PreMaturity in Newborn

By Ahmad Zulfahmi Sha'ari

Hospital Kemaman

Outlines

- Definition
- Classification
- Causes
- General measures of prematures
- Fluid & Nutrition & Supplements
- Complications
- Follow up cares

Key Facts

- Every year, an estimated 5-18 % or 15 million babies worldwide are born preterm and this number is rising.
- Preterm birth complications are the leading cause of death among children < 5 years of age, responsible for approximately 1 million deaths in 2015.
- Three-quarters of these deaths could be prevented with current, cost-effective interventions.
- BASED on the National Obstetric Registry, the incidence of premature births for 14 tertiary care hospitals in the country in 2012 was at 11.3%.
- Malaysian National Neonatal Registry (MNNR) reported that in 2007, a total of 3,651 infants' birth weight were less than 1500 grams, or 1.7 % of live births.

DEFINITION

- **WHO :** Liveborn infants delivered before 37 wks(259 days) from the first day of the last menstrual period.
- **Gestational age**: "time elapsed between the first day of the last menstrual period and the day of delivery." defined by the American Academy of Pediatrics (AAP)

Classification

- **Gestational age** (preterm, late preterm, term, post term),
- **Birthweight** (extremely low birthweight [ELBW], very low birthweight [VLBW], low birthweight [LBW], etc.),
- **Gestational age and birthweight combined** (small for gestational age [SGA], appropriate for gestational age [AGA], large for gestational age [LGA]).

The AAP recommends that all newborns be classified by birthweight and gestational age.

I. Gestational age assessment

- Prenatal assessment :(Maternal history and clinical examination)
- Postnatal gestational age assessment (Rapid assessment, New Ballard Score, Direct ophthalmoscopy)
- Based on gestational age

Prenatal gestational age assessment

- "Best estimate" of gestational age, since variability as much as 2 weeks can occur.
- **1. Maternal history**
- **a. Date of last menstrual period.** Reliable if dates remembered.
- **b. Assisted reproductive technology.**
- **c. Quickening.** (18–20 weeks for a primigravida, 15–17 weeks for a multipara).

Prenatal gestational age assessment

- **2. Clinical examination**
- **a. Pelvic examination.**
- **b. Symphysis pubis fundal height. c. Ultrasound examination**
- **i. First fetal heart tones heard at 8–10 weeks.**
- **ii. Fetal heart motion/beat** at 5.5–6.5 weeks by vaginal ultrasound, and 6.5–7 weeks by fetal ultrasound.

Prenatal gestational age assessment

- **iii. First trimester examination**
- **(a) Gestational sac mean diameter**.
- **(b) Crown-rump length** most reliable measurement of gestational age. It is used to date pregnancy between 6 and 14 weeks. It is accurate within 5 days.
- **iv. Second- and third-trimester examination.** The most common is the **biparietal diameter**.
- Other parameters used are head circumference, abdominal circumference, femur length, fetal foot length, and etc.

Postnatal gestational age assessment

- Usually done because prenatal estimates are not always accurate.
- Four approaches have been used: physical criteria alone, neurologic examination alone, physical criteria and neurologic examination together, and direct ophthalmoscopy.
- Dubowitz originally described a method that included a total of 21 physical and neurologic assessments. The test was widely used, but because of the time and difficulty in performing the assessment it was shortened and replaced by the **Ballard examination**.
- Both the Dubowitz and Ballard examinations were inaccurate at assessing gestational age in preterm neonates <1500 g and overestimated gestational age.

1. Rapid assessment of gestational age in the delivery room

Most include some of the following physical characteristics: skin texture, skin color, skin opacity, edema, lanugo hair, skull hardness, ear form, ear firmness, genitalia, breast size, nipple formation, and plantar skin creases.

One method for rapid gestational age assessment includes the **most useful clinical signs in differentiating among premature, borderline mature, and full-term infants, which are as follows (in order of utility)**: creases in the sole of the foot, size of the breast nodule, nature of the scalp hair, cartilaginous development of the earlobe, and scrotal rugae and testicular descent in males.

Table 5–1. CRITERIA FOR RAPID GESTATIONAL ASSESSMENT AT DELIVERY

Feature	36 Weeks and Earlier	37–38 Weeks	39 Weeks and Beyond
Creases in soles of feet	One or two transverse creases; posterior three-fourths of sole smooth	Multiple creases; anterior two-thirds of heel smooth	Entire sole, including heel, covered with creases
Breast nodule[a]	2 mm	4 mm	7 mm
Scalp hair	Fine and woolly; fuzzy	Fine and woolly; fuzzy	Coarse and silky; each hair single stranded
Earlobe	No cartilage	Moderate amount of cartilage	Stiff earlobe with thick cartilage
Testes and scrotum	Testes partially descended; scrotum small, with few rugae	?	Testes fully descended; scrotum normal size with prominent rugae

[a]The breast nodule is not palpable before 33 weeks. Underweight full-term infants may have retarded breast development.

