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Ready Reckoner for **PAEDIATRIC PRACTICAL EXAM**

Module 5: **NEWBORN**

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PART A – ANTENATAL PERIOD

First Trimester

Number of antenatal visits: Minimum 4 antenatal visits are recommended for every pregnant woman (NRHM guidelines/ FANC guidelines (WHO 2016).

8 Antenatal Contacts: WHO model

1st trimester : Contact 1 - up to 12 weeks
2nd trimester : Contact 2 - 20 weeks
Contact 3 - 26 weeks
3rd trimester : Contact 4 - 30 weeks
Contact 5 - 34weeks
Contact 6 - 36 weeks
Contact 7 - 38 weeks
Contact 8 - 40 weeks

First trimester blood tests: Advise blood tests for blood grouping and Rh typing, complete blood count, TSH, HIV, Hepatitis B and Syphilis, and Blood sugar.

Periconceptional folic acid (3 months prior to pregnancy): is advised to reduce the risk of neural tube defects. The recommended dose is 400 mcg per day.
(High risk women who have had NTD in previous pregnancy, dose of folic acid is 4 mg/day, however 5 mg preparation is advised due to availability issues).

Causes of fever with rash in first trimester: TORCH infection (refer to section of intrauterine infections)

Radiation exposure in Pregnancy: The fetus is most susceptible to radiation during organogenesis (2-7 weeks) and in the first trimester. A high dose of radiation >0.5 Gy or 50 rad may result in adverse effects including miscarriage, growth reduction, IQ retardation and severe mental retardation.

Examples of some Teratogenic drugs:

- Lithium: Ebstein anomaly
- Thalidomide: Phocomelia
- Warfarin: Fetal warfarin syndrome – nasal hypoplasia, skeletal abnormalities (bone stippling)
- Sodium Valproate: neuro development disorders (autism, ADHD), Neural tube defects, Facial & skull bone malformations (cleft lip /palate)
- Phenytoin: Fetal hydantoin syndrome

Weight gain in pregnancy: women who are normal weight at the start of pregnancy (ie BMI 18.5- 24.9 kg/m2) should aim to gain 11.5- 16 kg (2024 FOGSI guidelines).

First Trimester Scans & Screening:

According to Indian guidelines (MoHFW and FOGSI) a minimum of two to three USG scans are considered standard for a healthy, low risk pregnancy.

1. Dating Scan

At 6 to10–14 weeks : to confirm a viable, intra uterine pregnancy, placentation, no. of fetuses & establish due date.

2. Nuchal Translucency Scan

At 11 to 13 $^{6/7}$ Weeks: When combined with double marker test, this checks for genetic abnormalities like Down syndrome. Subcutaneous edema over nape of neck > 3.5 mm is significantly associated with chromosomal anomalies/aneuploidy.

3. Double Marker Test: It measures free Beta hCG & PAPP-A. A non invasive 1st trimester prenatal test (between 11 to 13 weeks) that screens for fetal chromosomal abnormalities. High Beta hCG & low PAPP-A indicate increased risk of Down, Edwards and Patau Syndromes.

4. NIPT (Non-Invasive Prenatal Test): A maternal blood test done from 10 weeks of pregnancy that analyses cell free fetal DNA to screen for chromosomal abnormalities. It is a screening test which has very high sensitivity for conditions like Downs syndrome (99%). It reduces the need for invasive testing.

Second Trimester

Quickening - It is the first that the pregnant mother feels the movement of foetus. For primi gravida - @20 weeks of gestation, and for multigravida - @16-18 weeks of gestation.

Supplements: Iron and calcium supplements from the second trimester of pregnancy until the onset of labor and at least three months after delivery.

- Elemental iron 100 mg daily for 180 days to prevent anemia, puerperal sepsis, low birth weight and preterm birth.
- Calcium supplements– 1.5g as nutritional supplement and to reduce risk of pre eclampsia.

2nd Trimester Scans & Screening:

Anomaly scans at 18-22 weeks for detection of congenital anomalies and localization of the placenta.

Anomaly Scan: (Targeted Imaging for fetal Anomalies – TIFFA) at 18 to 22 weeks.

Quadruple Test: Prenatal blood test performed between 15-20 weeks. It measures AFP, hCG, uE3 and Inhibin A that evaluate the risk of Down, Edwards and open neural tube defects. In Down syndrome, high hCG & Inhibin and low AFP & uE3 are seen.

