ENDOCRINE SYSTEM

- **Ductless gland system**
- Produces **hormones** (chemical messengers) that regulate body functions.

Three Mechanisms of Hormone Secretion

1. **Humoral** – Triggered by changes in **blood chemicals** (e.g., blood glucose, calcium levels).
2. **Neural** – Triggered by **nerve fibers**.
3. **Hormonal** – Triggered by **another hormone** (Hypothalamus → Pituitary gland → Target gland).

Hypothalamus

- **"Master Regulator"**
- Controls the pituitary gland.
- Produces hormones that stimulate or inhibit pituitary hormone release.

Pituitary Gland

- **"Master Gland"**
- **Other name:** Hypophysis
- **Location:** Base of the brain
- **Surgical procedure:** Transsphenoidal hypophysectomy (removal of pituitary gland through the sphenoid sinus)

---

2 BASIC PARTS OF THE PITUITARY GLAND

I. Anterior Pituitary Gland (Adenohypophysis)

Also called:

- **Adenohypophysis**
- Produces **stimulating hormones**

Hormones Secreted

1. ACTH (Adrenocorticotropic Hormone)

Target Organ: Adrenal Cortex

Function:

- Stimulates release of **corticosteroids (especially cortisol)**

Remember:

ACTH → Adrenal Cortex → Cortisol

2. Prolactin (PRL)

Function:

- Stimulates **milk production** after childbirth

Mnemonic:

PROlactin = PROduces milk

3. Growth Hormone (GH)

Function:

- Bone growth
- Muscle growth
- Protein synthesis
- Cell growth and repair

4. Thyroid-Stimulating Hormone (TSH)

Target Organ: Thyroid gland

Function:

- Stimulates release of **T3 and T4**
- Regulates **metabolism**

Remember:

TSH → Thyroid → T3/T4 → Metabolism

5. Melanocyte-Stimulating Hormone (MSH)

Function:

- Increases **melanin production**
- Responsible for **skin pigmentation**

6. Gonadotropic Hormones

FSH (Follicle-Stimulating Hormone)

- Females: Follicle development
- Males: Sperm production

LH (Luteinizing Hormone)

- Females: Ovulation and corpus luteum formation
- Males: Testosterone production

II. Posterior Pituitary Gland (Neurohypophysis)

Also called:

- **Neurohypophysis**

Function:

- **Stores and releases** hormones made by the hypothalamus.

Mnemonic:

"OA"

- **O** = Oxytocin
- **A** = ADH

1. Oxytocin

Functions:

- Stimulates **uterine contractions** during labor
- Causes **milk ejection (let-down reflex)** during breastfeeding
- Promotes **social bonding**

Mnemonic:

"Out baby, Out gatas"

- Baby out → Uterine contraction
- Milk out → Milk ejection

2. Antidiuretic Hormone (ADH)

Other Names:

- **Vasopressin**
- **Vasoconstrictor**

Receptors:

- **V1 receptor** – Vasoconstriction
- **V2 receptor** – Kidney water reabsorption

Target Organ:

- **Kidneys**

Functions:

- Decreases urine output
- Makes urine **dark and concentrated**
- Increases water reabsorption
- Increases blood volume
- Helps maintain blood pressure

Effects:

- **↑ ADH**
  - ↓ Urine output
  - Dark, concentrated urine
  - ↑ Fluid retention
  - ↑ Blood volume
- **↓ ADH**
  - ↑ Urine output
  - Dilute urine
  - Water loss
  - Dehydration

ANTIDIURETIC HORMONE

Also called: Vasopressin

Main Function

- Increases **water reabsorption** in the kidneys
- Decreases **urine output**
- Maintains blood volume and blood pressure

SYNDROME OF INAPPROPRIATE ANTIDIURETIC HORMONE (↑ ADH = SIADH)

Other Name:

- **Schwartz-Bartter Syndrome**

What Happens?

Too much ADH causes the kidneys to retain excessive water.

Effects

Urine

- ⬇️ Urine Output (**Oliguria**)
  - **<30 mL/hour**
- Urine becomes **concentrated**

Urine Laboratory Findings

- ⬆️ Urine Specific Gravity (USG)
  - **>1.030**
- ⬆️ Urine Osmolality

Body Fluids

- ⬆️ Water retention
- **Hemodilution** (blood becomes diluted)

Blood Laboratory Findings

- ⬇️ Sodium (**Dilutional Hyponatremia**)

Signs and Symptoms

- Weight gain
- Edema may occur
- Headache
- Confusion
- Altered level of consciousness
- Muscle cramps
- **Seizures** (due to severe hyponatremia)

Priority Nursing Concern

⭐ Seizure Precautions

Easy Flow

↑ ADH
⬇️
Water retained
⬇️
⬇️ Urine output
⬇️
Concentrated urine
⬇️
Hemodilution
⬇️
Hyponatremia
⬇️
Confusion → Seizures

DIABETES INSIPIDUS (↓ADH= DI)

What Happens?

Not enough ADH causes the kidneys to lose excessive water.