Usher R, McLean F, Scott KE. Judgment of fetal age: II. Clinical significance of gestational age and objective measurement. *Pediatr Clin North Am.* 1966;13:835. Modified and reproduced with permission from Elsevier Science.

Sole- have fine wrinkles, creases are not well formed

- Breast nodule- small or absent

Identification: Preterm LBW

Sole creases

Preterm

Identification: Preterm LBW

Breast nodule

- EAR- preterm ear cartilages are poorly developed, soft and poor recoil
- Hair- wooly and fuzzy

- Skin-skin is thin, gelatinous,shiny and excessively pink, abundant lanugo

- testes undescended and scrotum poorly developed

- Labia majora widely separated in females

- Reflexes are weak-moros,sucking swallowing and grasp extended posture due to poor tone

2. New Ballard Score

- The score spans from 10 (correlating with 20 weeks' gestation) to 50 (correlating with 44 weeks' gestation).
- It is best performed at <12 hours of age if the infant is <26 weeks' gestation.
- If the infant is >26 weeks' gestation, there is no optimal age of examination up to 96 hours.
- **Accuracy.** It overestimates gestational age by 2–4 days in infants between 32 and 37 weeks' gestation.
- **Criteria.** The examination consists of 6 neuromuscular and 6 physical criteria. The neuromuscular criteria are based on the understanding that passive tone is more useful than active tone in indicating gestational age.
- **Procedure.** Administered twice by 2 different examiners to ensure objectivity. The examination consists of 2 parts: neuromuscular maturity and physical maturity. The 12 scores are totaled, and the **maturity rating** is expressed in weeks of gestation (**gestational age**), estimated by using the chart provided on the form.

Name _____ Date/Time of birth _____ Sex _____ **SCORE**

Hospital No. _____ Date/Time of exam _____ Birthweight _____ Neuromuscular _____

Race _____ Age when examined _____ Length _____ Physical _____

Apgar score: 1 minute _____ 5 minutes _____ 10 minutes _____ Head circ. _____ Total _____

Examiner _____

Neuromuscular maturity

Neuromuscular maturity sign	Score							Record score here
	-1	0	1	2	3	4	5	
Posture								
Square window (wrist)	 >90°	 90°	 60°	 45°	 30°			
Arm recoil		 180°	 140° to 180°	 110° to 140°	 90° to 110°	 <90°		
Popliteal angle	 180°	 160°	 140°	 120°	 100°	 90°	 <90°	
Scarf sign								
Heel to ear								
							Total neuromuscular maturity score	

Maturity rating

Score	Weeks
−10	20
−5	22
0	24
5	26
10	28
15	30
20	32
25	34
30	36
35	38
40	40
45	42
50	44

FIGURE 5–1. *Maturational assessment of gestational age (New Ballard Score). (Reproduced, with permission, from Ballard JL, Khoury JC, Wedig K, Wang L, Eilers-Walsman BL, Lipp R. New Ballard Score, expanded to include extremely premature infants. J Pediatr. 1991;119:417.)*

Physical maturity

Physical maturity sign	Score							Record score here
	−1	0	1	2	3	4	5	
Skin	sticky friable transparent	gelatinous red translucent	smooth pink visible veins	superficial peeling &/or rash, few veins	cracking pale areas rare veins	parchment deep cracking no vessels	leathery cracked wrinkled	
Lanugo	none	sparse	abundant	thinning	bald areas	mostly bald		
Plantar surface	heel-toe 40–50 mm: −1 <40 mm: −2	>50 mm no crease	faint red marks	anterior transverse crease only	creases ant. 2/3	creases over entire sole		
Breast	imperceptible	barely perceptible	flat areola no bud	stippled areola 1–2 mm bud	raised areola 3–4 mm bud	full areola 5–10 mm bud		
Eye/ear	lids fused loosely: −1 tightly: −2	lids open pinna flat stays folded	sl. curved pinna; soft slow recoil	well curved pinna; soft but ready recoil	formed and firm, instant recoil	thick cartilage ear stiff		
Genitals (male)	scrotum flat, smooth	scrotum empty, faint rugae	testes in upper canal rare rugae	testes descending few rugae	testes down good rugae	testes pendulous deep rugae		
Genitals (female)	clitoris prominent & labia flat	prominent clitoris & small labia minora	prominent clitoris & enlarging minora	majora & minora equally prominent	majora large minora small	majora cover clitoris & minora		
							Total physical maturity score	

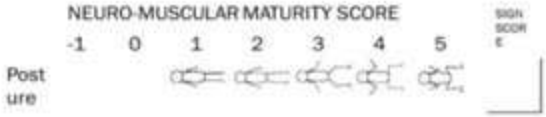
Gestational age (weeks)

