MCKINNON BTC
TOUCH, HEALTH, AND COMMON CONDITIONS

Endocrine System and Massage

12/9/20

1

TODAY…

- Anatomy and Physiology of the Endocrine System
- Common and Important Pathologies, including Diabetes
- Urinary and Reproductive Systems: Anatomy, Physiology, and Common Pathologies
- Final Research Article Summary Presentation
- Logistics: Schedule for remainder of course
- IF there is any spare time, medical terminology games…

2

NATURE OF THE ENDOCRINE SYSTEM

- **Endocrine and Nervous Systems work closely together** to regulate body processes, stimulate change, and maintain homeostasis
- For the most part, the **Endocrine System works more slowly than the Nervous System**, creating change by way of chemical secretions rather than by electrical impulse transmission

endo, G = within; "crine" is derived from, G, *krinein,* = to secrete

Exocrine glands contain cells that produce secretions transported through ducts.
Endocrine glands secrete hormones into the blood stream.

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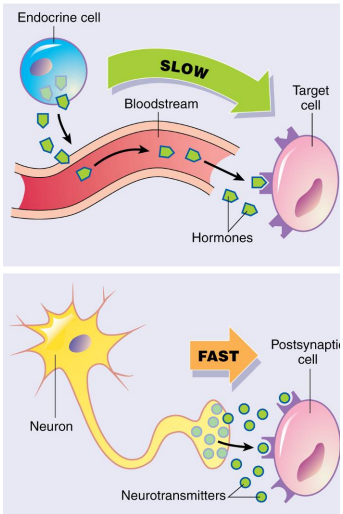
NATURE OF THE ENDOCRINE SYSTEM

The Endocrine System can be difficult to "digest." Please page through Ch. 6 in Premkumar, 3rd, and Ch. 9 in Werner, 7th and 6th. There are a lot of special information boxes about interesting topics like SAD; the way hormone secretions are organized; and stress, in addition to great images, tables, and diagrams.



Endocrine vs. Nervous System

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STRUCTURES AND RELATIONSHIPS…

- The endocrine system is comprised of a collection of **glands that secrete hormones directly into the bloodstream or into local tissues**
- The **hypothalamus (in the diencephalon of the brain) is the control center for endocrine (chemical) reactions and autonomic (electrical) reactions**
- The **hypothalamus connects to the pituitary** (master gland) via motor neurons and hormones
- Hormones from the hypothalamus and the pituitary travel through the bloodstream to target organs and tissues
- Many targets are other endocrine glands, which, in turn, secrete hormones into body tissues
- When the hypothalamus (or other glands) sense that secretions are normal, the signals to produce them stop: that is, a **negative feedback loop keeps levels in balance**

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INDIVIDUAL ENDOCRINE GLANDS

- The endocrine glands
  - Pituitary gland (controlled by the hypothalamus, it also sends hormones to other glands to get them to secrete hormones that act on target cells throughout the body)
  - Pineal gland
  - Thyroid gland
  - Parathyroid glands
  - Thymus gland
  - Adrenal glands
  - Pancreatic islets
  - Ovaries and testes
- Other organs (heart, intestines, kidneys) also possess endocrine qualities

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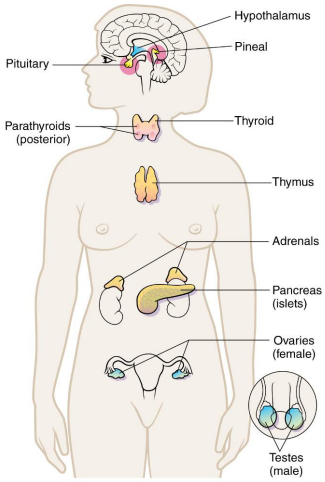
INDIVIDUAL ENDOCRINE GLANDS



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PHYSIOLOGICAL PROPERTIES AND ACTIONS OF THE ENDOCRINE SYSTEM

- Produces and secretes hormones
- Regulates body activities (growth, development, and metabolism)
- Regulates activities of smooth muscle, cardiac muscle, and some glands
- Helps body adapt during times of stress
- Regulates chemical composition and volume of body and cell fluids
- Contributes to the reproductive process

