



Certified Pediatric Nurse Review Course: Endocrine & Metabolic Disorders

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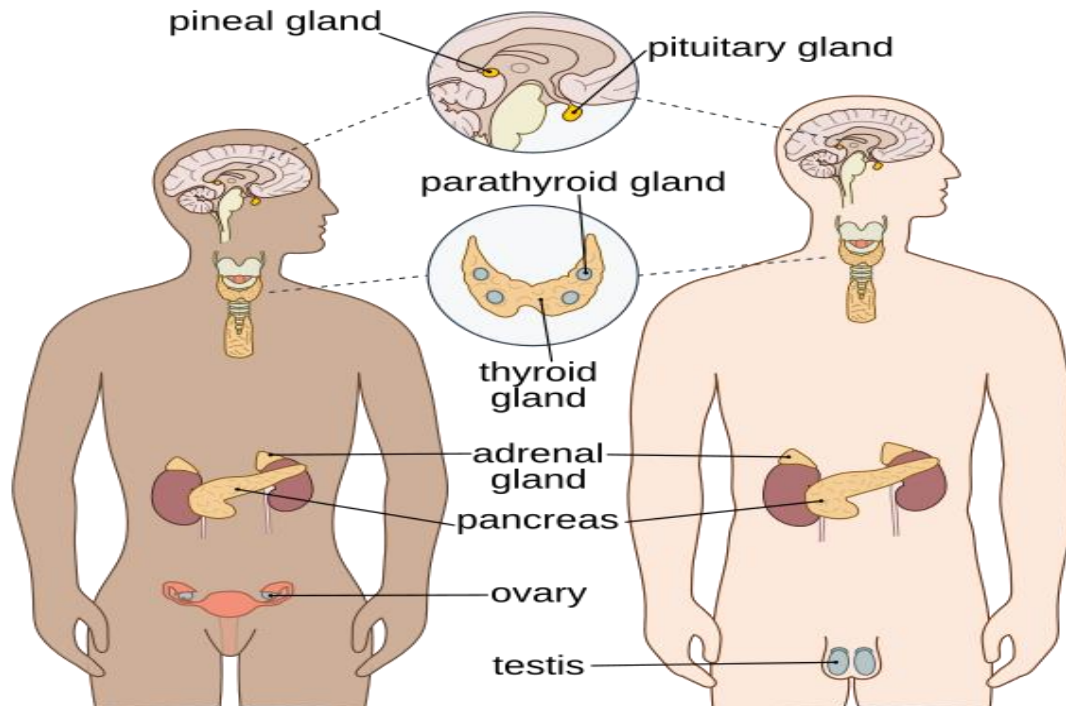


NEMOURS
CHILDREN'S HEALTH

Objectives

- Discuss components of the endocrine system.
- Review endocrine system function.
- Assess and plan nursing care for the child with type 1 diabetes.
- Describe conditions resulting from disorders of the endocrine glands.
- Assess alterations in growth and development from the hypo/hypersecretion of thyroid hormones.

Introduction



https://commons.wikimedia.org/wiki/File:1801_The_Endocrine_System.jpg

The endocrine system is responsible for regulating growth, metabolism, fluid and electrolyte balance, sexual reproduction, and the body's response to stress.

Endocrine glands are ductless and secrete hormones directly into the circulation.

Hormones are transported throughout the body and affect metabolic processes and functions.

Endocrine dysfunction can result from hyposecretion of hormones

Endocrine Glands

Pituitary

Thyroid

Parathyroid

Adrenal

Pancreas

Ovaries

Pineal

Testes

Thymus

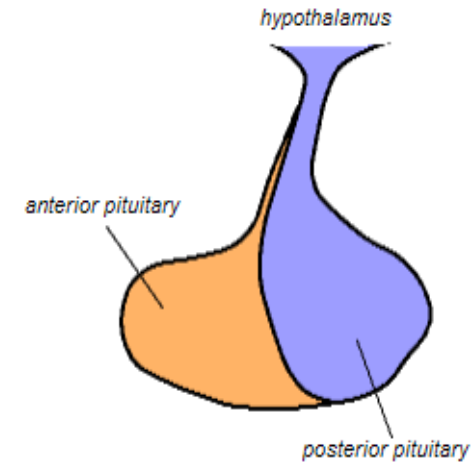
Pituitary Gland

Anterior Lobe

- Growth
- Sexual development
- Thyroid function
- Adrenal function
- Skin pigment

Posterior Lobe

- Influences uterine contractions
- Produces antidiuretic hormone



https://commons.wikimedia.org/wiki/File:Pituitary_gland_representation.PNG

- Releases growth hormone
- Called the master gland because it controls the release of other hormones



Altered Posterior Pituitary Function

SIADH

Syndrome of Inappropriate Antidiuretic Hormone



Result of brain tumor, head trauma or surgery, brain infection



Causes an increased release of ADH that tells the kidney to reabsorb too much water resulting in decreased output, extended fluid volume in the vessels, and diluted sodium concentration.