Diabetes Pregnancy study group of India (DIPSI) guidelines recommend a single step 75g oral glucose tolerance test (OGTT) to diagnose GDM . A two-hour venous plasma glucose level of >140 mg/dl is considered diagnostic regardless of the last meal.

*Anti-D injection to prevent rhesus alloimmunization to rhesus negative women at 28 weeks of pregnancy.

Third Trimester

3rd trimester scans : growth scans and as part of biophysical profile

Components of biophysical profile :

1. Fetal breathing movements
2. Fetal body movements
3. Fetal tone
4. Amniotic fluid volume
5. NST- non stress test

PART B – PERINATAL PERIOD

6 "Cleans" in delivery room

It is essential to prevent infection at birth by observing six cleans:

1. Clean hands: Appropriate hand hygiene and wearing sterile gloves.
2. Clean perineum: mother's perineum must be cleaned
3. Clean delivery surface: Use a clean and sterile towel to dry and cover the neonate.
4. Clean cut: The umbilical cord should be cut with a clean and sterile blade/scissor.
5. Clean tie: The cord should be clamped with a clean and sterile clamp or tie.
6. Clean cord: keep the cord dry and clean

Temperature Regulation in Delivery Room:

Delivery room temperature is 25-28°C and free from air draft.

- **Delayed clamping of the umbilical cord (DCC):** Umbilical cord clamping must be delayed for at least 60 seconds to allow additional 25-30 ml /kg blood transfer from the placenta to the infant. DCC is associated with improved hematologic status, iron status, and decreased clinical anemia in term infants at 2-6 months.

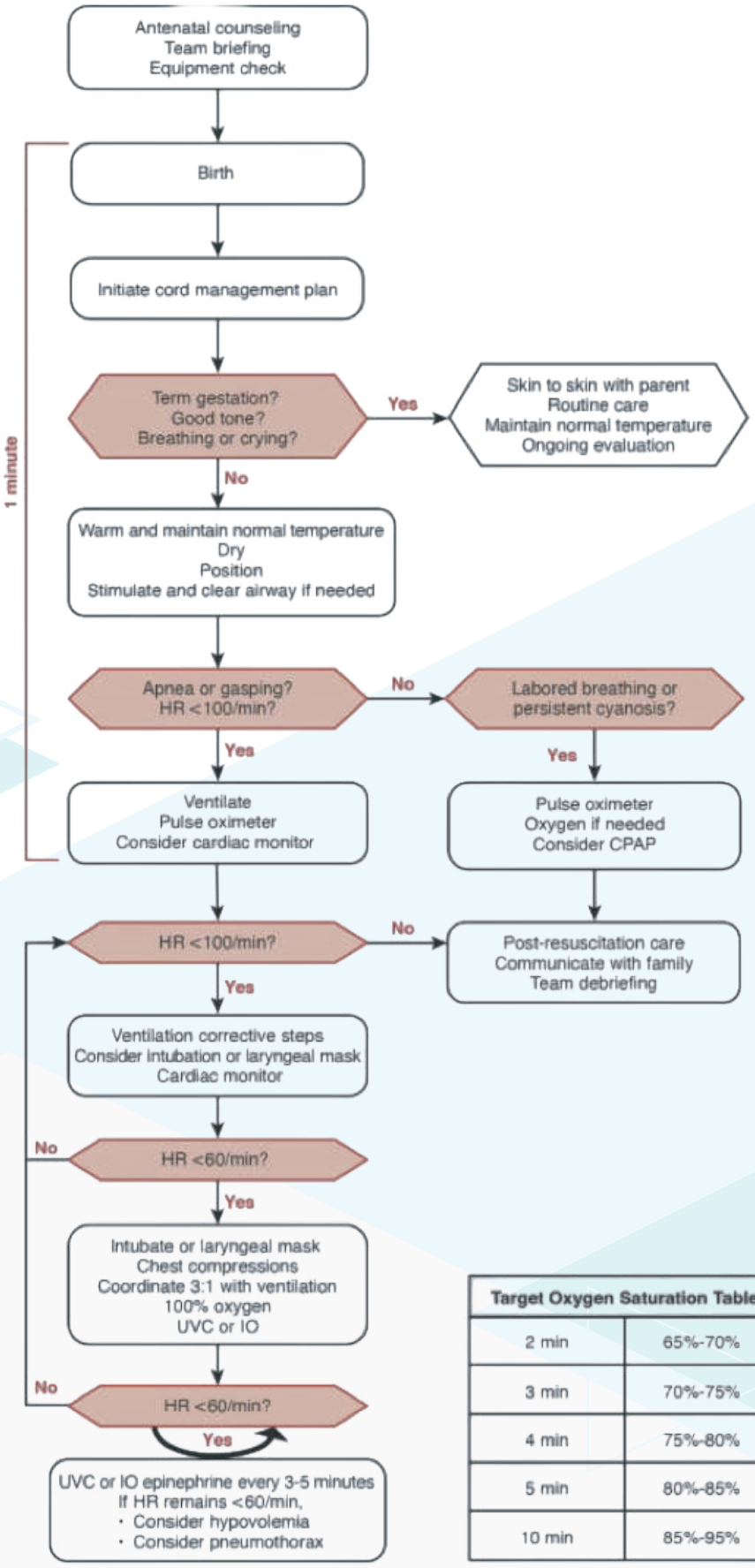
- **Skin to skin contact (STS):** Any infant born vaginally and requiring only routine steps should be placed on the mother's abdomen or chest immediately after the birth for the initial one hour of life to ensure early skin-to-skin (STS) contact with the mother. This will maintain the newborn's temperature, promote early breastfeeding, and decrease the mother's pain and bleeding.

