**TURNER’S SYNDROME**

- Group of X chromosome abnormalities. **Females c absent/nonfunctional sex chromosome**
- 1 in every 2500 female newborns.

- **Hallmarks:** Hypogonadism ⇒ primary amenorrhea or early ovarian failure*, delayed secondary sex characteristics (absence of breasts), infertility, short stature (c normal growth hormone levels), webbed neck, edema, low hairline, low set ears, widely spaced nipples. Renal & cardiovascular abnormalities.

**PATHOPHYSIOLOGY**

- **Mosaicism:** (67-90%). Some cells have a combination of X monosomy (45,XO – missing X chromosome), some cells that are normal (46,XX), cells with partial monosomies (X/abnormal X), or cells that have a Y chromosome (46,XY).
- 45, X0 = absence/nonfunction of 1 of the X chromosome ⇒ gonadal dysgenesis.

**CLINICAL MANIFESTATIONS**

- **Hypogonadism:** absent/nonfunctional sex chromosome (45XO) ⇒ gonadal dysgenesis ⇒ rudimentary, fibrosed ovaries ⇒ primary amenorrhea* in 80% (menopause before menarche) or early ovarian failure c secondary amenorrhea (20%), delayed secondary sex characteristics (absence of breasts), infertility in a majority of patients.

- **Physical Examination:** short stature, webbed neck, prominent ears, low posterior hairline, broad chest with hypoplastic widely-spaced nipples, (congenital lymphedema seen in neonates), short 4th metacarpals, high-arched palate, nail dysplasia. May have hearing loss.

- **Cardiovascular:** coarctation of the aorta (30%), mitral valve prolapse, bicuspid aortic valves, aortic dissection, hypertension.

- **Renal:** congenital abnormalities (ex horseshoe kidney), hydronephrosis.

- **Endocrine:** osteoporosis, hypothyroidism, Diabetes Mellitus, dyslipidemias

- **GI:** telangectasias (may present with GI bleeding), IBD, colon cancer, liver disease.

**DIAGNOSIS:**

1. Karyotyping – definite diagnosis. 45, XO, mosaicism, or X chromosome abnormalities.
2. High serum FSH & LH levels.

**MANAGEMENT**

1. Growth hormone replacement (may increase final height).
2. Estrogen/Progestosterone replacement to cause pubertal development

**KLINFELTER’S SYNDROME**

- **Males c an extra X chromosome = 47, XXY** karyotype (extra sex chromosome due to failure of separation of sex chromosome) ⇒ males c hypogonadism & small testes.
- 1:800 births. MC chromosomal abnormality with hypogonadism.

**CLINICAL MANIFESTATIONS**

- Normal appearance before puberty onset ⇒ tall stature (thin & long-limbed). In adulthood, they become obese. ±scoliosis, ataxia, mild development delays, expressive language disorders.

- **Hypogonadism:** small testicles & infertility (azoospermia), gynecomastia, scarce pubic hair.

**DIAGNOSIS**

- 47, XXY karyotype, low serum testosterone.
FRAGILE X SYNDROME

• X-linked genetic disorder that is the MC gene related cause of autism. The loss of function of the fragile X mental retardation 1 gene → lack of the production of the Fragile X mental retardation protein.

CLINICAL MANIFESTATIONS
• Younger males: mitral valve prolapse, hyperextensible joints, hypotonia, soft skin, flexible flat feet, macrocephaly.
• Older males: long and narrow face, prominent forehead & chin, large ears, macroorchidism (enlarged testicles).
• Behavioral: wide range of manifestations expressive language deficits > receptive.

DOWN SYNDROME (TRISOMY 21)

• Three copies of chromosome 21 (Trisomy 21) or 3 copies of a region of the long arm of chromosome 21.

CLINICAL MANIFESTATIONS
• Head & neck: low-set small ears, flat facial profile/flat nasal bridge, open mouth, protruding tongue, upslanting palpebral fissures, folded or dysplastic ears, brachycephalic, epicanthic folds, excessive skin at the nape of the neck, short neck.
• Extremities: transverse, single palmar (Simian) crease*, hyperflexibility of the joints, short broad hands, space between the 1st & 2nd toes (sandal gap)
• Neonates: Poor Moro reflex, dysplasia of the pelvis, hypotonia, anomalous ears. May develop a transient neonatal leukemia.
• Intellectual impairment: wide range of presentation
• Congenital heart disease: atrioventricular septal defects, ventricular septal defect, atrial septal defect, tetralogy of Fallot, patent ductus arteriosus.
• GI: duodenal atresia or stenosis, Hirschprung’s disease

EHLERS DANLOS SYNDROME (EDS)

• Genetic disorder of collagen synthesis leading to skin hyperextensibility, fragile connective tissue, joint hypermobility. 6 subtypes (ex classic, hypermobility & vascular).

PATHOPHYSIOLOGY
1. Abnormal production of collagen (especially type IV) affecting tendons, ligaments, skin blood vessels, eyes & other organs. Often die from ruptured aneurysms.

CLINICAL MANIFESTATIONS
1. Skin hyperextensibility* (ability to stretch skin >4cm in areas such as neck & forearm). Hyperextensibility increases c age.

2. Fragile connective tissue*: mitral valve prolapse. Classic skin findings: smooth velvety/doughy fragile skin* (skin bruises easily* or may split c trauma, widened atrophic scars, delayed wound healing). Upper eyelid may evert easily (Metenier’s sign).

MARFAN SYNDROME

• *Systemic connective tissue disease* (autosomal dominant) ⇒ *cardiovascular, ocular & musculoskeletal findings* in addition to multi-systemic involvement.

**PATHOPHYSIOLOGY**

• Mutation of the fibrillin-1 gene ⇒ TGBFR (transforming growth factor beta) mutation & misfolding of the protein fibrillin-1, leading to weakened connective tissues.

**CLINICAL MANIFESTATIONS**

1. **Cardiovascular:** mitral valve prolapse (85%), aortic root dilation ⇒ aortic regurgitation, aortic dissection & aortic aneurysms. *Associated c progressive aortic dilation*.
2. **Musculoskeletal:** TALL STATURE*, arachnodactyly (long, lanky fingers, arms & legs), scoliosis, anterior chest deformities: **PECTUS CARINATUM* (protrusion of chest and ribs/pigeon chest) or excavatum (breastbone appears sunken in chest). May develop spontaneous pneumothorax easily. *Joint laxity*
3. **Ocular:** ectopia lentis* (malposition or dislocation of the lens of the eyes) reduced vision extreme near sightedness.

*Common in MS & EDS:* aortic dilation, scoliosis, joint hypermobility/laxity, autosomal dominant Marfan’s only: tall stature, lens dislocation, pectus carinatum, progressive aortic dilation, overgrowth of the long bones, lack of the classic skin findings seen in EDS

FETAL ALCOHOL SYNDROME

• Due to maternal alcohol use during pregnancy.

**CLINICAL MANIFESTATIONS:**

• children are often born small and remain relatively small throughout their lifetime. Associated c developmental delays, congenital abnormalities of organs.
• **Small physical findings:** small distal phalanges, thin upper lip, microcephaly, long. Smooth philtrum.

NEURAL TUBE DEFECTS

• *Associated c maternal folate deficiency*.* Includes drugs that inhibit folate (methotrexate, valproic acid, phenytoin, sulfasalazine).
• **Clinical:** sensory deficits, paralysis, hydrocephalus, hypotonia.

