Adrenal gland disorders: Management of the client.

ENDOCRINE SYSTEM

Disorders of the Adrenal Glands: An overview and Care of the Client.

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Introduction

There are many diseases associated with the adrenal gland. Adrenal gland disorders, arise from over production or under production or adrenal hormones. The disorders could be as a result of problems with the adrenal gland itself, or due to a defect in another gland such as the pituitary gland.

Objectives

- Discuss the anatomy, physiology and pathology of the adrenal glands.
- Discuss several common diseases associated with adrenal gland dysfunction.
- Explain postoperative care for laparoscopic adrenalectomy clients.
- Discuss the management of complications associated with a transsphenoidal hypophysectomy.
- Develop a nursing care plan for a client with Cushing’s syndrome.

Overview of the adrenal gland.

There are 2 adrenal glands each located at the top of the kidneys. The adrenal has two distinct parts; an outer covering called the “Cortex” which surrounds the inner dark-colored mass called the “Medulla”. Arterial blood supply to the gland is from the superior, middle, and inferior suprarenal arteries. While venous drainage is from the suprarenal veins.

Adrenal cortex: The adrenal cortex is made up of three layers,

- Zona Glomerulosa: Outer narrow layer, it is the site of biosynthesis of the “Mineralocorticoid hormones”.

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- Zona Fasciculata: Middle layer, site of the production of “Glucocorticoid hormones” and “Adrenal androgens”
- Zona reticularis: Inner narrow layer, secreting “Glucocorticoids” along with the middle zone.

Adrenal medulla: Adrenal medulla is the inner most part of the gland, which is dark-colored mass. The adrenal medulla is neuroendocrine tissue composed of postganglionic sympathetic nervous system (SNS) neurons. It is really an extension of the autonomic nervous system, which regulates homeostasis in the body. The sympathomedullary (SAM) pathway involves the stimulation of the medulla by impulses from the hypothalamus via neurons from the thoracic spinal cord. It secretes two distinct hormones, namely;

- Epinephrine (or) Adrenaline
- Norepinephrine (or) Noradrenaline

Regulation of adrenal hormone secretion

To prevent abnormal hormone levels and a potential disease state, adrenal hormone levels are tightly controlled. The body maintains this control by balancing hormone production and degradation. Feedback mechanism govern the initiation and maintenance of most hormone secretion in response to various stimuli.

Positive feedback loops are characterized by the release of additional hormone in response to an original hormone release. Negative feedback is characterized by the inhibition of further secretion of a hormone in response to adequate levels of that hormone. This allows blood levels of the hormone to be regulated within a narrow range.

An example of a negative feedback loop is the release of glucocorticoid hormones from the adrenal glands, as directed by the hypothalamus and pituitary gland. As glucocorticoid concentrations in the blood rise, the hypothalamus and pituitary gland reduce their signaling to the adrenal glands to prevent additional glucocorticoid secretion. (See figure 1).

The adrenocorticotropic hormone (ACTH), also called corticotropin, released by the anterior pituitary gland stimulates the adrenal cortex to secrete corticosteroid hormones such as cortisol. The release of ACTH is regulated by the corticotropin-releasing hormone (CRH) from the hypothalamus in response to normal physiologic rhythms. A variety of stressors can also influence its release.
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Visit this link to view an animation describing the location and function of the adrenal glands. [https://www.youtube.com/watch?v=06jq3bxKE0](https://www.youtube.com/watch?v=06jq3bxKE0)

**Adrenal Cortex Hormones and their functions**

**Glucocorticoids:**
Glucocorticoids are an essential component of adaptation to “Severe stress.” **Cortisol (corticosterone, cortisone)** is the predominant glucocorticoids in humans, o. The hormone affect host metabolism and defense.

The metabolic functions of the glucocorticoids include:

- increase glucose production in the liver;
- promotes of protein and RNA metabolism,
- promotes lipolysis but can cause lipogenesis on other sides (such as the face and trunk) especially if production is higher than physiological levels.

The host defense functions of the glucocorticoids include

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The release of adrenal glucocorticoids is stimulated by the release of hormones from the hypothalamus and pituitary gland. This signaling is inhibited when glucocorticoid levels become elevated by causing negative signals to the pituitary gland and hypothalamus. Sources: [http://philschatz.com/anatomy-book/content/m46567.html#figch18_02_04](http://philschatz.com/anatomy-book/content/m46567.html#figch18_02_04)
Suppress the immune response by decreasing the number of circulating Glucosides and the migration of tissue leucocytes.

Necessary for maintenance of BP and cardiac output.

A low cortisol level can lead to subtle but serious problems, and in severe cases of stress and emergency, to shock and even death.

**Mineralocorticoids:** Aldosterone is the most potent hormone in this class.

**Aldosterone** is regulated by Renin, angiotensin system. This system is involved in the regulation of BP and electrolyte metabolism. It is important in the regulation of the concentration of sodium and potassium ions in urine, sweat, and saliva. The primary action of these hormones is to promote sodium (Na+) retention and K+ and H+ excretion in the renal tubules. Aldosterone is produced in response to changes in the plasma levels of K and angiotensin-II. Aldosterone increases the activity of several mitochondrial enzymes.

**Androgens:** Androgens promote the growth of axillary (underarm) and pubic hair in both males and females. In the male after puberty, the adrenal production of androgens plays a very small role compared with the potent androgen testosterone, which is produced by the testes. An excess of androgens in females can cause an increase in facial and body hair, acne, thinning of scalp hair and in great excess, can cause deepening of the voice and muscle enlargement.

**Adrenal Medulla Hormones** and their functions:

In humans adrenal medulla contains 80% of epinephrine and 20% nor epinephrine. Epinephrine and norepinephrine are also known as Catecholamine. Norepinephrine is primarily synthesized in sympathetic nervous system and acts locally as a neurotransmitter at the postsynaptic cell.

**Synthetic Adrenalin used in emergency situations causes bronchodilation, vasoconstriction, CNS stimulation and mydriasis.**

The release of catecholamine from the cells of the adrenal medulla is brought about by the action of acetylcholine released by stimulation of the nerve. Epinephrine is bound to plasma proteins mainly to albumin and nor-epinephrine is to a lesser extent.
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**Actions of catecholamine**

- Epinephrine lowers the diastolic pressure. Norepinephrine increase both systolic and diastolic blood pressure.
- Epinephrine relaxes the smooth muscles of gastrointestinal tract.
- Epinephrine stimulates glycogenolysis (breakdown of glycogen to glucose in the muscles and liver tissues) producing hyperglycemia.

_Glycogenolysis is the biochemical breakdown of glycogen to glucose in the muscles and liver whereas glycogenesis is the opposite, the formation of glycogen from glucose occurs in liver and muscle cells when glucose and ATP are present in relatively high amounts._

_Glycogenolysis takes place in the cells of muscle and liver tissues in response to hormonal and neural signals. Glycogenolysis plays an important role in the adrenaline-induced fight-or-flight response and the regulation of glucose levels in the blood._

- Both epinephrine and norepinephrine increases breakdown of triglycerides in adipose issue by increasing cyclic AMP level.
- Epinephrine increases hepatic Gluconeogenesis.
- Epinephrine increases blood lactic acid level by promoting muscle glycolysis.

- Epinephrine has a direct inhibitory action on insulin release from beta-cells of pancreas.

_In stressful situations, the output of Catecholamine is increased which leads to a rapid pulse, higher blood pressure (systolic), shakiness, sweating, pallor and/or blanching of the skin._

**Disorders of the Adrenal Gland.**

The disorders of the adrenal gland results from underactive or overactive adrenal gland. The most common disorders include;

- Cushing’s Syndrome
- Primary adrenal insufficiency (Addison’s disease)
- Secondary adrenal insufficiency
- Hyperaldosteronism
- Pheochromocytoma/Paraganglioma
- Congenital Adrenal Hyperplasia (CAH): Congenital adrenal hyperplasia refers to a group of genetic disorders that affect the adrenal glands.

