Endocrinology & Renal Disorders

Section 5

Diabetes

Diabetes mellitus

- A disease of glucose metabolism
  - High glucose levels stimulate the pancreas to secrete insulin, which cause blood glucose levels to enter the cells to return the glucose levels to normal
  - Insulin attaches to the cell membranes and carries the glucose across the membrane into the cells
- Pathophysiology
  - Glucose levels are to high and not enough glucose gets into the cells due to decreased insulin or the reaction of it from the pancreas

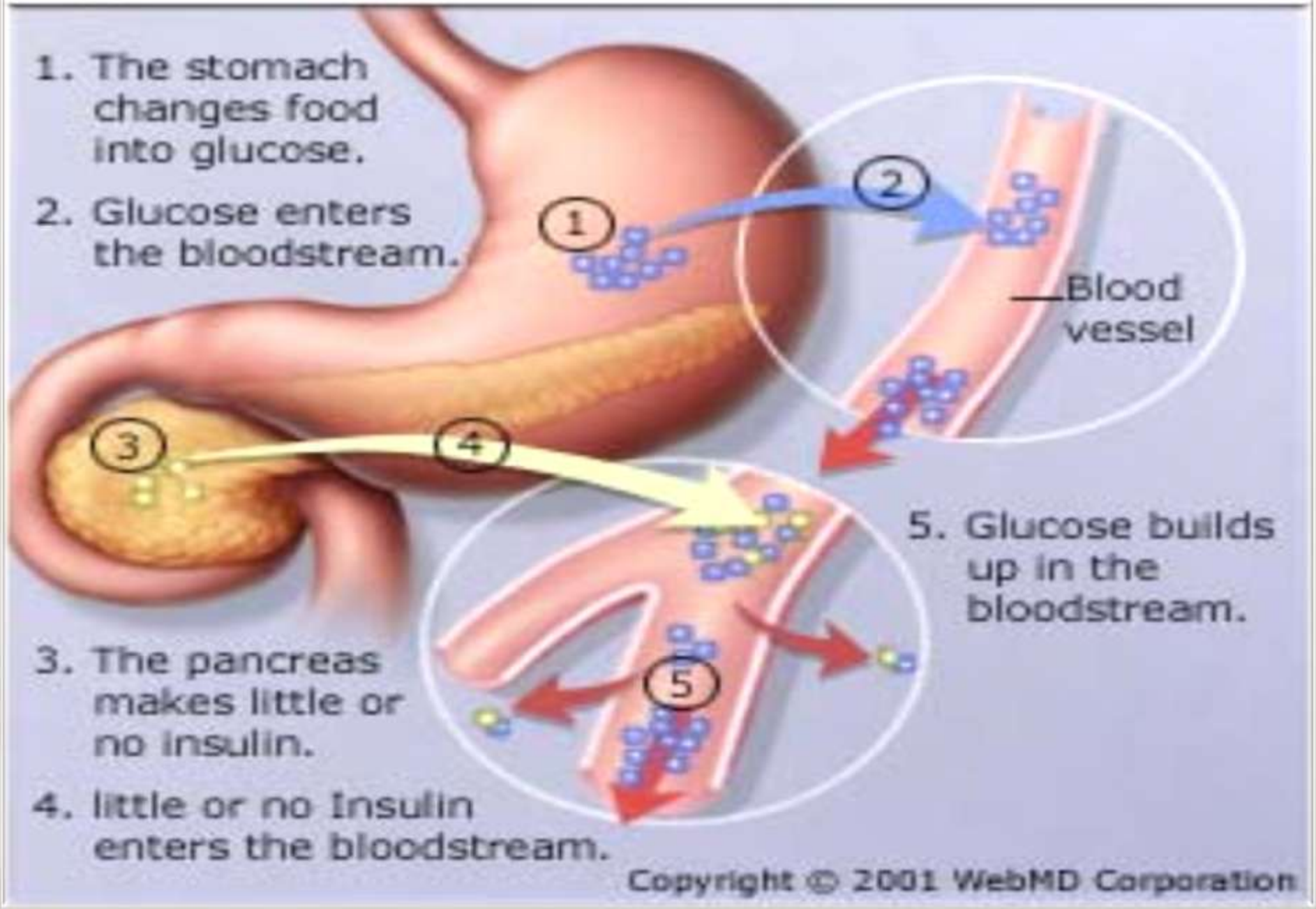
Risk Factors

- Pancreatic involvement with pancreatic viral infections and autoimmune reactions with the pancreas causes 10% of DM
- Family history, obesity, lack of exercise
- Over 45 years old
- In women, gestational diabetes (2%-5% of pregnancies) or giving birth to a baby greater then 9 pounds
- High blood pressure
- High cholesterol and triglycerides
- Higher incidence in Hispanics, African Americans, Native Americans, Asains, and Pacific Islanders