SIADH

Assessment

- Edema
- Intake & Output
- Risk of seizures and cerebral edema

Interventions

- Fluid restriction
- Vasopressin agonist
- Seizure precautions

Diabetes Insipidus

Diabetes Insipidus is due to under secretion of ADH resulting in massive fluid loss and hypernatremia

Central DI- caused by
Neoplasm, removal of
pituitary gland, or head
trauma

Nephrogenic DI- X
chromosome inherited
disorder, polycystic kidney
disease, electrolyte
disorders, nephrotoxic
drugs

Diabetes Insipidus

Assessment

- Polyuria
- Polydipsia
- Enuresis
- Dehydration

Diagnosis

- Fluid restriction trial
- IV vasopressin trial

Intervention

- Strict I&O
- Daily Weight
- Monitor for Electrolyte imbalance
- Hourly fluid replacement
- IV or Nasal Vasopressin

Precocious Puberty

Puberty occurs before 8 in females and before 9 in males

Rapid growth occurs, but epiphyseal plates close early causing short stature

Abnormal lab values: FSH, LH, Estradiol, and testosterone

Check for bone age by looking at epiphyseal closure on X-rays

Treatment- LH via IM injection every 4-12 weeks to slow progression of puberty

Deficient Anterior Pituitary Hormone:
Pituitary Dwarfism

Introduction

- Hypopituitarism results in decreased growth hormone.
- It can be idiopathic or caused by a brain tumor, trauma, or lesions.



Alpha Stock Images - <http://alphastockimages.com/>

Assessment

- Gradual decrease in height compared to peers
- **Short stature but normal body proportions**
- Appears younger than expected, but not malnourished
- **Bone age studies reveal growth retardation**
- Delayed pubertal development
- Dental anomalies with permanent teeth



https://www.freemalaysiatoday.com/_next/image?url=https%3A%2F%2Fmedia.freemalaysiatoday.com%2Fwp-content%2Fuploads%2F2020%2F03%2Fchild_health-problems_lifestyle-27032020.jpg&w=1200&q=75

Intervention



Administer growth hormone



Social and Psychological support



Treat according to mental age, not bone age or height

A photograph of four young children sitting on a grassy lawn outdoors. They are all smiling and clapping their hands. The child in the center is a young boy with curly hair wearing a white t-shirt. To his left is a girl with curly hair in a striped shirt. To his right is a girl with long dark hair in a pink shirt. On the far right, another girl is partially visible, also smiling. The background shows green trees and a clear sky.

Pituitary Disorders

Hyperpituitarism Introduction

Hyperplasia of pituitary cells or a pituitary tumor.

Signs and symptoms depend on whether hypersecretion of growth hormone occurs **before or after** the epiphyseal plate closes.

Hyperpituitarism - Gigantism

Increased release of growth hormone occurs **BEFORE** the closure of the epiphyseal plate.

Signs/Symptoms

- Elongation and enlargement of the long bones, facial bones, and accompanying body tissue
- Late closure of fontanel
- Proportional body growth

Hyperpituitarism - Acromegaly

Increased release of growth hormone occurs **AFTER** the closure of the epiphyseal plate.

