Breastfeeding Infants with Medical Problems

Mark Kadrofske, M.D., Ph.D.
Fellow, Division of Neonatology
Department of Pediatrics
Case Western Reserve University
MetroHealth Medical Center

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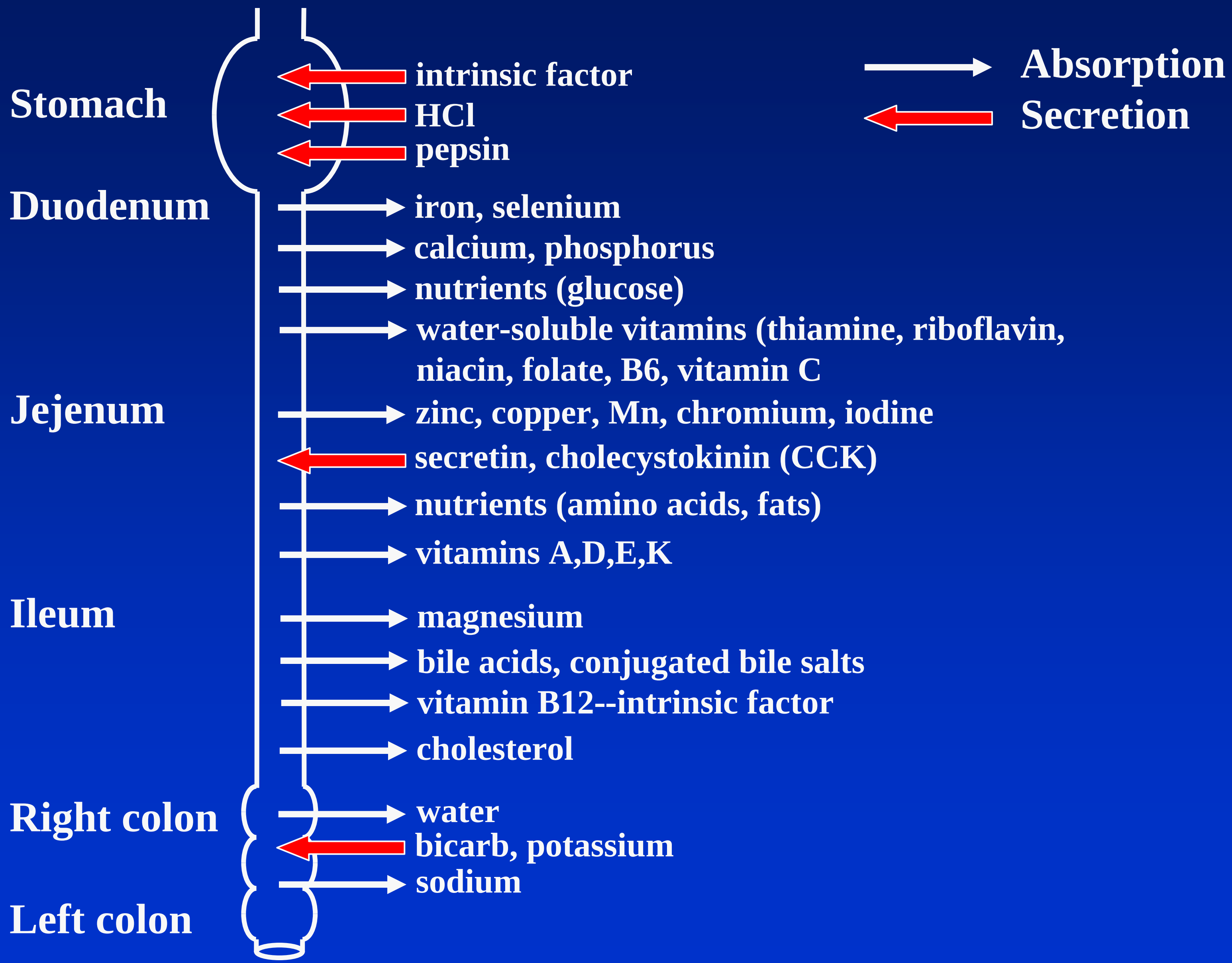
1. Overview of gastrointestinal (G.I.) system anatomy, physiology, and normal fetal development.