**Underactive Adrenal Gland Disorders**

The adrenal glands may fail to produce adequate levels of cortisol for many reasons. The problem may be related to a disorder of the adrenal glands themselves or to inadequate secretion of adrenocorticotropic hormone by the pituitary gland. Symptoms of underactive adrenal
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glands include fatigue, weight loss, poor appetite, weakness and gastrointestinal problems. These disorders include:

- Polyglandular autoimmune syndrome Type 1 and Type 2
- Primary adrenal insufficiency (Addison’s disease)
- Secondary adrenal insufficiency
- Congenital adrenal hyperplasia

**Overactive Adrenal Gland Disorders**

A tumor of the adrenal glands can result in the overproduction of various hormones. These include:

- Pheochromocytoma
- Primary hyperaldosteronism
- Cushing’s syndrome

**Addison’s disease**

**Causes of Addison’s disease**

Autoimmune disorders cause most cases of Addison’s disease. Infections and medications may also cause the disease.

- Up to 80 percent of Addison’s disease cases are caused by an autoimmune disorder,
- Infections such as tuberculosis (TB) and cytomegalovirus, Neisseria meningitidis can destroy the adrenal glands, accounts for 10 to 15 percent
- Other less common causes of Addison’s disease are
drugs, amiodarone, surgical removal of the adrenal glands, amyloidosis, secondary adrenal insufficiency

**Secondary adrenal insufficiency**

A lack of CRH or ACTH causes secondary adrenal insufficiency. The lack of these hormones in the body can be caused by

- Stopping long term treatment of corticosteroid medication
- Surgical removal of pituitary tumors
- Changes in the Pituitary Gland
  - tumors or an infection in the pituitary
  - loss of blood flow to the pituitary
  - radiation for the treatment of pituitary or nearby tumors
  - surgical removal of parts of the hypothalamus
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- Surgical removal of the pituitary

**Symptoms of Addison’s disease**

- The slowly progressive loss of cortisol and aldosterone secretion usually produces
- A chronic, steadily worsening fatigue,
- A loss of appetite, and some weight loss.
- Blood pressure is low and falls further when a person is standing (orthostatic hypotension), producing lightheadedness.
- Nausea, sometimes with vomiting, and diarrhea are common.
- The muscles are weak and often go into spasm.
- There are often emotional changes, particularly irritability and depression.
- Because of salt loss, a craving for salty foods is common.
- Finally, the increase in ACTH due to the loss of cortisol will usually produce a darkening of the skin that may look like an inappropriate tan on a person who feels very sick.

**Addisonian crisis**

Sudden, severe worsening of adrenal insufficiency symptoms is called adrenal crisis. Addisonian crisis occurs when an event like overexertion, exposure to cold, acute infection such as the flu, decrease in salt intake, an accident, or the need for surgery precipitates a worsening of client symptoms because of the deficient response from the adrenals to one of these stresses. An Addisonian crisis is a medical emergency. Client may present with circulatory shock, pallor, apprehension, weak and rapid pulse, rapid respirations and low blood pressure. Headache, nausea, abdominal pain and diarrhea.

Treatment of clients who present in possible adrenal crisis should not be delayed while diagnostic tests are preformed

**Diagnostic tests for Addison’s disease**

- History and physical especially hyperpigmentation of the skin or gums, is often enough to raise a strong suspicion.
- Elevated blood level of potassium, a low blood level of sodium may be present, a shift in the ratio of certain white blood cells
- EKG or chest x-ray changes that are caused by high potassium or low blood volume.
- ACTH stimulation test: This is the most specific test for diagnosing Addisons disease. Serum and/or urine cortisol levels are measured before and after a synthetic form of ACTH is given by injection. Serum cortisol level repeated 30 to 60 minutes after an intravenous
ACTH injection. *The normal response after an injection of ACTH is a rise in blood and urine cortisol levels.* Clients with either form of adrenal insufficiency respond poorly or do not respond at all. An elevated blood level of ACTH should also be found.

**Treatment of Addison’s disease**

All the manifestations of Addison’s disease are caused by the lack of cortisol and aldosterone, the treatment is to replace these with similar steroids.

- Cortisol is usually replaced orally by hydrocortisone or cortisone acetate, less often with prednisone tablets twice daily.
- Aldosterone is replaced by an aldosterone-like synthetic steroid, fludrocortisone (Florinef®) tablets given once daily.
- In emergencies or during surgery, hydrocortisone must be given intravenously.

**Assessing adequacy of therapy involves monitoring symptoms and signs, measuring blood pressure and looking for postural hypotension and normalizing of serum electrolytes (Na and K).**

**Signs of under-replacement are the symptoms of Addison's disease persisting, i.e. fatigue, postural hypotension, nausea, weight loss, and salt craving.**

- Management of adrenal crisis involves admission to the hospital, often to a critical care unit for intensive monitoring. The condition is managed with high-dose hydrocortisone parenterally and IV fluids.

**Client education for Addison’s disease**

Clients with Addison’s disease should be taught to treat minor illnesses with extra salt, fluids and extra hydrocortisone. This is especially important if fever, vomiting or diarrhea is present. Instruct client to seek immediate medical attention for persistence fever, vomiting or diarrhea. Treatment in an emergency room with intravenous saline and hydrocortisone. Addison’s disease is a chronic condition, daily replacement medication can never be stopped. The importance of not missing steroid doses and not stopping them abruptly. Instruct client to avoid dehydration. If the client is traveling, he/she should carry extra medication, and an emergency self-injection kit, along with specific instructions. Every client with Addison’s disease should wear an identification bracelet or a necklace stating that he or she has the disease, to insure proper emergency treatment.
An identification card outlining treatment is also suggested.

**Pheochromocytoma:**

Pheochromocytoma is a rare, usually benign, tumor of the adrenal glands resulting in the glands secreting excessive amounts of the hormones adrenaline and noradrenaline (catecholamines). This causes variable symptoms such as high blood pressure, sweating, headache, chest pain and anxiety.

**Risk Factors of Pheochromocytoma**

No known environmental, dietary, or lifestyle risk factors have been linked to the development of pheochromocytoma. 25% of all pheochromocytomas and extra-adrenal paragangliomas are linked to hereditary. Genetic testing is often recommended pheochromocytoma-paraganglioma syndrome.

**Clinical manifestations of Pheochromocytoma**

Some clients with pheochromocytomas and sympathetic extra-adrenal paragangliomas are asymptomatic and some may present with symptoms of excess catecholamine production, including the following:

- Hypertension.
- Headache.
- Perspiration.
- Forceful palpitations.
- Tremor.
- Facial pallor.

These symptoms are often paroxysmal, although sustained hypertension between paroxysmal episodes occurs in 50% to 60% of clients with pheochromocytoma. Episodes of hypertension can be variable in frequency, severity, and duration. Hypertensive crisis can lead to cardiac arrhythmias, myocardial infarction, and even death.

Clients are often very symptomatic from excess catecholamine secretion. Symptoms of catecholamine excess can be spontaneous or induced by a variety of events, including the following:

- Strenuous physical exertion.
- Trauma.
- Labor and delivery.
- Anesthesia induction.
- Surgery or other invasive procedures, including direct instrumentation of the tumor (e.g., fine-needle aspiration).
- Foods high in tyramine (e.g., red wine, chocolate, and cheese).

**Diagnostics for pheochromocytoma**

- The presence of an adrenal mass.
• A 24-hour urine collection for catecholamines (e.g., epinephrine, norepinephrine, and dopamine) and fractionated metanephrines
• Computed tomography (CT) imaging or magnetic resonance imaging (MRI) of the abdomen and pelvis are the most commonly used methods for localization of adrenal tumor.

**Treatment of pheochromocytoma**

Definitive treatment for localized and regional pheochromocytoma alpha- and beta-adrenergic blockade followed by surgery. For clients with unresectable or metastatic disease, treatment may include a combination of the following: Catecholamine blockade, Surgery, Chemotherapy, Radiofrequency ablation, Cryoablation, Radiation therapy.

