Hypothyroidism

- Metabolic disorder
- May be familial or sporadic
- May progress as permanent or transient disorder
- Congenital vs. acquired
  - Congenital - may affect fetus in 1st trimester
  - Juvenile - acquired - usually have onset in childhood or adolescence
Hypothyroidism

- Primary vs. secondary
  - Primary- disease or disorder of thyroid gland
  - Secondary- disease or disorder of hypothalamus or pituitary gland compromises thyroid gland function
Hypothyroidism

- **Etiology/ Incidence**
  - **Congenital Hypothyroidism**
    - Absence, underdevelopment or atrophy of thyroid gland most common
    - Inherent dysfunction in transport or assimilation of iodine or in synthesis or metabolism of thyroid hormone
    - Maternal disease adversely affecting fetal thyroid development and function
Hypothyroidism

- Iodine deficiency causing endemic goiter and cretinism
- Hypothalamic or pituitary disorder
- Affects 1 infant in every 4000 live births
- Higher incidence in Hispanic and Native-American infants
- Higher incidence in areas with endemic iodine deficiency
Juvenile-acquired Hypothyroidism
- Chronic lymphocytic thyroiditis
- Late manifestation of congenital absence
- Ablation of thyroid through medical procedure
- Exposure to iodine-containing drugs and agents
- Disease of hypothalamus or pituitary
- Endemic goiter from nutritional iodine deficiency
Signs and symptoms
- Affects multiple systems
- May be family history
- May be associated with other autoimmune disease or syndromes

Neonates/infants
- Infants have no obvious signs during first month
- History of lethargy, poor feeding, elevated bilirubin
- May be post-mature

Older infants, children, adolescents
- History of poor growth
- Developmental delay
Differential diagnosis

- Differentiate primary Hypothyroidism due to intrinsic thyroid gland defects from secondary thyroid deficiency caused by pituitary or hypothalamic disorders
- Congenital thyroxine-binding globulin deficiency
Hypothyroidism

- **Physical Findings**
  - Affects multiple systems
  - Neonates/infants
    - Prolonged jaundice
    - Growth deceleration
    - Hypothermia, skin mottling
    - Large fontanels
    - Normal, slightly enlarged thyroid gland
    - Hoarse cry
    - Axillary, prominent supraclavicular fat pads
    - Respiratory distress in term infant
    - Bradycardia
    - Distended abdomen
    - Lumbar lordosis
Hypothyroidism

- Findings - Infants, children, and adolescents
  - Increased weight for height
  - Linear growth retardation
  - Developmental delay
  - Delayed puberty
  - Skin cool, pale, gray, thickened
  - Hair dry, brittle
  - Possible enlarged thyroid gland
  - Galactorrhea
  - Myopathy
  - Delayed bone age
Diagnostic Tests/Findings

- Newborn screening for congenital Hypothyroidism is routine in all 50 states
  - If abnormal - repeat
  - Evaluated serum TSH and low T4 diagnostic of congenital hypothyroidism. May also test serum thyroxine-binding globulin
  - Positive TSH receptor-blocking antibodies - diagnosis for transient congenital Hypothyroidism
  - May also test - TBG, T3RU
Tests/findings con’t

- Acquired Hypothyroidism secondary to pituitary or hypothalamic disorder
  - Low TSH, low T₄ level, low T₃RU
  - Abnormal pituitary function tests
- Euthyroid sick syndrome secondary to acute or chronic illness-low T₄, normal TBG, low T₃, normal TSH, free T₄ and reverse T₃ normal to high
Hypothyroidism

Tests/findings con’t

- Autoimmune thyroiditis-(Hashimoto’s) with goiter-normal T4 and TSH; elevated serum thyroid peroxidase or thyroglobulin antibody titers
- Repeat thyroid function tests if clinical suspicion of hypothyroidism, history of disease in pregnancy, positive history
- May have abnormal thyroid scan, ultrasound, imaging, or bone age results
Hypothyroidism