2. Role of breast milk/breastfeeding in the infant with special nutritional requirements: premature (and LBW) infants, SGA infants, and postmature infants.

3. Breastfeeding considerations in infants with medical problems: cleft lip/palate, Down syndrome, respiratory illness, jaundice, GER disease, congenital heart disease, allergic/atopic disease, infants of diabetic mothers, and inborn errors of metabolism (PKU).

Sites of Absorption and Secretion Along the G.I. Tract



Development of the G.I. Tract in the Human Fetus

- **Birth and the abrupt interruption of placental flow of nutrients from mother to fetus requires the newborn infant's G.I. tract to adapt to extrauterine life.**

- **Months of gestation results in normal growth and development of the G.I. tract.**

Development of the G.I. Tract in the Human Fetus

- During fetal life, the G.I. system evolves as a digestive and absorptive organ with a massive surface area, the pancreas differentiates into an organ with both endocrine (hormone) and exocrine (secreted and acting locally) function, and the liver develops into the metabolic factory of the body.

- Components of the G.I. system do not evolve concurrently; there is a temporal sequence to its anatomic, motor, and functional development.

Anatomic Development of the G.I. Tract

- At 4 weeks gestation, the intestine is a simple tube.
- By the 5th week, it begins elongating faster that the trunk, so that by 40 weeks gestation, the intestine is 1000 times longer than at 5 weeks.
- The small intestine is 4-5 times longer than the body length at term; a small intestine of 250 cm would be comprised of 5 cm duodenum and 245 cm jejunum and ileum.
- The large intestine (colon) is 1/6 the length of the small intestine.
- Specialized features of the G.I. tract are anatomically present in the 2nd and 3rd trimester.

Anatomic Development of the G.I. Tract

Esophagus	
Superficial glands develop	20 wk
Squamous cells appear	28 wk
Stomach	
Gastric glands form; pylorus,fundus defined	14 wk
Pancreas	
Differentiation of endo- & exocrime tissue	14 wk
Liver-Lobules form	11 wk
Small intestine	
Crypt-villi develop, lymph nodes appear	14 wk
Colon	
Diameter increases, villi disappear	20 wk

Motor Development of the G.I. Tract

- **G.I. motor function involves 1) sucking and swallowing, 2) gastric emptying, and 3) intestinal transit.**

1. Sucking and Swallowing:

Immature suck and swallow pattern> short bursts of 4-7 sucks, rate 1-1.5 per second; swallows do not occur during sucking bursts but rather during resting periods between bursts.

Mature suck and swallow pattern> prolonged bursts of at least 30 sucks at a rate of 2 per second, coordinated with swallowing; no interruption of respiratory rhythm; associated with propulsive peristaltic waves in the esophagus.

Motor Development of the G.I. Tract

- Mature pattern is attained within days by full-term infants (rarely seen before 34 weeks gestation).

- Nipple feeds prior to 30 weeks gestational age could cause apnea or aspiration as airway-protective mechanisms may not be intact.

Motor Development of the G.I. Tract

- Suck and swallow maturation also related to postnatal age: a 28 wk may be able to suck 4 weeks after birth, but a 32 wk infant may not suck effectively for several days after birth.

- Non-nutritive sucking is the sucking behavior exhibited by infants using a pacifier; a series of shorter bursts and pauses (as compared to nutritive sucking).

- Passage of food from the mouth to stomach requires a functional lower esophageal sphincter (LES): premature infants (esp <33 wks have a higher rate of regurgitation after feeds because of decreased LES pressure.