Signs/Symptoms

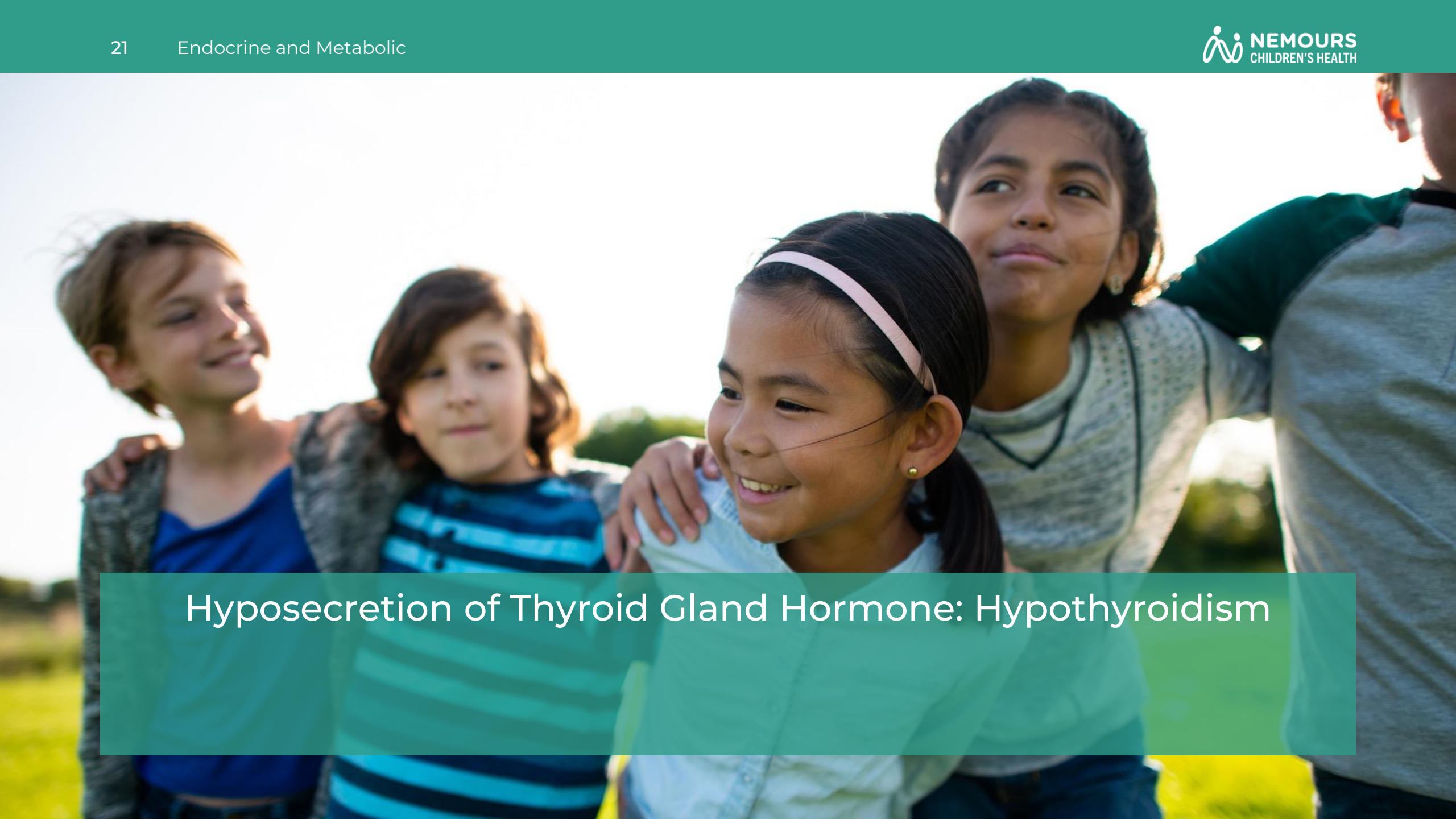
- Enlargement of hands, feet, nose, tongue, and jaw.
- Thickening of the skin and coarseness of facial features.

Interventions for Hyperpituitarism

Radiation



Social and emotional
support



Hyposecretion of Thyroid Gland Hormone: Hypothyroidism

Introduction

The thyroid regulates the basal metabolic rate.

Decreased secretion of thyroid hormones from decreased development of the thyroid gland or from medications that suppress hormone production.

The thyroid depends on dietary iodine and tyrosine to function normally.

Hypothyroidism can be congenital or acquired

Assessment – Hypothyroidism

Congenital Hypothyroidism

- **Intellectual disability-develops as disorder progresses if not treated.**
- **Short stature- legs shorter in relation to trunk size**
- **Short thick neck**
- **Enlarged tongue**
- Hypotonia
- Delayed dentition

Acquired Hypothyroidism

- **Slow basal metabolic rate (easy weight gain)**
- **Cool body and skin temperature**
- **Slow pulse**
- **Dry, scaly skin**
- **Decreased perspiration**
- **Constipation**
- **Fatigue, tiredness**