Classic Signs

- **Polyuria**
- **Polydipsia**

Mnemonic

DI = "Di Enough Hormone"

Daming Ihi

Dry Inside

Urine Findings

- ⬆️ Urine Output (**Polyuria**)
  - **4–20 L/day**
- Urine is **dilute**

Urine Laboratory Findings

- ⬇️ Urine Specific Gravity (USG)
  - **<1.010**
- ⬇️ Urine Osmolality

Body Fluids

- Fluid volume deficit
- Dehydration

Blood Findings

- **Hemoconcentration**
- ⬆️ Sodium (**Hypernatremia**)

Signs and Symptoms

- Extreme thirst
- Dry mucous membranes
- Hypotension
- Tachycardia
- Weight loss
- Dehydration

Easy Flow

↓ ADH
⬇️
Water not reabsorbed
⬇️
Massive urine output
⬇️
Dilute urine
⬇️
Dehydration
⬇️
Hemoconcentration
⬇️
Hypernatremia

SIADH vs. Diabetes Insipidus

SIADH (↑ ADH)	Diabetes Insipidus (↓ ADH)
↑ ADH	↓ ADH
Oliguria (<30 mL/hr)	Polyuria (4–20 L/day)
Concentrated urine	Dilute urine
↑ USG (>1.030)	↓ USG (<1.010)
↑ Urine osmolality	↓ Urine osmolality
Fluid overload	Fluid volume deficit
Hemodilution	Hemoconcentration
↓ Na^+ (Hyponatremia)	**↑ Na^+ (Hypernatremia)**
Weight gain	Weight loss
Risk for seizures	Risk for dehydration and hypovolemic shock

DIAGNOSTIC TEST

Water Deprivation Test

Purpose

Determines whether the kidneys can concentrate urine when fluids are withheld.

Finding in Diabetes Insipidus

- Urine remains **dilute**
- ⬇️ Urine Specific Gravity
- ⬇️ Urine Osmolality

SIADH (Syndrome of Inappropriate Antidiuretic Hormone)

Common Cause

⭐ **Small Cell Lung Cancer (SCLC)**

- A common malignancy associated with **ectopic ADH secretion**, leading to SIADH.

Management of SIADH

1. Medications

A. Vasopressin Receptor Antagonists ("Vaptans")

These medications **block the action of ADH**, allowing excess water to be excreted.

Examples:

- **Tolvaptan**
- **Conivaptan** *(correct spelling; sometimes misspelled as "Canivaptan")*

Remember:

VAPTAN = Blocks Vasopressin

B. Diuretics

Example:

- **Furosemide (Lasix)**

Purpose:

- Removes excess water
- Helps decrease fluid overload

2. Sodium Replacement

Mild Hyponatremia

- **0.9% Normal Saline (PNSS)**

Severe Hyponatremia

- **Na^+ <120 mEq/L**
- **3% Hypertonic Saline**
- Sometimes **5% NaCl** (less commonly used)

Hypertonic saline must be infused slowly because rapid sodium correction can cause **osmotic demyelination syndrome (central pontine myelinolysis).**

Nursing Management

Monitor:

- Neurologic status
- Level of consciousness
- Signs of seizures
- Intake and output (I&O)
- Daily weight
- Serum sodium levels

Interventions:

- **Fluid restriction** (major treatment)
- Seizure precautions
- Strict I&O monitoring
- Daily weight

Priority Nursing Concern

⭐ **Seizure precautions** due to **hyponatremia**.

Diabetes Insipidus (DI)

Common Types

1. Central Diabetes Insipidus

- Caused by **decreased ADH production or release** from the hypothalamus or posterior pituitary.

2. Nephrogenic Diabetes Insipidus

- Kidneys **do not respond to ADH**, even if enough ADH is present.

Management of Diabetes Insipidus

Hormonal Replacement Therapy ("Pressin")

1. Desmopressin (DDAVP)

- **Drug of choice for Central DI**
- Longer-acting than vasopressin

Route:

- Intranasal spray (common)
- Oral tablets
- Injection

Remember:

DESMO = Long-lasting

---

2. Vasopressin

- Short-acting
- Used mainly in emergencies

Contraindication:

- **Coronary Artery Disease (CAD)**
- **Myocardial Infarction (MI)**

Reason:

- Causes **vasoconstriction**, which can reduce coronary blood flow and worsen cardiac ischemia.

Fluid Replacement

Encourage fluids:

- Oral fluids if able
- IV fluids when needed

Common IV fluids:

- **D5W (5% Dextrose in Water)**
- **0.45% Sodium Chloride (Half Normal Saline)**

Purpose:

- Replace excessive water losses
- Prevent dehydration
- Correct hypernatremia gradually

Nursing Management

Monitor:

- Intake and output (I&O)
- Daily weight
- Urine specific gravity
- Urine output
- Serum sodium
- Signs of dehydration

Interventions:

- Encourage oral fluids
- Administer prescribed desmopressin
- Replace fluids as ordered
- Monitor for electrolyte imbalance

SIADH vs. Diabetes Insipidus Management

SIADH (↑ ADH)	Diabetes Insipidus (↓ ADH)
Common in **Small Cell Lung Cancer (SCLC)**	Central DI or Nephrogenic DI
Fluid restriction	Encourage fluids
Vaptans (Tolvaptan, Conivaptan)	Desmopressin (DDAVP)
Furosemide	Vasopressin (emergency use)
Replace sodium if hyponatremic	Replace water losses
Monitor neurologic status	Monitor dehydration
Daily weight & I&O	Daily weight & I&O
Priority: **Prevent seizures**	Priority: **Prevent dehydration and hypovolemic shock**