Motor Development of the G.I. Tract

2. Gastric emptying:

A. Begins at mid-gestation, but believed to be immature even at term.

B. Delayed in the first 12 hours of life in term and preterm infants.

C. Gastric half-emptying time for a 20-30 cc/kg oral feed = 45-60 min.

D. Body position does not affect emptying time.

E. Human breast milk empties faster than formula.

Motor Development of the G.I. Tract

3. Intestinal transit:

A. Intestinal motility increases between 29 and 31 wks gestation.

B. Small intestine transit time decreases with increasing GA; therefore, slow transit could actually facilitate greater absorption of nutrients secondary to longer exposure to digestive mechanisms.

C. Colon motility is poorly developed until close to term; nearly all full-term infants pass meconium in the first 48 hrs of birth, whereas preterm infants may not pass a stool until more than one week after birth.

D. Total transit time (mouth to anus) for full-term neonate = 13 ± 4 hrs.

Motor Development of the G.I. Tract

Gestational age (wks)

	12	16	25	26	32	34	40
Sucking & Swallowing	First signs of swallowing			LES high pressure		Nutritive suck and swallowing fully developed	
Gastric Emptying	←Evidence for transit through gut→|						
			Antral & duodenal activity		|←Increased antral contractions→|		
Intestinal transit					←Increasing intestinal motility with maturation→		

Functional Development of the G.I. Tract

- **Unlike anatomic development, which is nearly mature by 20 weeks gestation, intestinal absorptive processes are only partially mature by 26 weeks.**

- **Intestinal flora:**
  1. **G.I. Tract is sterile *in utero*, but becomes colonized with bacteria shortly after birth.**

  2. **The small intestine usually contains few bacteria, whereas the colon contains ~100 billion organisms per cc.**

  3. **The organisms present depend on the type of feeds: breast-fed infants are colonized with *Lactobacillus* and *Bifidobacterium.* Both produce certain organic acids shown to inhibit the growth of pathogenic (disease-causing) strains of bacteria.**

Functional Development of the G.I. Tract

1. ***Carbohydrate*:**
   Preterm infants malabsorb lactose, the principal carbohydrate in breast milk, in the small intestine; for example, with infants between 28-34 wks, the lactase (the enzyme which hydrolyzes the lactose) levels are present at ~30% of full-term term levels.

   However, lactose is efficiently salvaged because of bacterial fermentation by colonic flora of the unabsorbed carbohydrate.

2. ***Protein:***
   Efficient protein digestion does occur in the small intestine after 24-28 weeks gestational age.

   Breast feeding per se may enhance CCK levels (stimulate release of proteases)

Functional Development of the G.I. Tract

3. ***Lipid:***

Lingual (tongue) and gastric lipase appear by 26 weeks gestational age and have a high activity level at birth; functionally important because pancreatic lipase levels are low.

Human milk lipase enhances fat digestion in breast-fed infants;present in the milk of mothers of both term and pre-term infants.

Human milk lipase likely accounts for the superior absorption of the fat from human milk.

Components of Human Breast Milk Believed to Regulate G.I. Development and Function:

Hormones	Immunoglobulins
Growth Factors	Complement Factors
Cytokines	Enzymes
Protaglandins	Nucleotides

For example:

- Human colostrum and milk promote fat and protein digestion.
- Proteins present in human milk bind nutrients essential for bacterial metabolism.
- Secretory immunoglobulins and enzymes destroy pathogenic bacteria.

Breast milk/breastfeeding for Infants with Special Nutritional Requirements

- **Human milk is the preferred source of enteral nutrition for ALL infants, including premature and sick newborns (per policy statements from the AAP and ADA).**

- **Although many high-risk newborns are not able to nurse, including extremely premature, VLBW or LBW infants, expressed human breast milk (EBM) is the preferred initial feeding and is usually well tolerated.**

- **There are FEW circumstances in which the use of human milk would not be in the best interest of the infant (galactosemia, infant whose mother has active, untreated TB, infant whose mother has HIV, certain maternal drugs/medications).**

Use of Human Breast Milk in the Neonatal ICU

- Initiation of enteral feeds can occur shortly after birth in certain premature, LBW infants who are stable from a cardio-respiratory standpoint; under some circumstances, may begin enteral feedings even in ventilator-dependent infants.