Management/Treatment

- Physician consultation or referral to endocrinologist
- Drug of choice daily oral levothyroxine
- Once older children in euthyroid state - monitor their thyroid levels
- Educate parents and child about disease
- Excessive production and secretion of thyroid hormone - TH
Hyperthyroidism

- **Etiology/ Incidence**
  - Caused by excess production of thyroid hormone-TH
  - Autoimmune response- Graves’- most common cause
  - If mother is thyrotoxic prenatally or has history of Graves’, infants may have transient congenital Hyperthyroidism
  - More common in girls than boys
Signs and symptoms

- May have family history
- Neonates/infants
  - Usually have signs shortly after birth
  - Prematurity, low birth weight, poor weight gain, weight loss
  - Fever, flushing
Hyperthyroidism

- Child/Adolescent S/S
  - Weight loss, increased appetite
  - Nervousness, irritability, decreased attention span
  - Sleep restlessness
  - Visual disturbance
  - Palpitations and increased heart rate
  - Trembling
  - Frequent urination and stooling
  - Amenorrhea
Differential Diagnosis

- Neonates
  - systemic illness
- Children and adolescents
  - Nodular thyroid disease
  - Thyroid cancer
  - Euthyroid goiter
  - Chronic disease
  - Thyroiditis
  - Accidental or deliberate excessive thyroid hormone or iodine ingestion
  - Chorea
  - Psychiatric illness
Hyperthyroidism

- Physical Findings
  - Neonates and infants
    - May be small for gestation age
    - Lid retraction
    - Face may be flush
    - Enlarged thyroid
    - Cardiac problems
    - Increased gastrointestinal motility
Hyperthyroidism

- Children and adolescents
  - Warm, moist, smooth skin, diaphoretic skin
  - Eye findings: proptosis, exophthalmos, upper lid lag with downward gaze, lid retraction, stare appearance, periorbital and conjunctival edema
  - Enlarged thyroid, tender or nontender, spongy or firm with palpable border; may have thyroid bruit or thrill
  - Increased pulse rate, systolic hypertension, increased pulse pressure
  - Muscle weakness
  - Diminished motor skills, tremor, short DTR relaxation phase
  - Advanced skeletal maturation radiographically
Hyperthyroidism

Diagnostic Tests/Findings
- If signs or symptoms of thyrotoxicosis or enlarged thyroid, do confirm lab thyroid function tests
- Thyroiditis indicated by elevated T4, free T4, T3 resin uptake and low serum cholesterol
- Circulating thyroid stimulator immunoglobulin and other thyroid antibody tests including thyrotropin receptor antibody titers may be positive
- May have moderate leukopenia, hyperglycemia, and glycosuria
- Graves’ Disease- low TSH, elevated T4, advanced bone age
- Radioactive iodine uptake scan shows increased uptake if excess TH production. If increased released of TH only, will have decreased radioactive iodine uptake
- High T4 not always hyperthyroidism, must also have low TSH, with high T4
Hyperthyroidism

**Management/Treatment**
- Physical consultation - pediatric endo
- Treatment dictated by identified etiology
- Prompt diagnosis and treatment, especially important in neonates as condition may be life-threatening.
- Treatment goal is prompt return euthyroidism
- Restricted physical activities - with severe disease or in prep for surgery
- Educated parent and child about disease
- Genetic counseling may be indicated
Thyroiditis

- **Etiology/Incidence**
  - Acute suppurative thyroiditis with bacterial etiology e.g. GABHS, pneumococci, S. aureus, and anaerobes; rare
  - Subacute, nonsuppurative caused by viruses e.g. mumps, influenza, echovirus, coxsackie, Epstein-Barr, adenovirus; rare in US
  - Chronic autoimmune lymphocytic - most common cause of goiter and hypothyroidism in childhood
Thyroiditis

- Signs and Symptoms
  - May have recent family history of concurrent upper respiratory illness
  - May have recent family history of autoimmune thyroid disease
  - Onset is acute - rapid
  - Fever, malaise - may be very ill
  - Pain and tenderness of thyroid - may radiate to ear, chest. Severe pain with neck extension; no tenderness with chronic lymphocytic thyroiditis
  - Complaints of unilateral or bilateral swelling of thyroid, complaints of fullness in anterior neck; sensation of tracheal compression
  - May have sore throat, hoarseness, dysphasia
  - May have nervousness, irritability
Thyroiditis