Interventions for Hypothyroidism



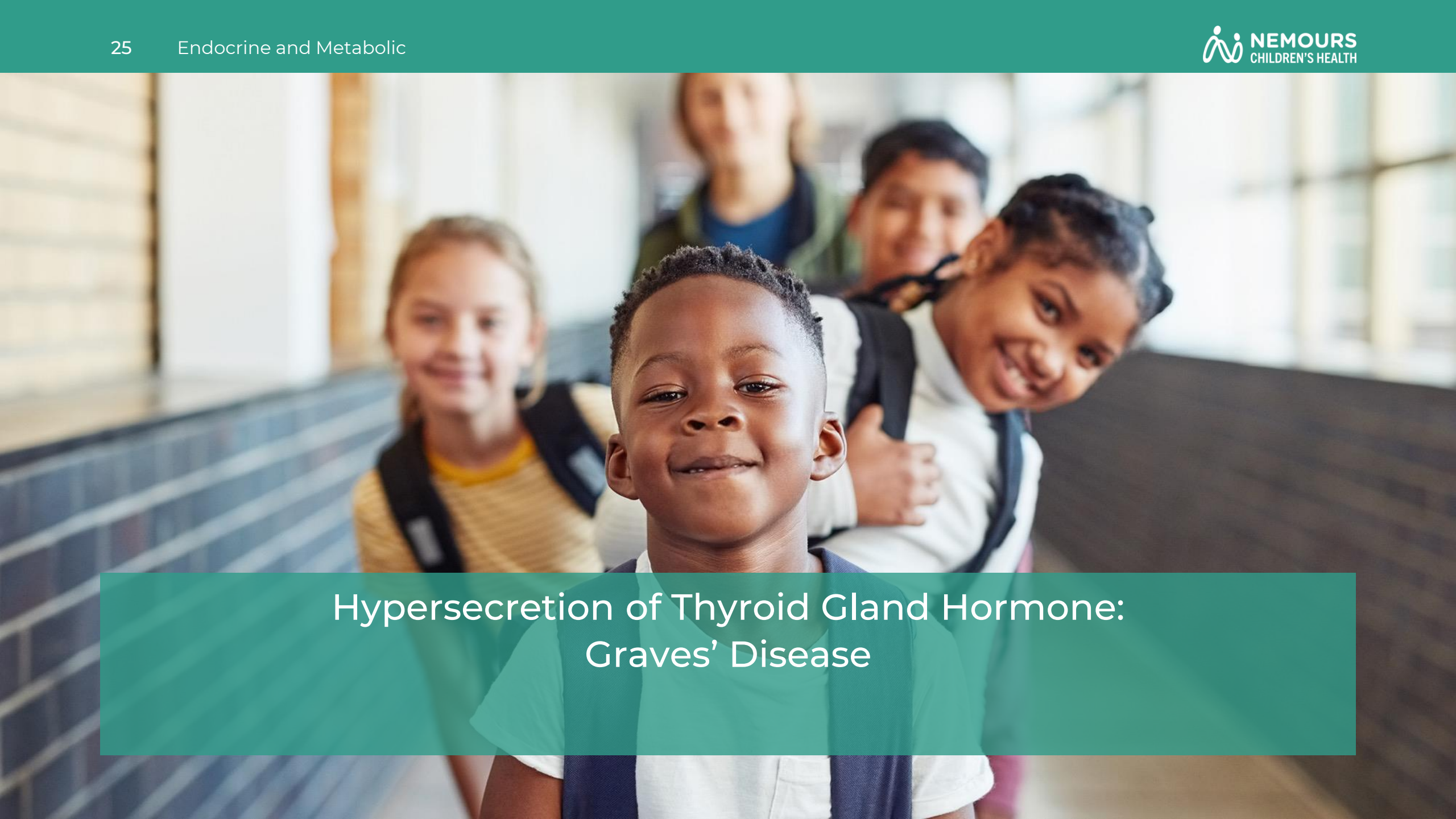
Oral thyroid hormone
(thyroxine)



Supplemental
Vitamin D



Monitor growth and
development



Hypersecretion of Thyroid Gland Hormone: Graves' Disease

Graves' Disease

- May be due to autoimmune response

Assessment

- Tachycardia
- Nervousness
- Tremors
- Heat intolerance
- Increased sweating, weight loss, insomnia, exophthalmos, goiter

Interventions

- Drug therapy
- Subtotal thyroidectomy
- Ablation with radiodine

Thyroid Storm

- Rare Emergency
- Due to sudden release of thyroid hormone
- Results in acute onset of high fever and tachycardia

Seek immediate medical attention





Parathyroid Disorders

Hypoparathyroidism

- PTH is secreted by the parathyroid gland
- Causes can be congenital or secondary

PTH is responsible for:

- ✓ Regulation of calcium released from the bone
- ✓ Absorption of calcium from the intestines
- ✓ Conservation of calcium in the kidneys



Hypoparathyroidism Assessment

Arrhythmias

Anxiety

Muscle
hypertonia

Brittle nails

Dry skin

Fatigue

Paresthesia

Poor dentition

Weakness

Seizures

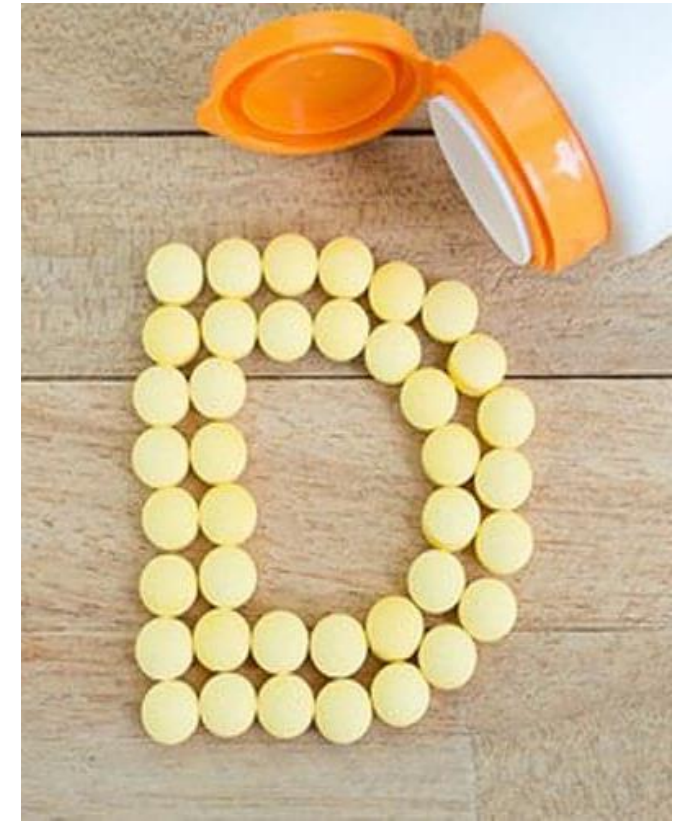
Laryngospasms

Chvostek sign

Trousseau sign

Hypoparathyroidism Nursing Interventions

- Administer Calcium
- Administer Vitamin D - promotes calcium absorption
- Trach kit should be available due to risk of laryngospasm and stridor
- Seizure precautions
- Educate on diet high in calcium and low in phosphorus