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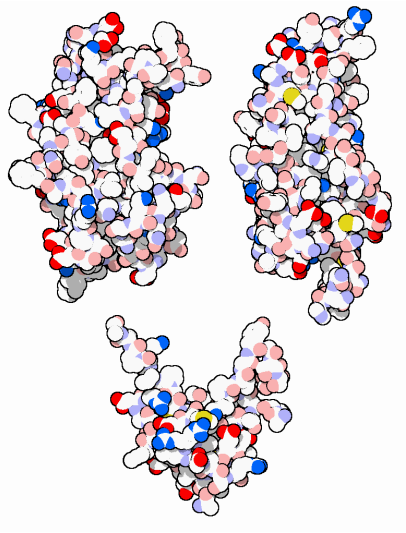
HORMONES…

- Are internal secretions that function as chemical messengers
- Act as catalysts in biochemical reactions; regulate physiological activity of cells
- Only affect target cells that have receptor sites for that hormone



Representation of Growth Hormones

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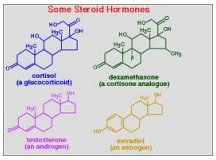
HORMONES…

- Most hormone cycles work best in gentle, rhythmic fluctuations
- Cycles can last hours, days, or weeks (hunger/satiety; circadian rhythm, menstrual cycle, etc.)
- There are several classes of hormones
  - *Peptides*: (growth hormone, erythropoietin, parathyroid hormone) Introduce chemical reactions to alter cell metabolism
  - *Amines*: (adrenaline, thyroxine) Function as neurotransmitters
  - *Steroids*: (cortisol, testosterone) Turn genes on and off to alter cell activity



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IN CASE YOU'RE CURIOUS…

- Organic compound = any compound of carbon and another element or a radical
- **Peptides** = organic compound composed of two or more amino acids (proteins) linked together to form a chain and bonded in a characteristic way
- **Amines** = organic compound derived from ammonia (something else substitutes for one or more of the hydrogen atoms)
- **Steroids** = organic compounds with a characteristic 4 rings of carbon atoms; many hormones and vitamins are steroids

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REVIEW…

Hormones only affect cells that have receptors for them. True

What is a hormone? A chemical messenger (neurotransmitter) released into the bloodstream that acts as a catalyst to regulate physiological processes within the cells.

The part of the brain that directly communicates with and controls the endocrine system is…? Hypothalamus

The endocrine system works much more quickly than the nervous system. False

The endocrine glands include… Pituitary, Pineal, Thymus, Thyroid, Parathyroid, Adrenals, Pancreas, Ovaries, Testes. Some organs also secrete hormones.

Which endocrine gland is protected by bone and called the "master gland?" Pituitary

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MOST ENDOCRINE REGULATION OPERATES IN A NEGATIVE FEEDBACK LOOP…

- When a condition requiring action is perceived [Hunger, for example: your blood sugar is low], a hormone is secreted from the pancreas (glucagon) that liberates glucose from the liver. This raises your blood sugar level, keeping you going until you can eat, at which time…
- Your blood sugar rises significantly. The signal is given to stop releasing glucagon and to start secreting insulin. Insulin is secreted from your pancreas to help your now increased blood sugar reach your hungry cells. Over a few hours…
- Your blood sugar level falls, and production of insulin slows or stops. Your blood sugar falls, and the cycle starts again.
- The entire sequence is designed to keep you within a certain blood glucose range, the kind of maintenance activity that is the hallmark of a negative feedback process.

See diagram, page 337, Premkumar, 3rd

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KEY HORMONES FOR MASSAGE THERAPISTS TO KNOW

- ***Growth hormone*** *(peptide)*
  - Converts fuel into new cells for growth (in children) and repair (in adults)
  - Secreted mostly in stage IV (Delta wave) sleep
  - Used/abused as supplement

- ***Epinephrine and norepinephrine*** *(amines)*
  - Also called adrenaline and noradrenaline
  - From the adrenal (gland) medulla: associated with short-term, high-grade stress; together, create and prolong sympathetic response; dilate bronchi, increase blood pressure and heart rate
  - Their release is governed directly by the nervous system

ad = L, (near) to; *ren* = L, kidney The adrenal glands rest on top of the kidneys.