**ANENCEPHALY:** failure of closure of the portion of the neural tube that becomes the cerebrum.

**SPINAL BIFIDA:**

• Incomplete closure of the embryonic neural tube ⇒ nonfusion of some of the vertebrae overlying the spinal cord ⇒ may lead to protrusion of the spinal cord through the opening. MC seen at the lumbar & sacral areas of the spine. 3 types:
• **Myleomeningocele:** MC type. Spinal cord herniates through opening. Often leads to disability in most cases.
• **Occulta:** Mildest form. The defects are too small for the spinal cord to herniate through. Overlying skin ± normal, have some hair growing over it, dimple in the skin or birthmark.
• **Meningocele:** meninges may herniate through the gap in the vertebrae.

**DETECTION:**

• ↑α -feto protein & acetycholinesterase.
DEVELOPMENTAL HIP DISLOCATIONS

• **BARLOW MANEUVER:** maneuver to see if hip can be dislocated c posterior pressure (by adducting a fully flexed hip with posterior thigh pressure). Positive if dislocation.

• **ORTOLANI MANEUVER:** maneuver c medial aspect of the flexed knee c thumb fully abduct the hips as the hip is brought to full adduction feel for spasm or a clunk.

PEDIATRIC FUNCTIONAL MURMURS

**Innocent (functional, physiologic) murmurs:** non-pathologic, “functioning” murmurs of heart moving through the chambers. Innocent murmurs tend to be soft, not associated with symptoms, position-dependent often occurs during systole, not associated with an abnormal S2. Systolic murmurs may be innocent or pathologic. Diastolic murmurs are almost always pathological.

1. **STILL’S MURMUR:** MC innocent murmur. Usually heard from 2 years of age - preadolescence. *Early to mid-systolic musical, vibratory*, *noisy, twanging high-pitched* murmur **Loudest in** inferior aspect of the **left lower sternal border & apex.** May radiate to the carotid. Thought to be due to vibration of the valve leaflets. Other murmurs can mimic it ex. small VSD or subaortic stenosis (HCM).
   - Diminishes c sitting, standing or Valsalva. Accentuated c fever, supine position

2. **VENOUS HUM:** 2nd MC innocent murmur. Due to the sound of the blood flowing from the head & neck into the thorax. Grade I or II, harsh systolic ejection murmur (may be continuous – if heard in diastole, it is the only non pathologic diastolic murmur). Localizes to upper left sternal border (infraclavicular).
   - Accentuated with patient supine & diminishes with Valsalva, gentle pressure on the jugular veins or when head is turned fully to the contralateral shoulder.

3. **PULMONARY EJECTION MURMUR:** due to blood flowing into the pulmonary artery. Commonly heard in in older children & adolescents. Best heard in **mid-systole** in the **second left intercostal space** (or superior aspect of the left lower sternal border). Harsh quality.

CONGENITAL CYANOTIC HEART DISEASES

1. **Truncus arteriosus 1 vessel** instead of normal 2 vessels (aorta & pulmonary artery)

2. **Transposition of great arteries 2 vessels:** aorta & pulmonary artery switched.

3. **Tricuspid atresia (3= tri)** absence of tricuspid valve leads to a hypoplastic right ventricle. An ASD AND VSD must be present for blood to flow out of the right atrium.

4. **Tetralogy of Fallot (4- tetra):** 4 things present: 1) pulmonary stenosis 2) right ventricular hypertrophy 3) overriding aorta 4) VSD.

5. **Total Anomalous Pulmonary Venous Return (5 vessels involved):** all 4 pulmonary veins connect to the 1 SVC instead of the left atrium.

Hypoplastic left heart syndrome is associated with mitral valve &/or aortic valve atresia
### ATRIAL SEPTAL DEFECT

<table>
<thead>
<tr>
<th>DEFINITION</th>
<th>PDA</th>
<th>Coarctation of Aorta</th>
<th>Tetralogy of Fallot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hole in atrial septum (opening between right &amp; left atrium).</td>
<td>Communication between descending thoracic aorta &amp; pulmonary artery</td>
<td>Congenital narrowing of descending thoracic aorta</td>
<td>Constellation of sx MC cyanotic CHD</td>
</tr>
</tbody>
</table>

#### SHUNT

<table>
<thead>
<tr>
<th>Left to Right (Noncyanotic)*</th>
<th>Left to Right (Noncyanotic)*</th>
<th>Noncyanotic or Cyanotic (in some)</th>
<th>RIGHT TO LEFT (Cyanotic)*</th>
</tr>
</thead>
</table>

#### ETIOLOGIES PATHOPHYS.

<table>
<thead>
<tr>
<th>Most patients asymptomatic or minimal sx until &gt;30y</th>
<th>Poor feeding, weight loss, frequent lower resp tract infections, pulmonary congestion</th>
<th>Secondary HTN*, bilateral claudication, cardiomegaly, CHF in adults</th>
<th>Blue Baby syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescents/Adults: exertional dyspnea, easy fatigability, palpitations, atrial arrhythmias, syncope, heart failure.</td>
<td>Eisenmenger’s syndrome: pul HTN (\Rightarrow) switches from left to right (noncyanotic) &amp; becomes right to left shunt (cyanotic).</td>
<td>Eisenmenger’s syndrome: seen c PDA, VSD, TOF ((\pm) ASD)</td>
<td>Eisenmenger’s syndrome: seen c PDA, VSD, TOF ((\pm) ASD)</td>
</tr>
<tr>
<td>Systolic ejection crescendo-decrescendo flow murmur @ PULMONIC AREA* (left upper sternal border). Sounds like PS (functional flow murmur)</td>
<td>Continuous machinery murmur* loudest @ pulmonic area</td>
<td>Systolic murmur that RADIATES TO THE BACK/SCAPULA/CHEST*</td>
<td>Harsh holosystolic murmur @ left sternal border (sounds like Pulmonic stenosis)</td>
</tr>
<tr>
<td>Widely split fixedSz* does not vary c respiration.</td>
<td>Wide pulse pressure: bounding peripheral pulses*</td>
<td>BP UPPER &gt; LOWER EXTREMITIES*.</td>
<td>An associated patient ductus arteriosus increases survival (because it allows for mixture of systemic &amp; pulmonary blood).</td>
</tr>
<tr>
<td>Loud Sz, hyperdynamic RV*</td>
<td></td>
<td>Delayed/Weak Femoral Pulses* (decreased flow distal to obstruction)</td>
<td></td>
</tr>
</tbody>
</table>

#### DIAGNOSIS

<table>
<thead>
<tr>
<th>CXR:</th>
<th>ECG:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiomegaly</td>
<td>LVH</td>
</tr>
<tr>
<td>Incomplete RBB (rsR’ in V1, RAD) RVH, RAE</td>
<td>(Left Vent. Hypertrophy)</td>
</tr>
<tr>
<td>ECG:</td>
<td>LAE</td>
</tr>
<tr>
<td>LVH</td>
<td>(L. atrial enlargement)</td>
</tr>
<tr>
<td>CXR:</td>
<td>ECG:</td>
</tr>
<tr>
<td>RIB NOTCHING*: (\Rightarrow) collateral circulation via intercostals</td>
<td>LVH*</td>
</tr>
<tr>
<td>3 SIGN*: Reverse “3” or “E” sign on barium swallow</td>
<td></td>
</tr>
<tr>
<td>ECG:</td>
<td>Angiogram: gold standard*</td>
</tr>
<tr>
<td>LVH*</td>
<td></td>
</tr>
<tr>
<td>CXR:</td>
<td>ECG:</td>
</tr>
<tr>
<td>- BOOt-SHAPED HEART*</td>
<td>- RAD, RVH*</td>
</tr>
</tbody>
</table>

#### MANAGEMENT

<table>
<thead>
<tr>
<th>Surgical correction</th>
<th>IV indomethacin if preterm* (closes PDA), Surgical correction</th>
<th>Surgical Correction</th>
<th>Surgery, PGE1 infusion: prevents ductal closure if patient is cyanotic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous closure likely</td>
<td></td>
<td>Balloon angioplasty, PGE1</td>
<td></td>
</tr>
</tbody>
</table>

### Ventricular Septal Defect:

harsh systolic murmur best hear at lower sternal border (MC type of CHD). May have combined Right ventricular hypertrophy & Left ventricular hypertrophy.