- Differential Diagnosis
  - Distinguish between infectious toxic thyroid thyroiditis and chronic lymphocytic autoimmune thyroiditis
  - Goiters induced by drugs
  - Cancerous or cystic thyroid nodules
Physical Findings

- Findings variable depending on etiology
- May be toxic-appearing if infectious etiology but not necessarily thyrotoxic
- If infectious- thyroid gland unilaterally or bilaterally enlarged, tender, firm
Thyroiditis

- Diagnostic Tests/ Findings
  - Laboratory findings variable depending on etiology
  - In infectious- serum total T₄, free T₄, and T₃RU usually normal or slightly elevated
  - In chronic- elevated TSH and thyroid antibodies, abnormal thyroid scan
  - Surgical or needle biopsy diagnostic
Thyroiditis

Management/Treatment

- Physical consultation
- Specific antibiotic therapy
- Treatment for autoimmune chronic lymphocytic thyroid controversial
- Adolescents need lifelong monitoring
- Genetic counseling may be indicated
Definition

Variation from average pattern of growth height > 2 standard deviations below mean

Etiology/Incidence

Normal growth variations

- Familial or genetic normal variant of average growth pattern
- Constitutional delay of growth
- Puberty

Primary growth abnormalities

- Osteochondrodysplasia
- Chromosome abnormalities
- Intrauterine growth retardation
- Dysmorphic syndromes
Short Stature

- Secondary growth failure
  - Malnutrition
  - Chronic illness
    - Gastrointestinal disease
      - Celiac disease
      - IBD
      - Cystic fibrosis
    - Cardiovascular disease
      - Cyanotic heart disease
      - Congestive heart failure
    - Renal disease
      - Uremia
      - Renal tubular acidosis
    - Hematologic disorders
    - Inborn errors of metabolism
    - Pulmonary disease
    - Chronic infection
    - Anorexia nervosa
Short Stature

- Endocrine disorders
  - Hypothyroidism
  - Cushing syndrome
  - Pseudohypoparathyroidism
  - Rickets
  - IGF-1 deficiency
    - GHD
    - Growth hormone insensitivity
    - Defects in IGF synthesis
Short Stature

- **Signs and Symptoms**
  - **Normal growth variation**
    - Familial short stature - small at birth
    - Constitutional growth delay - usually normal size at birth
  - **Pathologic growth variation**
    - nutritional
      - History of poor nutritional intake
      - malabsorption
    - Endocrine - growth hormone deficiency 1 in 4000
      - Failure to grow, headaches, delayed dental development, developmental delay, dull appearance, polyuria, polydipsia
    - Intrauterine growth retardation and low birth weight
    - Dysmorphism at birth
    - Signs and symptoms of neglect
    - Chronic drug intake
Differential Diagnosis: Distinguish normal variants of familial short stature and constitutional growth delay from pathologic causes

See pathological growth variations
Short Stature

- History
  - Pregnancy, delivery, newborn period
  - Parents’ and siblings’ height, weight and growth pattern
  - When growth started to slow
  - Chronic illness
  - Symptoms of hypothyroidism or other pituitary hormone deficiency
  - Trauma or insult to the CNS
  - Signs of an intracranial lesion
Short Stature- Exam

- Examine for clues to
  - Chronic illness
  - Dysmorphic syndrome
    - Childlike face with large prominent forehead
- Evaluation of the fundi for signs of ICP
- Palpation of the thyroid gland for a goiter
- Evaluation of the stage of puberty
- Measurements of body proportions
  - Arm span compared with height
  - Upper to lower segment ratio
    - Measure from the symphysis pubis to the heel to get the lower segment
      - Tables exist for children of all ages
Physical Findings