Alpha-adrenergic blockade treatment is initiated prior to surgery to prevent potentially life-threatening cardiovascular complications (Such as Hypertensive crisis, Arrhythmia, Myocardial infarction, and Pulmonary edema), which can occur as a result of excess catecholamine secretion during surgery.

A preoperative treatment period of 1 to 3 weeks with Phenoxybenzamine (a nonselective alpha-antagonist) or prazosin, terazosin, and doxazosin (selective alpha-1-antagonists) as alternative choices are

Resolution of spells and a target low normal blood pressure for age indicate that alpha-adrenergic blockade is adequate. During alpha-adrenergic blockade, liberal salt and fluid intake should be encouraged because volume loading reduces excessive orthostatic hypotension preoperatively and postoperatively. A beta-adrenergic blocker (e.g., metoprolol or propranolol) can be added if tachycardia develops or if blood pressure control is not optimal with alpha-adrenergic blockade. Beta-adrenergic blockade must never be initiated before alpha-adrenergic blockade; doing so blocks beta-adrenergic receptor-mediated vasodilation and results in unopposed alpha-adrenergic receptor-mediated vasoconstriction, which can lead to a life-threatening crisis.

**Blood pressure, heart rate, and glucose levels should be monitored immediately after surgery.**

**Alpha adrenergic blocking agents**

• Phenoxybenzamine hydrochloride (Dibenzyline): a long-acting adrenergic alpha-receptor blocker
that can produce and maintain a chemical sympathectomy. 10 mg PO BID initially; increase every other day to 20-40 mg PO BID/TID (sometimes higher doses necessary)

- **Phentolamine (Regitine, OraVerse):** Diagnosis of Pheochromocytoma: 5 mg IV/IM. Test for pheochromocytoma is positive if decrease SBP >35 mmHg & decrease DBP >25 mmHg.
  - Treatment of hypertension during pheochromocytoma surgery. 5 mg IV/IM 1-2 hr preoperative, repeat if necessary q2-4hr.
  - Phentolamine is a nonselective alpha-adrenergic blocking agent that produces transient and incomplete alpha-adrenergic blockade. This agent is often used immediately before or during adrenalectomy to prevent or control paroxysmal hypertension resulting from anesthesia, stress, or operative manipulation of the tumor.

- **Prazosin (Minipress, Prazin, Prazo):** Prazosin is a quinazoline compound that is a selective alpha1-adrenergic antagonist. Prazosin causes peripheral vasodilation by selective, competitive inhibition of vascular postsynaptic alpha1-adrenergic receptors, thus reducing peripheral vascular resistance and blood pressure.

  There are others.

**Primary hyperaldosteronism:**

Primary hyperaldosteronism, also called aldosterone secreting adenoma or Conn’s syndrome is a condition in which too much of the hormone aldosterone is produced by the adrenal glands. This can lead to lower levels of potassium, in the blood. This condition, often caused by a tumor (adrenal cortical adenoma) in the adrenal glands. It is one of the most common causes of secondary hypertension (high blood pressure).

**Cushing’s syndrome:**

Cushing’s syndrome, a disorder caused by prolonged exposure of the body’s tissues to high levels of the hormone cortisol. Pituitary disorders can lead to excess release of cortisol from the adrenal glands.

**Causes of Cushing’s syndrome**

The most common cause of Cushing’s syndrome is cortisol-like steroid medications, such as prednisone. These medications may be prescribed at a high dose for a long period of time to treat lupus, asthma and other conditions.
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Tumors or nodules in or near the pituitary and adrenal glands may also be the cause. These conditions include:

**Cushing’s disease:** Cushing’s disease is associated with non-cancerous and usually small pituitary gland tumors that secrete adrenocorticotropic hormone (ACTH). Too much ACTH enlarges the adrenal glands and causes them to over produce cortisol.

**Ectopic ACTH syndrome:** This condition is associated with cancerous or noncancerous tumors that develop outside the pituitary gland, most often in the lungs, and produce excess ACTH.

**Cortisol-producing adrenal tumors:** Small, non-cancerous adrenal tumors (adrenal nodules) can also produce too much cortisol. Symptoms are mild, so they may be overlooked for many years.

**Symptoms of Cushing’s syndrome**

At proper levels, cortisol helps the body respond to stress, regulate important functions in the body and convert fat, carbohydrates and proteins into energy. Cushing disease is marked by signs and symptoms caused by long-term excess cortisol levels; these symptoms develop over a period of time.

- **Weight gain in the neck, face and upper body:** Weight changes are caused by fat distributions, resulting in a moon face, dorsocervical hump (“buffalo” hump) on the upper back, and a large abdomen (centripetal obesity).
- **Skin changes:** Flushing in the face, easy bruising, and purple stretch marks on the stomach: The excess cortisol causes a decrease in collagen, resulting in thin, fragile skin. Large purple abdominal striae are also seen, which are different from the usual small, white striae seen after pregnancy or with weight gain. The client may also report an increase in acne.
- **Diabetes:** An increase in blood glucose caused by gluconeogenesis and insulin resistance may lead to diabetes. This increase, coupled with the immunosuppressive effects from excess cortisol, places the client at an increased risk for infection.
- **High blood pressure:** This occurs due to many pathophysiologic changes in Cushing disease. An increase in cortisol can raise the BP and stress the heart, causing hypertrophy leading to congestive heart failure.
- **Sex hormone changes (excess facial hair, infertility, and fewer menstrual periods in women):** Client's hair will become thin. Women are
prone to coarse hair growth on their face, thighs, and chest (known as hirsutism). Women often report menstrual changes such as amenorrhea.

- **Muscle weakness and bone changes (Osteoporosis):** The peripheral extremities exhibit signs of muscle wasting. The arms and legs have muscle atrophy due to protein loss, which results in client complaints of fatigue and muscle weakness. The catabolic effects of cortisol cause the bones to become fragile. The client may experience hypocalcemia due to the excretion of calcium through the kidneys and the decreased absorption of calcium by the gastrointestinal system. The body tries to compensate for hypocalcemia by pulling calcium from the bones; this compensation may result in osteoporosis.

- **Mental changes (Significant problems with memory and thinking, Depression):** Excess cortisol levels can affect your client's mood and may even cause depression, anxiety, insomnia, and unpredictable behavior.

**Diagnosis of Cushing’s syndrome**

Diagnosis is based on a review of a person’s medical history, a physical examination, and laboratory tests. X rays of the adrenal or pituitary glands can be useful in locating tumors. No single lab test is perfect for diagnosis. The three most common tests used to diagnose Cushing’s syndrome are

- **The 24-hour urinary free cortisol level test:** In this test, a person’s urine is collected several times over a 24-hour period and tested for cortisol. Levels higher than 50 to 100 micrograms a day for an adult suggest Cushing’s syndrome. The normal upper limit varies in different laboratories, depending on which measurement technique is used.

- **Midnight plasma cortisol and late-night salivary cortisol measurements:** The midnight plasma cortisol test measures cortisol concentrations in the blood. Cortisol production is normally suppressed at night, but in Cushing’s syndrome, this suppression doesn’t occur. If the cortisol level is more than 50 nanomoles per liter (nmol/L), Cushing’s syndrome is suspected. The test generally requires a 48-hour hospital stay to avoid falsely elevated cortisol levels due to stress. A late-night or bedtime saliva sample can be obtained at home, then tested to determine the cortisol level. Diagnostic ranges vary, depending on the measurement technique used.
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- **Low-dose dexamethasone suppression test (LDDST):** In the LDDST, a person is given a low dose of dexamethasone, a synthetic glucocorticoid, by mouth every 6 hours for 2 days. Urine is collected before dexamethasone is administered and several times on each day of the test. A modified LDDST uses a onetime overnight dose. Cortisol and other glucocorticoids signal the pituitary to release less ACTH, so the normal response after taking dexamethasone is a drop in blood and urine cortisol levels. If cortisol levels do not drop, Cushing’s syndrome is suspected. **Note:** The LDDST may not show a drop in cortisol levels in people with depression, alcoholism, high estrogen levels, acute illness, or stress, falsely indicating Cushing’s syndrome. On the other hand, drugs such as phenytoin and phenobarbital may cause cortisol levels to drop, falsely indicating that Cushing’s is not present in people who actually have the syndrome. **For this reason, physicians usually advise their clients to stop taking these drugs at least 1 week before the test.**

- **The dexamethasone-corticotropin releasing (CRH) hormone test:** This test may be needed to distinguish Cushing’s syndrome from other causes of excess cortisol, such as in people who have depression or anxiety disorders, drink excess alcohol, have poorly controlled diabetes, or are severely obese.