TOGA: Right to Left shunt (cyanotic) in newborns. CXR: Classic triad: 1* egg on a string* 2* pulmonary vascular congestion 3* mild cardiomegaly
ACUTE BRONCHIOLITIS

**BRONCHIOLITIS**: Lower respiratory tract infection of small airways ⇒ proliferation/necrosis of bronchiolar epithelium produces obstruction from sloughed epithelium & increased mucous plugging, submucosal edema leading to *peripheral airway narrowing & variable obstruction*.

- Highly contagious & is transmitted by direct contact with secretions and self-inoculation by contaminated hands via eyes & nose. Occurs typically in fall to early spring.

- *Respiratory Syncytial Virus (RSV) MC cause* (50-70%). *RSV part of paramyxovirus family* Other viruses (adenovirus, influenza, parainfluenza); ±mycoplasma pneumonia, chlamydia trachomatis.

**RISK FACTORS**: Infants <2y MC affected (esp ~2 mos). <6mos in age, exposure to cigarettes, lack of breastfeeding, premature (<37 weeks gestation), crowded condition.

**CLINICAL MANIFESTATIONS**: Fever, URI sx 1-2d precedes ⇒ respiratory distress (wheezing, tachypnea, nasal flaring, cyanosis, retractions ±rales).

**DIAGNOSIS**: CXR: hyperinflation, peribronchial cuffing, etc. Nasal washings using monoclonal Ab testing. *Pulse ox single best predictor of dz in children* (<96% admit to hospital).

**MANAGEMENT**:  
1. **Supportive** mainstay of treatment (Humidified O₂, IV fluids, acetaminophen/ibuprofen for fever, mechanical ventilation if severe).  
2. **Medications play limited role**: ± β-agonists, ± nebulized racemic epinephrine (if albuterol not effective); Corticosteroids not indicated unless h/o underlying reactive airway disease. Ribavirin if severe lung or heart disease, immunosuppressed.

**PREVENTION**: Palivizumab prophylaxis may be used in ↑risk groups*. Handwashing preventative!!

**COMPLICATIONS**: Otitis Media c Strep. Pneumo MC acute cx (Asthma MC cx later in life)*

INFANT RESPIRATORY DISTRESS SYNDROME

**IRDS** (hyaline membrane disease): disease of premature infants 2ry to insufficiency of surfactant production* & lung structural immaturity. MC single cause of death in 1st month of life

Surfactant production begins 24 – 28 weeks. By 35 weeks enough surfactant is produced.

**RISK FACTORS**: Caucasian, males (2x MC), C-section delivery, perinatal infections, multiple births (especially if premature), maternal diabetes (hyperglycemia delays surfactant production).

**CLINICAL MANIFESTATIONS**: usually presents shortly p partum: tachypnea, tachycardia, chest wall retractions, expiratory grunting, nasal flaring & cyanosis. Infant may develop respiratory failure & apnea. Clinical course (c or s treatment) is usually 2-3 days

**DIAGNOSIS**:  
1. **CXR**: bilateral diffuse reticular ground-glass opacities + air bronchograms*, poor expansion. Domed diaphragms.  
2. Histopathology: waxy appearing layers lining the collapsed alveoli. May show airway distention.

**MANAGEMENT**: CPAP, IV fluids, endotracheal tube if severe. *Exogenous surfactant given to open alveoli. If a pregnant woman anticipated preterm delivery, steroids given to mature lungs*
LARYNGEOTRACHEITIS (CROUP)

**Croup:** inflammation of larynx & subglottis 2ry to acute viral infection of upper airway.

- **MC seen from 6mos – 6y** (~15% of children experience croup in childhood).
- **MC in fall & early winter** (coinciding with parainfluenza infections).

**ETIOLOGIES**

- **Parainfluenza virus** MC cause*, Adenovirus, Respiratory Syncytial Virus (RSV), Human coronavirus etc. Rarely seen due to diphtheria (b/c of vaccination).

**CLINICAL MANIFESTATIONS**

- Infection leads to **subglottic larynx/trachea swelling** \( \Rightarrow \) **stridor, “barking” cough, hoarseness.**
  1. "Barking” seal-like cough:* due to narrowed upper airway.
  2. **Stridor:** both inspiratory & expiratory (worsened by crying & agitating child)
  3. **Hoarseness** (due to laryngitis)
  4. **Dyspnea (esp worse at night)**. ± URI symptoms either preceding or concurrent, fever.

**DIAGNOSIS:**

1. Usually clinical dx (once epiglottitis & Foreign body aspiration are excluded). Cultures
2. **Cervical X ray (frontal): STEEPLE SIGN*: subglottic narrowing of trachea (50%).

**MANAGEMENT**

1. **Cool (humidified) air mist.**
2. **Corticosteroids**:* reduces edema & inflammation of the larynx. Supplemental O2
3. **Nebulized epinephrine in moderate to severe cases.** Epinephrine cause vasoconstriction, reducing the fluid buildup in the airspaces and improves edema.

ACUTE EPIGLOTTITIS (SUPRAGLOTTITIS)

**Epiglottitis:** inflammation of epiglottis (thin flap @ base of tongue which prevents food from going into the trachea. Swelling of the epiglottis can interfere with breathing (medical emergency).

- **HAEMOPHILUS INFLUENZAE TYPE B (HiB) MC** (reduced incidence due to Hib vaccination). May rarely be caused by Streptococcus pneumonia, Staphylococcus aureus, GABHS.
- **MC n children** 3mos-6y. Males 2x MC. Occurs in any season

**CLINICAL MANIFESTATIONS:**

"3 D's" – Dysphagia, drooling, distress*, Fevers, odynophagia, inspiratory stridor, dyspnea, hoarseness, tripoding: sitting leaned forward c elbow on lap. Mortality usually secondary to asphyxiation). Non Hib seen more in adults (esp in patients with crack, cocaine use).

**DIAGNOSIS:**

1. **Laryngoscopy: DEFINITIVE DIAGNOSIS*** (direct visualization but may provoke spasm). **If high suspicion, DO NOT attempt to visualize epiglottis with tongue depressor.**
2. **Lateral Cervical Films: THUMBPRINT SIGN*** (swollen, enlarged epiglottis seen).

**MANAGEMENT:**

1. **Supportive & maintaining airway mainstay of tx**: place child in a comfortable position and keep the child calm. Tracheal intubation to protect the airway (usually reserved for severe cases).
2. **Antibiotics: 2nd/3rd gen cephalosporins** (±add penicillin, ampicillin or anti-staphylococcus coverage)
**PERTUSSIS (WHOOPING COUGH)**

**Pertussis (whooping cough): highly contagious infection 2ry to Bordetella pertussis.**

- Rarely seen due to widespread vaccination. Gram negative coccobacillus.

**CLINICAL MANIFESTATIONS:**

1. **catarrhal phase:** URI symptoms 1-2 weeks ➔ 2. **paroxysmal phase:** severe paroxysmal coughing fits *(with inspiratory whooping sound p cough fit)*. Post coughing emesis. The coughing stage may last for up to 6 weeks. Coughing fits may occur spontaneously or provoked by laughing, yawning, etc. 3. **Convalents phase:** resolving of the coughing phase.

**COMPLICATIONS**

*Common cx include pneumonia*, encephalopathy and seizures (↑ mortality in infants due to apnea/cerebral hypoxia).