Type1 Diabetes

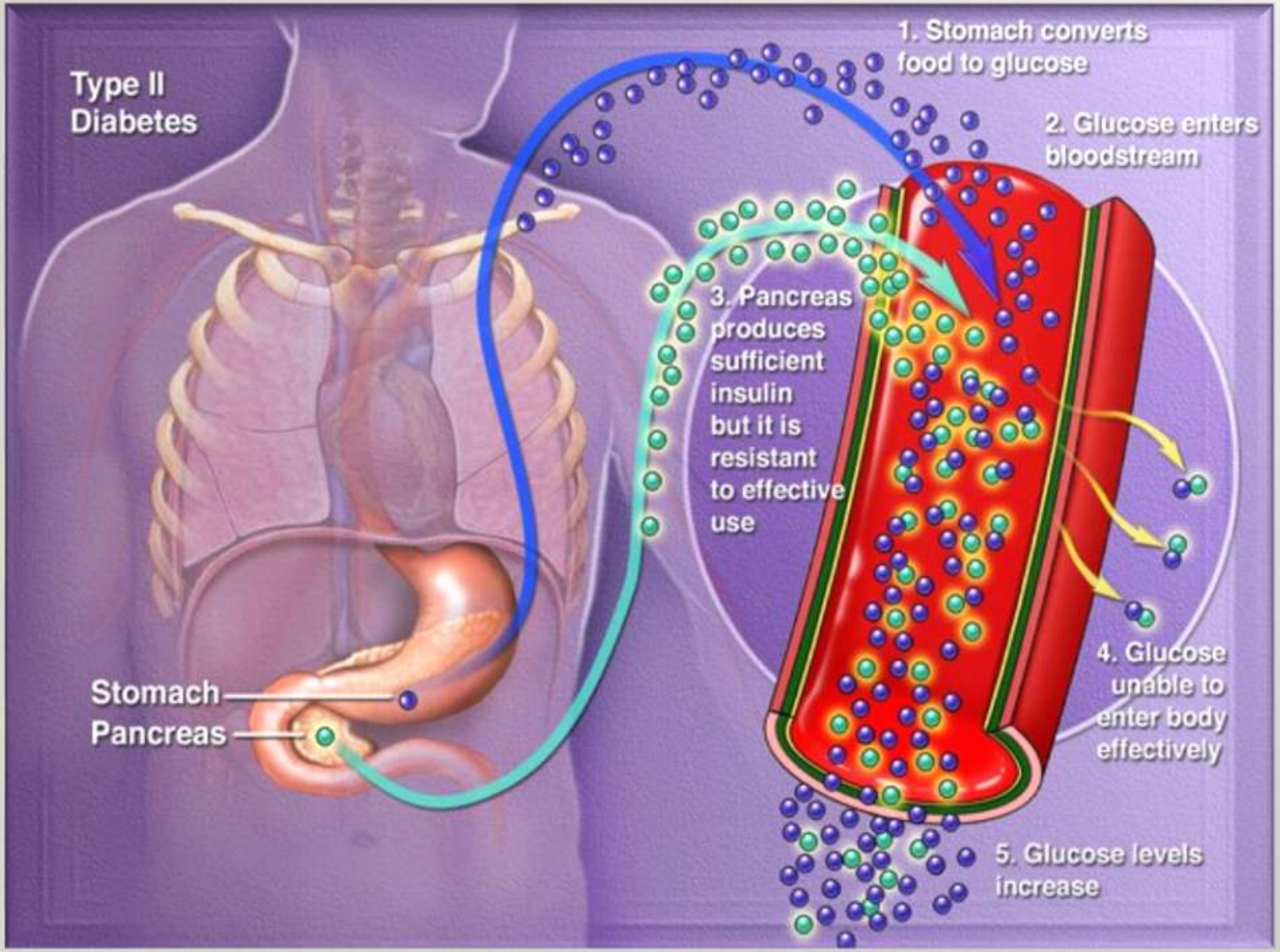
- An autoimmune process that destroys the cells of the pancreas – unknown cause
  - Results from the body's failure to produce insulin, the hormone that "unlocks" the cells of the body, allowing glucose to enter and fuel them
- Must treat with insulin injections
  - Because of the body’s inability to produce insulin
- Typically begins in childhood or adolescence
  - It is estimated that 10% of Americans who are diagnosed with diabetes have type 1 diabetes

Type 1 Diabetes



Type 2 Diabetes

- Results from insulin resistance
  - The body fails to properly use and react to insulin
  - The cells of the body becomes resistant to the effects of insulin
- 90% of cases of diabetes are Type 2
  - Over 80% of Type 2 Diabetes are obese
- Long term medical consequences
  - Pathologic changes in the heart, kidney, nerves. eyes, vascular system, decreased healing time, accelerated aging


Type II
Diabetes
1. Stomach converts
food to glucose
2. Glucose enters
bloodstream
3. Pancreas
produces
sufficient
insulin
but it is
resistant
to effective
use
4. Glucose
unable to
enter body
effectively
5. Glucose levels
increase
Stomach
Pancreas

Symptoms – Classical

- **Polydipsea** thirsty
- **Polyphagia** excessive eating
- **Polyuria** excessive urination

- Other symptoms include fatigue, diarrhea, visceral symptoms, dizziness and headaches

- Bear in mind that severe consequences of diabetes (especially untreated) is retinopathy and blindness, CAD, renal failure, peripheral neuropathy and vasculopathy resulting in chronic ulceration, gangrene and amputation

Type II Diabetes Blisters

Diagnosis

- Type 1
  - Starts in childhood – classically seen in child who has been toilet trained and starts bed wetting at a latter age due to the polyuria
- Type 2
  - Usually starts with visual symptoms, unexplained UTI or vaginal infections, with weakness & exhaustion
- Lab tests
  - Random blood sugar >110mg/dL (normal 70-110)
  - Fasting glucose >125mg/dL
  - Glucose tolerance test
  - Glucosuria and ketonuria
- YouTube - Dr Whiting on Diabetes and Hypoglycemia

Treatment of Diabetes Mellitus

- Type 1 Diabetes
  - All require insulin injection, which is carefully monitored with glucometers
  - Must follow a low glucose diet
  - Exercise and physical activity are needed
- Type 2 Diabetes
  - Management of diet, exercise, weight reduction
  - Oral hypoglycemic agents
    - Sulfonylureas – stimulate the pancreas to produce insulin
    - Biguanides – increases the body's receptivity to insulin
    - Alpha-glucosidase inhibitors – block enzymes in the gut that break down glucose levels

Diabetes Insipidus

- Disorder in which there is an abnormal increase in urine output, fluid intake and often thirst
- Symptoms such as urinary frequency, nocturia (frequent awakening at night to urinate) or enuresis (involuntary urination during sleep or "bedwetting")
- Urine output is increased because it is not concentrated
- Diabetes Insipidus resembles diabetes mellitus because the symptoms of both diseases are increased urination and thirst
- Treatment with Desmopressin
  - Oral, IM injection, nasal spray

- What is considered "excessive" urination?
  - Adult who urinates more than 50mL/kg body weight per 2 hours is generally considered to have a higher than normal output
  - Loosely translated, 50mL/kg is about 3.5 quarts per day for a 150-lb. adult
- What is considered "excessive thirst?
  - Adult who drinks more than 4 quarts (1 gallon) or approximately 12 glasses (144 oz) of beverages per day would have a higher than normal intake
- Four types of diabetes insipidus
  - Pituitary (also known as neurogenic), gestational, nephrogenic, primary polydipsia

Pituitary Diseases

Hypopituitarism

- Pituitary gland fails to produce one or more of its hormones, or doesn't produce enough of them
- Causes
  - Pituitary ademomas
  - Strokes
  - Metastatic carcinomas
  - Primary brain tumors
  - Autoimmune disorders
  - Brain trauma
  - Encephalitis
  - Idiopathic