The dexamethasone-CRH test rapidly distinguishes pseudo-Cushing from mild cases of Cushing’s. This test combines the LDDST and a CRH stimulation test. In the CRH stimulation test, an injection of CRH causes the pituitary to secrete ACTH. Pretreatment with dexamethasone prevents CRH from causing an increase in cortisol in people with pseudo-Cushing’s. Elevations of cortisol during this test suggest Cushing’s syndrome.

**Treatment of Cushing’s syndrome**

Treatment depends on the specific reason for excess cortisol and may include surgery, radiation, chemotherapy, or the use of cortisol-inhibiting drugs. If the cause is long-term use of glucocorticoid hormones to treat another disorder, the HCP will gradually reduce the dosage to the lowest dose adequate for control of that disorder.

For **Pituitary Adenomas:** The most widely used treatment for ACTH-secreting pituitary adenomas is surgical removal of the tumor using the transphenoidal adenomectomy. After
curative pituitary surgery, the production of ACTH usually drops two levels below normal. This drop is natural and temporary, and clients are given a synthetic form of cortisol such as hydrocortisone or prednisone to compensate.

Radiation therapy is used for treatment if transsphenoidal surgery fails or a client is not a suitable candidate for surgery. A Combination of radiation with cortisol-inhibiting drugs can help speed recovery.

Drugs used alone or in combination to control the production of excess cortisol are ketoconazole, mitotane, aminoglutethimide, and metyrapone.

For the overproduction of cortisol caused by **ectopic ACTH syndrome**, all of the cancerous tissue that is secreting ACTH must be eliminated. The choice of cancer treatment—surgery, radiation, chemotherapy, immunotherapy, or a combination of these treatments is used. If other treatments fail bilateral adrenalectomy may be used.

**For Adrenal Tumors:** Surgery is the mainstay of treatment for benign and cancerous tumors of the adrenal glands.

**Nursing Diagnoses for Cushing’s syndrome**

- **Risk for infection related to altered protein metabolism and inflammatory response.**
  - **Actions/Interventions:**
    - Assess client frequently for signs of infection such as an increase in temperature.
    - Have the client avoid others with infection.
    - Check the mouth, lungs, and skin for early signs of infection.

- **Risk for injury related to weakness, decreased bone density, increased capillary fragility, poor wound healing.**
  - **Actions/Interventions:**
    - Increase calcium, vitamin D and protein in diet
    - Assess skin for signs of bruising, breakdown, wounds not healing, changes in height
    - Instruct client about safety measures to reduce risk for falls and injury

- **Self-care deficit related to weakness, fatigue, and muscle wasting.**
  - **Actions/Interventions:**
    - Assess the client’s ability to perform self-care activities.
    - Encourage moderate activity.
    - Client should be reassured that symptoms will subside with treatment.
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- Help client plan rest periods throughout the day.

  ✷ Disturbed body image related to changes in physical appearance and decreased activity.
  ✷ Actions/Interventions:
    - Reassure client that physical changes are a result of the increased hormone levels and will most likely resolve when those levels return to normal.
    - Promote coping methods to help client deal with changes in appearance, clothing and grooming.
    - Assist client in locating a support group.
  
  ✷ Impaired skin integrity related to thin and fragile skin and impaired healing.
  ✷ Actions/Interventions:
    - Assess client’s skin.
    - Avoid using adhesive tape.
    - Encourage and assist the client to change positions frequently to prevent skin breakdown.

  ✷ Disturbed thought process related to mood swings, irritability and depression.

Promoting Home and Community-Based Care.

- Teach client about Addisonian crisis which may result from: Withdrawal of corticosteroids, adrenalectomy, and removal of a pituitary tumor.
- Teach the client with Cushing’s syndrome and the family what problems could arise and how to manage those that cannot be prevented.
- Explain what could happen if the client pt stops taking the corticosteroids.
- Talk to the client about dietary modifications.
- Teach how to monitor blood glucose levels, blood pressure and weight.
- Client that had an adrenalectomy or removal of a pituitary tumor need close monitoring.
- If you are a nurse giving homecare to a client with Cushing’s syndrome make sure you assess the pt psychological and physical status.
- Emphasize the importance of having a regular medical follow-up, knowing side effects of medications and wearing a medical identification bracelet.

Transsphenoidal hypophysectomy

The surgical procedure to remove a pituitary adenoma is a transsphenoidal hypophysectomy, in which the surgeon gains access to the pituitary gland through the sphenoid sinus. This approach is performed using a small keyhole incision in the area of the upper lip and gingiva.
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(upper gum). The adenoma or the entire pituitary can be removed through this incision, depending on the client's condition.

The nasal cavity will be packed for up to 3 days. Occasionally, a fat graft may be needed to stop leakage of cerebral spinal fluid (CSF), which is a possible complication.

Preoperative transsphenoidal hypophysectomy

Preoperatively, the client should be monitored and treated for hyperglycemia, hypertension, potential electrolyte imbalance (sodium, potassium, and calcium), and infection. The client must be physically and nutritionally stable before surgery. The client may be receiving beta-blockers and insulin to control the symptoms of hypertension and hyperglycemia. Expect a high-protein diet with potassium supplements to correct nutritional requirements before surgery.

Anticipate the client's lab values to reflect hyperglycemia, hypernatremia, hypokalemia, and hypocalcemia. Assess for signs and symptoms, such as:

Hyperglycemia—excessive thirst, frequent urination, blurred vision, and headache

Hypernatremia—loss of appetite, nausea, vomiting, generalized weakness, and excessive thirst

Hypokalemia—abnormal heart rhythms, constipation, muscle weakness, fatigue, and paralysis

Hypocalcemia—tetany (hyperirritability of the muscle), paresthesias and numbness, facial twitching (positive Chvostek sign), muscle cramps, and carpal spasm (found with positive Trousseau sign).

Other considerations for the client undergoing a transsphenoidal hypophysectomy include safety related to possible fractures; maintain a safe environment to prevent falls. Anxiety and depression can also be a problem related to an increase in cortisol levels. Your client may need a quiet environment. Remember, it's important during the pre-op period to teach your client what to expect after surgery.

Possible Complication following transsphenoidal hypophysectomy

Common complications of a transsphenoidal hypophysectomy include bleeding from the incision, infection of the brain (Meningitis), and increased intracranial pressure (ICP). Other less common complications include CSF leakage and fluid imbalance related to diabetes insipidus. Because of possible injury to
the pituitary gland or complete removal, the client may need post-op hormone replacement therapy.