**DIAGNOSIS:** Nasopharyngeal swab (if done in first 3 weeks of symptom onset)

**MANAGEMENT:**

1. **Supportive tx mainstay** *(Abx has no effect on duration/severity of illness* - only decreases contagiousness of affected patient).

2. **Macrolides drug of choice** *(Erythromycin, Azithromycin)*.

   *Bactrim 2nd line* (if allergic to macrolides).

---

**CYSTIC FIBROSIS**

*Autosomal recessive inherited d/o of defective Cystic Fibrosis Transmembrane Receptor (CFTR) protein prevents chloride transport* (water movement out of cell) ➔ buildup of thick, viscous, mucous in lungs, pancreas, liver, intestines, reproductive tracts ➔ **obstructive lung disease & exocrine gland dysfunction (pancretic insufficiency)***

- ↑ *incidence Caucasians* (1:3,000 live births). Median age of survival 36.8y.

**CLINICAL MANIFESTATIONS:**

- **GI:** meconium ileus at birth* (due to obstruction of intestine c meconium), ↓*fat absorption:* steatorrhea, bulky pale/foul-smelling stools, weight loss, Vitamin A, D, E & K deficiency. Pancreatitis, CF-induced diabetes. FTT in children.

- **Pulmonary:** recurrent respiratory infections, productive cough, dyspnea, chest pain, wheezing, chronic sinusitis.

- Infertility in males (due to abnormal sperm transport).

**DIAGNOSIS**

1. **Chloride sweat test***: increased chloride in pts c Cystic Fibrosis ↑Na/Cl in sweat. 1ry test done
2. **CXR:** bronchiectasis, hyperinflation of the lungs. PFT: obstructive disorder.
3. DNA analysis
4. **Sputum cultures:** often grow Pseudomonas aeruginosa, Haemophilus influenzae, or Staph aureus

**MANAGEMENT**

1. **Airway clearance tx:** bronchodilators, mucolytics, antibiotics, decongestants

2. **Pancreatic enzyme replacement**, Vitamin A,D, E & K supplementation.

3 diseases that may present c meconium ileus is cystic fibrosis, Hirschprung disease, Imperforate anus
KAWASAKI SYNDROME (Mucocutaneous Lymph Node Syndrome)

• *MC in children <5y (Asian children highest risk).* Thought to be an unidentified respiratory agent with a propensity towards vascular tissue.

• *Medium & small vessel vasculitis due to viral pathogen or autoimmunity*

CLINICAL MANIFESTATIONS & DIAGNOSIS:
“warm + CREAM” = fever + 4 of the following 5*
1. *Conjunctivitis: bilateral & nonsuppurative*
2. *Rash: polymorphous* (erythematous or mobiliform or macular)
3. *Extremity (peripheral) changes:* desquamation (especially perineum), edema, erythema of palms & soles, hands & feet induration, Beau’s lines (transverse nail grooves), arthritis.
4. *Adenopathy: cervical lymphadenopathy* (erythematous, nonsuppurative, induration)
5. *Mucous membrane:* pharyngeal erythema, lip swelling & fissures, strawberry tongue

COMPLICATIONS: *coronary vessel arteritis: coronary artery aneurysm*, *myocardial infarction*, pericarditis, myocarditis,

MANAGEMENT: *Intravenous Immune Globulin mainstay of tx, high-dose aspirin* (lowers fever, helps with joint pain, & prevent clot formation); steroids in refractory cases.

COXSACKIE VIRUS

• *Coxsackie virus* part of the enterovirus family. Enterovirus family includes Coxsackie, Rhinovirus, Poliovirus, Echovirus).

• *MC in children <5y.* Spread feco-or oral and oral-orally.

• *MC late summer/early fall. Coxsackie A & B:*

BOTH A & B:
1. *Aseptic meningitis,* rashes, common cold sx.

PRIMARILY COXSACKIE A:
1. **HAND FOOT & MOUTH DISEASE:** mild fever, URI sx, decreased appetite starting 3-5d p exposure ⇒ *vesicular lesions on a reddened base* in oral cavity (buccal mucosa & tongue) ⇒ vesicular lesions on distal extremities involvement 1-2 days p initial sx.

2. **HERPANGINA:** sudden onset of high fevers, **stomatitis:** small vesicles on soft palate & tonsillar pillars (grayish-white) that ulcerate before healing, sore throat.

PRIMARILY COXSACKIE B:
1. **PERICARDITIS & MYOCARDITIS:** Coxsackie virus *MC cause of pericarditis* (50%), *MC cause of myocarditis.*

2. **PLEURODYNIA:** severe pleuritic chest pain c swelling over the diaphragm, headache.

MANAGEMENT: supportive (fluids, antipyretics, topical lidocaine).

*Rashes that affects the palms & soles: Coxsackie (Hand Foot & Mouth), RMSF (esp if wrist), Syphilis (secondary), Janeway lesions, Kawasaki, Measles, Toxic Shock Syndrome, Reactive Arthritis (Keratoderma Blenorrhagica), Meningococcemia*
TYPES OF VACCINES

1. LIVE, ATTENUATED VACCINES:
   Contains a live, weakened version of the organism. Because it is the safest, closest thing to actually having the infection, it induces a good immune response of both **humoral (Antibody) immunity & cell-mediated immunity**. No booster usually need. Cons: they are unstable & must be refrigerated. Because they may become virulent, **live attenuated vaccines are not given to immunocompromised or pregnant pts***.
   - **MMR**: the only live, attenuated vaccine that can be given to HIV patients (if CD4 count >200).
   - **Chicken pox (VZV), Rotavirus**
   - Smallpox, yellow fever, oral typhoid, Franciscella tularensis, oral polio

2. KILLED (INACTIVATED) VACCINES:
   Killed organisms. These stimulate a weaker immune response compared to live attenuated vaccines so, they only induce a humoral (antibody) immunity and so may need booster shots.
   - **Influenza, Rabies, Polio Salk (K= killed** - this is the primary form used in US), Vibrio cholerae, **Hepatitis A Vaccine**

3. SUBUNIT CONJUGATE VACCINES:
   Presents only the essential antigens needed to induce an immune system response (instead of giving the whole organism). Often contain multiple antigens that are linked or "conjugated" to toxoids or antigens that the immature immune system will recognize to recognize bacterium that use their polysaccharide outer coating as a defense. **Made of capsular polysaccharides** so often used for many **encapsulated organisms “SHiN”**.
   - **H. influenza** (capsular polysaccharide), **N. meningitidis**

4. SUBUNIT RECOMBINANT VACCINES:
   A type of subunit vaccine in which recombinant DNA technology is used to manufacture the antigen molecules. For example, Hepatitis B genes that encode for the important antigens into Baker’s yeast. The yeast reproduces the antigens that are the purified.
   - **Hepatitis B vaccine** (HBsAg), **HPV vaccine** (6,11,16 & 18).