Signs & Symptoms

- Depending on which hormones are deficient
  - Fatigue , Headaches , Low tolerance for stress
  - Muscle weakness , Nausea
  - Constipation , Weight loss or gain
  - A decline in appetite , Abdominal discomfort
  - Sensitivity to cold or difficulty staying warm
  - Visual disturbances
  - Loss of underarm and pubic hair
  - Joint stiffness
  - Hoarseness
  - Facial puffiness
  - Thirst and excess urination
  - Low blood pressure
  - Lightheadedness when standing

- Men may experience
  - Loss of interest in sexual activity
  - Erectile dysfunction
  - Decrease in facial or body hair
- Women mat experience
  - Irregular or no menstrual periods
  - Infertility
  - Inability to produce milk for breast-feeding
- Children may experience
  - Stunted growth
  - Short stature
  - Slowed sexual development

- Diagnosis
  - Hormone levels
- CT or MRI scan - pituitary tumor
- Vision tests - pituitary tumor impaired visual fields
- X-ray
  - In children, an X-ray of the hand and wrist can measure whether the bones are growing normally
- Treatment
  - Remove the deficiency, if possible
  - Brain surgery for pituitary tomor
  - Corticosteroids
  - Levothyroxine (Levoxyl, Synthroid)
  - Sex hormones
  - Desmopressin (replaces ADH)
  - Growth hormone

Hyperpituitarism

- Excessive production of growth hormone, which continues to be produced well into adulthood
  - In adults, since the growth plates are closed, excessive levels cause abnormal growth of hands, feet, and internal organs – called acromegaly
  - In children, excess growth hormone causes increased height known as gigantism
- Diagnosis
  - Elevated GH in blood test
  - Pituitary tumor on CT or MRI

Hyperprolactinaemia

- Abnormally-high levels of prolactin in the blood
- Causes
  - Overexercise, excessive stress
  - Pregnancy, breast feeding
  - Medications (narcotics, estrogens, tranquilers)
  - Pituitary tumors, hypothyroidism
  - Cirrhosis, renal failure, MS
- S & S
  - Galactorrhea (bilateral breast discharge)
  - Amenorrhea
- Diagnosis is pituitary MRI
- Treatment
  - Surgery and treat increased cause of prolactin

Thyroid & Parathyroid Disorders

Hypothyroidism

- Low levels of thyroid hormones
  - Thyroxine (T-4) and Triiodothyronine (T-3)
- Causes of hypothyroidism
  - Autoimmune disease - Hashimoto thyroiditis
  - Treatment for hyperthyroidism
  - Radiation therapy
  - Thyroid surgery
  - Medications (lithium)
  - Less common causes
    - Congenital disease
    - Pituitary disorder
    - Iodine deficiency
    - Pregnancy

- Risk factors
  - Mainly in women over 50
  - Close relative, with an autoimmune disease
  - Prior treatment with radioactive iodine or anti-thyroid medications
  - Received radiation to your neck or upper chest
  - Have had thyroid surgery (partial thyroidectomy)
- S & S
  - Tiredness, weakness, slow reaction time, hypotension, cold intolerance, weight gain even when dieting
  - Sluggishness, constipation, muscle weakness
  - Joint pain, stiffness and swelling
  - Brittle fingernails and hair
  - Depression

- Diagnosis
  - TSH blood tests
  - Free T4 test and anti-thyroid antibodies
- Treatment
  - Synthroid – a T4 medication
  - Cytomel – a T3 medication
  - Thyrolar – a T3/T4 combination medication

Hyperthyroidism

- Thyroid gland produces thyroxine hormone
- An autoimmune disorder
- Significantly accelerates metabolism
  - Sudden weight loss, a rapid or irregular heartbeat, sweating, nervousness or irritability
  - Fatigue, muscle weakness, difficulty sleeping
  - Tremor, sweating
  - Changes in menstrual patterns
  - Increased sensitivity to heat
- 8 times more common in women

- Causes
  - Graves' disease, an autoimmune disorder, is the most common cause of hyperthyroidism
    - Antibodies produced by your immune system stimulate your thyroid to produce too much thyroxine
  - Hyperfunctioning thyroid nodules
  - Thyroiditis
- Diagnosis
  - Radioactive iodine uptake test
  - Thyroid scan
  - Increased T3 & T4
  - Increased ANA titers

- Treatment
  - Beta blockers (atenolol) block increased sympathetic stimulation
  - Thioamides – block production of thyroid enzymes
  - Increased iodine intake
  - Radioactive iodine
  - Lifetime thyroxine replacement if surgery utilized
- Graves Disease & Women
- Thyroid storm
  - Extreme over-activity of thyroid gland with a reaction to medication, surgery, or stress
  - Body core temperature to 107 degrees

Thyroid nodules

- Commonly palpated on routine palpation
  - Most are benign adenomas
- Diagnosis
  - Radioactive iodine scans
  - Ultrasound
  - Needle aspiration
    - To DD thyroid cyst, fibrosis, benign adenoma, nodular cancer
  - Biopsy if >1.5 cm
- Treatment
  - Conversion to malignancy very rare
  - Goiters are treated with iodine
  - YouTube - Thyroid Nodules

Hyperparathyroidism

- Usually caused by a parathyroid adenoma
- More common in women
- Often causes bone pain from high calcium
  - Hypercalcemia is also seen in metastatic bone disease (from breast, lung, prostate) and sometimes in pregnancy
- S & S
  - Bones – bone pain from high calcium
  - Stones – kidney stones common
  - Groans – pain and slow muscle contractions
  - Moans – psychiatric and mental changes

- Diagnosis
  - History of kidney stones in a patient with bone pain and abdominal problems suggests the diagnosis
  - Lab studies – high calcium & parathormone, low phosphate
  - US, CT, MRI of neck for mass
  - Fine needle aspiration
- Treatment
  - Surgical excision of adenoma
  - No specific treatment if adenoma not found
  - Keep patient well hydrated
  - YouTube - Dramatic Advance in Parathyroidectomy

Hypoparathyroidism

- Often seen after surgery of thyroid and parathyroid
  - If the parathyroid glands have been removed, then the diagnosis will be permanent
- Results in low serum calcium & high serum phosphate
- S & S
  - Low calcium causes muscle cramps, tetany, & paresthesias
  - Convulsions and arrhythmias
  - Acute onset, especially after thyroid surgery, could lead to respiratory spasm and suffocation – needing tracheostomy