- Familial or constitutional - Height, weight, HC growth curve patterns consistent
  - Familial - growth chart showing BW < 3%
  - Constitutional - normal size at birth then declining through 1 to 3 years to <5%

- Pathologic short stature
  - GH deficiency – BW may be normal, length 50% of normal, height and weight deficits; infantile fat distribution; youthful facial features; midface hypoplasia; visual field defects; small hands and feet; newborn may have microphallus (stretched penile length of <2.5cm vs. 4cm-normal); may have CNS findings
Physical findings-pathologic-con’t

- Primordial short stature
  - IUGR-subsequent growth <3rd percentile
  - Primordial dwarfism with premature aging
  - Short stature with and without dysmorphism
- Short stature associated with chromosomal abnormalities-
  Turners, Downs
- Short stature associated with bone or cartilage development
  disorder: skeletal dysplasia, short extremities with normal
  head and trunk, frontal bossing, disproportionate, rickets
Short Stature

- Short stature associated with symptoms of endogenous cortisol excess: moon facies, hirsutism, buffalo hump, striae, hypertension, fatigue, deep voice, obesity, amenorrhea
- Chronic drug intake
- Abnormalities in psychosocial development
Exam Findings

- Abnormalities in previous recordings of height, weight, and HC
- Height may be $< 3^{rd}$ percentile but growth rate normal
- May have abnormal complete and segmental growth measurements and upper to lower body ratio measurements
Lab test to confirm diagnosis

- Abnormal CBC-chronic anemia, infection, leukemia
- Elevated sedimentation rate-vascular disease, cancer, chronic infection
- Abnormal biochemical profiles-adrenal insufficiency, renal disease
- Abnormal stool examination-inflamatory bowel, parasitism
- Abnormal thyroid function studies-hypothyroidism
- Low serum human growth hormone
- Abnormal urinalysis-renal disease
Lab tests to confirm-con’t

- Delayed maturity on radiographic bone age
- Nutritional evaluation may show inadequate calories
- Abnormal home/social evaluation may suggest psychosocial etiology
- Abnormalities on skull-x-ray, CT, MR-inter cranial lesions
- Karyotype analysis in short girls with pubertal delay may indicate Turner syndrome
Short Stature

- Management/Treatment
  - Physician consultation - Endo
  - Boys may need short-term testosterone to initiate sexual development
  - Optimize treatment for other endocrine of systemic or chronic illnesses, adequate calories
  - GH may be indicated for children with know GH deficiency-controversial

  - The FDA has approved a number of indications for GH TX
  - The cost can be as high as $19,000 a year- if not covered by ins
  - Sides effects include
    - Insulin resistance, pseudotumor, edema, growth of nevi, carpal tunnel
Excessive Growth

- Variation from average pattern of growth in linear height with height >2 SD above the mean

Etiology/Incidence

- Normal variation in growth - tall structure
- Pathologic variation in growth
  - Endocrine disorder
    - IDM or GH excess or precocious puberty
  - Genetic causes
    - Marfan syndrome-connective tissue disorder
    - Chromosomal abnormalities- Klinefelter syndrome, XYY, XXYY
Excessive Growth

- **Other Etiology**
  - Idiopathic or exogenous obesity - early puberty with accelerated growth - not beyond genetic potential
  - Homocystinuria - inherited inborn metabolism error
  - Cerebral gigantism - possible hypothalamic dysfunction, adult stature normal to excessive
Excessive Growth

- Signs and Symptoms
  - Concerns primarily with girls/parents
  - Symptoms variable depending on underlying etiology
  - Familial or constitutional tall stature-Length normal at birth, tall stature evident at 3 to 4 years-growth rate slows after 4-5 years with normal curve
  - IDM-Hx maternal diabetes, LGA
  - Beckwith-Wiedemann-LGA, rapid growth in childhood; concern about height; symptoms of hypoglycemia
Excessive Growth

- Signs and symptoms con’t
  - GH excess - headache, visual impairment, coarsening of facial features, enlargement of nose and jaw, increases in hands and feet, polyuria, polydipsia, irregular menses, joint pain
  - Precocious puberty - concern about height, early development
Excessive Growth