5. TOXOID VACCINES:
   Chemically modified inactivated toxins from toxin-producing organisms to allow the body recognize the harmless toxin so it can fight off the natural toxin if exposed.
   - **Tetanus, diphtheria, pertussis**

VACCINE CONTRAINDICATIONS

- **Baker’s yeast**: **Hepatitis B** should be avoided (B – Bakers B- Hepatitis B)
- **Eggs**: Influenza
- **Gelatin**: avoid varicella, influenza
- **Thimerosal**: preservative used in vaccines so should be avoided in multidose vaccines.
- **Neomycin & Streptomycin**: **MMR** (Measles Mumps Rubella) & **inactivated Polio vaccine** should be avoided (Neomycin & Streptomycin are preservatives in these vaccines)

PREGNANCY

*Only vaccines safely given in pregnancy*: diphtheria, tetanus, influenza, HBV

*Avoid live vaccines:*
- **Live vaccines**: MMR, varicella
- **Live attenuated vaccines**: intranasal influenza vaccine (the intramuscular flu vaccine is inactivated form so is safe).
<table>
<thead>
<tr>
<th>TOXINS</th>
<th>CLINICAL EXAM</th>
<th>WORKUP</th>
<th>ANTIDOTES/MGMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACETAMINOPHENO</td>
<td>Toxicity overwhelms liver enzyme capability ⇒ glutathione ⇒ hepatic necrosis</td>
<td>• APAP levels Follow nomogram</td>
<td><em>N-acetylcysteine antidote</em> (glutathione substitute).</td>
</tr>
<tr>
<td></td>
<td>Anorexia, N/V, diaphoresis ⇒ RUQ pain, jaundice, coagulation abnormalities.</td>
<td>• LFT’s</td>
<td><strong>Activated charcoal</strong> esp if c/n 1 hour of ingestion.</td>
</tr>
<tr>
<td>SALICYLATES</td>
<td>• <em>Respiratory alkalosis</em>  due to respiratory stimulation ⇒ AG* metabolic acidosis occurs later. Fever</td>
<td>• Salicylates levels</td>
<td>Activated charcoal</td>
</tr>
<tr>
<td>- Aspirin</td>
<td>• CNS: seizures, coma, encephalopathy</td>
<td>• Metabolic acidosis</td>
<td>Glucose helps c CNS sx</td>
</tr>
<tr>
<td>- Pepto Bismol</td>
<td>• Renal failure, pulmonary edema</td>
<td>• <strong>Hypokalemia</strong> (from urinary K+ loss)</td>
<td>Hemodialysis (if severe)</td>
</tr>
<tr>
<td>- Ben Gay</td>
<td>• Esophageal or stomach perforation, epiglottitis</td>
<td>• EGD to assess for damage</td>
<td></td>
</tr>
<tr>
<td>- Oil of Wintergreen</td>
<td>• Respiratory distress</td>
<td>• Supportive care</td>
<td></td>
</tr>
<tr>
<td>BASES</td>
<td>• Irritated mucous membranes</td>
<td>• Emesis prevention</td>
<td></td>
</tr>
<tr>
<td>- Oven cleaner</td>
<td>• Esophageal or stomach perforation, epiglottitis</td>
<td>• ± small amount of H2O or milk as diluent</td>
<td></td>
</tr>
<tr>
<td>- Drain cleaner</td>
<td>• Respiratory distress</td>
<td>• Gastric lavage or acids contraindicated! (will worsen sx)</td>
<td></td>
</tr>
<tr>
<td>- Bleach</td>
<td>• Irritated mucous membranes</td>
<td>• Supportive tx</td>
<td></td>
</tr>
<tr>
<td>HYDROCARBONS</td>
<td>• <em>Aspiration pneumonitis</em></td>
<td>• CXR: ± pneumonia, PTX, effusion)</td>
<td>±Abx if PNA</td>
</tr>
<tr>
<td>- Gasoline</td>
<td>• Tachycardia, fever</td>
<td>• UA</td>
<td>Avoid emetics or lavage</td>
</tr>
<tr>
<td>- Benzene</td>
<td>• CNS depression</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>- Petroleum</td>
<td>• Mucosal irritation</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>- Kerosene, Motor oil</td>
<td>• Vomiting, bloody diarrhea</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>ANTICHOLINERGICS</td>
<td>• <em>CNS:</em> confusion, delirium, coma, seizure, respiratory depression</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>- Antihistamines</td>
<td>• Tachycardia, HTN</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>- Atropine</td>
<td>• Hot, flushed, dry skin &amp; mucous membranes*</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>- Tricyclic</td>
<td>• *<em>Mydriasis,</em> visual changes</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>antidepressants</td>
<td>• Urinary retention, ileus</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>(TCA’s)</td>
<td>• Anticholinergics have antimuscarinic effects</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Sympathetic Stimulation:</em></td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hyperthermia (no sweating)</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tachycardia, HTN</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Hot, flushed, dry skin &amp; mucous membranes</em></td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mydriasis,*visual changes</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Urinary retention, ileus</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>CNS:</em> confusion, delirium, coma, seizure, respiratory depression</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tachycardia, HTN</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <em>Hot, flushed, dry skin &amp; mucous membranes</em></td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>CHOLINERGICS</td>
<td>• <em>Muscarinic S/E:</em> &quot;SLUDD-C&quot;:</td>
<td>• ECG</td>
<td><strong>Activated charcoal</strong></td>
</tr>
<tr>
<td>- Organophosphates</td>
<td>• Salivation, lacrimation, urination, TGI: diarrhea, emesis, miosis.</td>
<td>• ECG</td>
<td>Whole bowel irrigation</td>
</tr>
<tr>
<td>- Insecticides &amp;</td>
<td>CV: bradycardia, hypotension</td>
<td>• ECG</td>
<td><strong>Physostigmine</strong> (Acetylcholinesterase inhibitor)</td>
</tr>
<tr>
<td>Pesticides</td>
<td>Respiratory: bronchospasm and rhinorrhea.</td>
<td>• ECG</td>
<td><strong>TCA:</strong> supportive. Sodium bicarbonate*, Diazepam for seizures.</td>
</tr>
<tr>
<td>- Chlorthion, Diazinon,</td>
<td>• Nicotinic S/E: Mydriasis, Tachycardia, Weakness, HTN, Fasciculations.</td>
<td>• ECG</td>
<td><strong>Atropine + pralidoxime</strong></td>
</tr>
<tr>
<td>Malathion</td>
<td>Children usually present c nicotinic S/E &quot;Garlic&quot; breath (also seen c arsenic)</td>
<td>• ECG</td>
<td><strong>Atropine (anticholinergic)</strong></td>
</tr>
<tr>
<td>- Sarin gas</td>
<td>• RBC cholinesterase levels</td>
<td>• ECG</td>
<td><strong>Pralidoxime</strong> reactivates cholinesterase enzyme</td>
</tr>
<tr>
<td></td>
<td>• Blood glucose</td>
<td>• ECG</td>
<td>Remove contaminated clothes</td>
</tr>
<tr>
<td></td>
<td>• <em>RBC indices</em></td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Metabolic acidosis</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• UA: assess for renal damage</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• LFT’s</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Liver dysfunction</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td>IRON</td>
<td>• GI: N/V, abdominal pain, coagulopathy, shock, red urine</td>
<td>• ECG</td>
<td><strong>Emesis c gastric lavage</strong></td>
</tr>
<tr>
<td></td>
<td>• RBC indices</td>
<td>• ECG</td>
<td><strong>Whole bowel irrigation</strong></td>
</tr>
<tr>
<td></td>
<td>• Metabolic acidosis</td>
<td>• ECG</td>
<td><strong>Desferoxamine</strong></td>
</tr>
<tr>
<td></td>
<td>• UA: assess for renal damage</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• LFT’s</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Emesis c gastric lavage</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Whole bowel irrigation</td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• <strong>Desferoxamine</strong></td>
<td>• ECG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hemodialysis</td>
<td>• ECG</td>
<td></td>
</tr>
</tbody>
</table>
LEAD POISONING ANEMIA  (PLUMBISM)


CLINICAL MANIFESTATIONS:
1. abdominal pain c constipation, neurologic symptoms:* (ex ataxia, fatigue, learning disabilities, coma, shock), anemia sx, metabolic acidosis, ± asxatic.