<https://www.freemalaysiatoday.com/category/bahasa/2019/04/01/bahaya-jangan-ambil-vitamin-d-berlebihan-ada-banyak-kesan-sampingan>

Hyperparathyroidism



- Parathyroid makes too much PTH causing high levels of calcium
- Causes can be benign tumors of the parathyroid gland, renal disease, and low vitamin D levels.
- If untreated can lead to osteopenia or osteomalacia and renal calculi

<https://icon-icons.com/icon/medical-disease-skeleton-bone-joint-injury-broken/133510>

Hyperparathyroidism Assessment



Joint pain, fractures, muscle weakness



Nausea, vomiting, abdominal pain



Weight loss, fatigue



Headaches, hallucinations, depression



Flank/kidney pain, frequent urination

Hyperparathyroidism Diagnosis

Abnormal lab values

Imaging studies – assess for parathyroid tumor

Bone density scan

EKG

Hyperparathyroidism Interventions

Surgery

Administer
high levels
of vitamin D

Safe and
restful
environment

Assess for
dehydration



Adrenal Disorders

Cushing Syndrome: Overview

Hyperadrenocorticism

High cortisol levels produced -> decreased secretion of ACTH

Often due to tumor in the pituitary gland

Can be caused by prolonged/excessive use of corticosteroids

Cushing Syndrome Assessment

Central obesity –
increased
accumulation of fat on
chest, upper back,
and face (moon face)

Increased
gluconeogenesis;
decreased glucose
tolerance

Muscle weakness and
atrophy

Purple striae on skin

Easy bruising

Osteoporosis

Acne

Facial hair
growth/hirsutism

Decreased linear
growth

Hypertension

Mood disorder

Poor wound healing

Cushing Syndrome Interventions

- **Promote a clean environment because of decreased immunity to infection**
- **Administer steroids early in the morning on and an alternate-day basis, if possible**
- Nasogastric decompression
- Be supportive related to mood changes
- Prepare for surgery if needed to remove tumor
- Slowly taper exogenous corticosteroids

Addison's Disease

Involves the hormones cortisol and aldosterone

90% of adrenal tissue must be nonfunctioning before s/s are manifested.

Assessment

- Craving salty food
- Dehydration, vomiting, diarrhea
- Fatigue, muscle weakness, hypotension
- Hyperpigmentation in crease of hands, elbows, and knees
- Hypoglycemia
- Weight loss

Intervention

- Administer cortisone and hydrocortisone
- Maintain fluid and electrolyte balance

Acute Adrenal Crisis

Critical deficiency of mineralocorticoids and glucocorticoids

Early s/s

- Abd pain, diarrhea, nausea, vomiting
- Headache, irritability, weakness

Other s/s

- Septic shock
- Hypotension, shallow respirations, weak peripheral pulse
- Circulatory collapse

Newborn s/s

- Cyanosis
- High fever
- Tachypnea
- Seizure

Acute Adrenal Crisis Interventions



Replacement
corticosteroids



Fluids



Antibiotics



VS every 15
minutes



Seizure
precautions

Congenital Adrenal Hyperplasia

- Failure of the adrenal gland to produce cortisol
- Autosomal recessive disorder

Females

- Infants - ambiguous genitalia, enlarged clitoris, labial fusions.
- During puberty - develop male characteristics (hirsutism, acne, deep voice, failure to menstruate)

Males

- No abnormalities in infants
- During puberty - deeper voice, enlarged penis, frequent erections.

Congenital Adrenal Hyperplasia Interventions



- IM cortisone or hydrocortisone
- IM hormones
- Emotional support and therapeutic communication
- Prepare child and patient for possible surgery
- Lifelong steroid replacement therapy will be needed
- Educate family on s/s of dehydration

Pheochromocytoma

Rare catecholamine secreting tumor of adrenal origin.

Presents between age 11-13 years of age.

More predominant in females.

Assess for: constipation, weight loss, hyperglycemia, hypertension, and tachycardia.

DO NOT palpate the mass because it can stimulate hypertension and tachyarrhythmias

Tumors secreting epinephrine cause tachycardia and require a beta blocker

Pancreatic Disorders:
Type 1 & Type 2 Diabetes Mellitus

Introduction Type 1 Diabetes



Most common type of diabetes in children

Usually diagnosed between 10-14 years of age

Can be genetic predisposition

Type 1 Diabetes

No insulin is produced, and the cells cannot use glucose; excess glucose in the blood spills into the urine.



