

Transition to Extruterine Life

Module 1

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Module 1: Transition to Extrauterine Life

Module 1 reviews the following topics:

- Physiologic changes that occur during transition to extrauterine life.
- Signs and symptoms of common problems during the transition period.
- A systematic approach to examining the neonate.
- Methods of determining gestational age, growth patterns and maturity.
- Intrapartum conditions that may result in complications for the newborn.

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This module provides an overview of transition to extrauterine life. It begins by briefly reviewing conditions that may arise during the intrapartum period that may negatively impact a baby's ability to successfully transition. Physiologic changes that occur during transition from fetal to neonatal life will be identified to aid in recognizing signs and symptoms of common problems that could arise if the physiologic changes do not occur properly. Gestational age and physical maturity assessment and alterations in growth patterns will be reviewed during the systematic approach to performing a physical assessment of the newborn.

Note to instructors: Your facility's policies and procedures related to care of the newly born as well as recognition/treatment of the compromised neonate should be followed; therefore, you may want to review these and be prepared to discuss them with participants.

Additional teaching adjuncts such as anatomic charts or models relevant to the content presented may be useful to reinforce the information presented in this module.

Objectives

- Identify intrapartum conditions that may result in complications for the newborn.
- Identify physiologic changes that occur during transition to extrauterine life.
- Recognize signs and symptoms of common problems during the transition period.
- Describe a systematic approach to examining the neonate.
- Describe methods of determining gestational age, growth patterns and maturity.

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The infant mortality rate has decreased from 47/1000 live births in 1940 to 6.9/1000 in 2002. With advances in modern obstetrics, adverse outcomes are not common, and most labor and delivery situations end with a healthy mother and baby. However, safe practice includes preparing for the possibility that a labor or birth could unexpectedly become high-risk. The first hours of a newborn's life are the most precarious. This is a time of great physiologic change from intrauterine placental support to extrauterine self-maintenance. The baby's ability to successfully accomplish this transition depends on gestational age, quality of placental support and physical attributes of major organ systems.

After finishing this module, the participant will be able to do the following:

- **Identify intrapartum conditions that may result in complications for the newborn**
- **Identify physiologic changes that occur during transition to extrauterine life**
- **Recognize signs and symptoms of common problems during the transition period**
- **Describe a systematic approach to examining the neonate**
- **Describe methods of determining gestational age, growth patterns and physical maturity**

Conditions Related to the Antepartum Period: Pregnancy Induced Hypertension

- Incidence: 5 – 10% of pregnancies
- Etiology: unknown
- Predisposing factors: primigravida < 18 and > 35 years of age, family history, low SES, malnutrition, obesity, diabetes, chronic hypertensive, renal disease, multiple gestation



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Pregnancy-Induced Hypertension: a major cause of maternal-fetal morbidity and death. Main pathophysiologic events are vasospasm, hematologic changes, and endothelial damage → leads to tissue hypoxia and multiple organ involvement.

Incidence: 5-10% of all pregnancies.

Etiology: unknown. Current theories involve an imbalance of placental proteins, immunology, dietary deficiencies or excesses, abnormal trophoblast invasion and lack of cardiovascular adaptation.

Predisposing factors: primigravida, less than 18 and greater than 35 years of age, family history, low socioeconomic status, malnutrition, obesity, diabetes, chronic hypertensive, renal disease, multiple gestation
(Broussard & Hurst, 2004; Gopalani & Benedetti, 2005)

Transition to Extrauterine Life: Fetal Blood Flow

- Ductus venosus
 - Allows 40-60% of well oxygenated blood to bypass the liver and empty directly into the heart
- Foramen ovale
 - Allows well oxygenated blood to directly enter the left atrium from the right atrium
- Ductus arteriosus
 - Connects the pulmonary artery to the descending aorta. Blood flows right (pulmonary artery) to left (aorta) because of low placental resistance
 - <10% of right ventricular output is directed into the pulmonary circuit (increased pulmonary vascular resistance)

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This slide describes the fetal shunts and what these pathways specifically do:

Ductus venosus

Allows 40-60% of well oxygenated blood to bypass the liver and empty directly into the heart.

Foramen ovale

Allows well oxygenated blood to directly enter the left atrium from the right atrium.

Ductus arteriosus

Connects the pulmonary artery to the descending aorta. Blood flows right (pulmonary artery) to left (aorta) because of low placental resistance.

<10% of right ventricular output is directed into the pulmonary circuit (increased pulmonary vascular resistance).