APGAR score (coined by Dr. Virginia Apgar)

	SIGN	0 Point	1 Point	2 Point
A	Appearance	Blue/ pale	Pink body, Blue Extremities	All Pink
P	Pulse	Absent	< 100 BPM	>100 BPM
G	Grimace	No response	Minimal response to stimulation	Cough or sneezes
A	Activity (Muscle Tone)	Limp	Some flexion of Extremities	Active motion
R	Respiration	Absent	Slow (Irregular)	Good Crying

Neonatal Resuscitation as per guidelines

The NRP 9th Edition Algorithm



Target Oxygen Saturation Table	
2 min	65%-70%
3 min	70%-75%
4 min	75%-80%
5 min	80%-85%
10 min	85%-95%

PART 3 - POST NATAL PERIOD

Neonatal Nomenclature

Neonate/newborn: Infant from birth up to 4 weeks (28 days)

Early Neonatal Period: First 7 days of life

Late Neonatal Period: From 7^{th} completed day to 28^{th} day of life.

Live Born: Product of conception irrespective of weight or gestational age that after separation from mother, shows any evidence of life such as breathing, heartbeat, pulsation of umbilical cord or definitive movement of voluntary muscle.

Stillbirth: A fetal death at a gestation age of 20 weeks or more or weighing more than 500 grams is defined as stillborn or stillbirth

Term: newborn delivered between $37^{1/7}$ and $41^{6/7}$ weeks of gestation irrespective of birth weight.
Early term (37 0/7 weeks of gestation through 38 6/7 weeks of gestation),
Full term (39 0/7 weeks of gestation through 40 6/7 weeks of gestation),
Late term (41 0/7 weeks of gestation through 41 6/7 weeks of gestation)

Preterm: Newborn delivered before 37 completed weeks of gestation.

Post Term: baby delivered at or after completed 42 weeks.

Low birth weight (LBW): Baby weighing <2500 grams at birth

Very low birth weight (VLBW): Baby weighing <1500 grams at birth

Extremely low birth weight (ELBW): Newborn baby weighing <1000 grams at birth

Small for gestational age (SGA): neonate with birth weight $<10^{th}$ percentile for that gestational age (according to modified Fenton Chart). Also known as small for date (SFD)

Appropriate for gestational age (AGA): Neonatal with birth weight between 10^{th} and 90^{th} percentiles for that gestational age.

Large for gestational (LGA): neonates with birth weight $>90^{th}$ percentile for gestational age. Also known as large for date (LFD).