By dates _____

By ultrasound _____

By exam _____

posture



Square window

SIGN	NEURO-MUSCULAR MATURITY SCORE						SIGN SCORE
	-1	0	1	2	3	4	5	
Square Window								

Arm recoil

NEURO-MUSCULAR MATURITY SCORE							SIGN SCORE
-1	0	1	2	3	4	5	
Arm Recoil							

Popliteal angle

NEURO-MUSCULAR MATURITY SCORE

-1 0 1 2 3 4 5

SIGN SCORE _____

Scarf sign

Heel to ear

MUSCULAR MATURITY SCORE

-1 0 1 2 3 4 5

SIGN SCORE

3. Direct ophthalmoscopy

- It is based on the normal embryological process of the gradual disappearance of the anterior lens capsule vascularity between 27-34 weeks of gestation.
- Before 27 weeks, the cornea is too opaque to allow visualization; after 34 weeks, atrophy of the vessels of the lens occurs.
- Accurate determination of gestational age at **27–34 weeks only**. This method is reliable to ±2 weeks.
- The pupil must be dilated under the supervision of an ophthalmologist, and the assessment must be performed within 48 hours of birth before the vessels atrophy.
- This method is highly accurate and is not affected by alert states or neurological deficits.

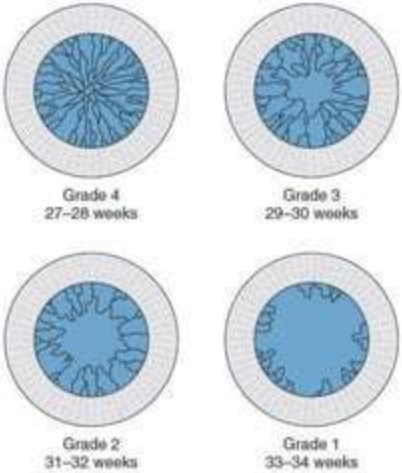


FIGURE 5–2. Grading system for assessment of gestational age by examination of the anterior vascular capsule of the lens. (*Reproduced, with permission, from Hittner HM, Hirsch NJ, Rudolph AJ. Assessment of gestational age by examination of the anterior vascular capsule of the lens.* J Pediatr. *1977;91:455.*)

Newborn classification based on gestational age

Table 5–2. DEFINITIONS OF PRETERM, LATE-PRETERM, TERM, AND POST-TERM INFANTS

	Weeks of Gestation (number of weeks after the first day of the mother's last menstrual period)	Completed Weeks (number of 7-day intervals after the first day of the mother's last menstrual period)	Days (common medical terminology)
Preterm	<37 weeks	On or before the end of the last day of the 37th week	≤259 days
Late preterm	34 0/7 to 36 6/7 weeks	On or after the first day of the 35th week through the end of the last day of the 37th week	239–259 days
Term (**early term:** 37 0/7 to 38 6/7 weeks; **full term:** 39 0/7 to 41 6/7 weeks)	37 0/7 to 41 6/7 weeks	On or after the first day of the 38th week through the end of the last day of the 42nd week	260–294 days
Post term	42 0/7 weeks or more	On or after first day of the 43rd week	≥295 days

Definitions of postnatal gestational age are based on conventional medical definition (day of birth counted as day 1) by the American Academy of Pediatrics, the American College of Obstetricians and Gynecologists, and the World Health Organization definitions.

Based on Engle WA, Tomashek KM, Wallman C; Committee on Fetus and Newborn, American Academy of Pediatrics. Late preterm infants: a population at risk. *Pediatrics*. 2007;120:1390–1401. Reaffirmed May 2010.

II. Birthweight classification

- **A. Micropreemie.** <800 g or 1.8 lb.
- **B. Extremely low birthweight (ELBW).** <1000 g or 2.2 lb.
- **C. Very low birthweight (VLBW).** <1500 g or 3.3 lb.
- **D. Low birthweight (LBW).** <2500 g or 5.5 lb.
- **E. Normal birthweight (NBW).** 2500 g (5.5 lb) to 4000 g (8.8 lb).
- **F. High birthweight (HBW).** 4000 g (8.8 lb) to 4500 g (9.9 lb).
- **G. Very high birthweight (VHBW).** >4500 g (9.9 lb).

III. Classification by birthweight and gestational age combined

- Plotting these against standardized intrauterine growth charts.
- This allows categorization as SGA, AGA, or LGA.
- These refer to the size of the infant at birth and not fetal growth.
- **A. How to decide if the infant is SGA, AGA, or LGA?** Plot gestational assessment
- against weight, length, and head circumference on one of the intrauterine growth
- charts to determine whether the infant is small, appropriate, or large for gestational age.

- **1. Appropriate for gestational age (AGA).** Between the 10th and 90th percentiles for the infant's gestational age.
- **2. Small for gestational age (SGA).** Defined as a birthweight 2 standard deviations below the mean weight for gestational age OR below the 10th percentile
- **3. Large for gestational age (LGA).** Defined as a birthweight 2 standard deviations above the mean weight for gestational age OR above the 90th percentile.