DIAGNOSIS:
- Peripheral smear: microcytic hypochromic anemia c basophilic stippling* (dots of denatured RNA seen in RBC’s) & ringed sideroblasts in bone marrow* (iron accumulation in mitochondria due to failure of incorporation of Fe into Hgb). May be normocytic.
- ↑serum lead & ↑serum Fe*, ↓TIBC, ±Ferritin (looks like ACD except it is assoc c ↑serum Fe)!
- X ray: "lead lines"* linear hyper densities @ metaphyseal plates. Lead lines in gums (adults)

MANAGEMENT: remove source of lead. Chelation therapy may be needed if severe.

JAUNDICE

Jaundice: yellowing of skin, nail beds & sclera by tissue bilirubin deposition as a consequence of hyperbilirubinemia. Not a disease but a sign of a disease. Occurs when Bilirubin levels >2.5mg/dL. Palms & soles helpful to evaluate for jaundice in darker skinned individuals.

Etiologies: impaired conjugation (up to 70% of neonates experience jaundice in 1st week of life), ↑bilirubin overproduction (ex. Hemolysis), ↓hepatic bilirubin uptake, biliary obstruction. ↑Bilirubin without ↑LFT’s ⇒ suspect familial bilirubin disorders (Gilbert’s, Dubin-Johnsons) & hemolysis.

GILBERT’S SYNDROME:

- Common benign hereditary d/o c mildly ↓ activity of UGT enzyme. (5% US population).
- Reduced UGT activity (10-30% of normal) ⇒ ↑ind Bili. Also assoc c mild defective bilirubin uptake mechanism.
- CLINICAL: Most asymptomatic. May experience transient episodes of jaundice during periods of stress, fasting, ETOH or illness*.
- DIAGNOSIS: usually incidental finding when the slight ↑isolated INDIRECT bilirubin level c normal liver function values*.
- MANAGEMENT: None needed. Mild, benign disease not associated c sequelae.

CRIGLER NAIJAR SYNDROME:

- Autosomal recessive d/o. Type I – no UGT activity. Type II very little UGT activity (usually asymptomatic). “more severe form of Gilberts”
- CLINICAL MANIFESTATIONS: Type I: jaundice 1st week of life c severe progression in 2nd week leading to kernicterus* = increased bilirubin in CNS & basal ganglia ⇒ deafness, lethargy, hypotonia, oculomotor palsy & death in 15 months if not treated.
- DIAGNOSIS: Isolated INDIRECT (unconjugated) hyperbilirubinemia c normal liver function tests. Type I: Serum bili 20-50mg/dL. Type II often between 7-10mg/dL (II milder than I). Mgmt: Phototherapy, plasmapheresis (in crisis), CaPhos + Orlistat, Liver transplant

DUBIN JOHNSON SYNDROME & ROTOR’S SYNDROME

- Isolated mild conjugated (DIRECT) hyperbilirubinemia due to inability of hepatocytes to secrete conjugated bilirubin (gene mutation MRP2)
- CLINICAL MANIFESTATIONS: mild conjugated (direct) hyperbilirubinemia but can increase with concurrent illness, pregnancy OCP’s. Otherwise asymptomatic. Grossly black liver. Management: None needed. Rotor’s syndrome: mild form (liver not black).
PYLORIC STENOSIS

PATHOPHYSIOLOGY: hypertrophy & hyperplasia of the muscular layers of the pylorus (causing a functional outlet obstruction).

• MC cause of intestinal obstruction in infancy.
• 95% present in 1st 3-12 weeks of life (rare >3mos). MC in whites, males.

CLINICAL MANIFESTATIONS:
1. nonbilious vomiting/regurgitation (70% projectile*), emesis after feeding.
2. signs of dehydration & malnutrition, may develop jaundice.

PHYSICAL EXAM:
1. "olive-shaped"* nontender, mobile, hard pyloris 1-2cm in diameter (palpated especially after the infant has vomited).

DIAGNOSIS:
Ultrasound MC test ordered*. Upper GI contrast study: string sign

MANAGEMENT: Pyloromyotomy

HIRSCHSPRUNG'S DISEASE

Hirschsprung disease: congenital absence of ganglion cells MC in distal colon & rectum (75%). May occur in other parts of the GI tract. Increased risk in children with Down syndrome.

PATHOPHYSIOLOGY:
1. Absence of enteric ganglion cells: Failure of complete neural crest migration during fetal development absence of enteric ganglion cells.
2. Functional obstruction: the aganglionic segment fails to relax, leading to a function intestinal obstruction. MC affects the distal colon (often with a transitional zone in the rectosigmoid colon).
3. Enterocolitis: vomiting, diarrhea signs of toxic megacolon.

CLINICAL MANIFESTATIONS:
2. Enterocolitis: vomiting, diarrhea signs of toxic megacolon (looks similar to sepsis).
3. Chronic constipation: or failure to thrive if minor cases.

DIAGNOSIS:
1. Abdominal X ray: signs of obstruction (decreased or absence of air in the rectum & dilated bowel loops).
2. Contrast enema: transition zone (caliber change) at the area between normal & affected bowel.
3. Anorectal manometry: lack of relaxation of internal sphincter with balloon rectal dissection. Often used as a screening test

MANAGEMENT:
1. Surgical resection of affected bowel
ERYTHEMA TOXICUM

Thought to be due to immune system activation. Seen in up to 70% of neonates.

CLINICAL MANIFESTATIONS:
Small erythematous macules or papules \(\rightarrow\) pustules on erythematous bases 3-5 days after birth. Does not involve the palms or soles. Individual lesions may spontaneously disappear.
MANAGEMENT: Usually resolves spontaneously 1-2 weeks.

MILIARIA

• **Blockage of eccrine sweat glands** (esp in heat & humid conditions). This leads to sweat into the epidermis & dermis. Increased counts of skin flora (S. epidermis, S. aureus)

TYPES
1. **Miliaria crystallina**: tiny, friable clear vesicles (due to sweat in the superficial stratum corneum). **MC in neonates** (esp 1 week old).
2. **Miliaria rubra**: severely pruritic papules (may develop pustules). Sweat deeper epidermis.
3. **Miliaria profunda**: flesh colored papules (due to sweating in the papillary dermis).

MILIA

• **1-2mm pearly white-yellow papules** (due to keratin retention within dermis of immature skin) especially the cheeks, forehead, chin & nose.
• Usually disappear by 1\(^{st}\) month (may be seen up to 3 months).

DIAPER RASH (DERMATITIS)

PATHOPHYSIOLOGY
1. **Wearing diapers**: contact dermatitis, miliaria, candida.
2. Appear in diaper area as well as other areas: atopic dermatitis, seborrheic dermatitis
3. Affects diaper area irrespective of diaper use: ex scabies, bullous impetigo