- Signs and Symptoms con’t
  - Klinefelter’s syndrome
  - Marfan’s-height, vision, cardiac problems
  - Obesity-normal height and weight at birth
  - Homocystinuria-concern about height, MR, vision, CNS sx, back pain
  - Cerebral gigantism-rapid growth, feeding problems and developmental delay
Excessive Growth

- Differential Diagnosis: normal variants need to be distinguished from pathologic causes.
- Physical Findings
  - Constitutional tall stature: 2 to 4 SD above average height for age.
Physical findings con’t

- Endocrine disorder
  - IDM- LGA at birth
  - GH excess- tall
  - Precocious puberty- tall

- Genetic disorders
  - Marfan’s- tall stature, dolichocephaly, abnormal proportions, scoliosis, myopia, heart murmur, hypotonicity, pectus excavatum, joint issues
  - Klinefelter syndrome- tall stature, underweight, MR, long legs, abnormal proportions, normal penis with small testes with decreased sensitivity to pressure, cryptorchidism, hypospadias
Excessive Growth

- Physical findings con’t
  - Other causes of tall stature
    - Obesity - normal exam
    - Homocystinuria - tall, myopia, CNS sx, convulsion, MR, osteoporosis, vertebral collapse
    - Cerebral gigantism - dysmorphic, abnormal proportions, MR, macrocephaly, dolichocephaly, prominent forehead, hypertelorism with other ocular issues, high palate, pointed chin, CNS sx, poor motor coordination
    - Beckwith-Wiedemann Syndrome - omphalocele, umbilical hernia, accelerated growth in childhood, macroglossia, high palate, midface hypoplasia, hemihypertrophy
  - Diagnostic Tests/Findings
    - Recordings of height/weight and OFC on growth chart show height > 2 SD above mean for age
Excessive Growth

- History/Diagnostic Tests/Findings
  - Recordings of height/weight and OFC on growth chart show height >2 SD above mean for age
  - Careful family history of tall growth patterns may elucidate familial etiology of tall stature
  - Lab tests to confirm diagnosis bases on clinical findings and rule out endocrine disease
  - Radiographic bone age not advance in constitutional tall stature
Excessive Growth

- Diagnostic tests/findings con’t
  - Abnormal echocardiogram with Marfan’s
  - Abnormalities on skull radiograph, CT, or MRI of cranium
  - Karyotype analysis may indicate chromosomal abnormalities
Excessive Growth

Management/Treatment
- Physical consultation
- Pharmacological management controversial
- Homocystinuria - restrict dietary methionine
- GH excess from CNS tumor or adrenal or gonadal tumor
- Management of endocrine disease associated with tall stature
- Beckwith-Wiedemann - treat excess insulin production
Symptoms provoked by abnormally low blood glucose levels occurring when child with diabetes receives excessive insulin, fails to eat, or exercises too strenuously; in child without diabetes, blood glucose lever must be $< 40 \text{ mg/dL}$ and $< 30 \text{ mg/dL}$ in newborns.
Etiology/Incidence

- Transient neonatal Hypoglycemia
  - SGA infants with decreased production of blood sugar
  - LGA IDM-exposure to maternal blood sugar
  - Increased glucose use-physiologic stressors secondary to asphyxia, respiratory illness, heart disease, cold injury, starvation

- Hypoglycemia of childhood
  - Hyperinsulinism
  - Functional fasting Hypoglycemia
  - Associated with CNS disorders
  - Metabolic disorders and endocrine insufficiency
  - Severe malnutrition states
  - Other-drug ingestion, drug toxicity(alcohol, aspirin, oral hypoglycemic agents)
Hypoglycemia

- Signs and Symptoms
  - Neonatal - findings variable -
    - Irritable
    - Jittery
    - Refusal to feed
    - Tend to be small for age
  - Childhood
    - Mood changes, nervousness, weakness, hunger, vomiting
    - History - family; may have symptoms of metabolic or hormonal disorders
    - Functional fasting - ketotic hypoglycemia - vomiting, anorexia, URI, may have early morning seizures
Hypoglycemia