- Diagnosis
  - Positive Chvostek's sign
    - Tapping facial nerve in front of ear – positive if jaw clenching and muscle spasming
  - Positive Trousseau's sign
    - Carpal spasm after BP cuff inflated
  - Lab studies – low serum calcium, high serum phosphate, low parathormone levels
- Treatment
  - Calcium and Vitamin D

Diseases of Adrenal Glands

- Adrenal medulla secretes
  - Catecholamines – stimulate sympathetic nervous system
    - Epinephrine, norepinephrine, dopamine
- Adrenal cortex secretes
  - Corticosteroids – a response to stress
    - Cortisol
  - Mineralocorticoids – regulates body fluid
    - Aldosterone
  - Androgens – secondary sex characteristics
    - Testosterone
  - Estrogens - secondary sex characteristics

Acute adrenocortical insufficiency

- May follow extreme stress, trauma, infection, & surgery
- S & S
  - Profound weakness
  - Mental sluggishness and confusion
  - Abdominal pain and low blood pressure

- Diagnosis
  - Not very common
  - Low serum cortisol and sodium, high potassium
- Treatment
  - IV steroids – patient is usually in ICU

Chronic adrenocortical insufficiency Addison's disease

- Usually an autoimmune disease in late childhood
- S & S
  - Weakness and fatigue
  - Bronze pigmentation in white patients
  - Low blood pressure and blood sugar
- Treatment
  - Steroid pills over several weeks

Cushing's disease adrenocortical oversecretions

- Too much circulating cortisol
  - Usually due to excess ACTH pituitary secretion
- Cushing's syndrome
  - Caused by taking to many steroids or cortisol for treatment of other conditions
- S & S
  - Central obesity, moon faces, buffalo hump
  - Purple striae, easy bruising, amenorrhea, weakness
  - Hypertension, osteoporosis, acne, irritability, ulcers
  - Poor resistance to infections

Cushing's disease-Pituitary Gland

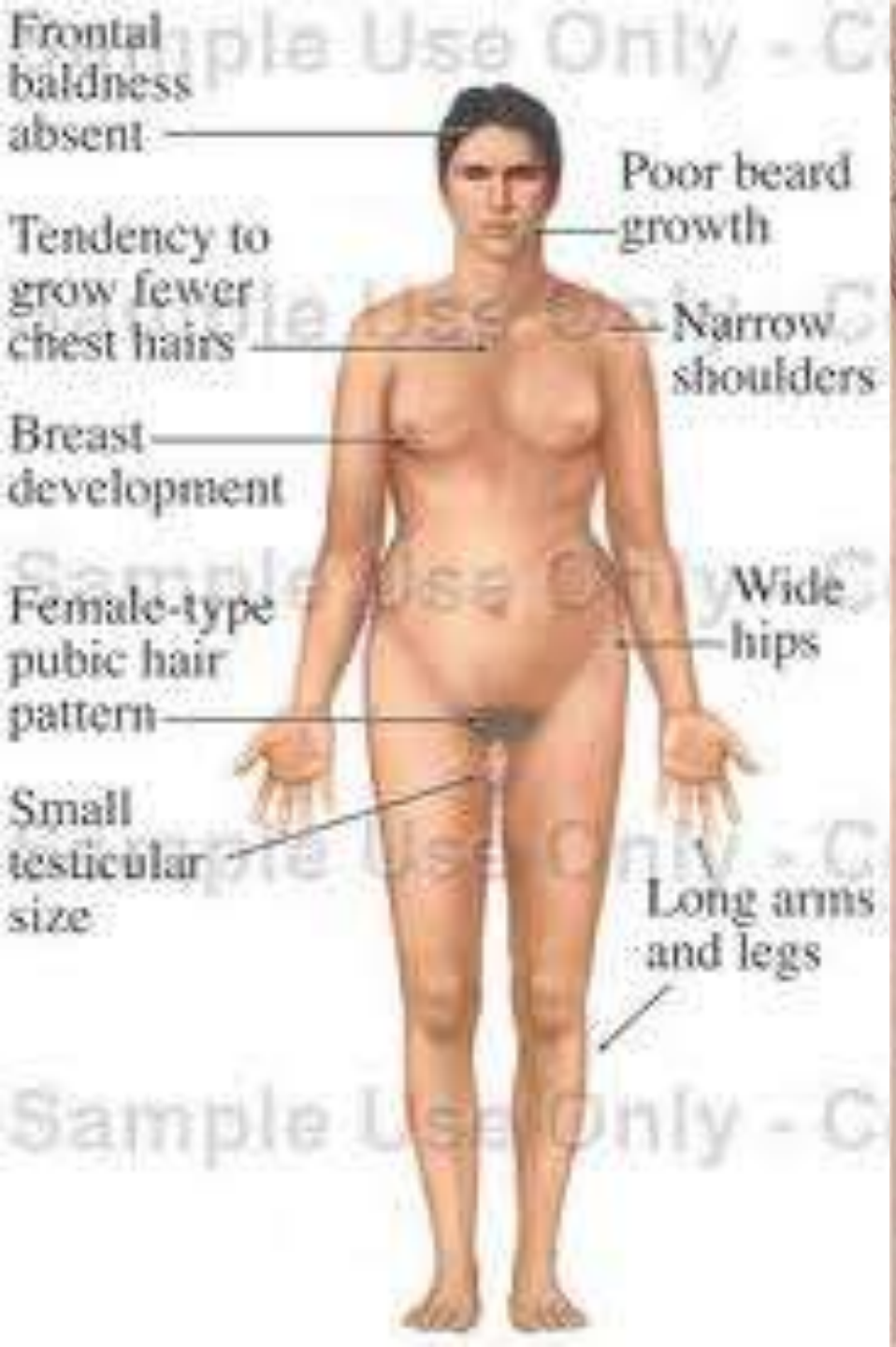
- Diagnosis
  - Diagnosis is obvious in patient's who have taken steroids for more then two weeks
  - Lab diagnosis reveals a high midnight serum cortisol
- Treatment
  - Cushing's syndrome – stop steroids
  - Cushing's disease – remove pituitary adenoma

Diseases of Testes

Hypogonadism

- Usually due to primary failure of the testicles to function properly & secrete male horomes
- Common causes
  - Alcoholism
  - Chronic illness
  - Medications (ketoconazole, cortisone)
  - Street drugs – marijuana
  - Hypothrroidism
  - Low pituitary function
  - Hyperprolactinemia
  - Genetic abnormalities