- Miminal enteral feedings with human milk can optimize growth, development, and progress for small premature infants.

- Advantages for LBW infant include the physiologic amino acid and fat profile, the bettern digestibility and absorption of these proteins and fats, and the low renal solute load.

Use of Human Breast Milk for Preterm Infants

- Human milk is the "gold standard" by which all preterm and term infant formulas are modeled and compared.

- Composition of human milk varies with gestation, lactation, within a feeding:

Composition of Nutrient	Gestation Preterm	Mature	Stage of Lactation Colostrum (1-5 days)	Mature >30 days	During a Feeding Fore-Milk	Hind-Milk
Lactose	Lower	Higher	Lower	Higher	Higher	Lower
Protein	Higher	Lower	Higher	Lower	Lower	Higher
Fat	Higher	Lower	Lower	Higher	Lower	Higher
Energy	Higher	Lower	Lower	Higher	Lower	Higher
WVitamins	Varies	Varies	Lower	Higher		
FVitamins	Varies	Varies	Higher	Lower		
Ca/Phos	Same	Same				
Iron	Higher	Lower	Higher	Lower		

Use of Human Breast Milk for Preterm Infants

Carbohydrate Source:

- **Lactose is the principal carbohydrate in human milk, providing ~40% of the total energy content.**

- **Lactase required for hydrolysis of lactose to glucose & galactose.**

- **Premature infants have low mucosal lactase activity, but tolerate lactose well, possibly owing to bacterial flora fermentation.**

Use of Human Breast Milk for Preterm Infants

Proteins:

- **Human milk is low in the aromatic amino acids, phenylalanine and tyrosine; advantageous to the preterm infant with low levels of the enzymes required to metabolize aromatic amino acids.**

- **Non-protein nitrogen (NPN) high in human milk; believed to aid in gut maturation and resistance to infection.**

Use of Human Breast Milk for Preterm Infants

Fats:

- Human milk contains 3.5-4.5% fat, which provides about 40-50% of the total calories.
- Triglycerides contribute about 98% of the total fat content of human milk.
- Fat is synthesized in the mammary gland alveolar cells and is stimulated by emptying the breast and by prolactin secretion.
- Arachidonic acid and DHA may be two important important fatty acids for brain and retinal development (both uniquely present in human milk).

Use of Human Breast Milk for Preterm Infants

Fats, continued:

- **Human milk contains factors that improve fat absorption, including lipases.**

- **Use of hindmilk, which is higher in fat and calories, may improve weight gain in LBW infants.**

Additional Advantages of Human Milk for Preterm Infants

- Ease of digestion and absorption of zinc and iron
- Low renal solute load.
- Presence of anti-infective factors.
- Possible protection against necrotizing enterocolitis (NEC).
- Possible protection against (late-onset) sepsis.
- Psychologic benefit to the mother who can participate actively in the care of her preterm infant.

Human Milk Fortification

- Despite the numerous advantages to human breast milk, some nutrient needs may not be met in the growing preterm infant.

- These nutrients include protein, calcium, phosphorus, magnesium, sodium, copper, zinc, vitamins B2, B6, C, D, E, K, and folic acid.

- These nutrient deficiencies can result in clinical manifestations of rickets, kwashiorkor, hyponatremia, and zinc deficiency.

- Fortification of human milk can minimize these (potential) deficiencies.

- When the preterm infant is tolerating human milk at greater than 100 cc/kg/day, supplementation can be started.

- Fortification of human milk is recommended until the infant is taking all feedings from the breast directly or weights 1800-2000g; during the transition from gavage or bottle and nipple to feeding at the breast, only those feedings by gavage or bottle require fortification.

Guidelines for Use of Fortified Human Milk for Premature Infants (MHMC NICU)

- Infants < 34 weeks gestation.
- Infants < 1500 grams at birth.
- Infants on TPN for greater than 2 weeks.
- Infants > 1500 grams at birth with suboptional growth.
- Infants > 1500 grams at birth with limited ability to tolerate increased volume intake.