GROWTH HORMONE

Other Name:

- **Somatotropin**

Regulation

Produced by the **anterior pituitary gland** and regulated by the hypothalamus:

- **Growth Hormone-Releasing Hormone (GHRH) → Stimulates GH release**
- **Somatostatin (Growth Hormone-Inhibiting Hormone, GHIH) → Inhibits GH release**

Flow:

Hypothalamus → GHRH → Anterior Pituitary → Growth Hormone (GH)
Hypothalamus → Somatostatin → ↓ GH

Functions of Growth Hormone

1. Bone Growth (Indirect)

GH stimulates the **liver** to produce:

- **Insulin-like Growth Factor-1 (IGF-1)**

IGF-1 promotes:

- Bone growth
- Cartilage growth
- Muscle growth

Remember:

GH → Liver → IGF-1 → Bone Growth

2. Metabolism

Growth hormone promotes:

- **Protein (CHON) synthesis**
- **Lipolysis** (fat breakdown)
- Tissue growth and repair

3. Antagonizes Insulin

GH increases blood glucose by:

- Decreasing glucose uptake into cells
- Increasing glucose production by the liver

Result:

- **↑ Blood Glucose**
- Long-term excess GH can lead to **Type 2 Diabetes Mellitus**

Disorders of Growth Hormone

↑ Growth Hormone (Hypersecretion)

Common Cause

⭐ **Pituitary Adenoma** (benign pituitary tumor)

Gigantism (Children)

Occurs **before epiphyseal plates close**.

Signs and Symptoms

- Extremely tall stature (**7–8 feet or more**)
- Long arms and legs
- Organomegaly
- Hyperglycemia
- Increased risk of **Type 2 Diabetes Mellitus**

Acromegaly (Adults)

Occurs **after epiphyseal plates have closed**.

Mnemonic

"MACRO" = Everything becomes larger

Signs and Symptoms

⭐ **Prognathism**

- Enlargement/protrusion of the lower jaw (mandible)

Other findings:

- Enlarged hands and feet (Acro = extremities)
- Increased ring size
- Increased shoe size
- Coarse facial features
- Thick lips
- Enlarged tongue (macroglossia)
- Organomegaly
- Hyperglycemia
- Headache and visual disturbances (from pituitary tumor compression)

Management of ↑ GH

1. Surgery (First-Line Treatment)

Transsphenoidal Hypophysectomy

- Removal of pituitary adenoma through the sphenoid sinus

Postoperative Nursing Care

- Monitor for **CSF leak** (clear nasal drainage; test for glucose/halo sign)
- Avoid coughing, sneezing, bending, or straining
- No nose blowing

- Elevate the head of the bed
- Monitor neurologic status
- Monitor for diabetes insipidus or SIADH after surgery

2. Medications

Somatostatin Analogs

These suppress GH secretion.

Examples:

- **Octreotide**
- **Lanreotide**

GH Receptor Antagonist

- **Pegvisomant**

Dopamine Agonists

- **Cabergoline**
- **Bromocriptine**

↓ Growth Hormone (Hyposecretion)

Dwarfism (Pituitary Dwarfism)

Causes

- Pituitary hypoplasia
- Deficiency of GH during childhood

Types

Proportionate Dwarfism

- Body parts remain proportional
- Most common in GH deficiency

Disproportionate Dwarfism

- Unequal body proportions
- Usually caused by skeletal disorders (e.g., achondroplasia), **not** GH deficiency

Signs and Symptoms

- Short stature (**<4 feet** in severe cases)
- Delayed growth
- Childlike or **cherub-like face**
- Normal intelligence
- Delayed puberty

Management of ↓ GH

Hormone Replacement Therapy (HRT)

Somatropin

- Recombinant (artificial) Growth Hormone
- Given by **subcutaneous injection**
- Most effective when started during childhood before growth plates close

ADRENAL GLAND

The adrenal gland has two parts:

1. **Adrenal Cortex** – produces corticosteroids
2. **Adrenal Medulla** – produces catecholamines

Adrenal Medulla

Hormones Produced

Catecholamines

1. **Epinephrine (Adrenaline)** ⭐ Most abundant
2. **Norepinephrine (Noradrenaline)**

Trigger

- Activated during emergencies
- Controlled by the **Sympathetic Nervous System (SNS)**

Remember:

Fight or Flight Response

Functions of Catecholamines

1. Increase Metabolism

- Glucose + Oxygen → ATP (Energy)
- Increases metabolic rate

2. Increase Blood Glucose

- Glycogen breakdown
- Increased glucose availability for energy

3. Bronchodilation

- Opens airways
- Improves oxygen delivery

4. Increase Vital Signs

- ↑ Blood Pressure
- ↑ Heart Rate
- ↑ Respiratory Rate

5. Mydriasis

- Pupil dilation

Disease: Pheochromocytoma

Definition

- Tumor of the **chromaffin cells** of the adrenal medulla
- Causes excessive secretion of catecholamines