Causes

- Multifactorial and involves complex interaction between fetal, placental, uterine and maternal factors
- **Fetal**
- • Fetal distress • IUGR • Multiple gestation • Erythroblastosis • Non immune hydrops
- **Placental**
- • Placental dysfunction • Placenta previa • Abruptio placentae • Uterine • trauma • Bicornuate uterus • Incompetent cervix (premature dilatation)/surgery

- **Maternal**
- • women younger than 16 and older than 35 • Maternal activity • Prior poor birth outcome • Inadvertent early delivery • Preeclampsia • Chronic medical illness • Infection • Drug abuse
- • chorioamnionitis • PROM • Polyhydramnios • Iatrogenic/ trauma

PRENATAL CONSIDERATIONS

- • Should be delivered in a facility with high risk obstetrical service and level 3 NICU
- • Prenatal administration of glucocorticoids to the mother even if there is no time for full course

• ETHICS- counselling should include discussions regarding survival rate and both short and long term complications

Management Before and During Labour

- Prewarmed incubator and appropriate equipment for neonatal intensive care should always be kept ready in the labour room or operating theatre.

Adequate Resuscitation

- **Thermoregulation.** A polyethylene wrap or bag used immediately after birth prevents heat loss at delivery in very preterm infants.
- **Respiratory support,** availability of pulse oximetry and blended O2 for resuscitation and low saturation protocol.
- If the infant is breathing spontaneously and heart rate >100, (CPAP) of 4–6 cm H2O should be initiated to prevent atelectasis.
- **Transport.** As soon as possible, the infant should be transported to the NICU.
- In a prewarmed portabe incubator equipped with blended O2 and CPAP availability.
- If not the baby must be wiped dry and wrapped in dry linen before transfer.

Admission Routine

- Ensure thermoneutral temperature for infant. An incubator or radiant warmer is necessary.
- Ventilation in NICU is often necessary if ventilated during transfer. However, some infants take longer to adapt to extrauterine life and may not require ventilation especially those with no risk factors and given a full course of antenatal steroids.
- For the larger preterm infants above 1250 grams, review the required ventilation to maintain a satisfactory blood gas and consider extubation if the ventilator requirements are low, patient has good tone and good spontaneous respiration.

Admission Routine

- Maintain SaO_2 between 89-92% for ELBW; 90-94% for the larger preterm
- Head circumference (OFC), length measurements, bathing can be omitted.
- Quickly and accurately examine and weigh the infant.
- Assess the gestational age with Dubowitz or Ballard score when stable.
- Monitor temp, HR, RR, BP and SaO_2.

Immediate Care for Symptomatic infants

- • Investigations are necessary as indicated : ABG, DXT, FBC, Blood culture, CXR (if respiratory signs and symptoms are present)
- • Start on 10% dextrose drip.
- • Correct hypotension (keep mean arterial pressure (MAP) > gestational age (GA) in wks). Ensure hyperventilation is not present (a cause of hypotension). If the baby has good tone and is active, observe first as the BP may rise after first few hours of life towards a MAP approximating GA in weeks.
- • Correct hypovolaemia: Give 10 ml/kg of Normal Saline over 20-30 mins, or packed cells if anaemic. Avoid repeat fluid boluses unless there is volume loss.
- • Start inotrope infusion if hypotension persists after volume correction.
- • Start antibiotics after taking cultures e.g. Penicillin and Gentamycin
- • Start IV Aminophylline or caffeine in premature infants <32-34 weeks.
- • Maintain SaO_2 at 89-92% and PaO_2 at 50 –70 mmHg.

General Measures for Premature infants

- Monitor vitals signs (colour, temperature, apex beat, respiratory rate). Look for signs of respiratory distress (cyanosis, grunting, tachypnoea, nasal flaring, chest recessions, apnoea). In VLBL and ill infants pulse oximetry and blood pressure monitoring are necessary.
- Check Blood Sugar .
- Keep warm in incubator at thermoneutral temperature for age and birth weight. ELBW should preferably have humidified environment at least for the first 3 days.
- Ensure adequate nutrition.
- Provide parental counselling and allow free parental access.
- Infection control: observe strict hand washing practices.

Temperature and humidity control.

- Has large skin surface area and minimal energy reserves, a constant **neutral thermal environment** (environmental temperature that minimizes heat loss without increasing O2 consumption or incurring metabolic stress) is essential.
- To maintain minimal evaporative heat loss, it is best if the environmental humidity is 80.
- **Warm humidification within the incubator is recommended.**
- **Minimize nosocomial infection in humidified environments.**

Temperature and Humidity

They have poor mechanisms for regulation of temperature and depend on environmental support.

- **1. Maintain axillary skin temperature of 36.0–36.5°C.**
- **2. Record skin temperature.**
- **3. Record the incubator humidity.**
- **4. Weigh low birthweight infants at least once daily for management of fluids and electrolytes.**
- **5. Other heat-conserving practices.** (knit hats, fetal positioning, and air boost curtains on incubators.)
- **6. Accessory items for infant care must be prewarmed.** To avoid heat loss by conduction.