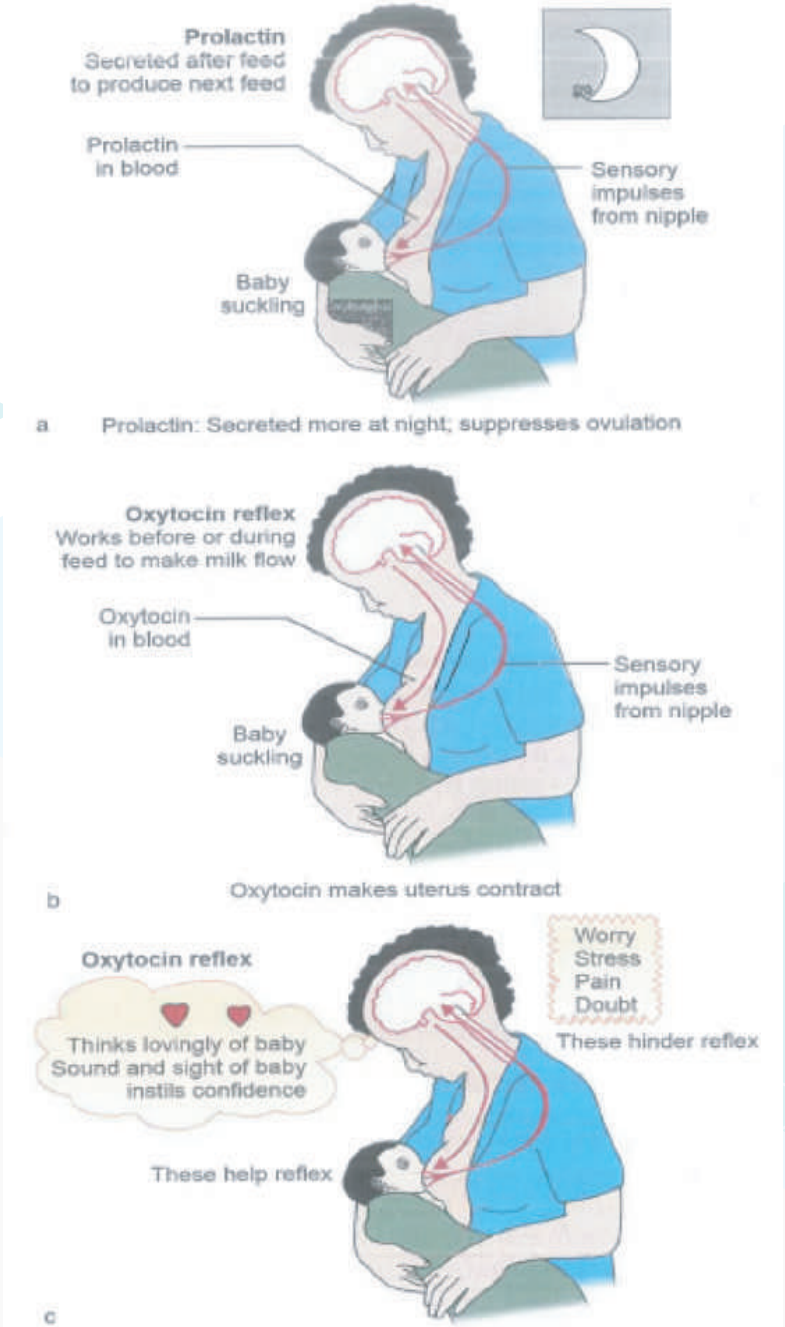
Breast Feeding

Exclusive breastfeeding: A proactive and systematic approach should be followed to initiate, support, and maintain breastfeeding. Ensure BHFI guidelines are being implemented.

New born reflexes related to breast feeding:

- Rooting Reflex
- Sucking Reflex
- Swallowing Reflex
- Coordination between swallowing and breathing

Reflexes in mother which help in breast feeding : Oxytocin reflex, Prolactin reflex

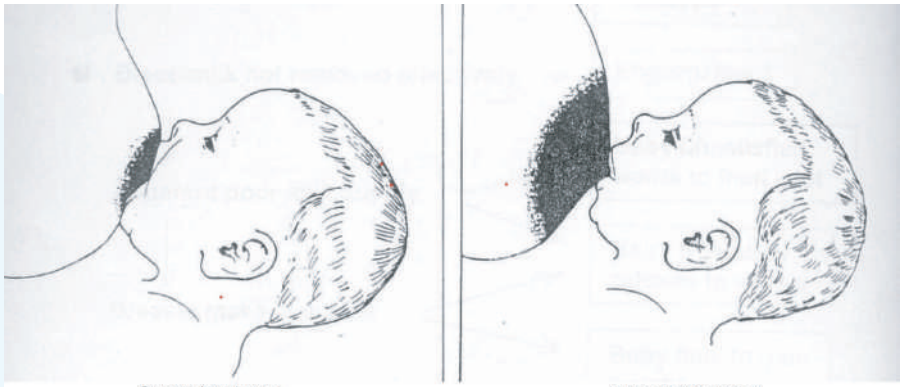


Positioning

- Baby's whole body is supported, head and neck with the mother's elbow and buttocks with mother's hands.
- Baby's head, neck and trunk should be in straight line.
- Baby's body turned towards the mother (abdomen of neonate touching abdomen of mother).
- Baby should be facing the mother with nose opposite to nipple.