Effects

- Massive release of epinephrine and norepinephrine
- Severe hypertension
- Hypermetabolic state

The "5 H's" of Pheochromocytoma

1. Hypertension ⭐ PRIORITY

- Episodic or sustained
- May reach **250/110 mmHg**
- Can cause **Hypertensive Crisis**

2. Headache

3. Hyperglycemia

4. Hypermetabolism

5. Hyperhidrosis

- Excessive sweating

Classic Triad

⭐ Remember:

Pheochromocytoma Triad

1. Hypertension
2. Palpitations
3. Headache

Commonly accompanied by:

- Diaphoresis (profuse sweating)

Diagnostic Tests

1. VMA Test

Vanillylmandelic Acid (VMA)

- 24-hour urine collection
- Measures catecholamine breakdown products

2. Plasma Metanephrine Test

- Highly sensitive test
- Detects elevated catecholamines

3. Imaging Studies

- CT Scan
- MRI

Used to locate the tumor.

Management

Positioning

Semi-Fowler's Position

- Elevate head of bed
- Helps reduce blood pressure and cardiac workload

Drug of Choice (DOC)

A. Alpha Blockers ⭐ FIRST

Examples:

- Phenoxybenzamine
- Phentolamine

Purpose

- Control hypertension
- Prevent hypertensive crisis

Important Rule

Alpha blocker FIRST before beta blocker

B. Beta Blockers

Examples:

- Propranolol

Purpose

- Slows heart rate
- Controls tachycardia

⚠️ Never give before alpha blockade.

C. Calcium Channel Blockers (CCB)

Example:

- Nifedipine

Purpose

- Additional blood pressure control

Surgery

Adrenalectomy

Definition

Removal of the adrenal gland.

After Adrenalectomy

Unilateral Adrenalectomy

(One adrenal gland removed)

- Temporary corticosteroid replacement
- Remaining adrenal gland eventually compensates
- Steroids gradually tapered

Bilateral Adrenalectomy

(Both adrenal glands removed)

- Permanent hormone replacement therapy
- Lifelong corticosteroid replacement

Reason

To prevent:
⭐ **Addisonian Crisis (Acute Adrenal Insufficiency)**

Nursing Priorities

Always Follow ABC

A – Airway

- Maintain airway patency

B – Breathing

- Monitor oxygenation

C – Circulation

- Monitor blood pressure and heart rate closely

Eye Terms

Mydriasis

= Pupil dilation (large pupils)

Miosis

= Pupil constriction (small pupils)

Easy Memory:

- **Mydriasis = Dilated**
- **Miosis = Constricted**

Adrenal Cortex

The **adrenal cortex** is the **outer layer** of the adrenal gland. It produces **corticosteroids (endogenous steroids)**.

There are **three major hormones** produced by the adrenal cortex:

1. **Glucocorticoids → Cortisol (Sugar)**
2. **Mineralocorticoids → Aldosterone (Salt)**
3. **Androgens → Sex Hormones**

Hypothalamic-Pituitary-Adrenal (HPA) Axis

The image illustrates the **HPA Axis**, which regulates **cortisol secretion** through **negative feedback** to maintain homeostasis.

Flow of Hormone Secretion

Hypothalamus
↓
CRH (Corticotropin-Releasing Hormone)
↓
Anterior Pituitary Gland
↓
ACTH (Adrenocorticotropic Hormone)
↓
Adrenal Cortex
↓
Cortisol

Negative Feedback

When **cortisol levels increase**, cortisol signals the:

- Hypothalamus → ↓ CRH
- Anterior Pituitary → ↓ ACTH

This decreases further cortisol production and maintains **homeostasis**.

Easy Flow

Hypothalamus

↓ CRH

Anterior Pituitary

↓ ACTH

Adrenal Cortex

↓ Cortisol

↑ Cortisol inhibits CRH and ACTH (**Negative Feedback**)

Hormones of the Adrenal Cortex

1. Glucocorticoids

Main Hormone

⭐ **Cortisol** ("Stress Hormone")

Regulation

- Controlled by **ACTH**

Peak Level

⭐ **8:00 AM**

Functions

A. Increases Blood Glucose

- Stimulates gluconeogenesis
- Increases glucose metabolism
- Provides energy during stress

Remember:

Cortisol = SUGAR

B. Anti-inflammatory Effect

- Suppresses inflammation
- Reduces swelling
- Decreases immune response

⚠️ Long-term excess cortisol can lead to **immunosuppression** and increased risk of infection.

C. Stress Response

During stress, cortisol:

- Increases blood glucose
- Supports blood pressure
- Provides energy
- Helps the body adapt to stress

2. Mineralocorticoids

Main Hormone

⭐ **Aldosterone**

Regulation

- Controlled mainly by the **Renin-Angiotensin-Aldosterone System (RAAS)**

Functions

Retains

- Sodium (Na^+)
- Water (Fluids)

Excretes

- Potassium (K^+)

Effects

↑ Aldosterone
⬇️
↑ Sodium
⬇️
↑ Water retention
⬇️
↑ Blood Volume
⬇️
↑ Blood Pressure

Meanwhile:

↑ Aldosterone
⬇️
↓ Potassium
⬇️
Hypokalemia

Remember

Aldosterone = SALT

"Save Salt, Spill Potassium."

