The Premature Infant
2021

I. Definition
- A. Preterm – birth occurs after 20 weeks but before 37 weeks
- B. LBW – Low birth weight – weight <2500Gm
- C. VLBW – weight < 1500Gm
- D. SGA - < 10^{th} percentile for given gestational age

II. Mortality
- A. Responsible for almost 2/3 of infant deaths, 5x risk of SIDS

III. Etiology (factors associated with prematurity)
- A. Fetal
  1. Multiple gestation
  2. Chromosomal syndromes
  3. Congenital viral syndromes
  4. Chorioamnionitis
- B. Maternal
  1. DM
  2. Preeclampsia
  3. Chronic hypertension
  4. Vascular disease
  5. Congenital heart disease
  6. Pyelonephritis
  7. Systemic bacterial or viral disease
- C. Placental
  1. Abruption
  2. Placenta previa
  3. Massive infarction
  4. Infection
  5. Abnormal shape (function)
- D. Uterine
  1. Polyhydramnios
  2. Fibroids
  3. Abnormality
- E. Other
  1. Elective delivery (miscalculation of dates)
  2. PROM cause 20-30% of births - cause unknown

IV. Physical Characteristics
- A. Weight/ measurements
  1. Weight – varies with gestational age
  2. Length 17-19 inches
  3. Head circumference 10-12 inches

- B. Skin
  - Color -
  - Translucent
  - Limited subcutaneous fat
  - Fragility - Decreased cohesion between dermis and epidermis and immature stratum corneum

- Nails –
- Lanugo –
- Vernix –
- Visible blood vessels –
- Scalp hair –

C. Head
- Skull bones –
- Fontanels –
- Soft Cranium
- Size –
- Nose – small and short
- Eyes – appear small, widely spaced
- Ears – pinna flat, will not bounce back, slow recoil

D. Chest
- Pliable thorax, immature lung tissue, and immature regulatory center leads to periodic breathing, hypoventilation, and frequent periods of apnea
- Periodic breathing –
- Hypoventilation – increased CO2 = acidosis
- Tactile Stimulation for apneic episodes
- Breasts –

E. Posture –

F. Reflexes
- Suck, swallow, gag –
- Moro, Tonic neck, Babinski –
- DTR's –
- Activity –

V. Physiologic Differences

A. Thermoregulation (SLP)
1. Heat Production
    a. Shivering/Nonshivering
2. Brown Adipose Tissue (BAT)
3. BAT Metabolism
    a. Easily metabolized as needed for heat in newborn
    b. Leads to acidosis
4. Neutral Thermal Environment
5. Prevent heat loss
    a. Drying
    b. Hats
    c. Radiant warmers
    d. Isolette
    e. Plastic wrap- aids in keeping heat and moisture close to baby
    f. Kangaroo care (skin to skin)
6. Record all temps!
7. Weaning Controlled Environment
    a. Watch temperature

b. Monitor weight
    i. May use calories to maintain temp
    ii. Possible weight loss or failure to gain
    iii. Expected weight gain= ½ to 1 oz/day

B. Maintenance of fluid and electrolyte requirements

1. Difficulty maintaining fluid/electrolyte balance
    a. Pathophysiology
        - Increased extracellular fluid
        - Immature renal system –
            - lack of ability to concentrate urine and excrete Na+ and Cl-
            - decreased ability to retain bicarb= metabolic acidosis
            - perinatal hypoxia= increased K+
        - B/P low = decreased kidney perfusion = decreased urine output = decreased reabsorption of glucose and amino acids- obligatory glycosuria
        - High insensible water loss
            - Evaporative loss through skin (decreased keratin)
            - 30% lost through respiratory tract
        - Decreased GFR

    b. S&Sx of fluid volume excess
        - Edema
        - Bulging fontanels
        - Crackles, rales
        - Rise in body weight
        - Decreased serum sodium

    c. S&Sx fluid volume deficit
        - Depressed fontanel
        - Poor skin turgor
        - Dry mucus membranes
        - Increased serum sodium
        - Drop in body weight