Infusion fluid volumes

Preterm low birthweight infants (>1500 g) require 60–80 mL/kg/d.

Preterm very low birthweight infants (1000–1500 g) require 80–100 mL/kg/d.

Preterm extremely low birthweight infants (<1000 g) require a range of fluid volumes from 50–80 mL/kg/d if cared for in doublewalled humidified (80%) incubators.

If cared for under a radiant warmer or in incubators without humidity, fluid requirements may be 100–200 mL/kg/d (see Table 12–1 for breakdown into 100-g birthweight increments).

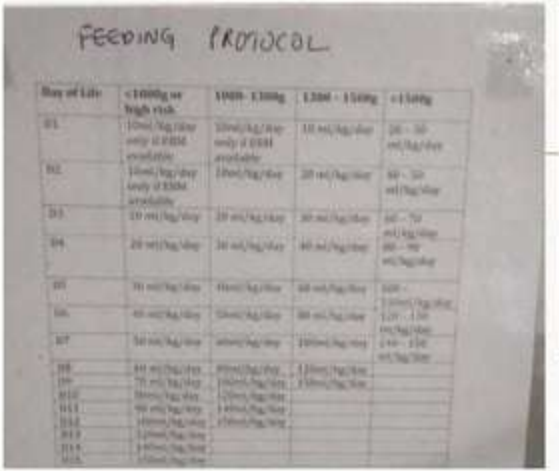
Birth weight(kg)		Fluid rate(ml/kg/day)	
	<24hrs	24-48 hrs	>48 hrs
1-1.5 kg	80-100	100-120	120-160
>1.5	60-80	80-120	120-160

Nutrition

- Breast milk is the milk of choice. All mothers should be encouraged to give breast milk to their newborn babies.
- Infant Formula Infant formula should only be given if there is no supply of EBM.
- Preterm formula : for babies born < 32 weeks or < 1500 grams
- It is recommended to add HMF to EBM as it will give extra calories, vitamins, calcium and phosphate.
- **Preterm infants : 120 – 140 kcal/kg/day**
- Babies who have had a more eventful course need up to 180kcal/kg/day to have adequate weight gain.
- TPN can be start within the first 24 hours OL in the smaller preterm infants BW <1250 grams or as indicated.

Minimal enteral feeding (MEF)

- Recommended in very preterm infants
- The principle is to commence very low volume enteral feeds on day 1 - 3 of life (i.e. 5 - 25 mls/kg/day) for both EBM and formula milk.
- MEF enhances gut DNA synthesis hence promotes gastrointestinal growth.
- This approach allows earlier establishment of full enteral feeds and shorter hospital stays, without any concomitant increase in NEC.



FEEDING PROTOCOL

Day of Life	<1000g or high risk	1000- 1300g	1300 - 1500g	>1500g
D1	10ml/kg/day only if EBM available	10ml/kg/day only if EBM available	10 ml/kg/day	20 - 30 ml/kg/day
D2	10ml/kg/day only if EBM available	10ml/kg/day	20 ml/kg/day	60 - 80 ml/kg/day
D3	10 ml/kg/day	20 ml/kg/day	30 ml/kg/day	60 - 70 ml/kg/day
D4	20 ml/kg/day	30 ml/kg/day	40 ml/kg/day	80 - 90 ml/kg/day
D5	30 ml/kg/day	40ml/kg/day	60 ml/kg/day	100 - 110ml/kg/day
D6	40 ml/kg/day	50ml/kg/day	80 ml/kg/day	120 - 130 ml/kg/day
D7	50 ml/kg/day	60ml/kg/day	100ml/kg/day	140 - 150 ml/kg/day
D8	60 ml/kg/day	80ml/kg/day	120ml/kg/day	
D9	70 ml/kg/day	100ml/kg/day	130ml/kg/day	
D10	80ml/kg/day	120ml/kg/day		
D11	90 ml/kg/day	140ml/kg/day		
D12	100ml/kg/day	160ml/kg/day		
D13	120ml/kg/day			
D14	140ml/kg/day			
D15	150ml/kg/day			

High risk - abnormal Doppler, IUGR, CPR/adrenaline at birth, inotropic support. In cases of stable IUGR without abnormal dopplers, and patients already off inotropic support, following non high risk category is an option based on clinician's judgement.

Feeding increment of 20 ml/kg/day can be done in 2 steps per day

Protocol serves as mere guideline. Clinician discretion is advised.

