NEWNORN BABIES (NB)

A pregnant woman in her first trimester came for regular antenatal care visit. One of the followings cannot be used by the obstetrician during this visit to assess the gestational age:

a. Date of last menstrual period
b. Expected delivery date
c. quickening (Date of first reported fetal activity and movement)
d. First reported fetal heart sounds
e. Abdominal Ultrasound examination

A 750-g female experienced respiratory distress after a preterm delivery at 27 weeks’ gestation. Pregnancy was uncomplicated, but labor was abrupt and therefore the mother did not receive steroid or penicillin therapy. The baby required intubation and Mechanical Ventilation with 100% $O_2$. The possible causes of respiratory distress include all the following except:

a. Spontaneous Pneumothorax
b. Transient tachypnea of newborn
c. Lobar emphysema
d. Group B streptococcal infection
e. Respiratory distress syndrome

Neonatal period: It is the first 4 weeks of human life (28 days). It is divided into:

Early Neonatal period: is the first week of life (7 days)

Late Neonatal period: > 7- 28 days of life

Perinatal mortality rate (PMR): Is the number of still born babies after 20 weeks of gestation + number of deaths in the first week of life per 1000 total births.

Neonatal mortality rate (NMR): Is the number of infants died during the first 28 days of life per 1000 live births.

NB by gestational age is classified as

PRETERM: NB delivered before 37 completed weeks (<259 days).
FULL TERM: NB delivered between 37-42 weeks (260-294 days).

POST TERM: NB delivered after 42 weeks (>295 days).

NB gestational age is assessed by:

1. History: LMP & EDD and quickening (Date of first reported fetal activity, usually occurs at 16-18 weeks)

2. Examination: Fundal height by obstetrician Examination and Expanded new Ballard score by Pediatrician

3. Investigations: First reported fetal heart sounds (10-12 weeks by Doppler ultrasound examination) and Ultrasound examination (very accurate if obtained before 20 weeks' of gestation).

NB by birth weight on growth charts is classified as:

Small for gestational age (SGA) is NB with birth weight of < 10th centile

Appropriate for age (AGA) is NB with birth weight between 10th - 90th centiles

Large for gestational age (LGA) is NB with birth weight of > 90th centile

Full term neonates normally have the following:

BW: Average 3.250 g (7.5 pounds), 95% (2.500 – 4.250 g)

Length: 50 cm, 95% (46 – 56 cm)

OFC 35 cm, 95% (33 – 38 cm)

Hb 14 – 22 g/ dl

WBC 5000 - 20000 / cm³

BP 80/50 mm Hg

RR 40 – 60 breaths/ minutes

PR 120 – 160 beats/ minutes
Urine passed within 24 hours of birth, max. 40 hours

Meconium passed within 24 hours, max 48 hours, If > 48 hours, think of imperforated anus. Preterm neonates might normally have delayed passage of meconium longer than 48 hours.

LOW BIRTH WEIGHT NEONATES (LBWN):

They are neonates whose birth weight < 2500 grams. They represents 6-7 % of all births, but they accounts for 2/3 of all neonatal deaths.

LBWN could be preterm, SGA, or both

PRETERM NEONATES: Any neonate who was born before 37 weeks completed.

Causes:

1. Maternal causes: maternal age <16 - >35 years, grand parity, smoking, poor housing, short stature, alcohol consumption, chronic maternal diseases like chronic HT, cyanotic CHD, chronic renal diseases, acute infections during pregnancy and drug abuse like cocaine.


4. Fetal causes: Fetal distress, multiple gestations, erythroblastosis fetalis, congenital anomalies, and non-immune hydropis fetalis.

5. Others: Premature rupture of membranes, polyhydraminos, iatrogenic e.g. poorly timed C/S, trauma including surgery.

PROBLEMS OR DISADVANTAGES OR COMPLICATIONS OF PREMATURITY:

1. Birth asphyxia and the need for resuscitation at birth (perinatal depression): due to immaturity of respiratory Centre, thin flail chest wall, and deficiency of surfactant.
2. Thermal instability (hypothermia or hyperthermia): Hypothermia may be due to large S.A compared to BWT, little or no subcutaneous fat, poor muscular activity, poor sweating mechanism, immature heat regulating centre in brain. So protect preterm neonates by putting him under over head heater after delivery and then in incubator.

3. Weak cough, sulking, swallowing and coordination reflexes: so they are prone to aspiration pneumonia if given direct fed before 34 weeks.