3. Androgens

Function

Produces small amounts of:

- Male sex hormones

Effects

- Pubic hair growth
- Axillary hair growth
- Libido
- Muscle development

Excess Androgens

Can cause:

⭐ **Virilization**

Signs include:

- Deepened voice
- Increased body hair (hirsutism)
- Male-pattern baldness
- Acne
- Menstrual irregularities

Definition

Cushing syndrome is a disorder caused by **excess cortisol (hypercortisolism)**.

Causes

1. Exogenous (Most Common)

- Long-term use of **corticosteroids (steroids)**

2. Endogenous

- **Pituitary adenoma → Cushing disease** (↑ ACTH)
- **Adrenal adenoma** (↑ cortisol)
- **Small Cell Lung Cancer (SCLC)** → ectopic ACTH production

---

Pathophysiology

↑ Cortisol causes:

- ↑ Blood glucose
- ↑ Protein breakdown (catabolism)
- Fat redistribution
- Aldosterone-like effects (salt and water retention)
- Immunosuppression
- Increased androgen production

Clinical Manifestations

A. ↑ Blood Sugar (Hyperglycemia)

Metabolic Effects

- **Hyperglycemia**
- May develop **Type 2 Diabetes Mellitus**

Fat Redistribution (Hallmark Features)

- **Moon face**
- **Buffalo hump**
- **Truncal obesity**
- **Abdominal fat redistribution**
- **Cushingoid appearance** *(hallmark appearance)*

Mood Changes

- Depression
- Emotional instability

B. ↑ Catabolism (Protein Breakdown)

Skin

- Thin, fragile skin
- Easy bruising
- **Purple striae**

Muscles

- Muscle wasting
- Thin extremities
- Muscle weakness

Bones

- Osteoporosis
- Pathologic fractures

C. Immune System

- Increased risk for **infection**
- Delayed wound healing

D. Aldosterone-Like Effects (Salt & Water Retention)

Excess cortisol acts like **aldosterone**.

Manifestations

- Hypernatremia (↑ Na^+)
- Fluid retention
- Hypertension
- Weight gain
- Peripheral edema

- **Hypokalemia (↓ K^+)** → may cause **cardiac dysrhythmias/arrhythmias**

E. Increased Androgens (Sex Hormones)

In Females (Virilization)

- Hirsutism
- Deepening of voice
- Breast atrophy
- Clitoromegaly
- Increased libido
- Acne

Diagnostic Test / Screening Test

Low-Dose Dexamethasone Suppression Test (DST)

Normal

- Dexamethasone suppresses cortisol production.

Cushing Syndrome

- **↑ Cortisol**
- **No cortisol suppression**
- Positive for Cushing syndrome

Management

1. If caused by Steroid Use

- Gradually **taper the steroid dose**
- **Never stop steroids abruptly**

---

2. Pituitary Adenoma (Cushing Disease)

Treatment

- **Transsphenoidal hypophysectomy**

Incision site

- Under the upper lip
- Upper gingival mucosa (**sublabial approach**)

---

3. Adrenal Adenoma

Treatment

- **Adrenalectomy**

4. Small Cell Lung Cancer (Ectopic ACTH)

Medications (Mnemonic: "MAK")

Drug	Action
Metyrapone	Decreases cortisol synthesis
Mitotane	Destroys adrenal cortex cells
Aminoglutethimide	Inhibits steroid synthesis
Ketoconazole	Inhibits cortisol production

Diet

Increase	Decrease
Protein (↑ CHON)	Sugar
Potassium (↑ K^+)	Sodium (Na^+)
Calcium (Ca^{2+})	
Vitamin D	

Nursing Management

Monitor

- Blood glucose
- Blood pressure
- Daily weight
- Electrolytes (especially **K^+** and **Na^+**)
- Signs of infection
- Skin integrity

Prevent Injury

- Promote safety due to:
  - Muscle weakness
  - Osteoporosis
  - Increased fracture risk
- Implement fall precautions.

Skin Care

- Handle skin gently.
- Prevent bruising and skin tears.
- Reposition frequently if immobile.

Infection Prevention

- Practice strict hand hygiene.
- Monitor temperature and WBC count.
- Avoid exposure to sick individuals.

After Transsphenoidal Hypophysectomy

- Monitor for **CSF leak** (clear nasal drainage; test for glucose/halo sign if ordered).
- Avoid coughing, sneezing, nose blowing, bending over, and using straws.
- Keep the head of the bed elevated.
- Monitor neurological status and vision.

Patient Education

- Take steroids exactly as prescribed.
- Do not discontinue steroids abruptly.
- Follow the recommended diet.
- Monitor blood glucose if diabetic or hyperglycemic.
- Report fever, infection, severe weakness, or signs of adrenal insufficiency immediately.