Signs of Good Attachment (Latch)

- Mouth should be wide open
- Chin should be touching the breast
- More areola should be visible above than below.
- Lower lip should be everted



Correct Attachment Incorrect Attachment

Assess adequacy of breastfeeding:

- Observe breastfeeding session in each mother baby dyad at least once a day. Assess position and attachment.
- Determine the LATCH score.
- Trend the weight daily. If >10% weight loss, ensure intensive lactation support, check serum sodium, Total Bilirubin/Conjugated Bilirubin, and blood glucose.
- Examine the mother's breast for cracked nipples, engorged breasts. Provide adequate advice and treatment.
- Baby should pass urine at least as many times as number of days in the first week.

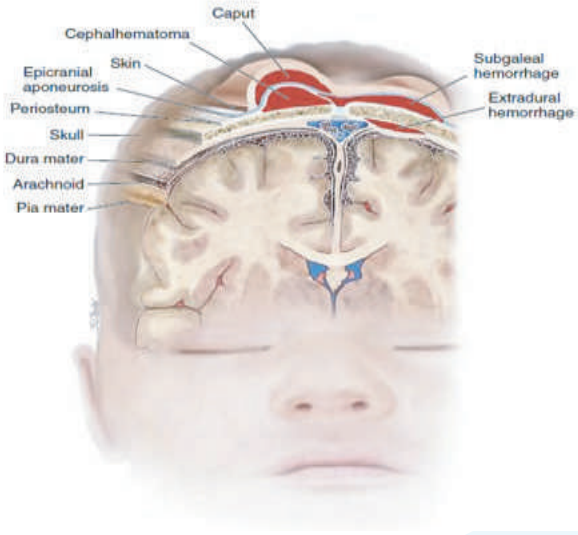
Table 1: LATCH charting system.[5]

Parameters	0	1	2
L: Latch	Too sleepy or reluctant, no latch achieved	Repeated attempts hold nipple in mouth stimulate suck	Grasps breast, tongue down lips flanged rhythmic suction
A: Audible swallowing	None	A few with stimulation	Spontaneous and intermittent <24 hours Spontaneous and frequent >24 hours old
T: Type of nipple	Inverted	Flat	Everted (after stimulation)
C: Comfort (Breast/nipple)	Engorged cracked, bleeding, large blisters, or bruises. Severe discomfort.	Filling reddened/small blisters or bruises mild/moderate discomfort	Soft, non-tender
H: Hold (positioning)	Full assist (Staff holds infant at breast)	Minimal assist (i.e., elevate head of bed; place pillows for support.) Teach one side; mother does other side. Staff holds and then mother takes over	No assist from staff mother able to position/hold infant

Differences between breast milk and cows milk. (refer : nutrition module page no:10)

Birth injuries

Caput and cephalhematoma



Caput succedaneum

Caput, cephalhematoma, subgaleal bleed, extradural hemmorhage

Table 9.9: Differences between caput succedaneum and cephalohematoma

Characteristic	*Caput succedaneum*	*Cephalohematoma*
Incidence	Common	Less common
Location	Subcutaneous plane	Over parietal bones, between skull and periosteum
Time of presentation	Maximum size and firmness at birth	Increasing size for 12–24 hours and then stable
Time course	Softens progressively from birth	Takes 3–6 weeks to resolve and resolves within 2–3 days
Characteristic findings	Diffuse; crosses suture line	Does not cross suture line; has distinct margins
Association	None	Linear skull fracture (5–25%); hyperbilirubinemia

Nerve Injuries

Brachial plexus injury: in large babies frequently with shoulder dystocia.

Duchenne Erb palsy – injury to C5-C6 .
Most common brachial plexus injury , extremities involved lies adducted, prone and internally rotated with flexion of the wrist and fingers. Called waiter's tip posture.

Klumpke paralysis (C7-C8, T1) – rare
Results in weakness of intrinsic muscles of the hand grasp reflex absent.
Cranial nerve and spinal cord injuries result from hyperextension, traction and overstretching with simultaneous rotation. Range from localised neuropraxia to complete nerve or cord transection.

Fractures:
Clavicle fracture. Most frequently fractured bone in the neonate during birth.