Long-term Follow-up of Growth in VLBW Infants

- Weight gain and growth in length and head circumference is similar in VLBW infants breast-fed or given standard formula post-discharge.

- Human milk intake associated with better bone mineral content.

- Iron supplementation is recommend by 2 months of age; evidence for iron deficiency was 86% in those breastfed but only 33% in those receiving iron-fortified formula.

Small-for-Gestational-Age (SGA) Infants

- Infants below the 10th percentile in weight for their gestational age are termed SGA.

- Difficulty maintaining core body temperature.

- Initially a poor suck and swallow; mother may need to use a breast pump to stimulate lactation.

- Prone to be hypocalcemic; providing breast milk early is advantageous because of the more physiologic Ca/Phos ratio.

- Hypoglycemia common; therefore, early feeding recommended.

- May have delayed maturation of G.I. tract; breast milk beneficial.

Breastfeeding the Postmature Infant

- Postmature=postterm=postdates (>42 weeks gestation).

- Pregnancies are generally not allowed to exceed 42 weeks (but may have inaccurate dates or no prenatal care).

- Morbidity and mortality rates rise severalfold vs term pregnancy.

- Approximately 20% of true postterm infants demonstrate some elements of dysmaturity or postmaturity syndrome: growth restriction, loss of fat stores> may appear “elderly” with crinkled skin, dry and peeling, long nales.

- Approximately 25% are macrosomic (>4000 g): these infants often are hypoglycemic (secondary to inadequate glycogen stores).

- Birth trauma more frequent (shoulder dystocia and arm palsies).

Breastfeeding the Postmature Infant

- Early feeding necessary to maintain blood sugar >40 mg/dl.
- Supplemental bottle feeds (or i.v. glucose) MAY be necessary.
- Take to the breast early.
- These infants frequently feed poorly initially.
- Once feeding established, they adapt very well.

Breastmilk and Breastfeeding for Infants with Medical Problems

- Cleft Lip/Palate
- Down syndrome
- Bronchopulmonary dysplasia (BPD/CLD)
- Jaundice
- Gastroesophageal Reflux
- Congenital Heart Disease
- Atopy/allergies
- Infants of Diabetic Mothers
- Inborn Errors of Metabolism (PKU)
- Multiple gestations

Cleft Lip/Palate

- Occurs in ~1 in 700 live births in the U.S.
- Most prevalent in white, males; associated with other anomalies.
- Cause unknown: ?environmental and/or genetic factors.
- Due to failure of embryonic fusion of the lip and/or mouth during the 6th week of gestation; can be unilateral or bilateral.
- Involves the soft and/or hard palate.
- May have difficulty sucking, swallowing, breathing, and talking.
- Severity of feeding difficulty determined by site and extent of the cleft.

Cleft Lip/Palate

- Poor sucking and prolonged nippling time may lead to poor weight gain.
- Adequate sucking is generated by negative intraoral pressure and effective muscular movement.
- Negative pressure is generated by good lip and palate seal, along with expansion of the intraoral cavity.
- Breast fed infants accomplish this by stabilizing the nipple against the palate while tongue movement strips milk from the breast (bottle fed infants use their tongues and palates less, relying primarily on their gums to hold the nipple).

Cleft Lip/Palate

- **A cleft lip can cause an air leak around the infant's seal on the nipple, preventing adequate negative pressure.**

- **Plugging the leak can be accomplished by breast-feeding with the cleft side against the breast.**

- **Small, isolated cleft lips or palates can usually breast feed.**

- **Positioning is important: direct milk into the pharynx and away from the cleft and nasal cavity.**

- **Slow, direct delivery of milk into the infant's mouth may be necessary; some infants do have difficulty creating an adequate seal> difficulty regulating velocity of milk flow.**

- **EBM may be necessary with use of special cleft palate feeders.**

Down Syndrome

- Trisomy 21 (mental retardation, characteristic facies, heart defects).

