Endocrinology Basics for Dental Students

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Endocrinology

n. the study of the ductless glands and the substances that they secrete (hormones *)

* substance produced in one part of the body, passes into the bloodstream and is carried to other organs or tissues where it acts to modify their structure or function

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3. Categories of Hormones

Categories of Hormones

- steroids- estrogen, testosterone, cortisol

- peptides- short- ADH, GnRH, TRH
  long- insulin, ACTH, PTH

- tyrosine derivatives- thyroid hormone, epinephrine

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4. Mechanism of Action

Mechanism of Action

- cell surface receptors- most peptides

- cytoplasmic receptors- steroids, thyroid hormone

- second messengers- G proteins, cyclic AMP

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5. Regulation of hormones

Regulation of hormones

- positive feedback - oxytocin during parturition

- negative feedback - numerous - glucose, thyroid

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7. Diabetes Mellitus: Insulin Physiology

Diabetes Mellitus: Insulin Physiology

- **Anabolic hormone**
  - glucose to glycogen (carbohydrate storage)
  - amino acids to proteins
  - fatty acids to triglycerides (fat storage)
- Acts at a membrane receptor
- Total lack of insulin leads to ketoacidosis
  - starvation response
  - ketones produced in liver from FA

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8. Diabetes Mellitus: Pathophysiology

Diabetes Mellitus: Pathophysiology

- **Type 1**
  - autoimmune attack on β cells of pancreas
  - usually younger onset, thin, prone to ketosis
- **Type 2**
  - combination of insulin resistance and insulin deficiency
  - 90% of diabetics, more familial, usually older onset, obese

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9. Diabetes Mellitus: Signs and Symptoms

Diabetes Mellitus: Signs and Symptoms

- polyuria
- polydipsia
- polyphagia
- fatigue
- blurred vision
- wt loss

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10. Diagnosis of Diabetes

Diagnosis of Diabetes

- Fasting blood sugar ≥ 126 mg/dl
  - FBS 100-125 = impaired fasting glucose

- Casual blood sugar ≥ 200 mg/dl
  - BS 140-200 at 2 hrs after 75g glucose = impaired glucose tolerance

- Either reading should be repeated for verification

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Oral manifestations of Diabetes

• Dental caries

• Periodontitis
  – associated with poor glycemic control
  – associated with increased risk of death from cardiovascular and renal disease in diabetes
  – higher levels of C-reactive protein (CRP), a measure of inflammation

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Cascade of Events Contributing to Periodontitis in Diabetes

Risk and Rate of Progression are Altered by Diabetes

Bacterial Component + Host Response Component = Clinical Sequelae

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13. The Vicious Cycle!!

The Vicious Cycle!!

Diabetes

INFLAMMATION

Periodontal Disease

Cardiovascular Disease
Atherosclerosis

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14. Oral Manifestations of Diabetes

Oral Manifestations of Diabetes

• Mucosal diseases
  – lichen planus
  – lichenoid drug reactions
• Xerostomia - may lead to Candidal infections
• Altered taste
• Parotid gland enlargement

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Chronic Complications of Diabetes

- **Nephropathy**
  - 25% of all kidney failure
- **Neuropathy**
  - various forms from sensory to autonomic
  - gastroparesis may lead to reflux and halitosis
- **Retinopathy**
  - leading cause of blindness

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Chronic Complications of Diabetes

- **Vascular disease**
  - myocardial infarction
  - stroke
  - amputations from peripheral vascular disease
- **Skin/mucosal infections**

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17. Home Blood Glucose Monitoring

Home Blood Glucose Monitoring

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18. Glycemic Goals

Glycemic Goals

- Premeal sugars 70-110
- Postprandial sugars 100-140
- Avoiding hypoglycemia (usually under 60-70 or higher if symptoms)
- Higher ranges may be appropriate for some patients

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Glycemic Goals

- **Hemoglobin A1C (HbA1C)**
  - A measure of longer term glycemic control (over 2-3 months) based on glucose attached to a subset of hemoglobin
  - Normal range 4.3-5.8% at NEMC
  - Goal under 6.5-7% with minimal or no low sugars

Management of Diabetes

- **Type 1**
  - insulin!!!!
  - usually 3-4 shots per day or insulin pump
- **Type 2**
  - diet and exercise
  - oral agents
  - insulin, combinations

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21. Management for Dental Procedures

Management for Dental Procedures

- **Know:**
  - type and duration of diabetes
  - how patient is being treated
  - degree of control of disease
- **AM procedure** best with regular breakfast
  - may need to cut down on dose of oral agent or amount of insulin depending on procedure

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22. Management for Dental Procedures

Management for Dental Procedures

- **Plan breaks** for snacks as necessary
- **Check FS** glucose during longer procedures
- **Try to avoid procedures** on unstable diabetics unless problem is contributing to poor control (infection)

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Management for Dental Procedures

- Do not discontinue insulin on type 1 diabetic!!!
- Discuss management with internist or endocrinologist for more major procedures

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Inpatient Procedures

- Check frequent FS on inpatients
- NPO after MN (nothing by mouth after midnight) for early AM procedure
- Continue basal insulin with IV D5W (5% dextrose in water)
- Hold oral agents
- Resume normal diet and regimen ASAP