The increased blood glucose can act as an osmotic diuretic, resulting in polyuria, dehydration, polydipsia, hypotension, and renal shutdown.



Without glucose, the cells are starving, resulting in signals of hunger and increased food intake.



The body attempts to compensate for lost energy by converting triglycerides to fatty acids, which then form ketones with resulting metabolic acidosis.

Diagnosis – Type 1 Diabetes



- **Two fasting plasma glucose levels of >126 mg/dl or two random plasma glucose levels >200 mg/dl**
- Prediabetes is considered a fasting blood sugar 100-125 mg/dl
- May appear thin and malnourished

Care of the Type 1 Diabetic Patient

- If unsure whether a stuporous diabetic is hypoglycemic or hyperglycemic, treat for hypoglycemia as this is life threatening.
- Illness increases blood sugar and insulin needs
- Exercise decreases blood sugar and insulin needs
- Diabetic Action Care Plan - stipulates amount of insulin needed based on blood sugar and a correction factor. Treatment for hypoglycemia is also included.

Hyperglycemia

- Can result from :
 - Increased intake of sugar
 - Decreased use of insulin
 - Decreased exercise with no decrease in food intake
 - Increased stressors
 - Infection
 - Cortisone use



Hyperglycemia Assessment

Cardinal signs and symptoms: polyuria, polydipsia, and polyphagia

Test blood sugar

Test for glycosuria and ketonuria using a dipstick ***when glucose reaches 200mg/dl, renal tubules cannot absorb all of the sugar, causing it to spill into the urine***

Dry, flushed skin

“fruity”/acetone breath odor

HgbA1c

Glycosylated Hemoglobin A1

Monitors long term control of blood sugar

HbgA1C below 7% is the goal

- **Hemoglobin in RBC's attaches to sugar**
- **RBC's live for 90-120 days**
- **HgbA1c measures the average amount of blood sugar over the past 90-120 days**





Continuous Glucose Monitoring

Check blood sugars continuously and sends information by wireless transmission to a receiver or insulin pump.

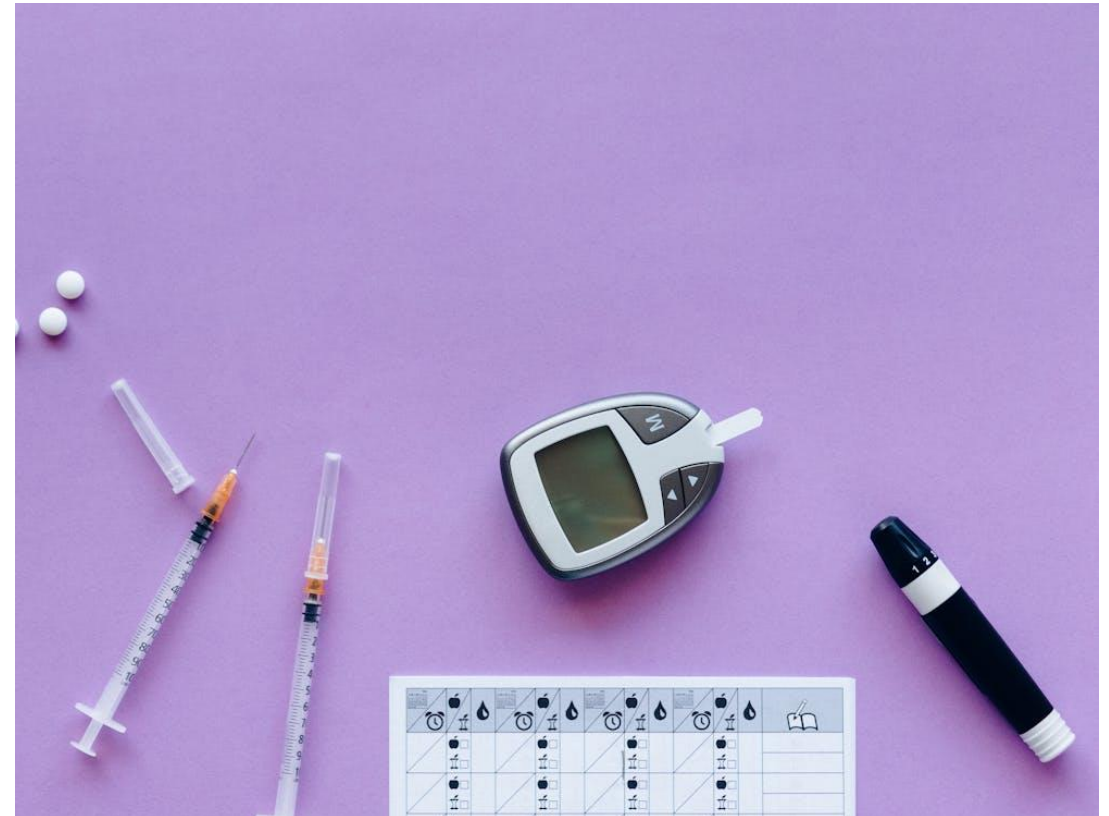
Does not replace the glucose monitor or need to check blood sugars

