Age Group Terminology

Premature	**Birth before 37 completed weeks gestation**
Neonate	**0-4 weeks**
Infant	**1month-1 year**
Child/children	**1-12 years**
Adolescent	**13-18 years**
Adult	**>18 years**

Neonatology

Hyperbilirubinemia in the Newbornb (Neonatal Jaundice)

- Bilirubin is derived primarily **from the breakdown of heme in the reticuloendothelial system**. Nonpolar and water-insoluble unconjugated bilirubin is conjugated inside liver cells to form Water-soluble conjugated bilirubin.
- Most conjugated bilirubin is excreted through the bile into the small intestine and eliminated in the stool. Some bilirubin may undergo hydrolysis back to the unconjugated fraction by intestinal glucuronidase, and may be reabsorbed (**enterohepatic recirculation**)
- Nearly all newborns develop transient hyperbilirubinemia (serum bilirubin >2 mg/dL) and nearly 65% (two third) are clinically jaundiced (serum bilirubin>5 mg/dL).
- Onset of jaundice in the **first 24 hours of life is always pathological** .
- Kernicterus **(Bilirubin Encephalopathy)** results when indirect (**unconjugated)** bilirubin is deposited in brain cells and disrupts neuronal function. Kernicterus usually does not develop in term infants when bilirubin levels are less than 20 to 25 mg/dL. **The incidence of kernicterus increases as serum bilirubin levels increase to greater than 25 mg/dL**
- Kernicterus may be noted at bilirubin levels less than 20 mg/dL in the presence of some conditions like **sepsis**, **meningitis**, and prematurity .

Unconjugated hyperbilirubinemia

1-Nonpathologic unconjugated hyperbilirubinemia

A-Physiologic Jaundice

- Physiologic jaundice is **an unconjugated hyperbilirubinemia that occurs after the first postnatal day and can last up to 1 week**. Total serum bilirubin (TSB) concentrations peak in the first 3 to 5 postnatal days and decline to adult values over the next several weeks.
- The underlying mechanisms for physiologic jaundice in newborn are related to:

  (a) **Increased bilirubin production** because of elevated red blood cell volume per body weight and a shorter life span.

  (b) **Infants have immature hepatic glucuronosyl transferase**, a key enzyme involved in the conjugation of bilirubin.

  (c) **Increased enterohepatic circulation** in newborn.

B-Breast milk jaundice

- 1-It occurs in some breast-fed infants because **breast milk may contain an inhibitor of bilirubin conjugation or may increase the enterohepatic recirculation of bilirubin because of breast milk glucuronidase**.
- Jaundice appears in the **seventh** day and it **gradually increased in severity** till it reaches its peak during third week. It may persists for several weeks.
- **Interruption of breast feeding and use of formula feeding for 1–3 days causes a prompt decline in bilirubin** (which do not increase significantly after breastfeeding resumes) but is only recommended for infants with serum bilirubin concentrations that put them at risk for kernicterus.

C-Breast feeding jaundice

1-Breastfeeding jaundice occur when a breastfeeding baby **is not getting enough breast milk** , which leads to infrequent bowel movements and increased enterohepatic circulation of bilirubin. It occurs during the first week of life) .

2-**Water and dextrose solutions should not be used** to supplement breastfeeding because they do not prevent hyperbilirubinemia and may lead to hyponatremia.

D-Prematurity.

1-Although preterm infants develop hyperbilirubinemia by the same mechanisms as term infants, **it is more common and more severe in preterm infants and lasts longer** (due to the relative immaturity of the red blood cells, hepatic cells, and gastrointestinal tract).

2-Kernicterus is extremely uncommon. However, kernicterus in preterm infants can occur at lower TSB concentrations .

2-Pathologic Unconjugated Hyperbilirubinemia.

A-Acute Hemolysis:

In this condition, jaundice appears at birth or during the ***first day*** and it is commonly severe. Serum bilirubin level may rise rapidly to reach serious levels where kernicterus may occur.

Kernicterus is a real risk and it may occur when serum bilirubin exceeds the critical level, which depends on the birth weight and the condition of the baby. The cause of haemolysis can be identified by clinical and laboratory evaluation.