- Incidence varies by maternal age (1:800 all births; 1:385 for 35 y.o.; 1:33 for 45 y.o. woman.

- Feeding difficulties secondary to hypotonia (although initially may have good tone and may even suck well at the breast).

- Feeding problems sometimes develop once the mother and infant have been discharged home.

- Large tongues may compromise sucking and swallowing coordination.

- Congenital heart defects may also complicate feeding.

Down Syndrome

- **Support for the head, jaw and general body requires considerable coordination from the mother.**
- **Patience may be required to teach the infant to suck with sufficient vigor to initiate the let-down; initial manual expression to start the flow and good support for the breast may be required.**
- **Stimulation and affection of breastfeeding may improve developmental outcome.**
- **Weight gain is poor whether breast or bottle fed.**

Bronchopulmonary Dysplasia (BPD or CLD)

- **Originally described in 1967 as a chronic pulmonary disorder developing in some premature infants with severe respiratory distress syndrome who were treated by mechanical ventilation and oxygen supplementation.**

- **Oxygen supplementation at 28 days of life -or- at 36 weeks adjusted age (e.g., 32 week gestation infant at 4 weeks of age).**

- **Exact etiology unknown, but likely due to immature lungs (with initial lack of surfactant) being damaged by excess volume or pressure from assisted mechanical ventilation.**

Bronchopulmonary Dysplasia (BPD or CLD)

- Incidence declining for infants >1000 g due to the use of artificial surfactant administration and improved (more gentle) mechanical ventilatory strategies.

- Unfortunately, increased survival for those infants born <1000 g has now created a “new” group of infants with BPD.

Bronchopulmonary Dysplasia (BPD or CLD)

MHMC Statistics (1997-2001)

BW (g)	%BPD
501-750	70
751-1000	64
1001-1250	39
1251-1500	8
1501-1750	2
1751-2000	2
2001-2250	0.4

GA (wks)	%BPD
24-25	67
26-27	74
28-29	48
30-31	15
32-33	3
34-35	1
36-37	0

Bronchopulmonary Dysplasia (BPD or CLD)

- BPD encompasses a wide spectrum of illness: infants may begin to convalesce or improve during any stage of progression.
- Clinical signs of respiratory compromise may persist for several months after NICU discharge, including tachypnea, increased work of breathing with nasal flaring and rib retractions.
- Frequent need for supplemental oxygen and/or diuretics.
- At increased risk to develop severe respiratory compromise from common upper and lower respiratory infections.
- May be at increased risk to develop bronchiolitis (e.g., RSV) or asthma.

Bronchopulmonary Dysplasia (BPD or CLD)

Nutritional Implications

Growth Failure and Feeding Problems:

- **Preterm infants with BPD show reduced rates of growth and percentile ranking during the first two years of life; catch-up growth may occur by age 3 or by ages 7-10.**

- **BPD may result in increased resting energy expenditure; however, decreased growth may be related to recurrent infections or lower nutrient intakes.**

- **Tachypnea may make feeding tiring or difficult.**

Breast Milk and Breast Feeding in Infants with BPD

- **Decreased ability to suck and swallow efficiently; endotracheal tube placement for mechanical ventilation may preclude oral feedings or pleasant oral stimulation;**

- **Noxious stimuli in or near mouth (OET, feeding tubes, suctioning, taping) may lead to aversion to feedings by pulling away from the nipple.**

- **Infants with BPD may require fluid restriction (and may be on diuretics); therefore, human milk fortifiers may be required to increase protein, mineral, and caloric intake.**

The Infant with Jaundice

- **Bilirubin results from the metabolic breakdown of heme within the red blood cells.**

- **Bilirubin deposition into the skin and sclera results in jaundice.**

- **Bilirubin is a toxin, and at high levels, accumulates in the brain.**

- **Irreversible brain damage caused by bilirubin deposition is called "kernicterus."**

- **Causes of hyperbilirubinemia include: (1) increased RBC destruction, (2) decreased enzymatic conjugation by the glucuronidase system, (3) decreased albumin binding, and (4) increased reabsorption from the G.I. tract (secondary to poor stooling).**