Check blood sugars for accuracy when monitor reads high or low blood sugars

Readings can be followed remotely via an app on cell phone or computer

Interventions for Hyperglycemia

- **Rapid acting insulin for fast action**
- **Give fluids without sugar to flush out ketones, this includes IV fluids with dextrose**
- **Follow treatment for acidosis**
- Monitor blood sugar



Hypoglycemia

Insulin shock

Blood sugar <70mg/dl

Can result from:

- Increased insulin use
- Excessive exercise
- Failure to eat

Assessment for Hypoglycemia

Increased vital signs

Sweating

Tremors

Behavior changes :
slow thinking,
confusion, irritability,
poor coordination

Ask if they have
eaten or exercised

Interventions for Hypoglycemia

Fast acting carbohydrate:

- **Tube of gel for cake icing**
- **½ cup orange juice**
- **½ cup regular soda**

Protein source: crackers with peanut butter or cheese

*****Avoid complex sugars such as a candy bar*****

Conscious child- Give 15 grams of fast-acting carbohydrates, followed later by a protein source

Unconscious child- administer glucagon. ***Place child on their side as glucagon can cause vomiting***

Seizure precautions

Insulins

- **Lispro/Humalog (clear/rapid acting):** onset 10-15 minutes, peaks in 30-90 minutes
- **Regular (clear, fast acting):** onset 30 minutes, peaks in 2-3 hours.
- NPH (cloudy, intermediate acting): onset 2-4 hours, peaks in approximately 8 hours.
- **Lantus (clear, long acting):** used only for basal needs; has no peaks and is not related to meals.

Do not mix Lantus with other insulins



Administration of Insulin

- When giving two types, draw up clear first
- Do not shake vial
- **Rotate injection sites to prevent lipodystrophy: lipodystrophy will alter the rate that insulin is absorbed.**
- **Eat when insulin peaks, in younger children it is acceptable to administer insulin immediately after eating.**
- **Insulin requirements may be altered with: Illness, stress, growth, food intake, and exercise**
- **The best way to determine insulin adjustment is glucose measurement**
- Dosage is based on either amount of carbohydrates consumed and/or blood sugar

Insulin

- Administered **at least** twice a day, before breakfast and dinner

Storage of insulin:

- Unopened vials in refrigerator
- Open vials may be stored at room temperature
- Open vials are good for 1 month
- Insulin pens are good for 14-30 days depending on type

Insulin pumps

- Delivers basal insulin (Lispro/Humalog) continuously.
- A bolus is needed to cover carbohydrates in meals
- Disconnect for water activities and showers
- When disconnected the blood sugar needs to be checked hourly-have fasting acting insulin available.





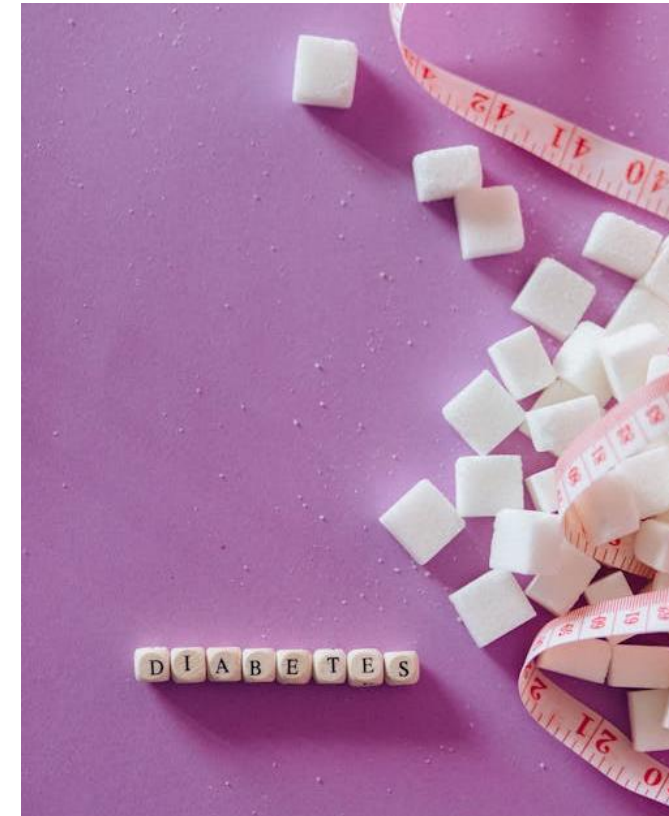
Type 1 Diabetes Meal Planning

May require a prescribed number of carbohydrates or an exchange list for carbohydrates

One carbohydrate choice is 15 grams of carbohydrates

Complications of Diabetes

- Shortened life expectancy
- Nephropathy - primary cause of death
- Premature atherosclerosis
- Retinopathy
- Poor wound healing
- Predisposition to infection



Honeymoon Period

One time remission
of symptoms

Occurs shortly after
insulin treatment is
started

Final effort by the
pancreas to produce
insulin

Can be insulin free
for up to 1 year, but
may need oral
hypoglycemics

Symptoms of
hyperglycemia will
reappear, and the
child will be insulin
dependent for life.