**Care after transsphenoidal hypophysectomy**

- Monitor for bleeding; the nose will be packed for approximately 3 days. Excessive bleeding isn't expected.
- Instruct your client how to breathe through his or her mouth because of the nasal packing.
- Postoperatively, headaches can be a problem related to the packing. Keep the head of the bed at 30 degrees to decrease the pressure on the sella turcica (an area on the surface of the sphenoid bone).
- If the client has a fat graft, the donor site will also need to be assessed and dressed.
- Client won't be able to use a toothbrush for 10 days to prevent suture line disruption. Perform mouth care every 4 hours to remove debris from the incision area on the inside of the upper lip and gum to prevent infection.
- The client may also receive I.V. antibiotics prophylactically.
- Persistent headaches unrelieved by mild analgesics may indicate an increase in ICP. Monitor the client's neurologic status for changes in level of consciousness and pupillary response because this may indicate neurologic complications. Teach the client to avoid straining with a bowel movement, coughing, and sneezing to decrease the risk of increased ICP.
- If you assess clear nasal drainage, obtain a specimen for the lab to determine the presence of CSF. Leakage of CSF can increase the risk of meningitis. Persistent headaches may also be a sign of CSF leakage.
- Strictly monitor the client's intake and output and obtain daily weights. The client is at risk for transient diabetes insipidus postprocedure. Observe for large volumes of dilute urine output; if this occurs, the client may become hypotensive and go into shock.

*Important note:* If the client receives steroids postoperatively, the surgeon may choose to wean the client off them within 24 hours after the surgery and monitor the cortisol levels daily, only giving corticosteroids if the client shows symptoms of adrenal insufficiency. When taking steroids, the adrenal glands go to sleep; therefore, abruptly stopping steroids can result in mild-to-severe adverse reactions, such as muscle weakness, fatigue, depression, joint pain, difficulty breathing, and vascular collapse. If the entire pituitary gland was removed, this will leave the client
with a deficiency of ACTH and pituitary hormones. The client will then require hormone replacement therapy for cortisol, thyroid, and sex hormones.

- Teach the client the importance of taking prescribed steroid dosages to stabilize serum levels. Also make sure that the client understands that steroids are essential for life and handling stress. The client's dosage may require frequent adjustments based on serum cortisol levels. Teach the client to report any muscle weakness, fatigue, depression, or joint pain because this indicates insufficiency.

**Adrenalectomy**

Laparoscopic adrenalectomy is the standard of care for removal of the adrenal gland. The traditional open adrenalectomy requires a large flank or subcostal incision to obtain adequate exposure of the adrenal glands. A large surgical incision increases the risk of wound infection, results in significant postoperative pain, and prolongs recovery time. The laparoscopic approach is associated with a significantly lower overall complication rate as compared to the open procedure.

**Preoperative nursing care**

- A complete history and physical examination is mandatory in the evaluation of a client with an adrenal mass.
- The nurse should use careful medical and surgical asepsis when providing care and treatments. Cortisol excess increases the risk of infection.
- Monitor the results of laboratory tests of electrolytes and glucose levels. Electrolyte and glucose imbalances are corrected before the client has surgery.
- A complete endocrinologic evaluation should include measurement of serum electrolytes, serum hormone levels, and urine levels of steroid hormones and their metabolites.
- Correction of electrolyte imbalances such as hypokalemia.
- Request a dietary consultation to discuss with the client about a diet high in vitamins and proteins. If hypokalemia exists, include foods high in potassium. Glucocorticoid excess increases catabolism. Vitamins and proteins are necessary for tissue repair and wound healing following surgery.
- Type and screened because of the potential for blood loss during surgery.
- Bowel preparation is not mandatory but may be required by the surgeon.
- Consent for the procedure must be signed and witnessed.
Client education
Educate the client as to what to expect during the intraoperative and postoperative phases.
Teach the client to turn, cough, and perform deep-breathing exercises. Although they are important for all surgical clients, these activities are even more important for the client who is at risk for infection. Having the client practice and demonstrate the activities increases postoperative compliance.

Post-operative nursing care
The adrenal glands play an integral part in stress responses and BP regulation, close monitoring of BP is necessary via an arterial line or BP cuff.
Post adrenalectomy clients require close monitoring of electrolytes, especially potassium.
Take and record vital signs, measure intake and output, and monitor electrolytes on a frequent schedule, especially during the first 48 hours after surgery. Removal of an adrenal gland, especially a bilateral adrenalectomy, results in adrenal insufficiency. Addisonian crisis and hypovolemic shock may occur.
Cortisol is often given on the day of surgery and in the postoperative period to replace inadequate hormone levels. Intravenous fluids are also administered.
Monitor the client closely for signs of acute hemorrhage such as sudden drop in B/P.
Assess the client's level of pain and medicate the client for pain as ordered.
Encourage client to ambulate shortly following surgery.
Urinary drainage catheter is removed on the first postoperative day.
A clear-liquid diet is started on the first postoperative day, and the diet is advanced as tolerated.
Serum cortisol levels are evaluated to assure that no element of adrenal insufficiency requires supplementation.
A client undergoing a unilateral adrenalectomy may require temporary replacement of glucocorticoids.
If bilateral adrenalectomy is performed, the client will be placed on cortisol replacement permanently.
Assess body temperature, WBC levels, and wound drainage. Change dressings using sterile technique. Impaired wound healing increases the risk of infection in
clients with adrenal disorders. Use aseptic technique to decrease this risk.

- Follow-up with the surgeon is usually a few days to a week after surgery.

**Points to Remember about Cushing’s syndrome**

- Cushing’s syndrome is caused by prolonged exposure to high levels of cortisol.
- Typical signs and symptoms include upper body obesity, a rounded face, skin that bruises easily and heals poorly, weakened bones, excess body hair growth, and menstrual irregularities in women.
- Cushing’s syndrome can be caused by exposure to glucocorticoids or the body’s overproduction of cortisol.
- Several tests are needed for diagnosis, including urine, blood, and saliva tests.
- Treatment depends on the specific cause and may include surgery, radiation, chemotherapy, or cortisol-inhibiting drugs.

**Points to Remember Addison’s disease**

- Adrenal insufficiency is an endocrine disorder that occurs when the adrenal glands do not produce enough of certain hormones.
- Addison’s disease, also known as primary adrenal insufficiency, occurs when the adrenal glands are damaged and cannot produce enough cortisol. The adrenal hormone aldosterone may also be lacking.
- Secondary adrenal insufficiency occurs when the pituitary gland fails to produce enough adrenocorticotropic hormone (ACTH), a hormone that stimulates cortisol production. If ACTH output is too low, cortisol production drops.
- The most common symptoms of adrenal insufficiency are chronic fatigue, muscle weakness, loss of appetite, weight loss, and abdominal pain. The slowly progressing symptoms are often ignored until a stressful event, such as surgery, a severe injury, an illness, or pregnancy, causes them to worsen.
- If not treated, an adrenal crisis can cause death.
- A diagnosis of adrenal insufficiency is confirmed through hormonal blood and urine tests. Imaging studies of the adrenal and pituitary glands can be useful in helping to establish the cause.
- Adrenal insufficiency is treated by replacing, or substituting, the hormones that the adrenal glands are not making.
- Problems can occur in people with adrenal insufficiency who are undergoing surgery, suffer a severe injury, have an illness, or are pregnant. These conditions place additional stress on the body, and people with adrenal insufficiency may need additional treatment to respond and recover.
- People with adrenal insufficiency should always carry identification stating their condition, “adrenal insufficiency,” in case of an emergency, as well as the supplies necessary to administer an emergency corticosteroid injection.
Management of Adrenal gland disorders.
Learn More/References


Management of Adrenal gland disorders.

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Review Questions

1. Which of the following is an anterior pituitary hormone released in response to decreased mineralocorticoid level?
   a. antidiuretic hormone ADH
   b. follicle-stimulating hormone (FSH)
   c. luteinizing hormone (LH)
   d. Cortisol
   e. adrenocorticotropic hormone (ACTH)

   **Rationale: answer E:**
   Adrenocorticotropic hormone (ACTH) anterior pituitary hormone that stimulates the adrenal cortex to secrete corticosteroid hormones (also called corticotropin). Antidiuretic hormone (ADH) hypothalamic hormone that is stored by the posterior pituitary and that signals the kidneys to reabsorb water. Follicle-stimulating hormone (FSH) anterior pituitary hormone that stimulates the production and maturation of sex cells. Luteinizing hormone (LH) anterior pituitary hormone that triggers ovulation and the production of ovarian hormones in females, and the production of testosterone in males.