(Primary Adrenal Insufficiency/ Hypocortisolism)

Definition

Addison's disease is a disorder caused by **decreased production of adrenal cortex hormones**, resulting in:

- **↓ Cortisol (Glucocorticoids)**
- **↓ Aldosterone (Mineralocorticoids)**
- **↓ Androgens (Sex hormones)**

Mnemonic: SSS = ↓ Steroids

Causes

1. Autoimmune (Most Common)

- Autoimmune destruction → adrenal atrophy

2. Infection

- **Tuberculosis (TB)** *(especially extrapulmonary TB involving the adrenal glands)*

3. Iatrogenic (Treatment-Related)

- Abrupt withdrawal of long-term corticosteroids
- Adrenal gland damage after surgery or treatment

Pathophysiology

↓ Adrenal cortex hormones cause:

- ↓ Cortisol → hypoglycemia
- ↓ Aldosterone → sodium loss and potassium retention
- ↓ Androgens → decreased libido
- ↑ ACTH → ↑ MSH → hyperpigmentation

Clinical Manifestations

A. ↓ Cortisol (Glucocorticoid Deficiency)

Manifestations

- **Hypoglycemia**
- Weakness
- Fatigue (prostration)
- Lethargy
- Weight loss
- Poor stress tolerance

B. ↓ Aldosterone (Mineralocorticoid Deficiency)

Manifestations

- **Hyponatremia (↓ Na^+)**
- Fluid loss
- Dehydration
- **Hypotension** *(not hypertension)*
- Orthostatic hypotension
- Weight loss
- Salt craving

C. ↓ Androgens (Sex Hormone Deficiency)

Manifestations

- Decreased libido
- Loss of axillary and pubic hair (especially in females)

D. Hyperkalemia & Hyperpigmentation

Hyperkalemia

- **↑ Potassium (K^+)**
- May lead to **cardiac dysrhythmias**

Hyperpigmentation (Hallmark Sign)

- Bronze skin pigmentation
- Darkening of skin creases, scars, elbows, knees, and oral mucosa

Why?

- **↓ Cortisol → ↑ ACTH**
- **↑ ACTH → ↑ Melanocyte-Stimulating Hormone (MSH)**
- **↑ MSH → ↑ Melanin production**
- **Result: Bronze skin pigmentation**

Addisonian Crisis (Acute Adrenal Crisis)

Definition

A life-threatening emergency caused by **sudden severe cortisol deficiency**.

Common Triggers

- Infection
- Trauma
- Surgery
- Severe physical or emotional stress
- Abrupt discontinuation of corticosteroids

Signs and Symptoms

- **Severe hypotension**
- Hypovolemic shock
- Severe dehydration
- Hypoglycemia
- Hyperkalemia
- Altered mental status
- Weakness
- Loss of consciousness (if untreated)

Management of Addisonian Crisis

IV Fluids

- **D5NSS (5% Dextrose in Normal Saline)**

IV Medication

- **Hydrocortisone (Solu-Cortef)**

Correct

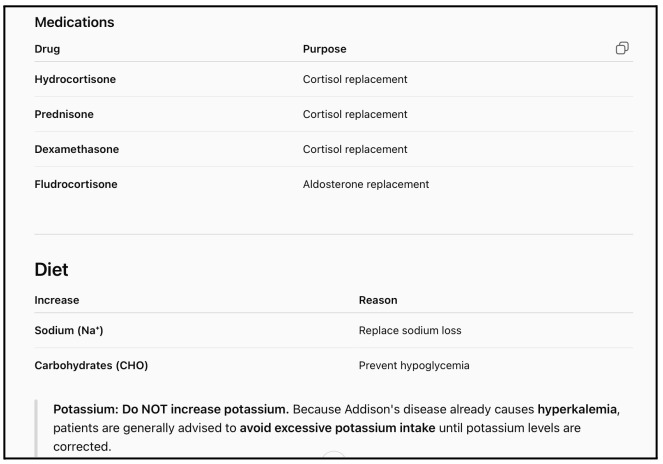
- Hypoglycemia
- Electrolyte imbalance
- Hypovolemia

Long-Term Management

Hormone Replacement Therapy (HRT)

Lifelong therapy

- Permanent treatment
- Supportive, **not curative**



Medications

Drug	Purpose
Hydrocortisone	Cortisol replacement
Prednisone	Cortisol replacement
Dexamethasone	Cortisol replacement
Fludrocortisone	Aldosterone replacement

Diet

Increase	Reason
Sodium (Na^+)	Replace sodium loss
Carbohydrates (CHO)	Prevent hypoglycemia

> **Potassium: Do NOT increase potassium.** Because Addison's disease already causes **hyperkalemia**, patients are generally advised to **avoid excessive potassium intake** until potassium levels are corrected.

Nursing Management

Monitor

- Blood pressure
- Blood glucose
- Electrolytes (especially **Na^+ and K^+**)
- Daily weight
- Fluid balance
- Signs of dehydration

Medication Administration

- Administer corticosteroids as prescribed.
- **Take oral steroids with meals** to reduce gastric irritation.
- Never stop corticosteroids abruptly.

Stress Management

- During illness, surgery, trauma, or severe stress:
    - **Increase ("stress-dose") corticosteroids** as prescribed.
    - **More stress = greater cortisol requirement.**

Prevent Addisonian Crisis

- Teach patients to:
    - Carry emergency steroid identification (medical alert bracelet/card).
    - Keep an emergency hydrocortisone injection if prescribed.
    - Seek medical attention during severe illness or vomiting.