- S & S
  - If congenital, may result in an intersex child – hermaphrodite – will result in delayed puberty
  - Affects if acquired as an adult
    - Decreased libido
    - Infertility and ED
    - Hot flashes and sweats
    - Severe fatigue
    - Decreased body hair
    - Loss of muscle mass and strength
- Diagnosis
  - Low FSH and serum testorone
- Treatment
  - Hormone replacement therapy – testosterone & progesterone


Frontal baldness absent
Poor beard growth
Tendency to grow fewer chest hairs
Narrow shoulders
Breast development
Female-type pubic hair pattern
Wide hips
Small testicular size
Long arms and legs


http://dermis.net

Hypoglycemia

- Low blood sugar
  - Normal levels = 80-110 mg/dL
  - Mild = <80 Significant symptoms <60
- Causes
  - Most are diabetics with to much insulin usage
  - Fasting
  - Alcoholics and liver disease
    - Drinking alcohol with sugar causes temporarilly
  - Overeating
  - Pancreatic tumor
  - Addison’s disease

- S & S – occurs when blood sugar < 60 mg
  - Sweatiness, dizziness, nervousness, shaking
  - Anxiety, faintness, weakness
  - Palpitations, hunger
  - Confusion, inappropriate behavior
- Diagnosis
  - Patient's history
  - Glucose tolerance test
  - Fasting glucose and insulin levels
- Treatment
  - Glucose now!!

Kidney Disease

Acute kidney disease

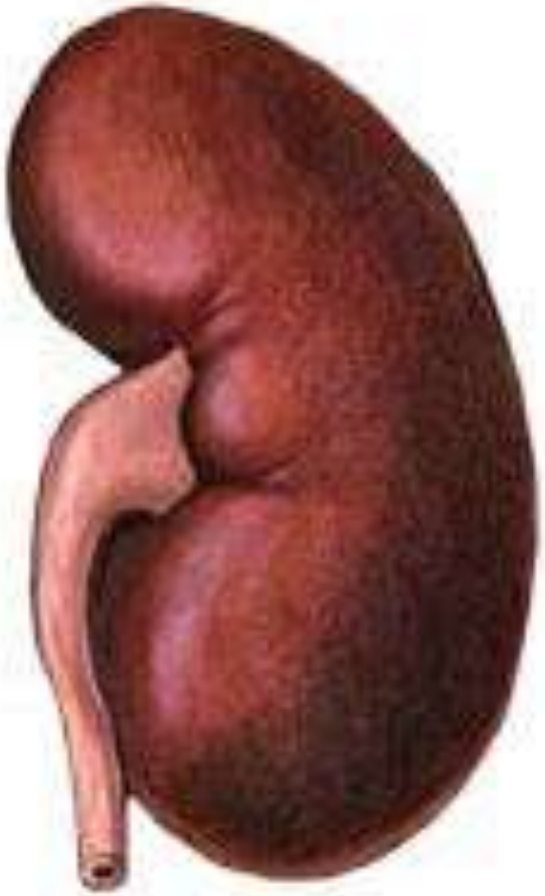
- Acute renal failure progresses to kidney failure in a few hours
- 25% of hospitilizied patients develop some degree of acute renal failure
- S & S
  - Fluid retention & swelling of hands and face
  - Cola colored urine
  - Decreased urine production
  - Fast heart rate, feeling faint, sweating and shock

- Acute renal failure comes in three forms:
  - Kidney failure due to poor renal perfusion
    - Hemorrhagic shock, septic shock, pancreatitis
    - Dehydration, cardiac failure, burns
  - Due to obstruction of urine, causing a backup
    - Stones, stenosis, anticholenergic drugs
  - Intrinsic renal disease
    - Acute tubular necrosis
    - Acute glomerulonephritis
    - Acute interstitial nephritis

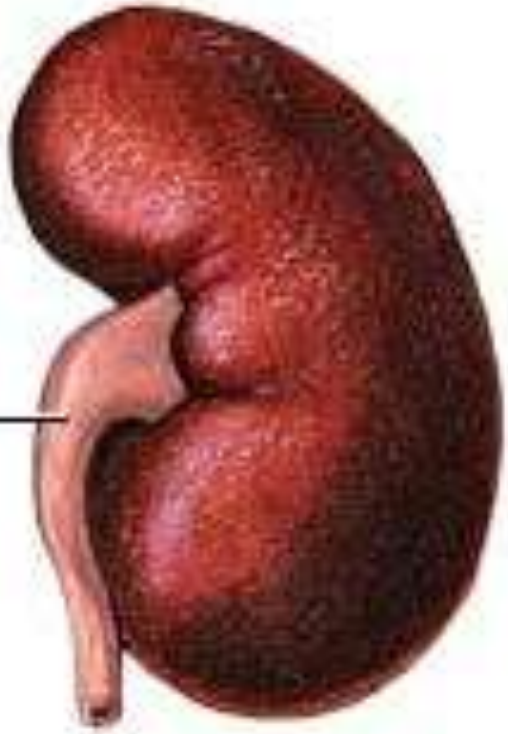
- Diagnosis
  - Increase in serum BUN & creatinine
    - Indicates nitrogenous breakdown products
- Treatment
  - Lifesaving, must be in the ICU