1-Rh incompatibility:

- It is the ***commonest*** cause of hemolysis. **It occurs in some Rh positive babies born to Rh negative mothers**. Hemolysis occurs due to placental passage of maternal antibodies active against the fetal red cells. The ***first baby*** is usually not affected as maternal sensitization usually occurs during delivery of the first baby.

- Rh incompatibility can be prevented by injection of ***Rh immune globulin to the mother within 72 hours after delivery*** which prevents her from forming antibodies which might affect subsequent babies.

2-ABO incompatibility:

ABO incompatibility may occur if the **mother's blood type is O** and **the infant's blood type is A or B** . The ***first baby*** may be affected. ***Jaundice*** is not severe. ***kernicterus*** is rare.

B-Neonatal septicemia:

1-Jaundice in septicemia, if present, usually appears between the ***fourth and seventh day*** or later and is usually moderate in severity.

2-The most important clinical signs are the markedly affected ***general condition(***The baby is not doing well with lethargy, poor suckling, fever or hypothermia, ...). Immediate hospitalization and combined parenteral antibiotic therapy are important .

Conjugated Hyperbilirubinemia

- 1-Conjugated (Direct-reacting) hyperbilirubinemia **is never physiologic** and should always be evaluated thoroughly.
- Direct-reacting bilirubin (composed mostly of conjugated bilirubin) **is not neurotoxic** to the infant, but **signifies a serious underlying disorder** involving cholestasis , hepatocellular injury or biliary atresia

Therapy of Indirect (unconjugated) Hyperbilirubinemia

The main concern is to prevent Kernicterus . Treatment options are:

A-Phototherapy. B-Exchange transfusion.

Table 2:bilirubin level at which phototherapy and exchange are indicated

	Phototherapy				**Exchange transfusion**			
	Healthy term baby		**Preterm or any risk factors***		**Healthy term baby**		**Preterm or any risk factors**	
	Mg/dl	**µmol/l**	**Mg/dl**	**µmol/l**	**Mg/dl**	**µmol/l**	**Mg/dl**	**µmol/l**
Day 1	Any visible jaundice**				15	260	13	220
Day 2	15	260	13	220	25	425	15	260
Day 3	18	310	16	270	30	510	20	340
Day 4 and after	20	340	17	290	30	510	20	340

* Risk factors include small size (less than 2.5 kg or born before 37 weeks gestation), haemolysis, and sepsis. ** Visible jaundice anywhere on body on day 1.

A-Phototherapy

- Blue light (not ultraviolet) of wavelength 450 nm **converts the bilirubin in the skin and superficial capillaries into harmless water-soluble metabolites, which are excreted in urine and through the bowel** .

- ❖ The **eyes are covered to prevent discomfort** and additional fluids are given to counteract increased losses from skin.

B-Exchange transfusion

1-This is required if the bilirubin rises to levels considered dangerous despite phototherapy.

2- Twice the infant's blood volume (i.e. 2 x 80 mL/kg) is exchanged over about 2 hours (or 2 x 85 mL/kg) [2].

3-The procedure is carried out **through umbilical vein catheter** [9].

Management of conjugated hyperbilirubinemia

Management depend on the treatment of the causative diseases (if treatable e.g. surgical correction of biliary atresia)

Infections

1-Bronchiolitis

- ❖ **Bronchiolitis,** a lower respiratory tract infection (LRTI) that primarily affects the small airways (bronchioles), is a common cause of illness and hospitalization in infants and young children.
- ❖ Bronchiolitis is seasonal, with **peak activity during winter and early spring**.
- ❖ Bronchiolitis occurs almost **exclusively during the first 2 years of life**, with a peak age at 2 to 6 months.
- ❖ Acute bronchiolitis is characterized by bronchiolar **obstruction with edema, mucus, and cellular debris**.

Etiology

1-Acute bronchiolitis is predominantly a viral disease. **Respiratory syncytial virus (RSV)** is responsible for more than 50% of cases.

2-Other agents include parainfluenza, adenovirus, *Mycoplasma,* and occasionally other viruses.

Clinical Manifestations.

1-The infant first develops a mild upper respiratory tract infection with **sneezing and clear rhinorrhea**. This may be accompanied by diminished appetite and fever.