2. Nursing Interventions
    a. Accurate I & O!
        1.) Weigh all diapers, mark dry weight
        2.) Monitor all IV fluids (meds, flushes, bloods, etc.)
        3.) Calculate IV fluids with nutritional fluids to avoid overload
        4.) Monitor volume of bloods drawn
    b. Fluid requirements: by day 3, 120-150cc/Kg/day
    c. Peak & trough levels of nephrotoxic drugs; BUN/Creat q.3 days
    d. Provide formula with correct solute load
    e. Na bicarb replacement prn
    f. Watch for S&S of dehydration (same as deficient fluid volume)
    g. Minimize insensible water losses
        1.) Plastic covering
        2.) Increase ambient humidity
        3.) Warmed, humidified oxygen

C. Disturbances in Nutrition

- Pathophysiology
  a. Immature GI system-
     - Small gastric capacity
     - Delayed gastric emptying/ slower peristalsis
     - Lacking adequate lactase enzymes= impaired lactose tolerance, poor fat digestion/absorption
  b. Reflexes:
  c. Abdominal musculature:
  d. Cardiac sphincter:
  e. Respiratory rate
  f. Impaired 3rd trimester maternal transfer of nutrients & vitamins
  g. Small glycogen stores in the liver (HR for hypoglycemia)
  h. Nutrition risks:
     - Anemia
     - Rickets Disease
     - Hypoglycemia

- Nursing Interventions
  a. Feeding
  b. Conserve Energy
  c. Measurements/monitoring:
     - Observe for S&S of residual: vomiting, abdominal distention, blood (in stools and gastric aspirate), increase in amount residual

  d. Adequate Feedings via proper route
     1.) IV- TPN for babies, specific to that baby's nutritional needs
     2.) Gavage- through an NG or OG tube, either given via feeding pump or gravity
     3.) Nipple- firm and stable nipple. Facilitates cupped tongue configuration and more controlled and manageable flowrate.
     4.) Breast- once baby has strong and coordinated suck & swallow reflex.

  e. Caloric needs: 120-150 cal/kg/day
     - Higher calorie formula/supplement as needed
  f. May need to feed with NG/OG in place to supplement feedings.
  g. Breast milk – preferred
     1. Mothers are encouraged to express milk until their baby can adequately latch. EBM may be given to baby
     2. Easier to digest in preterm gut
     3. Milk produced by mothers who delivered prior to term contains higher concentrations of protein, electrolytes, hormones needed for growth, and essential amino acids
     4. IgA is important to control bacteria in the intestinal tract, where it inhibits adherence and proliferation of bacteria on epithelial surfaces (protects against NEC)
     5. Fortifiers are commercially available to supplement protein, carbohydrates, vitamins and minerals essential for newborn growth. Will also need exogenous iron after feedings.

h. Gavage Feedings-
    - Enteral nutrition even when sucking, swallowing, and breathing are not coordinated
    - Allow breastmilk or formula to flow by gravity
    - Measured the same as adults
    - Check residual before each feed
        - Refeed residual and decrease that feed by residual amount.

i. Bottle Feeing- firm nipple to control flow
    -
    - Neck, chin, and cheek support
    - Promote oral sensitivity- stroke lips, cheeks, and tongue before feeing
    -
    -
    -
    -
    -
    - Attempting with a nipple for premature infants, can give chin and cheek support to help sucking
    - Decrease stimuli to help baby concentrate on eating and not other factors.

j. Nonnutritive sucking

VI. Risk for Infection

A. Deficient placental transmission/storage of minerals, vitamins, and immunoglobulins
    - Maternal IgM does not cross placenta
    - IgG level is lower the earlier in gestation birth occurs
    - IgA and IgM require time to rise after birth

B. Invasive procedures

C. Prolonged hospitalization

D. Sepsis – invasion by infectious agents resulting in a disease process
Septicemia – presence in blood of bacterial toxins

E. Increased risk of sepsis in preterm and any infant if prolonged ROM (>24hrs)

F. High mortality

G. Manifestations of sepsis
    1. Respiratory - cyanosis, grunting, apnea, retractions
    2. CNS – seizures, listlessness, bulging fontanel, jitteriness, unstable temperature- cold OR hot
    3. GI – feeding problems, vomiting, abdominal distention, diarrhea
    4. Skin – rashes, pustules, oomphalitis
    5. CV/Blood- jaundice, bleeding, purpura, petechiae, tachycardia or bradycardia, hypotension, decreased or poor perfusion (pallor, delayed cap refill, cool and clammy)
    6. Other – vague, “not doing well”