RISK FACTORS
1. **Friction, urine & feces, wetness.**

MANAGEMENT
1. Frequent diaper changes q2h or when soiled. Open air exposure. Zinc oxide or petroleum jelly. 1% hydrocortisone (use for <2 weeks). May need topical Abx.
<table>
<thead>
<tr>
<th>VARICELLA (Chicken Pox)</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flu-like sx: fever, h/a, malaise</td>
<td>Rash in DIFFERENT stages simultaneously* (macules, papules, vesicles, crusted lesions)</td>
<td>Vesicles on erythematous base dew drops on a rose petal*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VARIOLA (Small Pox)</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flu-like sx: fever, h/a, malaise</td>
<td>Lesions appear in the SAME stage simultaneously*</td>
<td>Usually does not involve palms/soles</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RUBEOLA (Measles)</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>URI prodrome: 3 C’s:</td>
<td>Cough, coryza, conjunctivitis</td>
<td>Maculopapular brick-red* rash beginning @ hair line/face ⇒ extremities. Lasts 7 days*</td>
<td>Koplik spots* on buccal mucosa*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RUBELLA (German Measles)</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>URI prodrome.</td>
<td>Post cervical &amp; post auricular lymphadenopathy</td>
<td>Maculopapular pink-light red* spotted rash on face ⇒ extremities. Lasts 3 days*</td>
<td>Photosensitivity &amp; arthralgias (joint pains) especially in young women</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROSEOLA (Sixth’s disease)</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 days of high fevers</td>
<td>Child appears well during febrile phase*</td>
<td>Pink maculopapular blanchable rash.</td>
<td>Lasts 1-3 days.</td>
</tr>
<tr>
<td>Only childhood viral exanthema that STARTS ON TRUNK/EXTREMITIES* then goes to face</td>
<td></td>
<td>Assoc c HHV-6 &amp; HHV-7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ERYTHEMA INFECTIOSUM (5th’s disease)</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coryza, fever</td>
<td>Parvovirus B-19*</td>
<td>Red flushed face “slapped cheek appearance” c circumoral pallor ⇒ lacy reticular rash on the body</td>
<td>Arthropathy in older adults</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COXSACKIE A VIRUS (Hand Foot Mouth)</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever, URI sx</td>
<td></td>
<td>Vesicular lesions on a reddened base c an erythematous halo in oral cavity ⇒ vesicles on the hands/feet (includes palms &amp; soles)</td>
<td>Seen especially in summer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Affects hands, feet &amp; genitals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ENDEMIC TYPHUS</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flu-like sx: fevers, chills, severe headache.</td>
<td>Maculopapular rash trunk &amp; axilla ⇒ extremities (spares the face, palms &amp; soles)</td>
<td>Flushed face, hearing loss (CN 8 involvement), conjunctivitis</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SCALDED SKIN SYNDROME</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local S. aureus infection</td>
<td>Fluid filled blisters c positive Nikolsky sign: (sloughing of skin c gentle pressure)</td>
<td>Seen in children &lt;6y</td>
<td>Due to S. aureus exotoxin</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOXIC SHOCK SYNDROME</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>High fever, watery diarrhea</td>
<td>Red rash (diffuse, maculopapular) c desquamation of palms &amp; soles</td>
<td>Seen in adults (ex tampon use, nasal packing left in long) due to Staph aureus exotoxin, Mgmt: IV Abx</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROCKY MOUNTAIN SPOTTED FEVER</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triad: fever, headache, rash</td>
<td>Red maculopapular rash first on wrists/ankles* ⇒ central (eventually palms &amp; soles). Petechiae</td>
<td>Fever c relative bradycardia</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KAWASAKI</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever, conjunctivitis, cervical lymphadenopathy</td>
<td>Strawberry tongue, edema/desquamation of palms &amp; soles. Rash can present in different ways</td>
<td>Rare but dreaded complication is MI &amp; coronary artery involvement</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SCARLET FEVER</th>
<th>PRODROME</th>
<th>RASH</th>
<th>MISCELLANEOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strawberry tongue, sandpaper rash*, facial flushing c circumoral pallor.</td>
<td>Forchheimer spots: small red spots on the soft palate (resolves quickly)</td>
<td></td>
</tr>
</tbody>
</table>
These recommendations must be read with the footnotes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are in bold.

<table>
<thead>
<tr>
<th>Vaccines</th>
<th>Birth</th>
<th>1 mo</th>
<th>2 mo</th>
<th>3 mo</th>
<th>4 mo</th>
<th>6 mo</th>
<th>9 mo</th>
<th>12 mo</th>
<th>15 mo</th>
<th>18 mo</th>
<th>19–23 mos</th>
<th>2–3 yrs</th>
<th>4–6 yrs</th>
<th>7–10 yrs</th>
<th>11–12 yrs</th>
<th>13–15 yrs</th>
<th>16–18 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis B (HepB)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mumps virus (Mumps)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diphtheria, tetanus, &amp; acellular pertussis (DTaP; &lt;7 yrs)</td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3rd dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tetanus, diphtheria, &amp; acellular pertussis (Tdap; ≥7 yrs)</td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4th dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemophilus influenza type b (Hib)</td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5th dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcal conjugate (PCV13)</td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6th dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactivated Poliovirus (IPV) (≥18 yrs)</td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7th dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles, mumps, rubella (MMR)</td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8th dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varicella (VAR)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9th dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatitis A (HepA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human papillomavirus (HPV2; females only; HPV4; males and females)</td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Menengococcal (Hib-MenCY ≥ 6 weeks; MenACWY-D ≥ 9 mos; MenACWY-CRM ≥ 2 mos)</td>
<td>1st dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3rd dose</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** The above recommendations must be read along with the footnotes of this schedule.
CAFÉ AU LAIT MACULES

- Uniformly hyperpigmented macules or patches with sharp demarcation either present at birth (or developing early in childhood). Varying colors from light brown to chocolate brown.
- Due to increased number of melanocytes & melanin in the epidermis.
- Children 6 or more (especially when accompanied with axillary or inguinal freckling) should be evaluated for possible Neurofibromatosis type I.

PORT-WINE STAINS (CAPILLARY MALFORMATION)

- AKA Nevus flammeus, capillary malformations. Port wine stains are vascular malformations of the skin (due to superficial dilated dermal capillaries).
- May also be seen with Sturge-Weber syndrome (especially if localized to the trigeminal area and around the eyelids. Sturge-Weber = glaucoma, hemiparesis contralateral to the facial lesion, leptomeningial venous angioma, seizures, and intracranial calcification).

CLINICAL MANIFESTATIONS:
Pink-red sharply demarcated macules and papules in infancy. Over time, they darken to a purple (port-wine) color and may develop a thickened surface.

They occur most commonly on the head and neck. Usually unilateral

MANAGEMENT:
Pulse laser dye treatment (best if used in infancy).

MONGOLIAN SPOTS

- Due to mid-dermal melanocytes (melanin producing cells) that fail to migrate to the epidermis from the neural crest.
- May be seen in >80% of black, Asians and East Indian infants.

CLINICAL MANIFESTATIONS:
Blue or slate-gray macular lesions most commonly seen in presacral area (may be seen on legs, shoulders, back and posterior thighs as well). May be solitary or multiple.

Spots usually fade over the first few years of life.
STAPHYLOCOCCAL SCALDED SKIN SYNDROME (RITTER DISEASE)

• *MC seen in infants & children <5y of age.*

PATHOPHYSIOLOGY

• *Disseminated exfoliative exotoxins produced by Staphylococcus aureus* (esp. strains 71 & 55). These toxins may cause proteolysis & destruction of the intraepidermal desmosomes of the skin.

CLINICAL MANIFESTATIONS

1. Malaise, fever, irritability, extreme skin tenderness ⇒ *cutaneous, blanching erythema* - bright, skin erythema often starting centrally & spreading diffusely. Erythema is worse in the flexor areas and around orifices - especially the mouth. After 1-2 days ⇒ develop sterile *blisters* ⇒ *Positive Nikolsky sign:* separation of the dermis & rupture of the fragile blisters when gentle pressure applied to the skin. *Desquamative phase* that easily ruptures, leaving moist, denuded skin.