Normal kidney

Kidney disease



Ureter



- healthy function
- proper size
- low urine protein

- granular surface
- decreased function
- smaller size
- high urine protein

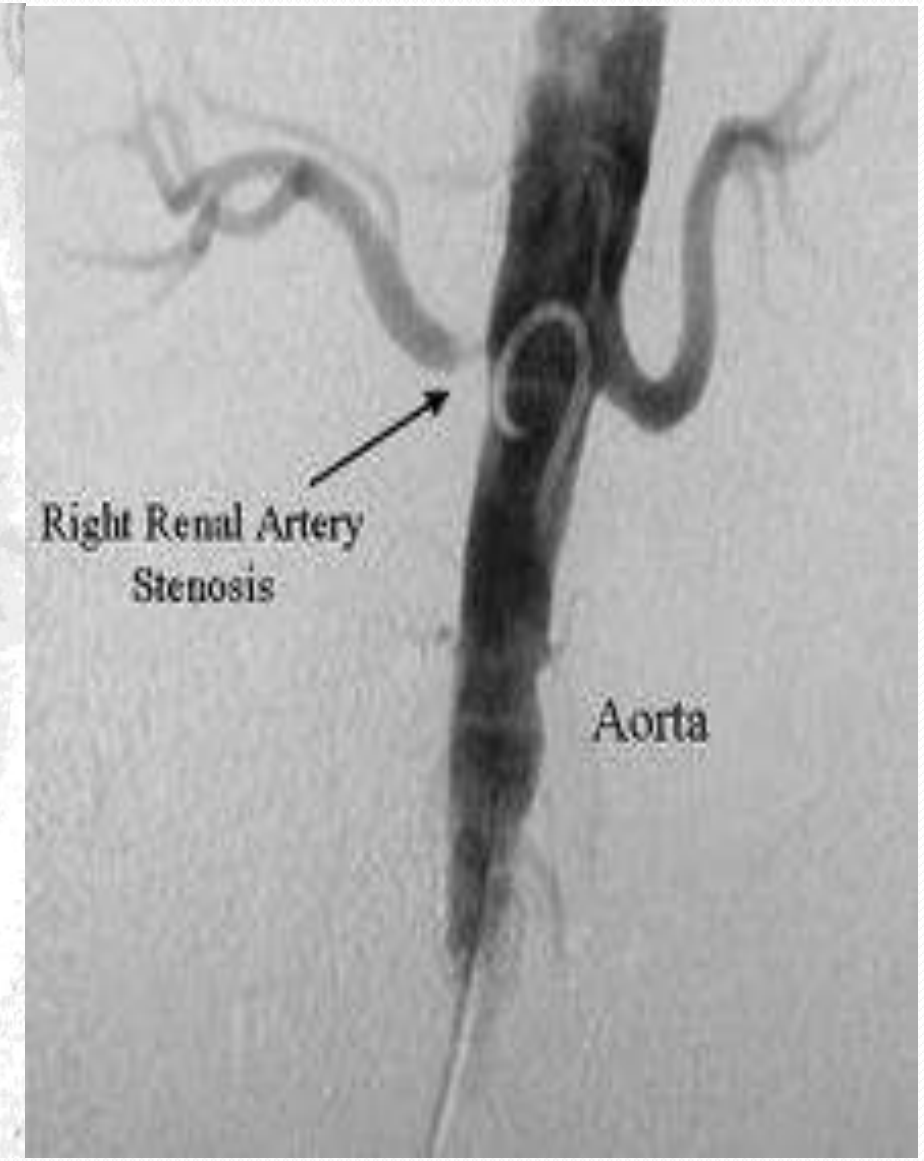
Chronic renal failure

- More common then acute failure
- Affects 20 million per year (1 in 9)
- Causes
  - 50% cases are due to diabetes and HTN
  - Diabetic neuropathy, HIV, collagen vascular disease, sickle cell disease, stones, prostate obstruction
- S & S
  - Fatigue, weakness, SOB, anorexia, nausea, vomiting
  - Skin symptoms, metallic taste in the mouth, HTN
  - Restless legs, cramps, paresthesias
  - Uremic frost (skin) and uremic pericarditis

- Diagnosis
  - Severely decreased urine output - oliguria
    - Less than 500 cc/day with good hydration
    - Normal level is 1500 cc/day
    - The body must put out 20 cc/hour to clear toxins
  - Lab findings
    - Serum creatinine increased, BUN increased
    - Hyperkalemia
- Treatment
  - Dietary management
  - May need short term course of dialysis
  - Kidney transplants recommended if conservative treatment does not respond
  - Dialysis Procedure - Films on Demand

RAS – renal artery stenosis

- RAS causes 5% of all HTN
- Ateriosclerosis leads to renal artery narrowing in 80% of cases
- S & S
  - Many have HTN with no symptoms
  - Headaches, tremors, flushing, anxiety, irritability
- Diagnosis
  - Kidney CT, US, MRI
  - Renal arteriogram
  - Urine specific gravity & concentration test
- Treatment
  - Surgical treatment with balloon catheter stent


Right Renal Artery
Stenosis
Aorta

Polycystic kidney disease

- Common hereditary disease affecting 1 in 400
  - Accounts for 10% of all dialysis patients
  - 50% of these patients will have end-stage renal disease
- S & S
  - Abdominal or flank pain with hematuria
  - History of frequent UTI is very common
  - Family history in 75% of cases
- Diagnosis
  - US, CT, MRI
- Treatment
  - No treatment – only symptomatic control
  - 15% will develop anuerysms in brain

Kidney Stones

- Pathophysiology
  - 80% of kidney stones are composed of calcium with oxalate or phosphate
  - Kidney stones are the result of crystallization of stone-forming salts that separate from the urine
  - Affects 5% of the population
  - Stones vary in size from microscopic to one-inch

- S & S
  - Can be asymptomatic if stone is microscopic
  - Usually renal colic with excruciating flank and back pain
  - Nausea, fever, chills
  - May have hematuria
- Diagnosis
  - Based on pain history
  - Ultrasound, cytoscopy, IVP
- Treatment
  - Cytoscopy stone removal
  - Lithotripsy with ultrasound
  - Potassium citrate pills after surgery in patients who tend to form stones
- Kidney Stones
- Uteroscopic stone removal