Care in PNC ward

- Keep mother & baby together "rooming in". "Bedding in" is preferred if the mother is conscious and able to care for the baby.
- Keep the baby warm by covering head, body and feet with cotton clothes.
- Monitor the temperature and feeding 6 hourly after the first 2 hour.
- Feed the baby on demand, ensure proper position for breastfeeding & advice regarding breastfeeding. All mothers require lactation support. Assess for risk for lactation problems. At least one feed should be observed by the resident doctor for proper position and attachment.
- Confirm whether the baby has passed meconium & urine within the first 24 hrs.
- Check the weight daily and watch for excessive (>10%) weight loss.
- Assess risk factors for severe hyperbilirunemia. Examine the baby twice a day for jaundice. If the baby is icteric on day 1 or below abdomen at any time send for a Total Bilirubin/Conjugated Bilirubin urgently.
- Supplement all newborns with Vitamin D3 400 IU at Discharge.
- Birth vaccinations to be done.
- Newborn screening to be ensured.

Comprehensive Newborn Screening (RBSK)

● Visible Birth Defects: Heat to toe examination at all delivery points for congenital malformations, birth injuries etc. within 24 hours of birth.

● **Functional Birth defects**

- Hearing screening is done by OAE (otoacoustic emission) or AABR (Automated Auditory brain stem response test) to detect congenital hearing loss (24-48 Hrs).
- Critical CHD screening (Pulse Oximetry screening): Check the preductal and postductal pulse oximeter saturations after 24 hours. A screening is considered as "pass" if the SpO2 > 95% and the preductal-postductal saturation difference is less than 3.
- Red reflex screening: using an ophthalmoscope to document bilateral red reflex before discharge.

● **Metabolic birth defects**

- Congenital hypothyroidism Screening: Send either cord blood at birth or post-natal sample at 48-72 hours (Indian Pediatrics 2023) for TSH. Cut off value of >20mIU/L is taken for repeat tesing.
- Collect a filter paper sample for metabolic screening after 48 hours of life. (for G6PD, Galactosemia, Congenital adrenal hyperplasia, Biotinidase deficiency).

● **Hridyam and Shalabham:** Comprehensive newborn screening program by NHM Kerala to detect 4Ds – visible defects at birth, diseases, deficiency and development delays. Key Screenings are visible birth defects, Pulse oximetry for CHDs, OAE for hearing defects, and screening for in born errors of metabolism.

Neonatal Jaundice

Physiological jaundice: jaundice in healthy babies during first few days due to physiological causes

Mechanisms of physiological jaundice:

1. Increased bilirubin production:

- Higher erythrocyte mass
- Shorter RBC life span (90 days vs. 120 days)
- Increased ineffective erythropoiesis
- Increased turnover of non hemoglobin heme proteins

2. Reduced hepatic metabolism

- Defective uptake
- Defective conjugation

3. Increased enterohepatic circulation – due to high levels of intestinal glucuronidase, paucity of intestinal bacteria, and decreased gut motility.

Pathological jaundice

- Any jaundice appearing on day 1 of age, or persisting beyond 2 weeks, or total serum bilirubin >15 mg/dl (95th percentile for postnatal age).
- Conjugated serum bilirubin >1 mg/dl or >20% total bilirubin.
- Rise in serum bilirubin levels >0.5 mg/dl/hr or associated features of BIND (bilirubin induced neurological dysfunction)

Jaundice appearing within 24 hours of age

- Hemolytic disease of newborn : Rh, ABO, and minor group incompatibility
- Intrauterine infections, Hemolytic anemias (G6PD & pyruvate kinase deficiency, Hereditary spherocytosis, Alpha thalassemia)
- Genetic causes like Crigler najjar syndrome

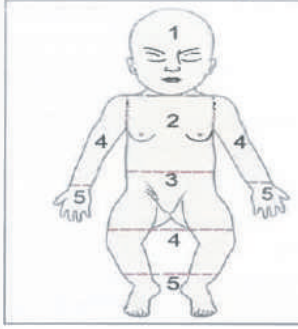
Jaundice appearing between 24 – 72 hours of life

Physiological, inadequate breast feeding, polycythemia, concealed hemmorrhages: cephalohematoma, subgaleal bleed

Jaundice appearing after 72 hours

Septicemia, hypothyroidism, metabolic disorders

Visual assessment of jaundice (Modified Kramer Rule)