2. The nurse is discussing Cushing’s syndrome with a client newly diagnosed with the disease. Which of these is the most appropriate explanation for the cause of Cushing’s syndrome? Cushing’s disease is a disorder caused by
   a. abnormally low levels of cortisol
   b. abnormally high levels of cortisol
   c. abnormally low levels of aldosterone
   d. abnormally high levels of aldosterone

   **Rationale: answer B:**
   Cushing’s disease is a hormonal disorder caused by prolonged exposure of the body’s tissues to high levels of the hormone cortisol.

3. A client with a history of Addison’s disease is admitted with gastrointestinal bleeding and scheduled for bowel resection. Which of these will the nurse

   **Rationale: answer:** Parenteral corticosteroids will likely be prescribed during any major procedure or times of major stress or trauma.

4. Which of these will the nurse include when teaching a client with Addison’s diseases? Select all that apply.
a. Emphasize the lifetime nature of taking corticosteroids.
b. Explain that periods of stress require more medication.
c. Teach the client to recognize signs of undermedication: weakness, fatigue, and dizziness.
d. Teach the client to avoid dizziness by moving from a sitting to a standing position slowly.
e. Carry identification stating their condition, in case of an emergency.
f. Explain the common side effects of long term use of steroids.

Rationale answer A, B, C, D, E, & F: Emphasize the lifetime nature of taking corticosteroids. Provide name, dosage, and action of the prescribed medication. Explain the common side effects of weight gain, swelling around the face and eyes, insomnia, bruising, gastric distress, gastric bleeding, and petechiae. Suggest the client weigh self daily, at the same time each day, and call the healthcare provider if weight changes by 5 pounds. Explain that periods of stress require more medication. Tell the client to call the healthcare provider for changes in dose if he or she experiences extra physical or emotional stress.

Illness and temperature extremes are considered stressors. Teach the client to recognize signs of undermedication: weakness, fatigue, and dizziness. Emphasize the need to report underdosing to the healthcare provider. Teach the client to avoid dizziness by moving from a sitting to a standing position slowly.

5. The nurse is assessing a male client with pheochromocytoma. Which of these findings are consistent with the client’s diagnosis?

a. A blood pressure of 130/70 mm Hg.
b. A blood glucose level of 130 mg/dl.
c. An apical pulse rate greater than 100 per minute.
d. A blood pressure of 176/88 mm Hg.

Rationale: answer D:

Pheochromocytoma, a tumor of the adrenal medulla that secretes excessive catecholamine, causes hypertension, tachycardia, hyperglycemia, hypermetabolism, and weight loss. It isn’t associated with the other options.

6. A female client with a history of pheochromocytoma is admitted to the hospital in an acute
hypertensive crisis. To reverse hypertensive crisis caused by pheochromocytoma, the nurse expects the HCP to order which of these medications:

a. Phentolamine (Regitine).
b. Methyldopa (Aldomet).
c. Mannitol (Osmitrol).
d. Felodipine (Plendil).

**Rationale: answer A:**
Pheochromocytoma causes excessive production of epinephrine and norepinephrine, natural catecholamines that raise the blood pressure. Phentolamine, an alpha-adrenergic blocking agent given by I.V. bolus or drip, antagonizes the body’s response to circulating epinephrine and norepinephrine, reducing blood pressure quickly and effectively. Although methyldopa is an antihypertensive agent available in parenteral form, it isn’t effective in treating hypertensive emergencies. Mannitol, a diuretic, isn’t used to treat hypertensive emergencies. Felodipine, an antihypertensive agent, is available only in extended-release tablets and therefore doesn’t reduce blood pressure quickly enough to correct hypertensive crisis.

7. A male client with a history of hypertension is diagnosed with primary hyperaldosteronism. This diagnosis indicates that the client’s hypertension is caused by excessive hormone secretion from which of the following glands?

**Rationale: answer A:**
Excessive secretion of aldosterone in the adrenal cortex is responsible for the client’s hypertension. This hormone acts on the renal tubule, where it promotes reabsorption of sodium and excretion of potassium and hydrogen ions. The pancreas mainly secretes hormones involved in fuel metabolism. The adrenal medulla secretes the catecholamines — epinephrine and norepinephrine. The parathyroids secrete parathyroid hormone.

8. The nurse is caring for a client diagnosed with Addison’s disease. The nurse will plan the client’s care knowing that which of these is the most appropriate diagnosis for a client with Addison’s disease?

**Rationale:**
a. fluid volume excessive
b. Urinary retention
c. **Risk for infection**

d. **Hypothermia**

**Rationale: answer C:**

Addison’s disease decreases the production of all adrenal hormones, compromising the body’s normal stress response and increasing the risk of infection. Other appropriate nursing diagnoses for a client with Addison’s disease include Deficient fluid volume and Hyperthermia. Urinary retention isn’t appropriate because Addison’s disease causes polyuria.

9. Which of the following questions should the nurse ask during an admission interview for a client admitted with a diagnosis of pheochromocytoma?

a. “Do you ever notice or feel an increase in your heart beating?”

b. “Do you suddenly feel warm and flushed when you get out of bed?”

c. “Do your symptoms subside when you eat simple sugars?”

d. “Do the attacks make you feel like you want to rest awhile and sleep?”

**Rationale: answer A:**

Pheochromocytoma is a tumor in the adrenal medulla that secretes excessive amounts of epinephrine and norepinephrine. Palpitations are a major clinical manifestation. Postural hypotension occurs frequently and would be noted with dizziness and cold and clammy skin. Hyperglycemia is another classic manifestation. Clinical manifestations that subside when simple sugars are eaten are characteristic of hypoglycemia. The “attacks” that occur are a result of the release of the catecholamines and cause the client to be extremely anxious, tremulous, and weak.

10. The nurse is planning teaching for a client newly diagnosed with pheochromocytoma. The nurse should explain that pheochromocytoma occurs as a result of disturbance in the secretion of which hormones?

a. Thyroid stimulating hormone

b. Follicle Stimulating hormone

c. **Epinephrine & Norepinephrine**

d. Adrenocorticotropic Hormone

11. The nurse is caring for a client who has been admitted with pheochromocytoma. Which of the following is consistent with the client’s diagnosis?
Management of Adrenal gland disorders.

a. Pyuresis  
b. Nausea & Vomiting  
c. Anxiety  
d. Hypertension

12. The nurse is reviewing the care given to a client with Addison’s disease. The client has a nursing diagnosis of ‘knowledge deficit related to disease management’. Which of the following responses by the client regarding medication management would indicate to the nurse that the goal has been met?

a. "I will need to call my doctor for an increase in medication dose when I’m experiencing a lot of stress."  
b. "I should stop my medication if I begin to experience any unpleasant side effects."  
c. "The medication I am taking is very safe and does not cause side effects."  
d. "If I’m nauseated and can’t take my medicine for a few days, I can do without them."

Rationale: answer A: people with Addison’s disease who are aldosterone deficient can benefit from following a diet rich in sodium. Corticosteroid treatment is linked to an increased risk of osteoporosis. People who take corticosteroids should protect their bone health by consuming enough dietary calcium and vitamin D.

13. The nurse is reinforcing diet teaching with a client who has Addison’s disease. Which of the following menu choices by the client would indicate a correct understanding of the teaching?

a. A cheese and beef sandwich, chicken nodule soup, and sherbet.  
b. Corn bread, shrimp salad, and pickles.  
c. Ham on toasted bread, tomato juice, and pretzels.  
d. Chicken salad on toasted bread, cranberry juice, and frozen yogurt.

Rationale answer A: people with Addison’s disease who are aldosterone deficient can benefit from following a diet rich in sodium. Corticosteroid treatment is linked to an increased risk of osteoporosis. People who take corticosteroids should protect their bone health by consuming enough dietary calcium and vitamin D.