Prostate Problems

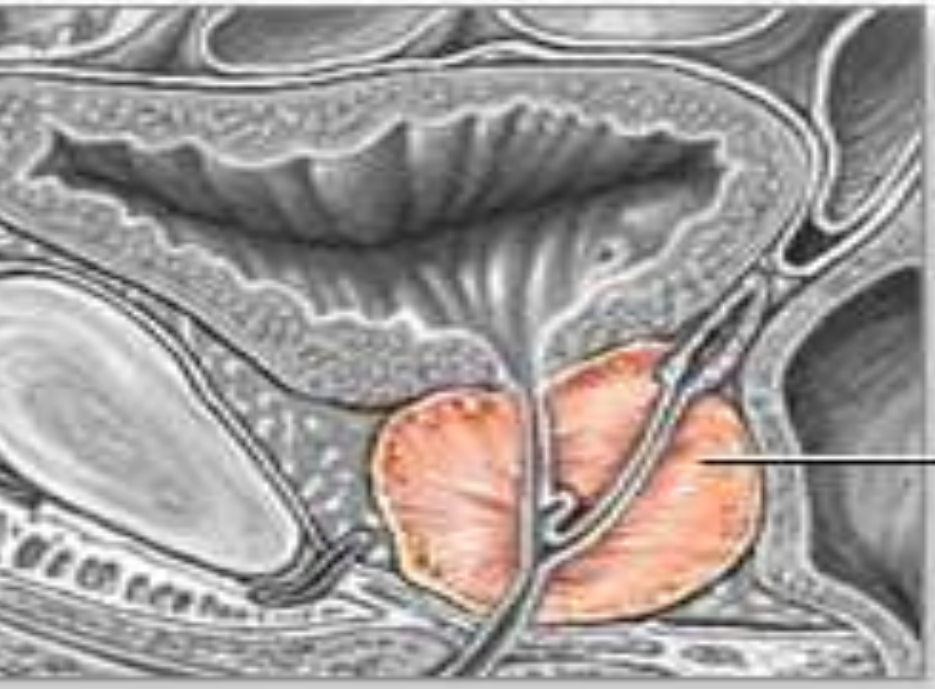
BPH – Benign prostatic hyperplasia

- Affects 50% of men 50-60
- At 75, most men experience decrease of force and caliber of urinary flow
- At 80, 90% of men have BPH
- Despite being one of the most common diseases of the aging male, the etiology of BPH remains a mystery

BPH - Pathophysiology

- The condition seems to be due to aging and DHT
  - Dihydrotestosterone
- After 50, serum testosterone decreases and estrogen increases
  - Estrogen increases the number of receptors on the prostate and inhibits it's metabolism
  - This ultimately causes urinary outflow obstruction
  - The muscles of the bladder try to compensate by increasing pressure to expel urine, which only leads to more instability and worse symptoms

Normal prostate



Benign prostatic hypertrophy (BPH)

ADA

Enlarged Prostate

BPH - Signs and Symptoms

- Most symptoms of BPH start gradually
- Main symptom is the need to get up more often at night to urinate
- The need to empty the bladder often during the day
- Difficulty starting urine flow & dribbling after urination
- Size and strength of the urine stream may decrease

These symptoms can be caused by other things besides BPH
They may be signs of more serious diseases, bladder cancer

- BPH - Diagnosis
  - Confirmed by rectal exam
  - UA and PSA test
  - AUA
- BPH - Treatment
  - Alpha-blockers to relax urinary smooth muscle
  - Finasteride
    - Blocks the conversion of testosterone to DHT
    - Can take up to six months
  - If recurrent UTI is present, then TURP surgery
    - Trans-urethral resection of the prostate

This is how most men see the urologist

AUA Scale

1. Over the past month, how often have you had the sensation of not emptying your bladder completely?
2. Over the past month, how often have you had to urinate again in less than 2 hours?
3. Over the past month, how often have you stopped and started when urinating?
4. Over the past month, how often have you found it difficult to postpone urinating?
5. Over the past month, how often have you had a weak urinary stream?
6. Over the past month, how often have you had to push or strain to begin urinating?
7. Over the past month, how many times did you most typically get up to urinate from the time you went to bed until the time you got up in the morning?

AUA Scale – Prostate Symptoms Score

- None = 0
  Once =1
  Twice = 2
  3 times = 3
  4 times = 4
  5 times or more = 5

- Mild BPH = 1 to 7
  Moderate = 8 to 19
  Severe = 20 to 35

Acute Prostatitis

- Bacterial prostate infection
  - Rare, but can be caused by *E. coli* or pseudomonas
- S & S
  - Supra-pubic pain, fever, severe dysuria
- Diagnosis
  - Urine culture – initial and midstream
    - Initial culture will have more WBC
- Treatment
  - Hospitilization with IV antibiotics, hydration and pain meds

Chronic Prostatitis

- It is the most common reason why men over 50 go to a Urologist
- Although it literally means “inflammation”, inflammation or infection is rarely present
- Only 5% of men have bacterial prostatitis
- 95% have non bacterial prostatitis which is often called male pelvic pain syndrome
- Etiology
  - Genetics, hormonal imbalances, aging, chemical irritants, and fungal infections
  - Differential Diagnosis – bladder cancer, prostate cancer, cystitis (all have prostatic symptoms)

- S & S
  - Same as with acute prostatitis, but not as severe
- Diagnosis
  - No real specific diagnosis
  - Sometimes bacterial or viral cultures used, but usually negative
- Treatment
  - Very limited and only supportative
  - Tranquilizers, such as Valium
  - Anti-spasm muscle relaxants

Prostate cancer

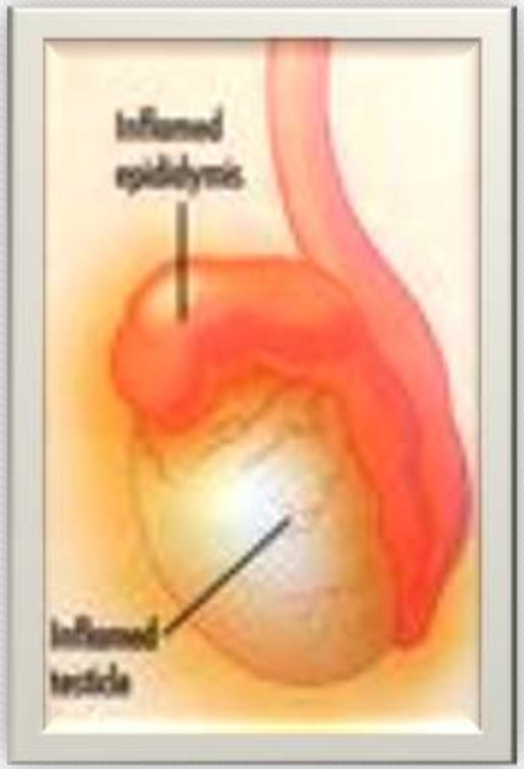
- Incidence
  - Most common cancer of men
  - 190,000 new cases per year with 31,000 deaths
  - Average age of Diagnosis is 72
  - Many pathologists believe that every man will eventually get prostate cancer, if they live long enough
- S & S
  - Same as BPH, but sometimes has hematuria