- **Differential Diagnosis**
  - Distinguish among various possible etiologies of Hypoglycemia
    - Functional (fasting)
    - Ketotic
    - Inherited disease
Hypoglycemia

- Physical findings
  - Neonatal
    - Cachexia or macrosomic infant
    - Irritability, lethargy, weak cry
    - Hypothermia, cyanosis, diaphoresis, pallor
    - Uncoordinated eye movement, eye-rolling
    - Apnea, irregular breathing, tachycardia
    - Twitching, jitteriness, convulsions, semi consciousness, coma
Hypoglycemia

Physical findings con’t
- Childhood
  - Signs same as neonate
  - Diminished growth
  - Difficulty talking
  - Signs of other systemic illness
  - Abdominal or pelvic masses
  - Unsteady gait
  - Concurrent illness
Hypoglycemia

- **Diagnostic tests/finding**
  - Transient neonatal hypoglycemia - routine Dextrostix; if
    - Whole blood glucose level $<35$ in first 24 hours or $<40$ thereafter or...
    - Plasma glucose level $<40$ in first 23 hours or $<45$ thereafter
  - Low blood glucose during episode; consistent and repeated levels below 40 with associated signs - need further workup
  - In hyperinsulinemia, serum insulin levels may be inappropriately elevated when compared with glucose level obtained at same time
Hypoglycemia

Management/treatment

- Consultation with endo
- Treat hypoglycemic episodes promptly and adequately
- Hypoglycemic reactions in children with diabetes-
  - Surgery for pancreatic adenoma, partial pancreatectomy if insulin secretion suppression unsuccessful
  - Children with function (fasting) hypoglycemia-treat with liberal carbohydrate diet with bedtime snacks, moderate restriction on ketogenic foods; avoid prolonged fasting; parents may need to check urinary ketones
Hyperglycemia-FYI

- Common hereditary metabolic and endocrine disorder characterized by insulin deficiency resulting in abnormal metabolism of carbs, protein, and fat

- Always admitted to pediatric hospital with onset- to endo services- never treated in primary care!!
Normal Puberty

- Physical changes occur in response to production of sex steroids by the ovaries or testes.
- Hypothalamic gonadotropin-releasing hormone regulates the release of luteinizing hormone and follicle stimulating hormone from the pituitary gland which in turn stimulate gonadal hormone secretion.
- Normal age range for entering puberty in girls is now earlier:
  - Signs may be noted as early as 6 years old in African American girls and 7 years old in Caucasian girls.
- The timing of menarche and reaching tanner stage 5 has not changed dramatically:
  - Menarche happens with 3 years of start of breast development.
  - 95% of girls will have started puberty by 13 years old.
- Boys may begin puberty as young as 9 years and the upper range is age 14 years:
  - The first sign of puberty is increased testicular volume in 85% of boys.
Early Puberty

Four categories

- **Premature thelarche**
  - Occurs in infant and toddler girls—is isolated breast development
  - Rarely progresses to true precocious puberty

- **Premature adrenarche**
  - Early onset of pubic hair in boys or girls, not associated with other features of true puberty, is most often idiopathic
  - These children are at increased risk for PCOS and metabolic syndrome

- **Isolated menarche**
  - Is uncommon, is one to a few episodes of vaginal bleeding without breast development
  - Rule out sexual abuse, vaginal tumor, functional ovarian cyst that produces estrogen and primary hypothyroidism

- **True precocious puberty**
Precocious puberty
- The onset of multiple features of puberty earlier than normal range
  - May include
    - Accelerated linear growth
    - Breast development or penis enlargement
    - Pubic hair development
    - Bone age may be advanced