14. The nurse is caring for a 36 year-old client who had Adrenalectomy two days ago. The client is receiving an opioid analgesic. While the client is receiving the medication, which of the following would be the primary goal of nursing care?

a. To control the client’s pain  
b. To facilitate slow, easy breathing by the client  
c. To encourage position change effectively.
 Management of Adrenal gland disorders.

d. To prevent the client from becoming dependent on the medication

Rationale: answer A:

15. The client with a history of diabetes insipidus is admitted with polyuria, polydipsia, and mental confusion. The priority intervention for this client is:
   a. Measure the urinary output.
   b. Check the vital signs.
   c. Encourage increased fluid intake.
   d. Weigh the client.

Rationale: answer B:

16. A client has had a unilateral adrenalectomy to remove a tumor. The most important measurement in the immediate post-operative period for the nurse to take is:
   a. The blood pressure
   b. The temperature
   c. The urinary output
   d. The specific gravity of the urine

Rationale: answer A:

17. A client with Addison’s disease has been admitted with a history of nausea and vomiting for the past three days. The client is receiving IV glucocorticoids (Solu-Medrol). Which of the following interventions would the nurse implement?

   a. Glucometer readings as ordered
   b. Intake/output measurements
   c. Evaluating the sodium and potassium levels
   d. Daily weights

Rationale: answer A: Glucocorticoids can elevate blood glucose levels. Other choices are important, but the most important is monitoring the glucose level.

18. A client with Addison's disease asks a nurse for nutrition and diet advice. Which of the following diet modifications will the nurse NOT recommend for this client?

   a. A diet high in grains.
   b. A diet with adequate caloric intake.
   c. A high protein diet.
   d. A low sodium diet.

Rationale: answer D: A client with Addison's disease requires normal dietary sodium to prevent excess fluid loss. Adequate caloric intake is recommended with a diet high in protein and complex carbohydrates, including grains.

19. Which of the following nursing interventions should be included in a plan of care for a client with Addison’s disease?
Management of Adrenal gland disorders.

a. Administer the prescribed diuretics
b. Give diet instructions for a low-carbohydrate, low-protein diet
c. Monitor for signs of Na+ and K+ imbalances
d. Encourage self-care activities

**Rationale: answer C.** Addison’s disease is deficiency of adrenal glucocorticoids and mineralocorticoids resulting in major disturbances in sodium (hyponatremia) and potassium (hyperkalemia). These clients need lifelong replacement therapy of glucocorticoids and mineralocorticoids. A high-carbohydrate, high-protein diet is ordered. With insufficient glucocorticoids and mineralocorticoids, the client is at risk for developing Addisonian crisis when under any stress, including self-care activities.

20. The nurse is developing a plan of care for a client with Addison’s disease. Which of these is the most appropriate nursing diagnosis for this client?

   a. **Risk for infection**
   b. Excessive fluid volume
   c. Urinary retention
   d. Hypothermia

**Rationale Answer A.** Addison’s disease decreases the production of all adrenal hormones, compromising the body’s normal stress response and increasing the risk of infection. Other appropriate nursing diagnoses for a client with Addison’s disease include Deficient fluid volume and Hyperthermia. Urinary retention isn’t appropriate because Addison’s disease causes polyuria.

21. A 32 year old female client is being treated for Cushing’s syndrome. Which of the following observations would indicate that the client is responding appropriately to the treatment?

   a. Normal serum glucose level.
   b. Thinning of scalp hair.
   c. Bone demineralization.
   d. A decline menstrual flow.

**Rationale Answer A.** Hyperglycemia, which develops from glucocorticoid excess, is a manifestation of Cushing’s syndrome. With successful treatment of the disorder, serum glucose levels decline. Hirsutism is common in Cushing’s syndrome; therefore, with successful treatment, abnormal hair growth also declines. Osteoporosis occurs in Cushing’s syndrome; therefore, with successful treatment, bone mineralization increases. Amenorrhea develops in Cushing’s syndrome. With successful treatment,
the client experiences a return of menstrual flow, not a decline in it.

22. A client has been taking Fludrocortisone (Florinef) for adrenal insufficiency. Which of the following signs and symptoms would indicate that the client has been experiencing negative side effects? Select all that apply.
   a. Edema
   b. Unpredictable changes in mood
   c. Rapid weight gain
   d. Increased frequency of urination
   e. Fatigue in the late afternoon

Rationale Answer A and C:
Fludrocortisone (Florinef) has a strong effect on sodium retention by the kidneys, which leads to fluid retention, causing edema and weight gain. Fatigue may occur with adrenal insufficiency and is not related to cortisone therapy. Unpredictable changes in moods commonly occur but are not as serious a threat as fluid retention. Fluid retention and decrease urination not frequency can occur.

23. Which parameter is measured with the dexamethasone suppression test?
   a. The amount of dexamethasone in the system.
   b. Cortisol levels after the system is challenged.
   c. Changes in certain body chemicals, which at altered in depression.
   d. Cortisol levels before and after the system is challenged with a synthetic steroid.

Rationale Answer D. Dexamethasone suppression test measures cortisol levels before and after the system them is challenged with a synthetic steroids. The dexamethasone suppression test doesn't measure the dexamethasone or body chemicals altered in depression. Dexamethasone is used to challenge the cortisol level.

24. A client is ordered dose of you epoetin alpha (aranesp) to treat anemia related to chemotherapy. They recommended does is 150 units/kilogram. The client weighs 60 kg. The vial is labeled 10,000 units per milliliter. How many milliliter of epoetin Alfa should the nurse administer? Record your answer using one decimal place.

Rationale answer: The answer is 0.9 mL.

25. A client with Addison disease is scheduled for discharge after being hospitalized for an adrenal crisis. Which statements by the client would indicate that the nurses
teaching has been effective? Select all that apply.

a. “I have to take my steroids for 10 days.”

b. “I need to weigh myself daily to be sure I don’t eat too many calories.”

c. “I need to call my doctor to discuss my steroid needs before I have dental work.”

d. “I will call the doctor if I suddenly feel very weak or dizzy.”

e. “If I feel like I have the flu, I will carry-on as usual because this is expected response.”

f. “I need to obtain and wear a medic alert bracelet.”

Rationale Answer C, D, F: Dental work can be at cause of physical stress therefore the client’s physician needs to be informed about the dental work so he can adjust the dosage of the steroids if necessary. Fatigue, weakness, and dizziness are symptoms of inadequate at steroids therapy. The physician should be notified if these symptoms occur. A medic Alert bracelet allows healthcare providers to access the client’s history of Addison's disease if the client is unable to communicate this information. A client with Addison's disease doesn't produce enough steroids, so routine administration of steroids is a lifetime treatment. Daily weight should be monitored to monitor changes in fluid balance, lots calorie intake. Influenza is a bad physical stressor that May require and increased dosage of steroids. The client should notify the physician, not carry on as usual.

26. The nurse completed assessment for a client diagnosed with Addison's disease. Which findings will suggest that the client is being treated effectively? Select all that apply.

a. Blood pressure 120/80 mmHg

b. Client states that purpose of hydrocortisone.

c. Denies muscle weakness and fatigue.

d. Serum glucose 90 mg/dl.

e. Serum sodium 120 8mEq/L.

f. Serum potassium 5.9 mEq/L.

Rationale Answer A, C &D. Addison's disease (adrenocortical insufficiency) is characterized by hypotension, muscle weakness, hypoglycemia, hyponatremia, hyperkalemia as well as other the signs and symptoms. A reversal of these symptoms indicate treatment is effective.

27. The nurse is developing a plan of care for a client diagnosed with Cushing’s syndrome. Which of these nursing diagnoses should the nurse document in the client’s plan of care? Select all that apply.
a. Hyperthermia related to suppression of adrenal hormone.

b. Disturbed taught process reelected to mood swings irritability and depression.

c. Risk for infection related to altered protein metabolism and inflammatory response.

d. Self-care deficit related to weakness, fatigue, muscle wasting, and altered sleep patterns.

e. Disturbed body image related to altered physical appearance and impaired Sexual functioning.

f. Risk for myxedema coma related to medication non adherence secondary to depression.