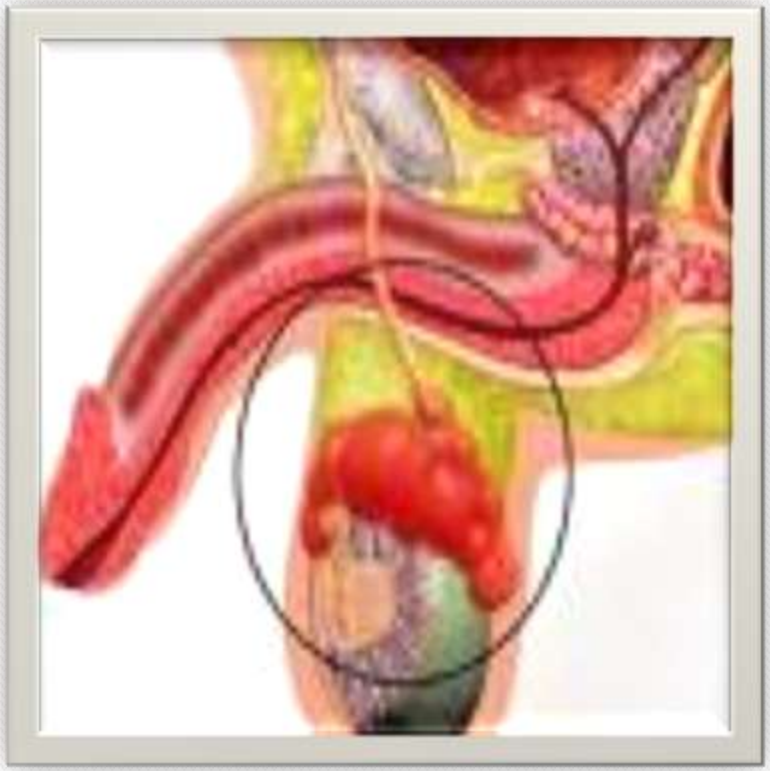
- Diagnosis
  - Yearly PSA screening
    - Should be done before rectal exam
  - Yearly rectal exams for all men over 55
  - Bone scan if bone pain present or if PSA over 10ng
- Treatment
  - Radiation has good success rates
  - Hormone replacement
  - Radical prostatectomy with lymph node dissection
  - Prostate Cancer Surgery - BBC

Other Men's Conditions

Epididymitis

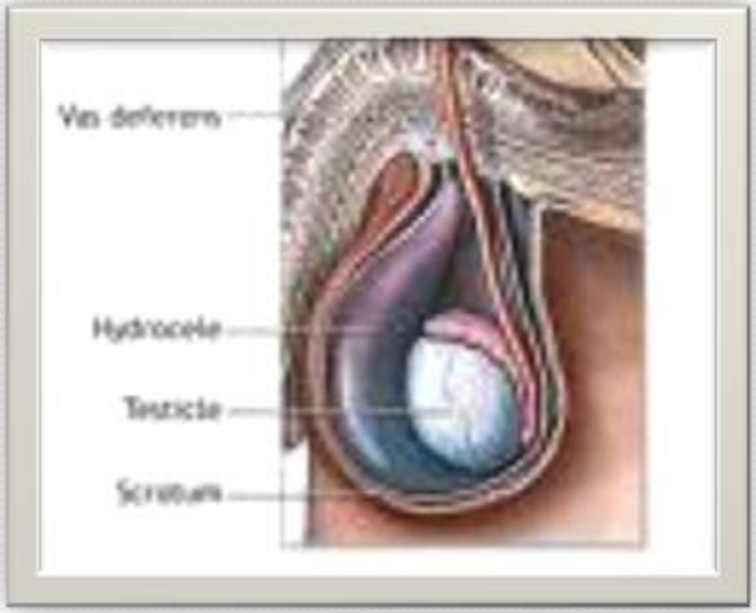
- Very painful inflammation of epididymis
  - Usually from *E. coli*
  - Can also be caused by trauma, after catheterization, or after a vasectomy
- S & S
  - Extreme testicular pain and low grade fever
- Treatment
  - Antibiotics, heat packs, bed rest


Inflamed epididymis
Inflamed testicle

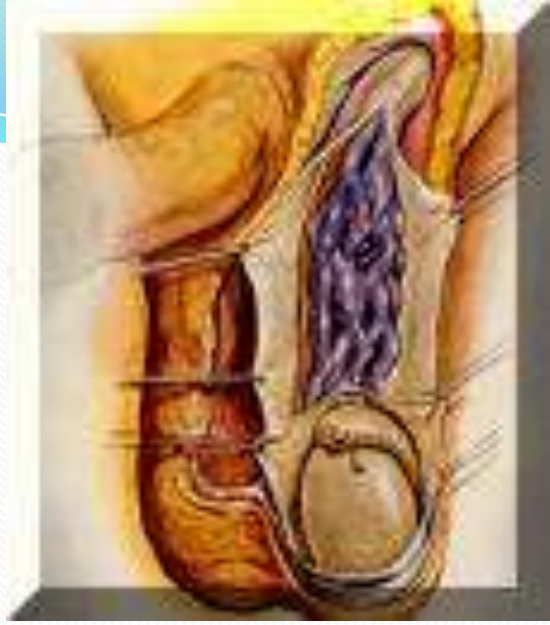


Hydrocele

- Common, painless swelling around testis with fluid
- S & S
  - Usually unnoticed, but can be large enough for a feeling or heaviness or fullness
- Diagnosis
  - Hydrocoele transilluminates with a flashlight because of the cystic lesion
- Treatment
  - No treatment as most spontaneously subside
  - Not usually drained because of the chance of introducing infection
  - Surgery only if large


Vas deferens
Hydrocele
Testicle
Scrotum

Varicocele



- Varicose veins of the testes
  - Very common and harmless
- S & S
  - Feels like a bag of worms in the top of the scrotum
- Diagnosis
  - Classic “bag of worms” palpation in testes
- Treatment
  - Usually no treatment used
  - If varicocele is large enough, can cause sterility

Endocrinology & Renal Acute Red Flags

- Diabetes with any change of consciousness
- Diabetes with any complication
- Acute adrenal insufficiency
- Any sign of acute renal failure
- Kidney stones
- Kidney transplant rejection
- Complications of dialysis
- Acute prostatitis
- Acute epididymitis

Endocrinology & Renal Subacute Red Flags

- Diabetes insipidus – if undiagnosed
- Any endocrine symptoms – if undiagnosed
- Any S & S of endocrine cancer
- A testicular mass
- Symptoms of male hypogonadism
- History of hypoglycemia
- Chronic renal failure
- Polycystic kidney disease
- Signs of prostate cancer
- Urinary retention from BPH
- Hypertension from renal artery stenosis