4. Respiratory problems: RDS, pneumothorax, apnea and bradycardia, congenital pneumonia and later BPD.

5. Jaundice and liver immaturity: jaundice may be severe leading to kernicterus. Liver immaturity may lead to bleeding, hypoproteinemia--edema.

6. Metabolic: hyper or hypoglycemia, hypocalcaemia, electrolyte disturbances, osteopenia of prematurity, and acidosis, low thyroxin status.

7. CVS: Hypotension due hypovolemia, cardiac dysfunction and vasodilatation due to sepsis. PDA leading to heart failure especially if associated with RDS.

8. CNS: Perinatal CNS depression, increase incidence of IVH, perventricular leukomalacia, seizures, deafness and hypotonia.

9. GIT: intolerance to formula feed especially fat, Paralytic ileus, hyperbilirubinemia, NEC, while breast feeding is protective against NEC.

10. Increase susceptibility to infections: due to very low immunoglobulin levels and impaired cell mediated immunity.

11. Hematologic: Anemia which may be exaggerated by frequent blood samplings. It may be early in the first 2 weeks and late after 6 weeks.
12. Ophthalmologic: Retinopathy of prematurity (ROP) which may lead to Partial or total blindness especially if received high O2 concentration for long period. They require follow up by fundoscopic examinations.

13. Surgical problems: especially inguinal hernia which can be dangerous as it might strangulate at any time so operate as early as possible.

14. Renal problems: hypernatremia, hyponatremia, hyperkalemia, edema Decreased GFR, inability to handle water and solute overload. Fluid and electrolyte management is more difficult.

15. Deficiency of iron, vitamin D: so they require supplement earlier than full term neonates, usually at 6 weeks or even earlier.

CLINICAL FEATURES OF PRETERM NEONATES:

It depends on the degree of prematurity, but generally they got:

- Larger head size compared with the body size
- Pink skin color or even dark red thin transparent skin
- Sleeps almost all the time
- Hypotonic with full extension of legs, arms (frog like posture with poor muscle tone).
- No palpable breast tissue, shapeless soft ears
- Undescended testes in males and widely separated labia in females with labia minora not covered by labia majora
- Weak cry, weak sulking, swallowing, coordination, cough reflexes
- Little subcutaneous tissue
- The body is covered with black soft brittle hair all over the back and shoulder (lanugo hair)
MANAGEMENT OF PRETERM NEONATES:

1. IMMEDIATE POSTNATAL: a. Delivery should be in appropriately equipped and staffed hospital. b. Resuscitation and stabilization with qualified personnel and equipment with O2 supply, temp. Control, etc.

2. NEONATAL MANAGEMENT:
   a. Thermal regulation by controlling environmental temperature with minimal O2 consumption using overhead radiant heater and closed incubator.
   b. Respiratory support by O2 therapy and assisted ventilation by CPAP, surfactant for RDS. CPAP shown to decrease the need for intubation, Mechanical ventilation and surfactant if used early in preterm neonates.
   c. Circulatory support by blood, plasma, saline infusion
   d. Monitoring of HR, PR, RR, TEMP, O2 monitoring by pulse oximetry, transcutaneous measurement of arterial O2, blood gas analysis from peripheral venous or arterial or umbilical arterial cath. keep PaO2 60-90 mmHg, PaCO2 35-50 mmHg. Chest x ray to confirm diagnosis of respiratory diseases like RDS, and to confirm the position of endotracheal tube and umbilical catheters.
   e. Metabolic disturbances: blood glucose is checked regularly and I.V dextrose 5%, 10% given to prevent hypoglycemia. Fluid requirement is variable from 60 ml/kg/day reaching 150-180 ml/kg (<1 kg) in the 5th day, as they have high insensible water loss and to maintain good hydration and normoglycemia.
   f. Minimal handling: Most procedures could be done inside the incubator, and be done as rapid and efficient as possible.
g. Nutrition: parenteral (partial, total TPN) and enteral (NG tube, direct oral). They are unable to suckle and swallow well or tolerate enteral feeding. So start with i.v fluids thenavage (NG tube) then breast or bottle feeding if older than 34 weeks. Breast feeding is better than formula for its nutritional, immunity, protective against NEC, and developmental benefits.

h. Supplements of calcium, phosphate, vitamin D, iron and folic acid started at 6th week. Recombinant human erythropoietin may decrease the need for frequent blood transfusions.

i. Hyperbilirubinemia: it is inevitable in many preterm NB, so monitor TSB, phototherapy and exchange transfusion may be needed early.

j. Infections: they are treated by combination of broad spectrum AB started after strong suspicion of infection and after taking samples for C&S. Consider antistaph for VLWT neonates as they need many procedures, manipulations and increased risk of nosocomial infections.