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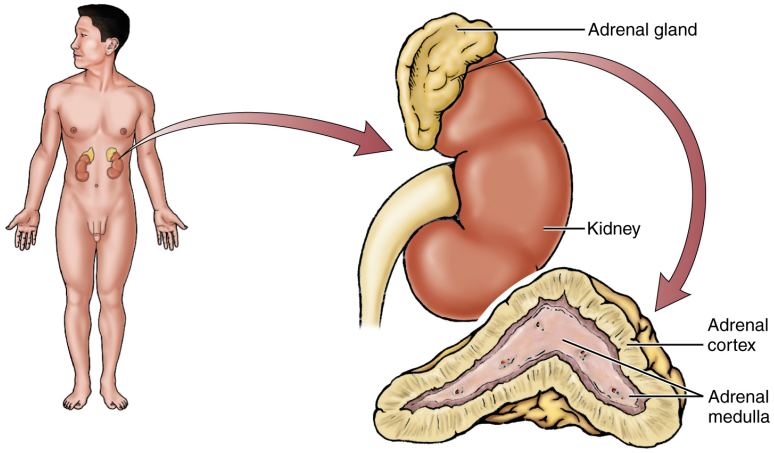
ADRENAL GLANDS



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KEY HORMONES FOR MASSAGE THERAPISTS TO KNOW, CONT.

- ***Cortisol*** *(steroid)*
  - A steroid glucocorticoid from adrenal cortex
  - Secreted during long-term, low-grade stress; measurable in saliva
  - Powerful anti-inflammatory; dissolves connective tissue; suppresses immune system

- ***Insulin/glucagon (peptides)***
  - Antagonistic hormones from pancreas: insulin decreases blood glucose (BG) by stimulating cells to take up glucose from the blood; glucagon raises blood glucose by stimulating glucose production from glycogen in liver and skeletal muscle

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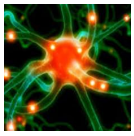
KEY HORMONES FOR MASSAGE THERAPISTS TO KNOW, CONT.



- ***Thyroid Hormones*** *(amines)*
  - Secreted from the thyroid, in two forms: T_3 and T_4 (Triiodothyronine and Thyroxine)
  - Stimulate metabolism of fuel into energy (rather than storage of fuel or use for growth)
- ***Calcitonin (peptide)***
  - Also from the thyroid, it stimulates osteoblasts, increases bone density, and decreases blood calcium
- ***Parathyroid hormone (peptide)***
  - From the parathyroid glands, it is the antagonist of calcitonin: it stimulates osteoclasts, decreases bone density, and increases blood calcium

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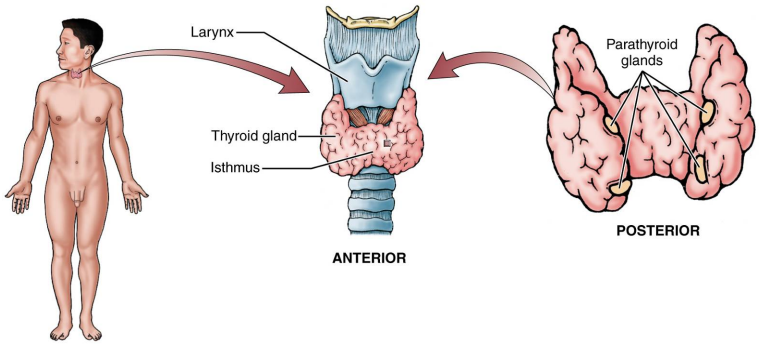
THYROID GLAND



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KEY HORMONES FOR MASSAGE THERAPISTS TO KNOW, CONT.

- ***Testosterone, estrogens, progesterone*** *(steroids)*
  - From gonads and other cells: stimulate changes creating secondary sexual characteristics (breast development, facial hair growth, etc.)
  - Environmental exposures and estrogen dominance can upset balance

- ***Other hormones***
  - **Aldosterone** from the adrenal cortex; regulates fluid balance and electrolytes; "salt-retaining hormone"
  - **Erythropoietin (EPO)** from kidneys increases red blood cell (RBC) production
  - **Thymosin** from thymus helps in the maturation of T cells
  - **Melatonin** from pineal gland helps determine sleep/wake cycle
  - **Prostaglandins** are all over: they promote inflammation, pain sensation, and smooth muscle contraction

For an endocrine system summary & a discussion of the power of touch, check out the video "Ch 9, HPA Axis" at http://thepoint.lww.com/Werner6e

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REVIEW . . .

Calcitonin and Parathyroid Hormone work in opposition. Which one increases bone density?

Calcitonin

Hormone levels are regulated by which kind of feedback loop?