The Infant with Jaundice

- **Jaundice visible under 24 hrs of age is a special concern because it may be associated with infection or abnormal RBC destruction.**

- **Phototherapy is a frequently used option; if severe, exchange blood transfusions may be necessary.**

- **The AAP <u>discourages</u> the interruption of breastfeeding in healthy term newborns and encourages continued and frequent breastfeeding (at least 8-10 times per 24 hours).**

- **Supplementing nursing with water or dextrose water does not lower the bilirubin levels.**

- **Under certain circumstances, and depending on the mother's and physician's judgment, breastfeeding may be supplemented with formula feeds and breastfeeding may be interrupted.**

The Infant with Jaundice

	Early jaundice (breastfeeding jaundice)	Late jaundice (breast milk jaundice)
Onset	2-5 days of age	5-10 days of age
Duration	Transient: 10 days	Persists >1 month
Feed volume	Infrequent feeds	Lots of milk
Stools	Stools delayed/infrequent	Normal stooling
Bili levels	$\leq$ 15	May be $\geq$ 20
Treatment	None or phototherapy	PT, temporary discontinuation of BF; rarely, exchange transfusion

Management of Early Jaundice while Breastfeeding

1. **Monitor all infants for initial stooling. Stimulate stool with rectal stimulation if no stool in 24 hours.**

2. **Initiate breastfeeding early and frequently. Frequent, short feeding more effective than infrequent, prolonged feeding.**

3. **Discourage water, dextrose water, or formula supplements.**

4. **When bilirubin levels ~15, stimulate stooling, augment feeds, may stimulate breast milk with pumping, use phototherapy.**

5. **No evidence suggests early jaundice is associated with an abnormality of the breast milk, so withdrawing breast milk as a trial is only indicated if jaundice persists longer than six days or rises above 20.**

Breast Milk Jaundice or Late-Onset Jaundice

- **Rare (may occur in ~1 in 200 breast fed infants).**
- **Due to the milk itself, not the process of breastfeeding.**
- **Exact cause unknown: initially believed secondary to a substance(s) in breast milk which inhibits normal bilirubin metabolism; however, this is controversial.**
- **Other causes of jaundice must first be ruled out (e.g., infection, specific infant enzyme defects).**

Breast Milk Jaundice or Late-Onset Jaundice

- **Diagnosis made by temporarily discontinuing breastfeeding (x 12-24 hrs), then measure the bilirubin levels.**

- **Then re-challenge and re-measure the bilirubin. A significant fall, then rise, is highly suggestive of the diagnosis.**

- **If levels remain < 20 with breast feeds, may resume breast feeding.**

- **Sympathetic explanation and support of the mother is essential.**

Gastroesophageal Relux (GER)

- **GER is the frequent, nonprojectile, postprandial vomiting or regurgitation of breastmilk or formula (or foodstuffs in older children/adults).**

- **Diagnosed now more frequently by clinicians.**

- **It is believed that GER is reduced in breast fed infants.**

- **May be related to more upright position during breastfeeding.**

- **Also, may be reduced because the suckling motion of the tongue triggers peristaltic waves in the G.I. tract.**

Congenital Heart Disease

- **Congenital heart disease is NOT a contraindication to breastfeeding, even cyanotic heart disease.**
- **The “work” required to breastfeed is less than the “work” required to bottle-feed.**
- **Heart and respiratory rates remain stable during feeding at the breast.**
- **Cardiac surgeons frequently plan surgery for a certain weight; may be beneficial to increase fat by feeding at one breast.**

Infants at Risk for Atopy

- **Breastfeeding is associated with a lower incidence of developing atopic symptoms such as eczema or asthma (allergies in general).**

- **Even if symptoms present, may have reduced severity in early life (protective effect may last through childhood).**

- **IgA in colostrum and breast milk may prevent the absorption of foreign macromolecules when the infant's immune system is immature.**