For infants below 800g, if your centre support this weight, feed increment should be advanced slowly by 10 ml/kg/day

For patients on non invasive ventilation, gaseous dimension of the abdomen can occur and should not be assumed to be feed intolerance

2 hourly feeding for infants < 1250g, 3 hourly feeding feeding for infants > 1250g

Maximum feeding : up to 160 ml/kg/day first 2 weeks of life, up to 180 ml/kg/day from 2 - 4 weeks of life, up to 200 ml/kg/day beyond 4 weeks of life (provided child is receiving EBM and on cup feeding)

Vitamins & Iron

- At birth: IM Vitamin K (0.5 mg for BW<2.5 kg; 1 mg for BW ≥ 2.5 kg)
- MVT can be given after **day 14** of life when on feeding of 150 ml/s kg/day.(once on full feeding)
- Supplements at 0.5 mls daily to be continued for 3-4 months post discharge.
- Premature infants have reduced intra uterine iron accumulation and can become rapidly depleted of iron when active erythropoiesis resumes. Babies of BW< 2000g should receive iron supplements.
- Iron is given at a dose of **3 mg/kg** elemental iron per day.
- Ferric Ammonium Citrate (400mg/5mls) contains 86 mg/5 mls of elemental iron.
- Start on **day 42 (6 week)**, continue until 3-4 months post discharge or until review.
- Babies who have received multiple blood transfusions may not require as much iron supplementation.

Immunisation

- Hep B vaccine at birth if infant stable and BW is >1.8 kg. Otherwise give before discharge.
- Ensure BCG vaccine is given on discharge.
- For long stayers other immunisation should generally follow the schedule according to chronological rather than corrected age.
- Defer immunisation in the presence of acute illnesses.

Skin care

- **Zinc-based tape** can be used.
- Alternatives to tape include the use of a **hydrogel adhesive**, which removes easily with water. Products also include electrodes, temperature probe covers, and masks.
- Skin care must focus on maintaining skin integrity and minimizing exposure to topical agents.
- Transparent adhesive dressings can be used over areas of bone prominence, such as the knees or elbows, to prevent skin friction breakdown and under adhesive monitoring devices that are frequently moved.
- Use of humidity helps maintain skin integrity until skin is mature (2–3 weeks).

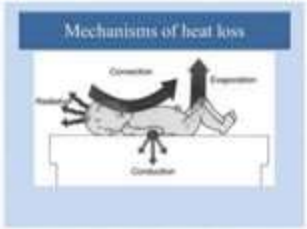
Complications

Early and Late Complications in premature infants
Hypothermia
Respiratory distress syndrome, Apnoea
Hypotension, Patent ductus arteriosus
Intraventricular haemorrhage, Periventricular leukomalacia
Gastrointestinal: Paralytic ileus, Necrotizing enterocolitis
Hypoglycaemia, Hyperglycaemia
Neonatal Jaundice
Hypoprothrombinaemia
Fluid and Electrolyte disorders: hyponatraemia, hyperkalemia, metabolic acidosis
Septicaemia
Anaemia
Osteopaenia of prematurity
Retinopathy of prematurity
Chronic lung disease
Neuro-developmental disability
Psychosocial problems

Generally

Early

- Hypothermia – large surface area, thin skin, less fat (less brown fat, more glycogen).
- Hypoglycemia
- Infection



RESPIRATORY ISSUES

- Poor development of respiratory muscles- CPAP or ventilator support
- a) Perinatal depression-special care air-oxygen mixtures, oximetry monitoring, prevent heat loss
- b) RDS- due to surfactant deficiency
- • APNEA • Due to developmental immaturity of central respiratory drive

RDS

- ~91% at 23–25 weeks' gestation, 88% at 26–27 weeks', gestation, 74 % at 28–29 weeks' gestation, and 52% at 30–31 weeks' gestation.
- Sx: Tachypnoea, labored breathing, recessions, nasal flaring, expiratory grunting, +-cyanosis
- CXR: Uniform reticulogranular pattern (ground glass appearance) with/out low lung volume and peripheral air bronchogram within the first 24 hours of life.
- Mx: Antenatal corticosteroids, tocolytic agent, surfactant replacement, Respiratory support; ETT ventilation, CPAP, SIMV, SEDATION Fluid & nutritional support, Antibx

Surfactant

synthesis begins at **24–28 weeks'** gestation

- The survival from RDS is at >90%. RDS accounts for <6%of all neonatal deaths.
- Some literature supports early administration of surfactant during the first 4 hours of life to decrease chronic lung disease.
- Recent research supports early CPAP in the delivery room over prophylactic surfactant.
- Administration criteria for surfactant include absence of antenatal steroids, increased oxygen demand >30%, and a radiograph consistent with surfactant deficiency.

GUIDELINES OF SURFACTANT USAGE IN HOSPITAL KEMAMAN

All of the following criteria must be fulfilled :

1. Premature ≤ 32 weeks of gestations.
2. Birth weight 800 - 1800 gm .
3. Apgar score ≥ 7 at 10 min .
4. Requiring assisted ventilation .
5. ABG : pH > 7. 25 , PaO_2 > 50 mm Hg (SaO_2>89%)
6. Capillary refill < 2 seconds.
7. Hypotension (if present) has been reversed by fluids/ inotropes.
8. Hypothermia or hypoglycaemia (if present) has been corrected .