Negative

The hormone associated with tissue repair in adults that is secreted in Stage 4 (deep) sleep is…

Growth Hormone (GH or HGH)

The hormone associated with short-term, high grade stress is…

Epinephrine, aka Adrenaline

EPO (Erythropoetin) regulates RBC production and is secreted by the…

Kidneys

T3 and T4 regulate…

Metabolism of fuel into available energy

The glands that sit atop the kidneys are…

Adrenals (aka Suprarenals)

Insulin and glucagon have opposite effects on…

Blood glucose levels

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ENDOCRINE SYSTEM DISORDERS

- **Acromegaly** – rare: excessive secretion of growth hormone
- **Addison disease** – relatively rare: inhibition of adrenal cortex hormone secretions
- **Cushing syndrome** – relatively rare: excessive blood levels of cortisol, stimulated by other underlying pathology (tumors) or steroid use
- **Diabetes mellitus (di uh BEE teez meh LI tis)**
- **Hyperthyroidism**
- **Hypothyroidism**
- **Metabolic syndrome**
- **Thyroid cancer** -- most varieties are slow-growing and treatable; note distinction between thyroid nodules and thyroid cancer

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DIABETES MELLITUS

Diabetes = "to pass through"
Mellitus = "sweetened with honey"

- ***Definition***
  - Group of related disorders that all result in hyper/glyc/emia
  - 98% are type 1 or type 2

hyper = G, over, above, excessive;
glyc = G, sweet; *em(ia)* = G, blood

Werner 6th, pp.425-9; 7th, 460-4; Prem 3rd, pp. 349-50

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DIABETES MELLITUS, CONT.

- ***Demographics***
  - 30 million are thought to have Type 2 (9.3% of US population); 7 million don't know yet
  - 1.5 million diagnoses/year:
    - Aging population + more obese young people + sedentary lifestyle. Affects 25% of those over 65 yrs.
  - $327 billion in direct and indirect costs: one of the most expensive diseases in the US
  - Disproportionally high incidence among Native Americans, African Americans, Pacific Islanders, Asian Americans, Latinx

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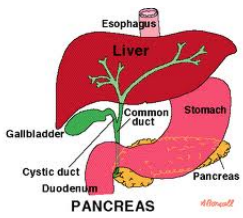
DIABETES MELLITUS, CONT.

- ***Etiology: What happens?***
  - Insulin is in short supply or
  - The body is resistant to the effect of insulin (insulin resistance)
  - Either way: glucose accumulates in blood while cells have to burn fat, protein for fuel



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DIABETES MELLITUS, CONT.

- ***Type 1***
  - Used to be called juvenile onset (now juvenile occurrence not limited)
  - Could be caused by exposure to drugs or chemicals; complication of infections
  - Autoimmune attack on beta cells → lifelong deficiency in insulin
  - Symptoms usually show before age 30
  - 1.25 million in the United States have it
  - High risk for big fluctuations in blood glucose (BG), diabetic emergencies

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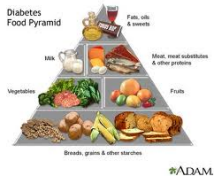

DIABETES MELLITUS, CONT.

- ***Type 2***
  - Used to be called non-insulin dependent, adult onset (now neither is consistently true)
  - Risk factors: Women > men; most often over 45 yrs old; 20% or more over healthy weight; family history
  - Usually controllable with diet, exercise, some medication; but many patients end up supplementing insulin
  - Can be related to wear and tear on pancreas, which reduces insulin production
  - Can be related to insulin resistance
  - Generally related to genetic predisposition and lifestyle factors that can be modified to reduce severity

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WERNER CITES RESEARCH ON AN INTERESTING CORRELATION…

- Higher risks of developing Type 2 Diabetes occur with higher ingestion of animal products (meats, eggs, dairy, etc).
- Lower risks of developing Type 2 Diabetes occur with lower ingestion of animal products.
- This finding is consistent, even when other contributors (like sedentariness, physical activity, and age) are factored in.
- The theory is that eating saturated fats affects cell membranes – and that this, in turn, affects the ability of insulin to escort glucose into the cells – but we really don't know for sure what the mechanism is.

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DIABETES MELLITUS, CONT.

- *Other types*
  - Gestational diabetes
  - Complication of trauma, other endocrine disorder or treatment

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DIABETES MELLITUS, CONT.

- ***Signs and Symptoms***
  - Three *poly*'s
    - Polyuria– excessive urination
    - Polydipsia– excessive thirst
    - Polyphagia – excessive eating
  - Also: fatigue, weight loss, nausea, vomiting
  - Early signs are often missed; complications develop

poly = G, many or much

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DIABETES MELLITUS, CONT.