Rationale Answer B, C, D, E: The overproduction of Adrenal cortical hormones that occurs in Cushing’s syndrome produces changes to the vascular, endocrine, metabolic, immune, skeletal, G.I., muscular, and psychiatric changes. Cushing syndrome occurs from overproduction of adrenal cortical hormone. Myxedema is associated with Hypothyroidism.

28. The nurse is providing incisional wound care to a client after open adrenalectomy following staples removal. While applying a transparent film dressing to the client, the nurse finds that his skin is diaphoretic. What is the most appropriate first intervention by the nurse in this situation?

a. Apply skin sealant preparations under the dressings.

b. Shave the area around the wound with a razor before placing the dressings.

c. Clean the skin with soap and water, pat dry before dressing the wound.

d. Pat the area dry and apply the dressing and change it every 5 days.

Rationale Answer C: When the client’s skin is diaphoretic or excessively oily, then the adhesive tape may not adhere to the skin. Therefore, the nurse should cleanse the client’s skin with soap and water to remove sweat and pat dry. The nurse should apply a skin sealant if the client has fragile skin. This helps to prevent skin damage. The nurse should not shave the area around the wound with a razor as it can cause nicks or abrasions. However, it will not reduce excessive sweating. The nurse should change the dressing every 3 days to prevent
infection and to provide effective wound care.

29. The registered nurse has noticed that the nursing assistant (NA) did not document the elevated temperature and heart rate reported to the RN at the beginning of shift on a client who is 2 days post-op adrenalectomy. What is the RN’s best action?

a. Enter the vital signs under the current time.
b. Ask the NA to re-take the temperature.
c. Omit the elevated temperature reading.
d. Advise the NA to document the findings.

Rationale Answer D: Most agencies permit NAs to record vital signs. The NA should record his/her own work. The NA should document what he/she did, not the RN. The temperature should be retaken to ensure it has decreased; but the elevated temperature still needs to be recorded. The RN likely intervened and must document the client’s response based on the elevated temperature and associated interventions. The assessment data should be included in the client’s medical record.

32. Alendronate (Fosamax) is prescribed for a client with osteoporosis secondary to Cushing’s syndrome. The nurse should instruct the client taking this medication to:

a. Take the medication at bedtime while sitting upright.
b. Take the medication in the morning with breakfast or a glass of milk to prevent gastric irritation.
c. Lie down on the left side for 30 minutes after taking the medication.
d. Take the medication with a full glass of water first thing in the morning and sit upright for at least 30 minutes.

Rationale Answer D: Precautions need to be taken with administration of alendronate to prevent gastrointestinal side effects (especially esophageal irritation) and to increase absorption of the medication. The medication needs to be taken with a full glass of water after rising in the morning. The client should not eat or drink anything for 30 minutes following administration and should not lie down after taking the medication.

33. The nurse is planning room assignments for the day. Which client should be assigned to a private room if only one is available?
Management of Adrenal gland disorders.

a. **The client with Cushing's disease**
b. The client with diabetes
c. The client with acromegaly
d. The client with myxedema

**Rationale Answer A:**

34. The client returns to the unit from surgery following laparoscopic adrenalectomy, with a blood pressure of 90/50, pulse 132, and respirations 30. Which of these is a priority action by the nurse?

a. Continuing to monitor the vital signs
b. **Contacting the physician**
c. Asking the client how he feels
d. Asking the LPN to continue the post-op care

35. Late in the postoperative period after the removal of an aldosteronoma the nurse would expect the client's blood pressure to:

a. **Gradually return to near normal levels**
b. Rise quickly above preoperative levels
c. Fluctuate greatly during this entire period
d. Drop very low, then rise rapidly to normal levels

**Rationale Answer A:** Once the excessive secretion of aldosterone is stopped, the BP gradually drops to a near normal level. The BP drops gradually; it does not rise. The BP will only fluctuate if the hypervolemia is overcorrected, causing hypovolemia; this is not expected. The BP drops gradually in response to decreasing serum corticosteroid levels; a rapid drop immediately following surgery may indicate hemorrhage.

36. A client with Addison’s disease is admitted with suspicion of Addison’s crisis. Based on these diagnosis the nurse will expect the physician to order which of these?

a. Intravenous normal saline, glucose, and glucocorticoid hormones immediately.
b. Intravenous insulin and dextrose 50% water to combat hyperkalemia.
c. Intravenous glucocorticoid hormones, normal saline and ringers lactate solutions immediately.
d. Head CT Scan with contrast and Intravenous Dextrose 5% with normal saline.

**Rationale Answer A:**
37. What would be most important information for the nurse to give a patient who is prescribed corticosteroid therapy?

  a. The patient's diet should be low protein with ample fat.
  b. There will be no change in appearance.
  c. The patient is at an increased risk for developing an infection.
  d. The patient is at a decreased risk for development of thrombophlebitis and thromboembolism.

Rationale Answer C:

38. A client with Cushing’s syndrome is asking for a midafternoon snack. Which of these would be most appropriate snack selection for the client?

  a. Ice cream sundae.
  b. Salted Pretzels.
  c. Chocolate chip cookies.
  d. Banana and peanut butter.

Rationale Answer D:

39. A client who has been on chronic corticosteroid therapy for several years has been scheduled for a colonoscopy. The nurse will expect client’s corticosteroid therapy be altered in what way to accommodate this impending procedure?

  a. The patient should stop taking the corticosteroid 7 days prior to the procedure.
  b. The patient should continue taking the regular dose of his corticosteroid.
  c. The patient should temporarily change to IV administration of his corticosteroid.
  d. The patient should temporarily take a higher dose of his corticosteroid.

Rationale Answer D: For people receiving chronic corticosteroid therapy, dosage must be increased during periods of stress or illness. Some common sources of stress for most people include surgery and anesthesia, infections, anxiety, and extremes of temperature.

40. The nurse is caring for a patient with a diagnosis of Addison's disease. Which of these assessment findings are associated with the client’s diagnosis?

  a. Truncal obesity
  b. Hypertension
  c. Muscle weakness
  d. Moon face

Rationale Answer C: Patients with Addison's disease demonstrate muscular weakness, anorexia, gastrointestinal symptoms, fatigue, emaciation, dark pigmentation of the
skin, and hypotension. Patients with Cushing syndrome demonstrate truncal obesity, “moon” face, acne, abdominal striae, and hypertension.

41. The nurse is caring for a patient with Addison's disease who is scheduled for discharge. Which of these should the nurse include when teaching the patient about hormone replacement therapy?

a. The possibility of precipitous weight gain
b. The need for lifelong steroid replacement
c. The need to match the daily steroid dose to immediate symptoms
d. The importance of monitoring liver function

**Rationale Answer B:** Because of the need for lifelong replacement of adrenal cortex hormones to prevent addisonian crises, the patient and family members receive explicit education about the rationale for replacement therapy and proper dosage. Doses are not adjusted on a short-term basis. Weight gain and hepatotoxicity are not common adverse effects.

42. A patient with suspected adrenal insufficiency has been ordered an adrenocorticotropic hormone (ACTH) stimulation test. Administration of ACTH caused a marked increase in cortisol levels. The nurse accurately interpret this finding as...

a. The patient's pituitary function is compromised.
b. The patient's adrenal insufficiency is not treatable.
c. The patient has insufficient hypothalamic function.
d. The patient would benefit from surgery.

**Rationale Answer A:** An adrenal response to the administration of a stimulating hormone suggests inadequate production of the stimulating hormone. In this case, ACTH is produced by the pituitary and, consequently, pituitary hypofunction is suggested. Hypothalamic function is not relevant to the physiology of this problem. Treatment exists, although surgery is not likely indicated.