ONLY STABILISED PATIENTS SHOULD BE GIVEN SURFACTANT .

Surfactant should not be given to patients who do not respond to resuscitation or deteriorating .

Please discuss with Paediatrician if in doubt.

SURVANTA DOSING CHART

WEIGHT (grams)	TOTAL DOSE (ml)	WEIGHT (grams)	TOTAL DOSE (grams)
600-650	2.6	1301-1350	5.4
651-700	2.8	1351-1400	5.6
701-750	3.0	1401-1450	5.8
751-800	3.2	1451-1500	6.0
801-850	3.4	1501-1550	6.2
851-900	3.6	1551-1600	6.4
901-950	3.8	1601-1650	6.6
951-1000	4.0	1651-1700	6.8
1001-1050	4.2	1701-1750	7.0
1051-1100	4.4	1751-1800	7.2
1101-1150	4.6	1801-1850	7.4
1151-1200	4.8	1851-1900	7.6
1201-1250	5.0	1901-1950	7.8
1251-1300	5.2	1951-2000	8.0

Apnea of prematurity

- Pause of breathing > 20secs with brady or desaturation, HR drop 30bpm from baseline
- **Cause**: Physiologic immaturity of respiratory centre, lack of pharyngeal muscle tone and collapsed upper airway -usually present after 1–2 days of life,
- **Mx**: Supportive O2, relieve obstruction (CPAP), aminophylline/caffeine citrate as resp. stimulant, mechanical ventilation.

NEUROLOGIC

- • Perinatal depression
- • ICH- from fragile involuting vessels –Cranium USG at 5-7 days
- Neurodevelopmental delay, growth failure, cerebral palsy, mental retardation, epilepsy, blindness and deafness

IVH and PVL

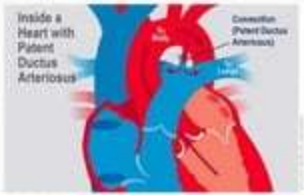
- **IVH (intraventricular hemorrhage)** - fragile blood vessels in germinal matrix above caudate nucleus - occurs in < 32wks (within 5 days after birth)
- Sx: pallor, shock, hypotonia, apnoea, seizure, hydrocephalus
- **PVL (Periventricular leucomalacia)** - necrosis of white matter at dorsal and lateral
- Complications: spastic diplegia, cognitive and intelectual deficit, visual deficit, seizure disorder

CARDIOVASCULAR

- A) hypotension• hypovolemia • cardiac dysfunction • sepsis induced vasodilation •
- B) PDA- between 24-48 hrs of birth

Patent Ductus Arteriosus

- Incidence of persistent PDA is inversely proportional to gestational age.
- SSx include: Wide pulse pressure/ bounding pulses • Systolic or continuous murmur • Tachycardia • Lifting of xiphisternum with heart beat • Hyperactive precordium • Apnoea • Increase in ventilatory requirements
- An **echo**cardiogram is recommended to rule out other structural heart defects and confirmation of PDA when concerned.
- **Overhydration must be avoided.**
- Up to 30% of PDAs spontaneously close.



PDA

- Currently it is unclear whether a conservative, pharmacologic or surgical approach is advantageous.
- If the decision is made to treat a hemodynamically significant PDA, indomethacin or ibuprofen is generally accepted.
- Renal and GI adverse effects are less common with administration of ibuprofen or with slower infusion rates of indomethacin.

PDA

- IV or oral Indomethacin 0.2mg/kg/day daily dose for 3 days or
- IV or oral Ibuprofen 10mg/kg first dose, 5mg/kg second and third doses, administered by syringe pump over 15 minutes at 24 hour intervals.

❖ Surgical ligation

- Persistence of a symptomatic PDA and failed 2 courses of Indomethacin
- If medical treatment fails or contraindicated

In older preterm infant who is asymptomatic, i.e. only cardiac murmur present in an otherwise well baby – no treatment required. Most PDA in this group will close spontaneously.

HEMATOLOGIC

- • A) anaemia- exaggeration of normal physiologic anaemia
- TRANSFUSION- low RBC volume, low hematocrit <40%
- • B) Hyperbilirubinemia
- keep SBR <10 mg/dl
- • exchange transfusion if > 12mg/dl

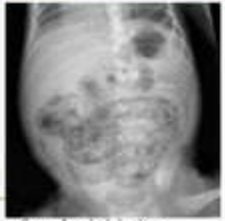
Guidelines for packed red blood cells (PRBCs) transfusion thresholds for preterm neonates.