Pulmonary Adaptation

- Fetal lung fluid is mostly absorbed prior to delivery.
 - Aeration of lungs with initial breaths drives the fluid into the interstitium.
- Surfactant production
- Labor induces a mild hypercapnia, hypoxia and acidosis that stimulate the respiratory center.
- Cold, light, noise, tactile stimulation



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Throughout fetal life, there have been “breathing movements” that contribute to lung development. Fetal lungs actively secrete approximately 25-30 cc/kg, which is comparable to a necessary postnatal lung volume of 25 cc/kg. **Most of this fluid is absorbed through the lymphatics prior to birth. The process is initiated by the release of catecholamine secreted at the onset of labor. If there is no labor, there is an increased risk of fluid retention.**

Surfactant is produced as early as 20 weeks gestation. The absolute quantity increases with increasing gestational age.

Labor induces a mild hypercapnia, hypoxia and acidosis that stimulate the respiratory center. The extrauterine environment may be cold, dry, bright, noisy and provide lots of tactile stimulation, which also stimulates sustained breathing.

(Verklan, 2004)

Pulmonary Adaptation

- Initial breaths overcome high airway resistance and may require inspiratory pressures greater than 35 cm H₂O to open alveoli
 - Subsequent breaths require 15-20 cm H₂O
 - Ability to build the functional residual capacity depends on surfactant
 - Lung compliance improves as remaining fetal lung fluid clears
- PVR continues to decrease

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Initial breaths overcome increased airway resistance, such that required inspiratory pressures may be greater than 35 cm H₂O to open and aerate the alveoli. Once the major airways and the alveoli are opened, subsequent breaths require more normal physiologic pressures of 15-20 cm H₂O. The aim is to have air retained in the lung upon expiration to create the functional residual capacity. This is the place where gas is exchanged. The ability to build the functional residual capacity depends on the presence of adequate surfactant.

Lung compliance improves as airway resistance decreases. Airway resistance falls with the clearance of fetal lung fluid (wet airways tend to collapse) and the creation of the functional residual capacity.

Note to instructor: use the example of a balloon never blown up to one that has been expanded several time—easier with each expansion.

With the initial breaths, air is retained in the lung and the remaining fetal lung fluid is driven into the interstitium. PVR continues to decrease with increasing oxygenation, providing greater surface area for gas exchange.

Note to instructor: please refer to Textbook of Neonatal Resuscitation, 5th edition (AAP, 2006) for guidelines for the management of the neonate requiring resuscitation and stabilization at birth.

First Feedings

- Healthy term and near-term neonates should have frequent early feedings on demand.
 - Term: maximum of 4 hours between feeds
 - Pre-term: maximum of 3 hours between feeds
 - Near-term: maximum of 3-4 hours as per clinical condition
- Evaluate sucking, swallowing and breathing prior to feeding.
- Contraindications to feeding



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The neonate should begin feeding when he/she is demanding nutrition and the physical examination does not indicate any contraindications to feeding. The pre-term baby weighing < 2.5 kg should not exceed 3 hours between feeds while the term baby should not exceed 4 hours. The near-term infant's clinical condition should guide the feeding interval. It is not unusual for the breastfed baby to demand nutrition once every 2 hours.

Prior to initiation of feeds, all babies should be evaluated for the presence of bowels sounds and soft non-tender abdomen. **The baby should demonstrate sucking and swallowing reflexes.** The baby should exhibit no signs of respiratory distress.

Contraindications to bottle/breastfeeding include choanal atresia, respiratory rate >60-70 breaths/minute, poor/lack of suck, swallow, breathe reflex.

Contraindications to any enteral feedings include signs of cardiopulmonary distress, difficulty with transition to extrauterine life and suspicion of gastrointestinal obstruction.

(Verklan, 2004)

Gestational Age Assessment: Neuromuscular Maturity

- Posture
- Square Window
- Arm Recoil
- Popliteal Angle
- Scarf Sign
- Heel to Ear

	-1	0	1	2	3	4	5
Posture							
Square Window (wrist)							
Arm Recoil							
Popliteal Angle							
Scarf Sign							
Heel to Ear							

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Note to instructor: provide participants a copy of the New Ballard Score so they can follow along.