Patient Education

- Take medications for life.
- Maintain adequate hydration.
- Follow a **high-sodium diet** if recommended.
- Recognize symptoms of adrenal crisis (severe weakness, dizziness, vomiting, hypotension).
- Avoid missing doses of corticosteroids.

Feature	CUSHING (FAST & WET)	ADDISON (SLOW & DRY)
Cortisol	↑	↓
Body Build	Fat (moon face, buffalo hump, truncal obesity)	Thin, weight loss
Blood Sugar	↑ Hyperglycemia	↓ Hypoglycemia
Blood Pressure	↑ Hypertension	↓ Hypotension
Sodium	↑ Na^+	↓ Na^+
Potassium	↓ K^+	↑ K^+
Fluid	Fluid retention (Wet)	Dehydration (Dry)
Skin	Purple striae, bruises	Bronze pigmentation
Hallmark	Moon face & Buffalo hump	Bronze skin & Salt craving
Weight	Gain	Loss
Treatment	Lower cortisol	Replace cortisol
Emergency	—	Addisonian Crisis
Mnemonic	"Too Much Everything"	"Too Little Everything"

THYROID GLAND

Thyroid Hormones

1. **T4 (Thyroxine)** – Most abundant, stable hormone
2. **T3 (Triiodothyronine)** – Most potent, active hormone
3. **Thyrocalcitonin (Calcitonin)** – Regulates calcium releasing

Function:

- ↑ Cellular metabolism (↑ ATP production)

Diet:

- Iodine

HYPOTHALAMIC AXIS

Hypothalamus
|
▼
TRH (Thyrotropin-Releasing Hormone)
|
▼
Anterior Pituitary Gland
|
▼
TSH (Thyroid Stimulating Hormone)
|
▼
Thyroid Gland
|
▼
T3 and T4

Negative Feedback

↑ T3 and T4

↓

↓ TRH

↓

↓ TSH

HYPERTHYROIDISM

Problem

⬆️ Thyroid Hormone

Causes

Autoimmune

Graves' Disease / Basedow's Disease / Toxic Diffuse Goiter

⬇️

TSI (Thyroid Stimulating Immunoglobulin)

- Stimulates thyroid gland
- ↑ T4/T3
  - Goiter
  - Exophthalmos (Proptosis)

Other Causes

- Toxic Adenoma (+ single nodule)
- Toxic Multinodular Goiter (TMNG) – Plummer's Disease

Diagnostic Test

Thyroid Panel

- ⬇️ TSH
- ⬆️ Thyroid Hormone (T3/T4)

Clinical Manifestations

"High & Fast"

Brain

- Insomnia
- Anxiety
- Irritability
- Restlessness

Vital Signs

- ⬆️ Systolic Blood Pressure
- ⬆️ Heart Rate (Palpitations)
- ⬆️ Respiratory Rate

Gastrointestinal

- ⬆️ Motility
- Diarrhea
- Watery stools

Temperature

- Heat intolerance
- Wet skin (Diaphoresis)

Muscles

- Tremors

Weight

- Weight loss
- ⬆️ Appetite

Menstruation

- Oligomenorrhea
- Amenorrhea (absence of menstruation)

Watch Out For (WOF)

Thyroid Storm (Thyrotoxicosis)

Cause

Stress:

- Infection
- Trauma
- Surgery

Signs and Symptoms

- Altered LOC
- Delirium
- Hyperpyrexia (>40°C)
- ⬆️ Heart Rate (>130 bpm)

Management

- Antipyretics
  - ❌ No Aspirin (will make it severe)
- Cooling measures
- Beta-blockers
  - Propranolol
- Antithyroid drug
  - PTU

Diet

- ⬆️ Calories
- ⬆️ CHON (Protein)
- ⬇️ Iodine
- ⬆️ Fluids

Drugs

Antithyroid Medications (Thioamides)

PTU (Propylthiouracil)

- Safe for pregnancy

Methimazole (Tapazole)

Adverse Effect

Agranulocytosis

- ⬇️ WBC
- Risk for infection

Watch Out For

- Fever
- Sore throat

Beta-blockers

Drug

Propranolol

Controls

- Tremors
- Palpitations

Iodine Preparation

SSKI

Saturated Solution of Potassium Iodide ("KISS")

Lugol's Solution (Pre-op)

Mechanism of Action

- Reduces size of thyroid gland
- Reduces vascularity
- Limits/prevents bleeding after thyroid surgery

Health Teaching

- Drink with a straw
- Mix with fruit juice

Radioactive Iodine Therapy (RAI)

Drug

RAI-131

Route

- Oral capsule
- Oral liquid

Mechanism of Action

Destroys overactive thyroid cells

Watch Out For

Hypothyroidism

Replacement Therapy

- Levothyroxine

Contraindicated

- Pregnancy

Surgery

Thyroidectomy

Nursing Considerations

Monitor for Bleeding

- Inspect suture site frequently
- Check the back of the neck
- Check the pillow
- Patient may complain of a "wet feeling" (+ dampness)

Monitor Airway

Watch for:

- Neck swelling
- Hematoma
- DOB
- SOB
- Dyspnea

Keep at bedside:

- Tracheostomy set

Position

- Elevate HOB (Semi-Fowler's)
- Avoid neck flexion
- Avoid hyperextension

Monitor for Laryngeal Nerve Damage

- Hoarseness
  - Within 24 hours – expected
  - More than 24 hours – report

Monitor for Hypocalcemia
Watch Out For

- Tetany

HYPORTHYROIDISM

Problem

⬇️ Thyroid Hormone

Causes

Diet

- ⬇️ Iodine *(Worldwide)* ⭐

Autoimmune

- **Hashimoto's Thyroiditis** ⭐

Iatrogenic

- Treatment-related (e.g., thyroid surgery, radioactive iodine)

Diagnostic Test

Primary Hypothyroidism

Problem: Thyroid gland

- ⬆️ TSH
- ⬇️ Thyroid Hormone (T3/T4)

Secondary Hypothyroidism

Problem: Anterior Pituitary Gland

- ⬇️ TSH
- ⬇️ Thyroid Hormone (T3/T4)

Tertiary Hypothyroidism

Problem: Hypothalamus

- ⬇️ TRH
- ⬇️ TSH
- ⬇️ Thyroid Hormone (T3/T4)

Clinical Manifestations

"Low and Slow"

Brain

- Drowsiness
- Fatigue (Prostration)
- Lethargy

Vital Signs

- ⬇️ Blood Pressure
- ⬇️ Heart Rate
- ⬇️ Respiratory Rate

Gastrointestinal

- ⬇️ Motility
- Constipation

Temperature

- Cold intolerance
- Dry skin

Muscle

- Weakness

Weight

- Weight gain
- Anorexia

Menstruation

- Menorrhagia (Excessive menstrual bleeding)
- Amenorrhea (Absence of menstruation)

Watch Out For (WOF)

Myxedema Coma

Causes

- Stress

  - Infection
  - Trauma
- Extreme cold exposure
- CNS Depressants
  - Sedatives
  - Benzodiazepines
  - Opioids

Signs and Symptoms

- Altered level of consciousness
- Coma
- Hypothermia (<35°C)
- ⬇️ Blood Pressure
- ⬇️ Heart Rate → Shock
- ⬇️ Respiratory Rate → Respiratory Depression

Management

- Mechanical ventilator + Oxygen
- IV Fluid (IVF) administration
- Passive rewarming measures
- IV Levothyroxine

Diet

- ⬇️ Calories
- Small, frequent feedings
- ⬆️ Fiber *(Insoluble fiber—may decrease drug absorption)*
- ⬆️ Fluids
- ⬆️ Iodine
  - Seafood
  - Iodized salt
  - **RA 8172** (Iodization Law signed during the administration of Fidel V. Ramos)

Avoid / Limit Goitrogenic Foods

Cruciferous vegetables

- Cabbage
- Cauliflower
- Broccoli

Others

- Soy products
- Cassava

Drugs

Hormone Replacement Therapy (HRT)

Levothyroxine (T4)

- **Brand:** Synthroid

Liothyronine (T3)

- **Brand:** Cytomel

Purpose

- Achieve **euthyroid state**

Adverse Effects (Overdose)

- Irritability
- Anxiety
- Palpitations
- Chest pain

→ Report immediately

Best Taken

- Morning
- Before meals
- On an empty stomach (best absorption)

PARATHYROID GLAND

Hormone

PTH (Parathormone / Parathyroid Hormone)

Effects

- ⬆️ Calcium (Ca^{2+}) in the blood
- ⬇️ Phosphate in the blood

Functions of PTH

- ⬆️ Osteoclast activity
  - ⬆️ Bone resorption
  - Moves calcium from **bones → blood**
- ⬆️ Calcium absorption in the **small intestine**
- ⬆️ Calcium reabsorption in the **kidneys**
- ⬇️ Phosphate (increases phosphate excretion)

HYPERPARATHYROIDISM

Cause

- Tumor

↓

⬆️ PTH

Effects

Bones

- ⬆️ Bone resorption (bone breakdown)
- Fractures
- Osteoporosis
- Bone pain

Calcium

- ⬆️ Hypercalcemia
- Nephrolithiasis (Kidney stones)
- Polyuria
- Polydipsia

Muscles

- Muscle weakness
- Fatigue

Gastrointestinal

- Constipation

Laboratory Finding

- ⬇️ Phosphate

Management

Hydration

- Increase fluids

Drugs

- **Bisphosphonates**
  - ⬇️ Bone resorption
- **Calcitonin**
  - Promotes calcium deposition in bones
- **Cinacalcet**
- **Diuretics**
  - ❌ Avoid thiazide diuretics

Nursing Care

- Promote safety

Surgery

- Parathyroidectomy

HYPOPARATHYROIDISM

Cause

- Surgery

↓

⬇️ PTH

↓

- ⬇️ Calcium
- ⬆️ Phosphate

↓

Hypocalcemia

Clinical Manifestations

"CATS"

C – Convulsions (Seizures)

A – Arrhythmias (Prolonged QT Interval)

T – Tetany

- Positive Chvostek's Sign
- Positive Trousseau's Sign

S – Stridor

Keep at Bedside

- Tracheostomy set
- Calcium gluconate

Management

- ⬆️ Calcium
- ⬆️ Vitamin D
  - Diet
  - Supplements