Divided into two broad categories
- Central, gonadotropin dependent
  - Idiopathic
  - CNS disorder
- Peripheral, gonadotropin independent
  - Girls - McCune Albright syndrome, ovarian cyst, estrogen secreting ovarian or adrenal tumor
  - Boys - severe, non-salt wasting, congenital adrenal hyperplasia
  - Testotoxicosis, testicular tumor
- FYI - prolonged exposure to exogenous sex hormones can also cause precocious puberty
  - Mothers birth control pills or fathers topical testosterone
Disorders of Pubertal Development

- History
  - Symptoms; such as
    - Breast development, pubic hair, phallic enlargement, acne, body odor, oily scalp
  - Age of onset
  - Progression
  - Duration
  - Pattern of growth
  - Any symptoms of CNS lesion
  - Pattern of family puberty
  - Exposure to topical estrogens or testosterone or oral estrogens
Disorders of Pubertal Development

- Physical Exam
  - Assessment of stature and growth velocity
  - Description of the tanner stage

- Diagnostic tests
  - Premature thelarche
    - No tests
  - Premature adrenarche
    - Serum 17 hydroxpyrogestrone
      - To exclude congenital adrenal hyperplasia
    - 24 hour urine for 17-ketosteroids or Imaging of the adrenal glands
      - To exclude an adrenal tumor
  - Isolated menarche
    - Thyroid function
      - To exclude primary hypothyroidism
    - Pelvic ultra sound
      - To look for ovarian cyst or pelvic tumor
Disorders of Pubertal Development

- Precocious puberty
  - Bone age
  - LH, FSH, estradiol or testosterone
    - If the LH and FSH are high do an MRI to exclude CNS tumor
    - If LH and FSH are low do a GnRH stimulation test to distinguish central from peripheral puberty
      - For peripheral
        - Pelvic or testicular ultrasonography
        - Serum 17-OHP to rule out severe CAH
Management of precocious puberty done with the guidance of Endo

- Treatments depend on;
  - the underlying disorder
  - Age of the child
  - Advancement of the bone age
  - Child's and family's emotional response to the condition

- Treatments include
  - radiation, surgery, or chemotherapy for CNS tumor
  - Long acting GnRH agonist to bring serum sex steroids to prepubertal levels

- Treatment goal is to increase final adult height
Delayed Puberty

Puberty is considered delayed when a boy 14 years or older or a girl 13 years or older has no clinical features of puberty.

Epidemiology

- Any chronic condition that delays the bone age may cause delayed puberty (since the bone age correlates with puberty better than the chronologic age).
- Also failure of any part of the hypothalamic-pituitary–gonadal axis may also delay puberty.
- The most common cause of delayed puberty is Constitutional Growth Delay.
  - Which is covered in the failure to thrive lecture.
- Other causes include:
  - Chronic illness
  - Growth hormone deficiency
Clinical findings in delayed puberty

- History and physical should focus on:
  - Clinical clues indicating a chronic illness
    - Signs and symptoms of hypothyroidism
    - History of CNS insult
    - New CNS symptoms suggesting hypopituitarism
  - ROS
    - Pattern of growth
    - Sense of smell
    - Galactorrhea
Disorders of Pubertal Development

- **Diagnostic tests**
  - Screen for acute and chronic illness
    - CBC
    - Sed Rate (ESR)
    - UA
    - Liver enzymes
    - Electrolytes (renal function)
  - Bone age
  - Thyroid screening
  - IGF-1 and IGFBP-3 if growth hormone deficiency suspected
  - Serum prolactin
  - LH and FSH
    - When gonadal failure is present, LH and FSH are abnormally elevated if the bone age is older than 11 years in a girl and 12 years in a boy
Management of delayed puberty

- Refer to Endo
  - hormone replacement is the treatment of choice for hypogonadism
Gynecomastia

- **Definition**
  - Visible glandular enlargement of the male breast

- **Etiology/Incidence**
  - Neonatal - due to cross-placental transfer of maternal hormones; usually resolves by 2 to 3 weeks
  - Pubertal - too little androgen and/or too much estrogen on mammary tissue, may occur in up to 75% of normal boys
  - Pathologic - secondary to drug side effects, underlying disease
Gynecomastia