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Diabetic Emergencies

• Hypoglycemia
  – Symptoms: tachycardia, sweating, confusion, bizarre behavior
  – PO juice, crackers, glucola
  – IV D5 or D10
  – IM glucagon (1 mg), epinephrine (0.5 mg of 1:1000)

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Diabetic Emergencies

• Hyperglycemia
  – DKA, coma
    • severe volume depletion, acetone breath
  – Usually underlying cause evident
  – Get to ER
  – Fluids and insulin Rx

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27. Calcium Metabolism and Homeostasis

Calcium Metabolism and Homeostasis

- Calcium - goal intake 800-1500 mg daily
  - most of this is retained in the bones
- PTH - from the parathyroid glands
  - needed to activate vit D, affects bones and kidneys
- Vitamin D - converted to active form by kidneys
  - most produced by the skin (none in N.E. from Nov-May)

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28. Calcium Disorders

Calcium Disorders

- Hyperparathyroidism- high Ca, PTH
  - usually adenoma, may be 4 gland hyperplasia
  - bones of the mouth are less radiodense
  - lamina dura may be absent; radiolucent areas may appear
  - central giant cell granulomas from osteoclasts may be present

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Calcium Disorders

- Hypoparathyroidism
  - low calcium, low PTH
  - usually autoimmune
  - may be associated with Candidiasis
  - hypoplasia of the enamel and dentin, short roots, delayed eruption of teeth

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Calcium Disorders

- Osteomalacia
  - vitamin D deficiency
    - 2005 study from BU – higher vitamin D levels associated with less bleeding on gingival probing
  - familial or acquired
  - rickets- hypocalcification of dentin, enamel and alveolar bone

- Renal osteodystrophy
  - prone to accelerated alveolar bone loss

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31. Calcium Disorders

Calcium Disorders

- Vitamin D excess
  - endogenous - sarcoidosis, lymphoma
  - exogenous - too much vit D in the milk!!
- Hypercalcemia from tumors
  - lung, breast - PTHrP or bony invasion

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32. Calcium Disorders

Calcium Disorders

- Osteoporosis
  - most common in postmenopausal women
  - but also seen in men
  - risk factors - thin body habitus,
    Caucasian, Asian, low calcium intake,
    hyperthyroidism
  - assess by DXA scan
  - Rx with calcium, vitamin D,
    antiresorptive agents, rPTH

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33. Endocrinology Basics for Dental Students: Slide 33

Hyperthyroidism

34. Hyperthyroidism

Hyperthyroidism

• Causes
  – Graves’ disease (autoimmune)
  – toxic nodular goiter
  – toxic adenoma
  – exogenous from excess thyroid hormone medication

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Hyperthyroidism

• Symptoms and Signs
  – rapid HR, weight loss, heat intolerance, anxiety, restlessness
  – accelerated tooth development in children
  – malocclusion may occur if eruption of secondary teeth are precocious
  – teeth usually normal but demineralization may occur
  – avoid using epinephrine in local anesthetics if possible

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Hyperthyroidism

• Diagnosis
  – high T4 and T3, low TSH

• Treatment
  – antithyroid drugs (PTU, Tapazole)
  – radioactive iodine (I-131)
    • concentrates in salivary glands causing xerostomia, caries
  – surgery- thyroidectomy

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Hypothyroidism

• Causes
  – Autoimmune Hashimoto’s thyroiditis
  – Post radioactive iodine therapy
  – Post surgery

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Hypothyroidism

• Symptoms and signs
  – Fatigue, weight gain, cold intolerance, dry skin
  – Cretinism- maxillary prognathism, retarded tooth development
  – Excessive dental caries
  – Macroglossia and swollen lips when advanced (myxedematous)
  – Exaggerated response to narcotics and barbiturates

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39. Hypothyroidism

Hypothyroidism

• Diagnosis
  – low T4, high TSH

• Therapy
  – L-T4 therapy (Synthroid, Levoxyl, Levothroid, Unithroid)
    • adjust for normal TSH value
  – screening done at birth with T4 and TSH

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40. Acromegaly

Acromegaly

• Excess of GH from a pituitary tumor
• Everything is big!!!
  – Gigantism- large hands, feet, skin tags, excess sweating, colonic polyps
• Accelerated tooth eruption in children
• Enlarged jaw with prognathism
  – teeth are spaced and tipped outward

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Acromegaly

- Coarsened facial features
- Larger maxillary sinuses
  - deeper voice
- Excess deposition of cementum on the roots of teeth
- Treatment
  - surgery, radiation, somatostatin therapy, GH receptor blockade

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43. Cushing’s Syndrome

Cushing’s Syndrome

- Excess cortisol production
  - endogenous: pituitary, adrenal or ectopic tumor
  - exogenous: too much therapeutic steroid

- Hypertension, central obesity, easy bruising, osteoporosis

- Increased periodontitis, oral candidiasis

- Gums bleed easily and may be swollen

- Treatment- surgery, radiation, medication

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44. Addison’s Disease

Addison’s Disease

- Primary lack of adrenal hormones including both cortisol and aldosterone

- Causes- autoimmune, TB, metastatic tumor, bilateral hemorrhage

- Low cortisol and aldosterone, high ACTH

- Irregularly shaped blotchy melanin patches on oral mucosa

- Affects the buccal mucosa near the commissures first and spreads posteriorly

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Corticosteroid Therapy Issues

- Patients taking steroids for more than 2 weeks may be adrenally insufficient and may require steroid coverage for up to a year after treatment!!