- **Obvious benefit in preventing cow's milk protein allergy (rhinitis, eczema, gastroenteropathy--reflux, bloody stools, poor feeding tolerance, failureto thrive). If infant believed at risk, and displays these symptoms, the mother's decrease in cow's milk containing foods MAY ameliorate the symptoms.**

Infants of Diabetic Mothers (IDMs)

- **IDMs experience alterations in the delivery and utilization of metabolic fuels during gestation.**

- **For example, maternal hyperglycemia results in elevation of fetal serum glucose levels, which in turn causes fetal pancreatic islet cell hypertrophy, beta cell hyperplasia, and fetal hyperinsulinemia.**

- **Hypoglycemia may then result because of the sudden cessation of maternal glucose delivery to the infant from the placenta immediately after birth while elevated insulin levels persist.**

- **The insulin levels normalize by ~3 days of life and problems with hypoglycemia cease.**

Infants of Diabetic Mothers

- **Also, because insulin is a growth factor, hyperinsulinemia results in macrosomia (>4000 g at term).**

- **Macrosomia can lead to birth trauma and to asphyxia secondary to *in utero* cord compression.**

- **In contrast, some IDMs (mother with vascular disease) can be IUGR and born SGA.**

- **There are many other neonatal complications of maternal diabetes; etiologies not well understood.**

Infants of Diabetic Mothers

Complications Associated with IDMs

•Hypoglycemia	•Respiratory distress
•Hypocalcemia	•Resp distress syndrome
•Hypomagnesemia	•Congenital anomalies
•Macrosomia	•Hyperbilirubinemia
•Birth injury	•Polycythemia
•Asphyxia	•Cardiomyopathy

Infants of Diabetic Mothers

- Early feeding mandatory to maintain blood sugar >40 mg/dl.
- Take to the breast early (in the delivery room or OR): there are NO contraindications to breastfeeding the IDM.
- Supplemental bottle feeds (or i.v. glucose) MAY be necessary.
- These infants may feed poorly initially, secondary to hypotonia (usually seen in macrosomic IDMs).
- Once feeding established, they adapt very well.
- Breastfeeding may be especially beneficial to the macrosomic infant, because breast-fed babies tend to be leaner after the first six months of life, and tend to be less obese later in life.

Inborn Errors of Metabolism: Phenylketonuria (PKU)

- **Most common amino acid metabolic disorder.**
- **Phenylalanine accumulates because of an enzyme defect in its metabolism.**
- **If untreated, leads to severe mental retardation.**
- **Breast milk does contain significant amounts of phenylalanine (although less than standard cow's milk-based formulas).**

Inborn Errors of Metabolism: Phenylketonuria (PKU)

- **Treatment is generally use of a phenylalanine-free formula, combined with added formula or breast milk (to provide a little phenyalanine because every infant still requires a small amount).**

- **Phenylalanine blood levels are measured, and the amount of breast milk given is adjusted accordingly: a balance can be between formula feeds and breastfeeding that permits optimal phenylalanine blood levels.**

Breastfeeding Twins and Triplets

- **Many studies support the ability that a mother can nurse twins and triplets.**
- **The breast is capable of responding to the nutritional demands on it.**
- **No known deleterious effects to the infant from a nutritional standpoint, or to the mother.**
- **Key deterrent is not usually the milk supply, but time.**
- **If the mother can nurse both infants simultaneously, the time factor is minimized, and many tricks have been suggested to achieve this feat.**

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Cleft Lip/Palate

Problem	Prevention/intervention strategies
Inadequate lip seal	Allow breast to fill the defect; may necessitate a different hold for each breast
Inefficient or weak suck	Begin let-down process with warm washcloth before placing to breast; assisting flow by expressing milk into infant's mouth
Regurgitation of fluid through nose	Correct positioning; feed in semi-upright position (45-60 degrees) to allow flow down into pharynx and away from nasal cavity
Decreased endurance with oral feeds and poor wt gain	Discontinue feeding after 20-30 minutes, conserving energy for next feed; gavage supplementation may be necessary