2. Inflamed conjunctiva may be seen (may become purulent) but *mucous membranes are not involved.*

DIAGNOSIS

• Skin biopsy: granular layer splitting. Intact bullae are sterile

COMPLICATIONS

• Secondary infections: sepsis, pneumonia, cellulitis; Excessive fluid loss; Electrolyte imbalances

MANAGEMENT

• *Penicilllase-resistant penicillin:* Nafcillin, Oxacillin
• Clindamycin may be used in addition. Vancomycin if MRSA is suspected.
• Supportive skin care: maintain clean and moist skin, emollients to improve barrier function.
• Fluid & electrolyte replacement.
PRADER-WILLI SYNDROME

- Characterized by prenatal hypotonia, postnatal growth delay, development disabilities, hypogonadotrophic hypogonadism & obesity after infancy

PATHOPHYSIOLOGY

- 75% occurs due to small deletion/unexpression of genes on the paternal chromosome 15 (15q 11-13) from loss of paternal copy of a region of chromosome 15. The maternal copy of the gene is silenced through imprinting although the mutated paternal copy. Majority of cases occur sporadically.

- 25% occurs due to maternal uniparental disomy (a person receives 2 copies of a chromosome or part of a chromosome from one parent & no copies from the other parent).

CLINICAL MANIFESTATIONS:

- **Prenatal:** breech positioning, polyhadramnios (excess amniotic fluid) & reduced fetal movement.

- **Neonates:** severe hypotonia: floppy baby, weak cry, newborns have feeding difficulties: trouble swallowing & suckling, making nasogastric feeding a necessity. Genital hypoplasia, cryptorchidism, depigmentation of the skin & eyes, excessive sleeping, strabismus.

- **Early childhood:** during the first year of life, muscle tone improves and children develop a voracious appetite/hyperphagia (may have aggressive behavior especially related to eating) that leads to obesity if food intake is not controlled. Major milestone & intellectual delays. They often have short stature and reduced levels of growth hormone production. They often develop behavioral & learning difficulties. Skin-picking is increased in these patients. Patients may have lighter skin & hair (relative to other family members).

- **Late childhood/adolescence:** premature development of pubic & axillary hair with delay of the other secondary sex characteristics, epilepsy & scoliosis.

- **Adulthood:** sterility is almost universal in women

PHYSICAL EXAMINATION

- Almond-shaped eyes, high/narrow forehead, thin upper lip c small, down-turned mouth; prominent nasal bridges. Small feet & hands (c tapering of the fingers). Soft skin that easily bruises (may have extreme flexibility). Excess fat (especially truncal obesity).

DIAGNOSIS

- DNA testing (DNA-based methylation studies).

MANAGEMENT

Growth hormone replacement, controlling obesity by monitoring food intake
NEUROFIBROMATOSIS TYPE 1  (von Recklinghausen’s disease)

•Autosomal dominant primarily neurocutaneous disorder due to a mutated NF1 gene (on chromosome 17q 11.2) for the neurofibromin (a tumor suppressor).
•90% of all cases of neurofibromatosis.

PATHOPHYSIOLOGY:
• Loss of neurofibromin ⇒ increased risk of developing benign and malignant tumors. Mutations are highly variable between patients with NF1 and can appear at any age.

CLINICAL MANIFESTATIONS:
• require at least 2 of the following:
  - ≥6 café-au-lait spots: (>5mm in greatest diameter if prepubertal or >15 mm if postpubertal). Café-au-lait spots seen in almost universally. Café-au-lait are flat, uniformly hypopigmented macules that appear during the first year of birth and increase in number during early childhood.
  - Freckling: especially axillary or inguinal freckling. May also be seen in intertriginous areas, such as the neckline. Freckles are usually not present at birth but often appears by age 3 to 5 years.
  - Lisch nodules of the iris: hamartomas of the iris seen on slit lamp examination. Often elevated and tan-colored.
  - ≥2 neurofibromas or ≥1 plexiform neurofibroma. Neurofibromas are focal, benign peripheral nerve sheath tumors (often a combination of Schwann cells, fibroblasts, perineural cells and mast cells) described as small, rubbery lesions with a slight purplish discoloration of the overlying skin. Neurofibromas typically involve the skin but may be seen along peripheral nerves, blood vessels and viscera. Most commonly becomes noticeable after Plexiform neurofibromas are located longitudinally along a nerve and involve multiple fascicles. Plexiform neurofibromas may produce an overgrowth of an extremity.
  - Optic pathway gliomas: may involve the optic nerve, optic chiasm, and postchiasmal optic tracts. Most commonly occurs in younger children (ex. <6y). May develop an afferent pupillary defect. If the tumor is large and involves the hypothalamus, it may be associated with delayed or premature onset of puberty.
  - Osseous lesions: Scoliosis is common (especially thoracic spine), sphenoid dysplasia, long bone abnormalities.
  - 1st degree relative with NF1.
  - Patients often have a short stature.

NEUROIMAGING:
- MRI: unidentified bright objects = hyperintense T2-weighted signals (may be due to demyelination or focal areas of increased water content). Seen most commonly in the basal ganglia, brainstem, cerebellum and subcortical white matter. There are no associated neurologic deficits. Increased brain volume often seen.

MANAGEMENT:
• Optic pathway glioma: regular ophthalmologic screening annually. If any symptoms, an MRI of the brain & orbits should be performed.
• Neurofibromas: not removed unless there are associated complications
NEUROFIBROMATOSIS TYPE 2

- Autosomal dominant associated with multiple CNS tumors [Bilateral CN VIII tumors] (also known as schwannomas, vestibular neuromas or acoustic neuromas), spinal tumors & intracranial tumors.

PATHOPHYSIOLOGY
- Mutation of the NF2 gene which normally produces the tumor suppressor schwannomin (merlin).

CLINICAL MANIFESTATIONS:
1. Neurologic lesions:
   - *bilateral vestibular schwannomas* (95%). Usually develop by 30 years of age. Presents with hearing loss (usually gradual and progressive), tinnitus, and balance disturbances. Over a period of time, they can expand, causing hydrocephalus & brainstem compression.
   - Meningiomas: often multiple (especially in childhood), spinal & intramedullary tumors, neuropathy

2. Optic lesions: cataracts (may cause visual impairment early in childhood), retinal hamartomas

3. Skin lesions:
   - Cutaneous tumors, skin plaques (slightly raised and may be hyperpigmented), subcutaneous tumors that presents as nodules. Café-au-lait spots are seen with less frequency in NF2.

MANAGEMENT:
1. Vestibular schwannomas:
   - Surgery may be needed for complicated tumors, symptomatic tumors.
   - Bevacizumab: may cause shrinkage of the tumor and improvement in hearing. **MOA:** monoclonal antibody against vascular endothelial growth factor (VEGF)

TAY-SACHS DISEASE

- Rare, autosomal recessive genetic disorder most common in Ashkenazi Jewish families of Eastern European descent, Cajuns in Southern Louisiana & French Canadians.

PATHOPHYSIOLOGY
- Mutation of the HEXA gene on chromosome 15 ⇒ deficiency in β-hexosaminidase A ⇒ accumulation of gangliosides in the brain ⇒ premature neuron death & progressive degeneration of neurons.

CLINICAL MANIFESTATIONS
- **Infantile onset:** increases startle reaction, loss of motor skills. At 4-5 months of age ⇒ decreased eye contact, hyperacusis (exaggerated startle reaction to noise), paralysis, blindness, progressive developmental retardation & dementia. **2nd year:** seizures and neurodegeneration. Death usually occurs between 3-4 years.

- **Juvenile onset:** symptoms occurs between the ages of 2-10y ⇒ cognitive and motor skill deterioration, dysphagia, ataxia, spasticity. Often death between the ages of 5-15y.

- **Adult onset:** usually develops symptoms during the 30's and 40's. usually presents with unsteady, spastic gait and progressive neurological deterioration (leading to speech, swallowing difficulties), psychosis.

PHYSICAL EXAMINATION
- Retinal examination: cherry-red spots c macular pallor. Macrocephaly

DIAGNOSIS: Enzymatic assay

MANAGEMENT:
- No treatment. Death usually occurs by the age of 3-4y.