Prevention of infection: Hand washing is the most important preventive measure. Clean incubators, education of staff, avoid nosocomial infection from infected staff, use of disposable materials, napkins, cloths, isolate infected preterm NB, try to use AB according to results of C&S, avoid new admissions if outbreaks occur, avoid overcrowding of patients and staff.

Immunization of All preterm infants

- Vaccine doses should not be reduced for preterm infants.
- Use thimerosal-free vaccines.
- Intramuscular injections to preterm infants might require a shorter needle than the standard 5/8- to 1-inch needle.
- Immunizations may be given during corticosteroid administration.
- Palivizumab (Synagis) should be given according to the respiratory syncytial virus (RSV) policy.
- Preterm infants should receive a full dose of diphtheria and tetanus toxoids and a cellular pertussis (DTaP), *Haemophilus influenzae* type B (Hib) conjugate, inactivated poliovirus (IPV) at 60 days’ chronologic age, regardless of birth weight and gestational age, as long as they are medically stable and consistently gaining weight.

- Immunizations for preterm infants may be given over 2 or 3 days to minimize the number of injections at a single time.

- Hospitalized infants with birth weight lower than 1000 g should be observed for apnea for 72 hours after the primary series of immunizations.

- Breast feeding by a mother who is positive for hepatitis B surface antigen (HBsAg) poses no additional risk for acquisition of hepatitis B virus (HBV) infection by the infant.

- Infants with chronic respiratory tract disease should receive the influenza immunization annually, before or during the influenza season, once they are 6 months postnatal age or older:
  - The infant should receive two doses of vaccine, 1 month apart.
  - Family and other caregivers should also receive influenza vaccine annually in the fall to protect the infant from exposure.

- The American Academy of Pediatrics recommends routine immunization of infants in the United States with rotavirus vaccine.
  - Preterm infants who are clinically stable should be immunized on the same schedule and with the same precautions as term infants. The infant’s postnatal age must be between 6 weeks and 14 weeks, 6 days postnatal age.
  - Preterm infants who are in the NICU or nursery may be immunized at the time of discharge if they are clinically stable and age-eligible for the vaccine.
  - Any rotavirus vaccine-immunized infant who requires readmission to the NICU or nursery within 2 weeks of vaccination should remain under contact precautions for 2 to 3 weeks after vaccine administration.

**PROGNOSIS:** The prognosis of those infants with only moderate problems adjusting to extra uterine life is good. The risk of mortality and morbidity is decreased with increasing age. Severe impairment occurs in small population. Until recently, infants born before 28 weeks had bad prognosis, but now with intensive care including artificial ventilation, CPAP, IV nutrition, more and more preterm NB are surviving.

For long term sequels, 10-15% of those < 1 500 grams are found to have major handicap such as CP, developmental delay, blindness, and deafness.

**COMPLICATIONS OF PREMATURITY**
Early: RDS, Jaundice, PDA, IVH, Early anemia of prematurity. These occur while the patient in hospital.

Late: ROP, BPD (CLD), Late anemia of prematurity, Rickets, CNS damage. These occur while patient in hospital or after discharge.

EARLY COMPLICATIONS OF PREMATURITY:

1. Respiratory distress syndrome (RDS) or (HMD)

It is a deficiency of pulmonary surfactant (phospholipid- protein mixture ) that decrease surface tension and prevent alveolar collapse. The surfactant is produced by type 2 pneumocyte in increasing quantities from 24-25 weeks of gestation onwards, reaching normal concentration at 34 weeks.