Kramer zones	Approximate TSB level
1. Face and neck	5–7 mg/dL
2. Chest and upper abdomen	7–9 mg/dL
3. Lower abdomen and thighs	9–11 mg/dL
4. Legs and arms/forearms	11–13 mg/dL
5. Palms and soles	13–15 mg/dL

Transcutaneous billirubinometer

Complications of neonatal jaundice:
Acute: Acute bilirubin encephalopathy or BIND –(bilirubin induced neurological dysfunction) -refers to clinical manifestations of bilirubin toxicity in neonatal period.
Chronic : Chronic bilirubin encephalopathy or Kernicterus- chronic and permanent sequelae of bilirubin toxicity associated with choreoathetoid cerebral palsy, sensori-neural hearing loss, enamel dysplasia, limited upward gaze (sunsetting sign)

Treatment for neonatal jaundice:
a. Phototherapy :
Mechanisms of action – configurational isomerization, Structural isomerization and photooxidation of bilirubin to water soluble products.

b. In severe cases, exchange transfusion

PART D – PRETERM AND LOW BIRTH WEIGHT BABY

Antenatal steroids for preterm deliveries

Prevention of preterm births is not always possible. The single most important intervention to prevent RDS is antenatal corticosteroids.

- Drugs: Betamethasone or Dexamethasone.
- Dose: 2 doses of betamethasone is administered 12 mg IM at an interval of 24 hours

or 4 doses of dexamethasone, 6 mg each at an interval of 12 hours. Effect starts 24 hours (possibly as early as 4 hours) after the 2nd dose and continues for 7 days.

Complications of preterm babies

Table 119.5	Neonatal Morbidities Associated with Prematurity
RESPIRATORY	
Respiratory distress syndrome (hyaline membrane disease)	
Bronchopulmonary dysplasia*	
Pneumothorax, pneumomediastinum; interstitial emphysema	
Congenital pneumonia	
Apnea	
CARDIOVASCULAR	
Patent ductus arteriosus	
Hypotension	
Bradycardia (with apnea)	
HEMATOLOGIC	
Anemia (early or late onset)	
GASTROINTESTINAL	
Poor gastrointestinal function—poor motility	
Necrotizing enterocolitis*	
Hyperbilirubinemia—indirect and direct	
Spontaneous gastrointestinal isolated perforation	
METABOLIC-ENDOCRINE	
Hypocalcemia	
Hypoglycemia	
Hyperglycemia	
Metabolic acidosis	
Hypothermia	
Euthyroid but low thyroxine status	
Osteopenia	
CENTRAL NERVOUS SYSTEM	
Intraventricular hemorrhage*	
Periventricular leukomalacia*	
Seizures	
Retinopathy of prematurity*	
Deafness	
RENAL	
Hyponatremia	
Hypernatremia	
Hyperkalemia	
Renal tubular acidosis	
Renal glycosuria	
Edema	
OTHER	
Infections* (congenital, perinatal, nosocomial: bacterial, viral, fungal, protozoal)	

IUGR – Intrauterine Growth Restriction

Ponderal Index:

used to differentiate between the symmetrical and asymmetrical babies with IUGR.
(Weight in gram /length in cm3) x 100.
Ponderal Index <2 in asymmetric IUGR and >2 in symmetric IUGR.

Symmetric vs asymmetric IUGR

	Symmetrical	**Asymmetrical**
Prevalence	20-30%	70-80 %
Time of prenatal insult	1st and 2nd trimester	3rd trimester
Etiology	Chromosomal, genetic, teratogenic, and infection	Poor maternal nutritional status, placental insufficiency, hypertensive disorders of pregnancy
Antenatal ultrasound	Proportionately decreased head circumference (HC) , abdominal circumference (AC), biparietal diameter and femur length	Only abdominal circumference decreased, HC and length are spared.
Cell number	Decreased	Normal
Cell size	Normal	Decreased
Post natal anthropometry	All parameters (HC, length and weight) reduced	Reduced weight, HC normal and length low to normal
Ponderal Index	>2	<2
Features malnutrition	Less common	More marked (loose skin folds, scaphoid abdomen, prominent ribs, and triangular facies)

PART E- HIGH RISK NEWBORN

Hypoglycemia

Babies at risk for hypoglycemia

Low birth weight neonates <2500 g, SGA neonates, LGA neonates >4000 g and neonates who are not feeding well with >10 % weight loss,

Other high risk infants:

Infant of a diabetic mother, neonates with perinatal asphyxia, polycythemia, hypothermia, sepsis, following exchange transfusion, infants born to mothers on tocolytics – β blockers -terbutaline, isoxsuprine, chlorpropamide, propranolol.

