ketoacidosis or pts taking steroids.**
- **Follow up every 3 months are required to adjust for increasing insulin requirements.**
- **As a child enters puberty daily insulin requirements may increase to more than 1 unit /kg as puberty increases insulin resistance.**

Intensive therapy dosing

- The basal insulin requirement is approximately 40-50% of the total daily dose.
- Correction of elevated blood glucose- an insulin correction factor can be used to adjust the insulin dose for hyperglycemia before meals or between meals.
- For rapid acting insulin divide 1500 by the total daily insulin dose. This calculation estimates the decrease in blood glucose from one unit of a rapid acting insulin.
- Utilization of ingested carbs.
- The amount of carbs covered by 1 unit of insulin can be calculated by dividing 500 by the total insulin dose, e.g. if the total insulin dose is 50 units /day then 1 unit of insulin will cover 10 gms of carbs.

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- On average 1 unit of insulin is required to cover.
 1. 20 gms of carbs in most young children
 2. 10-12 gms of carbs in older prepubertal children.
 3. 8-10 gms of carbs in pubertal adolescents.

Honey moon phase

- A few weeks after the diagnosis and initiation of insulin therapy, a period of decreased exogenous requirement of insulin may occur.
- During this period , the remaining functional beta cells secrete some endogenous insulin resulting in reduced exogenous requirement.
- Close monitoring is required as hypoglycemic episodes are likely if the insulin dose is not adjusted.
- The duration of this phase is variable and may last a few months to a few yrs.
- The end of the phase is indicated by rising blood glucose A1c and increasing insulin requirements.

Other management issues

- **Nutrition**
- **Exercise**
- **Psychosocial issues**
- **Follow-up**

frequency of follow up visits is tailored to the needs of the child and family.

Visits more common initially.

Once the family is well trained follow up should be every 3 months.

Screening

- 1. A complete physical exam should be done at least twice a yr.**
- 2. Ht and wt**
- 3. Blood pressure**
- 4. Pubertal assessment**
- 5. Thyroid examination**
- 6. Examination of injection sites**
- 7. Fundoscopic exam**
- 8. As disease progresses extremity examination**

Laboratory evaluation

- **Glycemic control**
- **Screening for complications and associated conditions (celiac disease, nephropathy, retinopathy, dyslipidemia, autoimmune thyroiditis)**
- **A1c every 3 months**
- **Annual screening for micro albuminuria for children > 10 yrs or more than 5 yrs duration of diabetes**
- **Annual ophthalmological exam for children > 10 yrs or 3-5 yrs duration**
- **Annual foot examination**
- **Celiac disease screening every other yr.**
- **Lipid profile at puberty and if normal every 5 yrs/**
- **Thyroid function testing and if normal every 1-2 ykrs**



Any questions ?