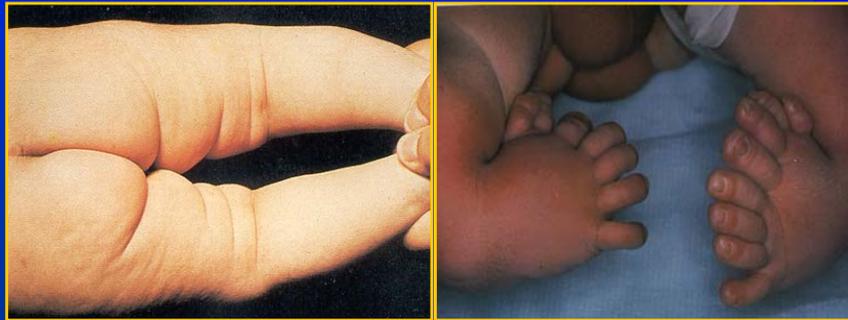
- Posture:** observe while the baby is quiet in a supine position. Tone develops from toes up toward the head, such that flexion and hip adduction increase with increasing postmenstrual age.
- Square Window:** using sufficient pressure to get full flexion, flex the infant's hand on the forearm between your thumb and index finger. Visually estimate the distance between the hypothenar eminence and ventral aspect of the forearm. The angle will decrease with increasing postmenstrual age as a result of maternal hormonal influence.
- Arm recoil:** while the infant is in a supine position, flex the arms for 5 seconds, then fully extend by pulling the hands downward and release. This criterion evaluates the degree of arm flexion as well as the strength of recoil.
- Popliteal Angle:** With the infant in a supine position and the pelvis flat on the bed, place the thigh in the knee-chest position using the left index finger and thumb. Placing the right index finger behind the baby's ankle, extend the leg using gentle pressure, and measure the angle between the lower leg and thigh, posterior to the knee. The angle will decrease with increasing postmenstrual age (PMA).
- Scarf sign:** while the infant is positioned supine, pull the baby's hand across the chest and around the neck toward the opposite shoulder as far posterior as possible. Observe the position of the elbow with respect to the midline of the baby's body.
- Heel to ear:** while the infant is positioned supine and the pelvis is flat on the bed, draw the foot toward the head as near as it will extend without using force. Note the angle of the knee extension and distance between the foot and the head.

(Furdon & Benjamin, 2004)

Reprinted with permission from Elsevier from Furdon, S., & Benjamin, K. (2004). Physical assessment. In M. T. Verklan & M. Walden, Eds., *Core curriculum for neonatal intensive care nursing, 3rd Ed.*, Figure 7-2, p.

Physical Examination: Lower Extremities

- Note size, shape and symmetry of legs and feet.
- Note shape and number of digits.
- Assess for developmental dysplasia of the hip.



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Note the size, shape and symmetry of the legs and feet. Note the resting posture and muscle tone. The legs should appear slightly bowed with everted feet. Palpate for fractures.

Count the toes. Polydactyly and syndactyly may be present. Clubfoot (talipes equinovarus) may be positional or structural. If positional, it will easily be moved into the anatomically correct position with little resistance. Clubfoot will need an orthopedic consult. Rocker bottom feet are associated with congenital syndromes.

Developmental dysplasia of the hip (DDH) may be unilateral or bilateral and is more common in females. Asymmetry of the gluteal and thigh folds and asymmetry of the buttocks can be seen on inspection. When the knees are flexed to 90-degree angle with the feet flat, the knees will not be at an equal level. Ortolani maneuver detects dislocated hips by abducting the hip and listening for a “click” or a “clunk.” Barlow maneuver determines dislocatable hips when it elicits a “click” or a “clunk” when the hip is adducted.

(Gardner & Johnson, 2006)

Infant on left has developmental dysplasia of the hip. Note asymmetry of the gluteal folds.

Reprinted with permission from B. C. Decker from Rudolph, A. J. (1997). Musculoskeletal disorders. In A. J. Rudolph, Ed. *Atlas of the newborn*, Vol. 2, Figure 1.95, p. 33.

Infant on the right has a tibia-reduction polydactyly.

Reprinted with permission from B. C. Decker from Rudolph, A. J. (1997). Musculoskeletal disorders. In A. J. Rudolph, Ed. *Atlas of the newborn*, Vol. 2, Figure 1.106, p. 37.

Parent Teaching Before Delivery

- If there are expected complications, anticipate the needs of the baby at birth
- Tour of the special care/intensive care nursery
- Parental support



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Prenatal care may have alerted the parents to anticipated complications at time of birth such as congenital anomalies. Additionally, a mother may be observed for an extended period of time in the maternal-fetal unit due to multiple gestation, preterm labor or premature rupture of the membranes. Having an anticipated plan of care upon delivery and alerting the neonatal team of complications will provide for a well planned transition to extrauterine life.

If time permits, and the mother's condition is stable enough, a tour of the special care/intensive care nursery will familiarize her/the family with the unit's location, equipment and personnel. Encourage the parents to express feelings, fears, ask questions and involve their support network.