Infant of diabetic mother

Neonatal complications :

- Fetal Macrosomia: premature birth, difficult delivery, perinatal asphyxia, shoulder dystocia and birth trauma
- Intrauterine growth retardation
- Metabolic : hypoglycemia , hypocalcemia, hypomagnesemia
- Pulmonary : RDS, TTN
- Hematology : polycythemia, hyperbillirubinemia, thrombocytopenia, arterial and venous thrombosis
- Cardiac: asymmetric septal hypertrophy, cardiomyopathy, and congenital heart disease in pregestational DM
- CNS: caudal regression syndrome (overt diabetics)
- GIT- small left colon syndrome

Respiratory distress in newborn

Causes of respiratory distress in newborn

Category	Cause
Respiratory	Respiratory distress syndrome (RDS), Transient tachypnoea of newborn (TTNB), Meconium aspiration syndrome (MAS), Early onset sepsis and congenital pneumonia, Persistent pulmonary hypertension (PPHN),
Cardiac	Congestive cardiac failure (CCF), Patent ductus arteriosus (PDA) in preterm, Transposition of Great arteries
Neurologic	Perinatal asphyxia, Intracranial haemorrhage, birth trauma
Hematology	Severe anemia, polycythemia
GIT	Necrotising enterocolitis, abdominal distension due to any cause
Surgical causes	Tracheoesophageal fistula, Diaphragmatic hernia, Bilateral choanal atresia, Congenital lobar emphysema, Cystic adenomatoid malformation of the lung
Miscellaneous	Sepsis, hypothermia, hypoglycemia, hemmorrhage, metabolic acidosis, shock

Intrauterine infections

Transmission : the intrauterine infections is more likely to be transmitted to the fetus if the maternal infection is primary and occurs later in the pregnancy.The severity of fetal disease is more if infection is acquired in the first trimester.

Clinical findings associated with TORCH infections

Infection	HSM	Cardiac lesion	Skin lesions	Hydro-cephalus	Micro-cephaly	Ocular /intracranial calcification	Hearing deficit
Toxo-Plasmosis	+	-	Petechiae, Purpura, Maculopapular rash	++	+	Chorioretinitis/ Diffuse intracranial calcifications	-
Syphyllis	+	-	Petechiae, Purpura, Maculopapular rash	-	-	Chorioretinitis, gluacoma	-
Rubella	+	PDA, PS, Myo-carditis	Petechiae, Purpura,	+	-	Chorioretinitis, Cataract, micropthalmia	++
CMV	+	+	Petechiae, Purpura,	-	++	Chorioretinitis/ Periventricular calcifications	++
HSV	+	Myo-carditis	Petechiae, Purpura, vesicles	+	+	Chorioretinitis, cataract	+

CMV – cytomegalovirus, HSV- herpes simplex virus, PS- pulmonary stenosis, PDA- patent ductus arteriosus

Congenital rubella syndrome – triad

Sensorineural deafness (66%)

Cataract (78%)

Cardiac defects (58%)- PDA(patent ductus arteriosus

Questions

1. What is the recommended frequency of antenatal visits during each trimester of pregnancy?
2. what is normal AFI in each trimester ?
3. define oliguria and polyuria and the causes for same?
4. Tests for GDM (gestational diabetics mellitus) during pregnancy and cut off values ?
5. Complications of PIH (pregnancy induced hypertension) ?
6. Features of congenital hypothyroidism ?
7. What are the causes of respiratory distress in a term and preterm baby?
8. what are fetal effects of pregnancy induced hypertension ?
9. risk factors for neonatal hypoglycemia ?
10. define Birth asphyxia ?
11. what are the featal complications and malformation secondary to gestational diabetics mellittus ?
12. define SGA (small for gesatational age) and LGA (large for gestational age) babies?
13. symptoms of neonatal sepsis ?
14. what are the screening tests and procedure recommended for normal newborns ?
15. what is CCHD screening ?
16. what are the hearing tests done for screening in neonatal period ?
17. how will to diagnose and evaluate a case of congenital hypothyroidism ?
18. complications of preterm neonate ?
19. what are screening for tchromosomal defects during pregnancy ?
20. Difference betweeen physiological and pathological juandice ?

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