- Signs and Symptoms
  - Breast development in other than pubertal females
- Differential diagnosis
  - Obesity
  - Breast infection
  - Fat necrosis due to injury
  - Drugs
  - Klinefelter’s
Gynecomastia

Physical Findings

- Neonatal—usually bilateral, tissue enlargement
- Pubertal—breast tissue enlargement, movable, disk-shaped
- Pathologic—malnourishment, lymphadenopathy, delayed sexual maturity
Gynecomastia

- Diagnostic Tests
  - Endocrinology studies as indicated
  - Imaging techniques as appropriate
  - Karyotyping if Klinefelter’s suspected
Gynecomastia

- Management
  - Neonatal- Parent education
  - Pubertal- explanation, reassurance and observation
  - Physiologic- medical or surgical treatment is usually required
Definition-

- Primary amenorrhea - failure of onset of menarche in females who are 16 years and have normal pubertal growth and development; 14 years with absence of normal growth and development; or in girls who not begun menstruation 2 years after completed sexual maturation.

- Secondary amenorrhea - absence of menstruation for > 3 cycles at least 6 months after menstruation established.
Amenorrhea

- Etiology/Incidence
  - Primary
    - Constitutional/familial – common
    - Obstruction of flow e.g. fusion or stenosis, imperforate hymen
    - Estrogen deficiency
      - Primary ovarian insufficiency-organic or functional ovarian failure e.g. anatomic anomalies, pelvic irradiation, enzyme defects, autoimmune disease, infection
      - Secondary-hypothalamic/pituitary disorders e.g.-DM, CF, anorexia, excessive exercise, endocrine disease
    - Androgen excess e.g.-polycystic ovaries, adrenal androgen excess (Cushing's)
    - Ovarian tumors
Amenorrhea

- Etiology - Secondary amenorrhea; many causes same as primary
  - Pregnancy - most common
  - Hypothalamic, pituitary and adrenal disorders
  - Tumors
  - Chromosomal abnormalities (Turners);
  - Endocrinopathies
  - Chronic illness - esp... with weight loss
  - Conditions affecting gonadal function
  - Pharmacological agents (discontinuance of birth control pills, use of tranquilizers)
  - Significant emotional stress or strenuous exercise programs - especially with runners, ballet dancers, and gymnasts, major weight loss
  - Uterine dysfunction after abortion, infection or C-Section
  - Hysterectomy
Amenorrhea

- **Signs and Symptoms**
  - Primary - no history of menses in adolescence; may have symptoms of stress, adrenal dysfunction or gonadal disease, pituitary or hypothalamic disease, chronic illness including eating disorders, chromosomal abnormalities, pregnancy, cyclic abdominal pain without menstruation in pseudoamenorrhea.
  - Secondary - sudden or gradual cessation of menses; symptoms vary depending on etiology; may exercise excessively.
Differentials-

- Determine if underlying etiology due to chronic illness, CNS disease, endocrinopathy
- Distinguish primary amenorrhea due to constitutional or familial etiology, from pregnancy
- Distinguish secondary amenorrhea due to pregnancy, underlying disease or disorder
- Determine amenorrhea vs. pseudoamenorrhea (menstruation occurs but obstruction prevents release of menstrual blood)
Physical Findings

- May have normal exam, or signs of chronic disease, syndromes, may show signs of pregnancy
- May lack development of secondary characteristics or normal sexual development
- Pelvic exam may show pregnancy, reproductive system abnormalities e.g. cervical atresia, imperforate hymen
Amenorrhea

- Diagnostic Tests/Findings
  - Pregnancy test
  - Careful family history to rule out constitutional/family delay,
  - Consultation with physician and/or referral to specialists as needed.
Amenorrhea

Management and Treatment

- Constitutional/family primary amenorrhea – educate, reassurance, monitoring
- Amenorrhea associated with other etiologies requires further evaluation, physician consultation or referral to specialist
- Treatment directed at management or correction of underlying cause of abnormal menstrual process
- Sensitivity to significant concern of delayed development by child and family—very important
- Parent and child education to cause and treatment
- Genetic counseling-PRN