- ***Diabetic Emergencies***
  - ***Ketoacidosis***
    - Type 1 diabetes only
    - Shortage of insulin and glucose in cells
    - Metabolism of fat and protein → ketones, acidosis
    - Triggered by stress, infection, trauma
  - Can lead to shock, coma, death
  - Not to be confused with "ketosis"

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DIABETES MELLITUS, CONT.

- ***Insulin shock***
  - Too much insulin, BG is dangerously low
  - Can occur in Type 1 or Type 2
  - Dizziness, confusion, weakness, tremors
  - Treated with milk, juice, candy, sugared (not diet) soda to replace BG

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DIABETES MELLITUS, CONT.

- ***Complications***
  - ***Cardiovascular disease***
    - Endothelium becomes vulnerable to damage, atherosclerosis
    - Plaque accumulates everywhere
    - There is increased risk of stroke, hypertension, aneurysm
    - Most diabetics die of a cardiovascular problem

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DIABETES MELLITUS, CONT.

- ***Edema***
  - Sluggish blood return, stasis dermatitis
- ***Ulcers, gangrene, amputations***
  - Poor circulation → risk of skin, tissue damage especially at feet
  - Leading cause of non-traumatic amputations
- ***Kidney disease***
  - Renal arteries have plaque, glucose is hard on nephrons
  - Number 1 cause of end-stage renal failure

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Wounds in Peripheral Areas Associated with Diabetes Mellitus

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DIABETES MELLITUS, CONT.

- ***Impaired vision***
  - Thickened capillaries in eye; microaneurysms, glucose in lens
  - Number 1 cause of new blindness in people 20–70
- ***Neuropathy***
  - Lack of circulation and excess sugar contribute to peripheral nerve damage
  - Tingling, pain, numbness
  - At cranial nerves → poor gastrointestinal (GI) motility, low blood pressure

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DIABETES MELLITUS, CONT.

- ***Others***
  - Every system is affected
  - Urinary tract infections, candidiasis, birth defects, aggressive infections, gingivitis, tooth loss

- ***Diagnosis***
  - Fasting blood sugar
  - Normal is 110 mg/dL of blood or below
  - 125+ mg/dL means diabetes

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DIABETES MELLITUS, CONT.

- ***Treatment***
  - Insulin developed in 1921: diabetes became manageable
  - Four goals: improve insulin production if possible; inhibit release of glucose from liver; increase sensitivity to insulin; decrease absorption of carbs in small intestine
  - Also: maintain eyes, feet, skin carefully
  - Type 1: insulin supplementation
  - Type 2: diet and exercise, then medication and insulin
  - Renal insufficiency happens for many; hemodialysis can help while hoping for transplant

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DIABETES MELLITUS, CONT'D.

- ***Massage***
  - Can be appropriate: weigh risks and benefits
    - How intense is the disease?
    - How well is it controlled?
    - How long has it been there?
    - Does the person have Type 1 or Type 2?
    - Does the person supplement with insulin?
  - Cardiovascular and kidney problems contraindicate rigorous circulatory massage
  - Work when insulin is ***not*** at peak
  - Communicate about possible BG drop with massage
    - Is there a quick option for eating?
    - Do you want to keep something on hand?
  - Be cautious about numbness, reduced sensation, skin lesions, injection or pump sites

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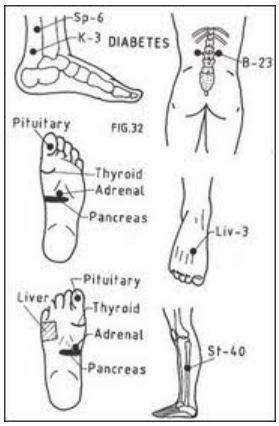
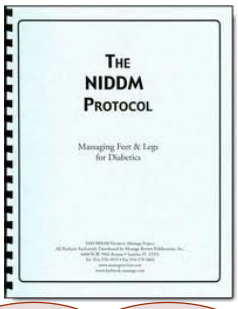
DIABETES MELLITUS, CONT'D.