Risk factors that increase or decrease the risk of RDS:

<table>
<thead>
<tr>
<th>Increase risk</th>
<th>Decrease risk</th>
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<tbody>
<tr>
<td>prematurity</td>
<td>Chronic intrauterine stress</td>
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<td>Male sex</td>
<td>Prolonged rupture of membrane</td>
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<td>Familial predisposition</td>
<td>Maternal hypertension</td>
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<td>Elective C/S (Delivery without labor)</td>
<td>Narcotic / cocaine use</td>
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<tr>
<td>Perinatal asphyxia</td>
<td>IUGR or SGA</td>
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<td>Chorioamnionitis</td>
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<td>Multiple gestation</td>
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<td>Maternal diabetes</td>
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Clinical features: Incidence of RDS is about 44% of those with 501-1500 grams. RDS is more in males than females. It is rare in full term neonates except in IDM, hypoxia, acidosis, hypothermia. It worsens in first few hours of life and then progress over 48-96 hours and subsequently improves. They presents with tachypnea, expiratory granting, chest recession with retraction of subcostal, intercostal, suprasternal muscles and diaphragm causing chest indrawing. There is also cyanosis and tachycardia. Recovery is accompanied by brisk diuresis. Death is rare in the first day, but it occurs in 2-7th day due to interstitial emphysema, pneumothorax, pulmonary hemorrhage, and IVH.
**Diagnosis:** Clinical course, chest x ray, blood gases, other Investigations and echocardiogram when needed.

Chest x ray classically show increased reticulogranular pattern of lung field that may obscure the heart border (ground-glass appearance, or white lung). Sometimes air bronchogram is seen.

Blood gases usually show increased paCO2, decreased paO2, and PH.

**Differential diagnosis:**

*Transient tachypnea of newborn (TTN)* may be distinguished by its short and mild clinical course and is characterized by low or no need for oxygen supplementation. More in term baby, especially after Elective C/S. **OTHER D.D, Group B streptococcal infection, Cyanotic congenital heart diseases, aspiration syndromes, primary pulmonary hypertension of newborn (PPHN), spontaneous pneumothorax, diaphragmatic hernia, pleural effusion, lobar emphysema, congenital anomalies of lung.**

**Prevention of RDS:**

1. Prevent premature delivery by:
   a. Appropriate management of high risk pregnancies
   b. Prenatal diagnosis of high risk neonates
   c. Avoid unnecessary or poorly timed caesarian section

2. Antenatal steroid to enhance in utero lung maturity by 2 doses of betamethasone 12 mg i.m at 24 hours interval, administered 48 hours before premature delivery of fetuses between 24-34 weeks of gestation.

3. Prophylactic Surfactant (human or bovine). The first dose is given into the trachea of premature neonate immediately after birth or during the first 15 minutes of life.
Treatment of RDS:

1. Supportive: a. Fluid and nutrition b. Gentle minimal handling
c. Circulatory monitoring d. Temperature control by incubator care.
e. Warmed humidified oxygen. f. CPAP (continuous positive airway pressure) which decrease the need for ventilation and surfactant if given early to preterm neonates. g. Assisted mechanical ventilation via endotracheal tube, if severe RDS or complications like recurrent apnea

2. Specific: By instillation of multidose exogenous surfactant via endotracheal tube, given every 6-12 hours for 1-3 doses, best started in the first 24 hours of life, usually after confirming the diagnosis of RDS by clinical course, chest x ray and blood gas analysis.

Complications of RDS & its intensive care:

1. Endotracheal tube complications like tracheal perforation and trauma, esophageal perforation, laryngeal edema, tube obstruction or kinking, infection, subglottic stenosis

2. Umbilical artery and vein catheterization including too far or too close insertion, perforation.

3. Extra pulmonary extravasations of air like pneumothorax, pulmonary interstitial emphysema, pneumomediastinum


Prognosis: prenatal diagnosis of high risk pregnancies and neonates, improvement in intensive care, antenatal steroid, postnatal surfactant use, and improved modes of ventilations, all above measures, reduce the mortality to < 10%. The mortality rate is inversely related to gestational age. The outlook is better in NB > 1500 grams. 80% of those < 1500 grams have no neurologic or mental sequel. 80-90% of those surviving RDS and its care are normal. The long term prognosis for normal pulmonary function in most infants surviving RDS is excellent.
Name ___________________________ Date of exam ____________________
Hospital No. _____________________ Sex _________________________
Race ___________________________ Length _______________________
Date of birth ____________________ Head circ. __________________

Gestational age __________________

Weight percentiles

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<th>Gestational Age (week)</th>
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Head circumference percentiles

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Classification of Infant*

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<th>Weight</th>
<th>Length</th>
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<td>Appropriate for Gestational Age (AGA) (10th to 90th percentile)</td>
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*Place an "X" in the appropriate box (LGA, AGA, or SGA) for weight, for length, and for head circumference.

Postnatal assessment of gestational age

Neurovascular Maturity

Physical Maturity

Skin

Lungs

Eye

Other

Gestation

Hair

Maturity

Motor

Language

Social