H. Diagnostic workup

I. Treatment

J. Nursing Interventions
1. Strict hand washing (for staff & family)
2. Reverse isolation
3. Individual use equipment
4. Adequate nutrition

VII. Risk for Hemorrhage/ Anemia
A. Etiology
1. Low prothrombin due to poor vitamin K synthesis
a. decreased bacterial flora
b. increased tendency to bleed
2. Immature liver function
3. Increased rate of hemolysis –

4. Walls of blood vessels very fragile –

5. Loss of blood to lab specimens
6. Impaired RBC production
7. Physiologic anemia occurs earlier in preterm (4-8 weeks) because preterm RBC survival time is less, growth is rapid, Vitamin E deficiency common

B. Nursing Interventions
1. Handle gently
2. IM Vitamin K
3. Monitor withdrawal of blood for labs
4. Blood replacement
5. Iron supplements

VIII. Risk for Jaundice
A. Etiology
1. Rapid destruction of immature RBC's and immaturity of liver = prolonged course of higher bilirubin levels and jaundice
2. Treatment same as term baby – phototherapy, exchange transfusion

IX. Respiratory System
A. Physiologic differences
1. Small amount of pulmonary elastic tissue
2. Weak respiratory muscles
3. Immature alveoli of lungs
4. Decreased amount of surfactant
5. Weak or absent cough and gag reflexes

B. Respirations
1. Irregular
2. Rapid
3. May be shallow with periods of apnea, periodic breathing
a. Cause of apnea of prematurity is most likely due to immaturity of neurologic and chemical respiratory control mechanisms
b. Can also be a sign of cold stress, hypoglycemia, infection
c. Treatment/Prevention –

X. Goals of care
- A. Maintain NTE
- B. Provide nutrition – EBP supports early minimal enteral feeding of EBM
- C. Decrease physiologically stressful situations (conserve energy)
- D. Observe for subtle changes in clinical condition
- E. Provide developmental stimuli for growth and development
- F. Provide quiet, soothing environment and allow for sleep cycle
- G. Assist the family in the attachment process

XI. Emotional Aspects of Care
- A. Decreased tactile, loving stimuli if multiple treatments, invasive procedures
- B. Many painful stimuli
- C. S&S of anxiety
- D. Tx

XII. Prognosis
- A. Higher mortality than term in first year of life
- B. SIDS rate 5X greater
- C. Morbidity higher esp in VLBW group
- D. Developmental problems/ delays – need meticulous follow-up
- E. Acquired or developmental sucking defect
- F. Complications
  1. ROP – loss of vision
  2. BPD – chronic lung disease
  3. Speech defects
  4. Neurological defects – seizure disorders, CP, hydrocephalus, low IQ
  5. Sensorineural hearing defects – Gentamycin & Lasix are ototoxic

XIII. Parental reactions to premature birth
- A. Psychological tasks
  1. Anticipatory grief
     - Preparing for infant's death; also concerned re: deformities or MR
     - Grieving the processes they had anticipated
     - Realization and acceptance of mother's failure to carry to term = guilt
     - Feelings by one or more parents that they did something to cause preterm birth
  2. Establishing a relationship with the infant
     - Need lots of support
     - Allow parents to participate in care
     - Assist parents in learning the special needs of their baby (confidence)
     - Support groups helpful

XIV. Growth and Development of the Premature infant
- A. Intellectual
  - May have reduced intellectual development if damaged brain tissues and poor socioeconomic background
- B. Neurological

- 10-15% have some degree of CP; mental and speech problems not a rule unless anoxia has occurred

C. Behavioral
- Decreased coordination
- Distractibility, short attention span
- Emotional instability
- Learning difficulties

D. Health and Illness
- Greater risk of infectious diseases in first year of life- vaccinations, handwashing, avoid sick people, etc.
- SIDS more common