Reflexology and acupressure points for Diabetes

This booklet by the late Dietrich Meisler describes his successes with massage to improve circulation and support health in those with Type 2 Diabetes. Meisler founded the ***Daybreak Geriatric Massage Project,*** *still in existence under the direction of Dr. Sharon Puzko.*



See Sharon demonstrate some elder massage techniques appropriate for diabetics at https://www.facebook.com/DaybreakGeriatricMassageInstitute/videos/485646861466697/

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THYROID CONDITIONS

Please browse pages 433-35 in Werner, 6th and 465-67 in Werner, 7th

- **Hyperthyroid Conditions**: Too much thyroid hormone, converting too much fuel into energy
  - **Causes:** autoimmune disorder (Graves disease), nodules, inflammation
  - **Signs and Symptoms:** anxiety, irritability, insomnia, rapid heartbeat, tremor, sweating, sensitivity to heat, frequent bowel movements, unintentional weight loss, skin changes, goiter possible
  - **Massage?**
    - Avoid skin lesions as necessary
    - Avoid anterior neck massage if goiter is present
    - Provide temporary relief from frantic, internal pace

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THYROID CONDITIONS

Please browse pages 433-35 in Werner, 6th And Werner, 7th, 468-70

- **Hypothyroid Conditions**: Too little thyroid hormone; leaves cells without energy and allows for too much storage
  - More common than hyperthyroid conditions
  - **Causes**: Autoimmune disorder (Hashimoto), idiopathic subclinical, result of treatment for hyperthyroidism
  - **Signs and Symptoms:** weight gain, fatigue, depression, sluggish digestion/bowels, dry skin, cold intolerance, goiter possible; coma possible in extreme cases
  - **Massage?**
    - Will not improve thyroid function, but may ameliorate some of the fatigue and depression that often accompany this condition

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Werner, 6th, pp. 435-6 and Werner, 7th, pp. 470-71

METABOLIC SYNDROME

- Like all Syndromes, Metabolic Syndrome is not a disease, but, instead, a collection of signs and symptoms/conditions
- This collection of conditions is **highly predictive** of Type 2 diabetes and cardiovascular disease
- **30% to 35% of Americans** fit these diagnostic criteria!!
- Risk increases with increasing age and Body Mass Index (BMI)
- Amazingly, reducing weight by 5% to 7% can reduce risk of developing serious disease by 60%! Other significant gains can be made by increasing exercise, limiting alcohol, and quitting smoking.

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Werner, 6th, pp. 435-6 and Werner, 7th, pp. 470-71

METABOLIC SYNDROME

When 3 of the 5 below conditions are met, Metabolic Syndrome is diagnosed.

- **High blood glucose** (BG) after 9 hours of fasting (over 100 mg/dL)
- **Abdominal obesity**: waist measurement of over 88 cm (35 inches) for women or over 102 cm (40 inches) for men; for Asian Americans, the risk begins at 80 cm (32 inches) for women and 90 cm (35 inches) for men
- **Elevated triglyceride levels** (>140 mg/dL for men, >150 mg/dL for women)
- **Low levels of HDL** (High Density Lipoproteins) <40 mg/dL for men, < 50 mg/dL for women)
- **Hypertension** (> 130 mm Hg systolic/>85 mm Hg diastolic)

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Werner, 6th, pp. 435-6 and Werner, 7th, pp. 470-71

METABOLIC SYNDROME

Massage?

- A person at high risk for diabetes or cardiovascular disease may have more trouble with rigorous massage than someone else (that is, the massage may be more challenging to their homeostasis and general well-being).
- While massage alone is unlikely to have a profound impact on metabolic syndrome, along with changes in diet and exercise, it can be part of a supportive change in lifestyle practices that can reduce the risk of this condition becoming a more serious problem.

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REVIEW . . .

Metabolic syndrome affects 30-35% of the US population. It can be addressed with lifestyle changes to affect its defining conditions, which include…

High BG; low HDL; high triglycerides; central obesity; hypertension

Which type of diabetes makes a person more likely to have diabetic emergencies?

Type 1

All types of diabetes result in…

High blood glucose (hyperglycemia)

Susceptibility to cold, sluggish bowels, fatigue, weight gain, depression, and dry hair are characteristic of…

Hypothyroidism

Which type of diabetes is most common?

Type 2

What is metabolic syndrome?

A set of conditions that is highly predictive of diabetes and/or cardiovascular disease

The three main symptoms of diabetes mellitus are…

Polyphagia, polydipsia, polyuria

What are some important considerations for massaging those with diabetes?

Caution around injection sites or pumps; loss of sensation; timing of massage vis a vis food and insulin; severity of condition

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WHAT'S NEXT?

Urinary System; Reproductive System; Natalie's article summary presentation; and maybe some medical terminology games, if time permits.

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