< 28 days age, and	• Assisted ventilation with FiO_2 > 0.3: Hb 12.0 gm/dL or PCV < 40% • Assisted ventilation with FiO_2 < 0.3: Hb 11.0 g/dL or PCV < 35% • CPAP: Hb < 10 gm/dL or PCV <30%
> 28 days age, and	• Assisted ventilation: Hb < 10 gm/dL or PCV < 30% • CPAP: Hb < 8 gm/dL or PCV < 25%
Any age, breathing spontaneously, and	• On FiO_2 > 0.21: Hb < 8 gm/dL or PCV < 25%* • On Room Air: Hb < 7 gm/dL or PCV < 20%* **Consider transfusion if there is poor weight gain or metabolic acidosis as an indication of tissue hypoxia.*

GI

- Increased risk of NEC, paralytic ileus
- Feeding intolerance
- • formula feeding is an additional risk factor
- • breast milk- protective • gradual increments in feeds
- • Renal- immature kidneys-low GFR

NEC



- Ischemic and inflammatory necrosis of the bowel primarily affecting premature neonates after the initiation of enteral feeding.
- Incidence 6–10% in infants weighing <1500 g.
- Usually occurs within 1st week of life/ between 14 and 20 days of age or 30–32 weeks'
- Sx: Feeding intolerance, abdominal distension, blood in stool, vomit milkcurd /greenish bile, shiny skin abdomen, absent BS
- AXR: distended loops of bowel, Pneumatosis, pneumoperitoneum
- Mx: keep NBM, start parenteral feeding (TPN/OGT), antibx for 10-14days regimen should cover pathogens that can cause late-onset sepsis + anaerobic coverage if bowel necrosis or perforation.
- Complications: bowel perforation, strictures, malabsorption, parenteral nutrition–associated liver disease

Prognosis in Prematurity

- Mortality and morbidity are inversely related to gestation and birth weight.
- Complications include retinopathy of prematurity, chronic lung disease, neurodevelopmental delay, growth failure, cerebral palsy, mental retardation, epilepsy, blindness and deafness

FOLLOW UP CARE

- • Respiratory syncytial virus –most important cause of respiratory infection in premature infants Good hand hygiene, avoid passive cigarette smoking exposure • Influenza vaccine- when older than 6 months
- • Immunizations-same schedule as term infants with exception of hepatitis B • Medically stable,thriving infants- hep B as early as 30 days of age regardless of gestational age or bw
- • Anaemia- supplemental iron(2-3mg/kg) for first 12-15 months of life • Multivitamin drops- 2 weeks of age
- • Rickets- higher risk infants- long term parenteral nutrition, frusemide and fat malabsorption • All breast fed infants- 400 IU of vit D along with calcium 200mg/kg at time of discharge
- • Metabolic screening at 3-4 weeks of age

Screening

Cranial Ultrasound for premature infants ≤ 32 weeks is recommended at:

- • Within first week of life to look for intraventricular haemorrhage (IVH).
- • Around day 28 to look for periventricular leucomalacia (PVL).
- • As clinically indicated.

Screening for Retinopathy of Prematurity (ROP) at 4-6 weeks of age is recommended for

• All infants ≤ 32 weeks gestation at birth or birth weight <1500 g.

• All preterms < 36 weeks who received oxygen therapy depending on individual risk as assessed by the clinician.

• The infants are discharged once they are well, showing good weight gain, established oral feeding and gestational age of at least 35 weeks.

When is infant ready for discharge??

Once they are well, showing good weight gain, established oral feeding and gestational age of at least 35 weeks.

- • A sustained pattern of **weight gain**(15-25 gm) • Competent feeding by breast or pallada without cardiorespiratory compromise • Physiologically mature and stable cardiorespiratory function
- • An apnea free period(5-7days) • Nutritional risks assessed and therapy dietary modification
- • Hearing evaluation • Fundoscopic examination • Neurodevelopmental and neurobehavioral status assessed and explained to parents • Review of hospital course completed.
- • Family and parents: • Determine family's caregiving and psychosocial readiness • Pre discharge education-safe sleep practices and SIDS prevention.
- • **Parents** should be able to- independently and confidently care for their infant; • provide medications, nutritional supplements and any special medical care; • recognize signs and symptoms of illness and respond appropriately • understand the importance of infection control measures and a smoke-free environment.

Thank You

November 17th is World Prematurity Day

On this day, efforts are made to increase awareness of the health risks associated with preterm birth and how to reduce them.

References

- **PAEDIATRIC PROTOCOLS For Malaysian Hospitals (3rd Edition)** by Hussain Imam Hj Muhammad Ismail/ Ng Hoong Phak/Terrence Thomas
- **NEONATOLOGY Management, Procedures, On-Call Problems, Diseases, and Drugs (7th Edition)** by LACY GOMELLA, MD/M. DOUGLAS CUNNINGHAM, MD/FABIEN G. EYAL, MD
- https://emedicine.medscape.com/article/prematurity/ updated Oct 13, 2017 by Susan A Furdon, RNC, NNP-BC, MS Neonatal Clinical Nurse Specialist/Nurse Practitioner, Department of Pediatrics, Albany Medical Center