2-Gradually, respiratory distress ensues, with paroxysmal **wheezy cough**, **dyspnea**, and **irritability**. The infant is often **tachypneic**, which interferes with feeding.

3-As a result of limited oral intake due to coughing combined with fever, infants are frequently **dehydrated**.

Diagnosis

The diagnosis of bronchiolitis is based primarily on **history and clinical findings** .

Treatment

1-The mainstay of treatment is **supportive**. Therapy of bronchiolitis primarily consists of administration of supplemental **oxygen** and replacement of fluid deficits (**hydration**) as needed .

2-The risk of aspiration of oral feedings may be high in infants with bronchiolitis owing to tachypnea and the increased work of breathing. **The infant may be fed through a nasogastric tube**.

3-A number of agents have been proposed as adjunctive therapies for bronchiolitis:

A-Bronchodilators produce modest short-term improvement in clinical features. **Nebulized epinephrine may be more effective than β-agonists**.

B-Corticosteroids, whether parenteral, oral, or inhaled, are widely used despite **conflicting studies**.

C-Ribavirin, is a compound with antiviral activity against RSV administered by **aerosol**, has been used for infants with congenital heart disease (CHD)or chronic lung disease (CLD) although **its benefit is uncertain** [5].

D-Antibiotics have no value unless there is secondary bacterial pneumonia.

Prophylaxis

Palivizumab is a monoclonal antibody to RSV and can be used as prophylaxis initiated just before the onset of the RSV season (monthly IM injection for 5months starting in October) confers some protection from severe RSV disease

2-Pneumonia

1-Pneumonia is defined as **infection of the lung parenchyma** (that is of the alveoli rather than the bronchi or bronchioles) and **characterized by consolidation**. (**Consolidation** is a pathological process in which the alveoli are filled with a mixture of inflammatory exudate, bacteria and WBCs that on chest X-ray appear as an opaque shadow in the normally clear lungs)

Etiology

Viruses alone account for 14–35% of all community acquired pneumonia in childhood. *M. pneumoniae* and *Chlamydophila pneumoniae* are principal causes of **atypical pneumonia** . Common infecting bacterial agents by age are :

1-**Neonates***:* group B streptococcus, *Escherichia coli*, *Klebsiella*, *Staphylococcus aureus*.

2-**Infants***: Streptoccus pneumoniae*, *Chlamydia*.

3-**School age**: *Streptococcus pneumoniae*, *Staphylococcus aureus*, group A streptococcus, *Bordetella pertussis*, *Mycoplasma pneumoniae*.

Clinical Manifestations

In many cases these symptoms are preceded by minor upper respiratory tract infection symptoms. The patient may also be complaining of pleuritic chest pain or abdominal pain. The typical history will have:

- **Temperature** $\geq$ 38.5 ^{0}C;
- **Tachypnea and Shortness of breath**;
- **Cough**; [with sputum production in older children (>7yrs)].

Diagnosis

- Diagnosis of pneumonia in many cases is made based on the **presence of clinical signs and symptoms.**
- **Chest x-ray** are often used to confirm the diagnosis.

Treatment .

1-Oral antibiotics are safe and effective in the treatment of community acquired pneumonia. IV antibiotics are used in children who cannot absorb oral antibiotics or in those with severe symptoms.

Antibiotic therapy for pneumonia

Under 5yrs

Streptococcus pneumoniae is the most likely pathogen. The causes of atypical pneumonia are *Mycoplasma pneumoniae* and *Chlamydia trachomatis*

- *First-line treatment:* amoxicillin
- *Alternatives:* co-amoxiclav or cefaclor for typical pneumonia; erythromycin, clarithromycin, or azithromycin for atypical pneumonia

Over 5yrs

Mycoplasma pneumoniae is more common in this age group

- *First-line treatment:* amoxicillin is effective against the majority of pathogens, but consider macrolide antibiotics if mycoplasma or chlamydia is suspected
- *Alternatives:* if *Staphylococcus aureus* is suspected consider using a macrolide, or a combination of flucloxacillin with amoxicillin

Severe pneumonia

Co-amoxiclav, cefotaxime, or cefuroxime IV

2-Supportive therapies Consider whether any of the following are needed:

• **Antipyretics** for fever.
• **IV fluids**: consider if dehydrated or not drinking.
• Supplemental **oxygen**.