Introduction Type 2 Diabetes



- Typically seen in obese and overweight children who are physically inactive
- Occurs as a result of insulin resistance plus some insulin deficiency
- 30%-45% of DM in children is Type 2
- Caused by genetic and environmental factors
- Biggest cause of morbidity and mortality for the next generation of adults

Assessment of Type 2 Diabetes



- Acanthosis nigricans- a thickening and hyperpigmentation of the skin at the neck and axillary areas
- Hypertension
- Hyperlipidemia
- Sleep apnea



Interventions

Activity

Weight loss

Medication

Metformin –(Glucophage)- decreases glucose production by the liver



Let's Check Your Knowledge!

Question 1

The nurse working on a pediatric endocrine unit is caring for a 12-year-old patient newly diagnosed with Type 1 diabetes. Which of the following is the **most important** point for the child and caregivers at discharge?

- A. Proper storage of insulin pens/vials
- B. The importance of limiting all carbohydrates from the diet
- C. Recognizing signs and symptoms of hypoglycemia
- D. That oral medications will be used before insulin injections

Answer

C. Recognizing signs and symptoms of hypoglycemia

Hypoglycemia is a blood glucose less than 70 that can lead to medical emergencies such as loss of consciousness and seizures. Patients and caregivers need to be educated on signs and symptoms of hypoglycemia in the conscious and unconscious child so that it can be treated as quickly as possible. Proper storage of insulin is importance but not an emergency. Patients and families should be educated on counting carbohydrates to administer the correct amount of insulin for coverage, but do not need to eliminate carbohydrates form their diet. Oral medications are used with Type 2 diabetes.

Question 2

A 7-year-old child is diagnosed with Acquired Hypothyroidism. Which of the following findings should the nurse expect to find during the assessment?

- A. Hyperactivity and weight loss
- B. Tachycardia and irritability
- C. Constipation and dry scaly skin
- D. Heat intolerance

Answer

C. Constipation and dry skin

Constipation and dry scaly skin are classic signs of acquired hypothyroidism. Bradycardia, fatigue and tiredness are also symptoms. Hyperactivity, weight loss, tachycardia, irritability, and heat intolerance are all signs and symptoms of Hyperthyroidism.

Question 3

A nurse is caring for a child with newly diagnosed diabetes insipidus (DI). Which of the following findings should the nurse expect?

- A. Low urine output and concentrated urine
- B. High urine output and signs of dehydration
- C. Hyperglycemia and fruity smelling breath
- D. Chvostek sign and Trousseau sign

Answer

B. High urine output and signs of dehydration.

Diabetes insipidus is caused by a deficiency of or insensitivity to antidiuretic hormone (ADH), leading to polyuria, dilute urine, and dehydration despite high fluid intake. Low urine output and concentrated urine are more consistent with SIADH, not DI. Hyperglycemia and fruity smelling breath are consistent with DKA, a complication of Type 1 Diabetes, not DI. Chvostek sign is Hyperirritability of the facial nerve occurring when the facial nerve branches are tapped. Trousseau sign is a spasmic contraction of the muscles of the hands and feet triggered after blood pressure cuff is inflated. Both are signs of Cushing Syndrome, not DI.

Question 4

A nurse is providing education to the caregivers of a 6-year-old girl newly diagnosed with precocious puberty. Which statement by the parents indicates a need for further teaching?

- A. "We will help her deal with peer issues related to early development."
- B. "She will likely need hormone therapy to delay puberty progression."
- C. "She may begin to have mood swings or emotional changes earlier than her peers."
- D. "We should expect her to reach normal adult height without treatment."

Answer

D. “We should expect her to reach normal adult height without treatment”

Without treatment, early epiphyseal plate closure can result in reduced adult height, even though the child may be initially tall for age.

Question 5

A nurse is caring for a 10-year-old child with Type 1 Diabetes who reports feeling shaky, dizzy, and sweaty. The glucometer reads 58mg/dl. What is the **PRIORITY** nursing action?

- A. Administer IM glucagon
- B. Give the child 4 ounces of orange juice
- C. Notify the healthcare provider
- D. Recheck the blood glucose in 30 minutes

Answer

B. Give the child 4 ounces of orange juice.

The child is conscious and showing signs of mild to moderate hypoglycemia. The best immediate treatment is a quick acting carbohydrate, such as juice.

IM glucagon is used when the child is unconscious or unable to swallow. Notifying the healthcare provider is not necessary for routine hypoglycemia if it is managed effectively. The nurse should recheck the blood glucose 15 minutes after treating, not 30 minutes.

References

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