Prematurity and Intrauterine Growth Retardation

DEFINITIONS.

Liveborn infants delivered before 37 wk from the 1st day of the last menstrual period are termed premature by the World Health Organization.

Low birthweight (LBW; birthweight of 2,500 g or less) is due to:-

1- prematurity.
2- poor intrauterine growth (IUGR, also referred to as SGA), or both. Prematurity and IUGR are associated with increased neonatal morbidity and mortality.

INCIDENCE.

There is an increasing percentage of deaths in children less than 5 yr of age that occur in the neonatal period. Approximately 38% of deaths in this age group occur within the 1st mo of life, of which 28% are attributable to premature birth. In developing countries, approximately 70% of LBW infants have IUGR. Infants with IUGR have greater morbidity and mortality than do appropriately grown, gestational age–matched infants.

VERY LOW BIRTHWEIGHT INFANTS.

VLBW infants weigh <1,500 g and are predominantly premature. The VLBW rate is an accurate predictor of the infant mortality rate. VLBW infants account for over 50% of neonatal deaths and 50% of handicapped infants.

FACTORS RELATED TO PREMATURE BIRTH AND LOW BIRTHWEIGHT.

It is difficult to separate completely the factors associated with prematurity from those associated with IUGR . A strong positive correlation exists between both preterm birth and IUGR and low socioeconomic status. Families of low socioeconomic status have higher rates of maternal undernutrition, anemia, and illness; inadequate prenatal care; drug misuse; obstetric complications; and maternal histories of reproductive inefficiency (abortions, stillbirths, premature or LBW infants). Other associated factors such as single-parent families, teenage pregnancies, short interpregnancy interval, and mothers who have borne more than four previous children are also encountered more frequently.

Identifiable Causes of Preterm Birth

Fetal
Fetal distress Multiple gestation Erythroblastosis Nonimmune hydrops
Placental
Placental dysfunction Placenta previa Abruptio placentae
Uterine

Bicornuate uterus
Incompetent cervix (premature dilatation)
Maternal
Preeclampsia
Chronic medical illness (cyanotic heart disease, renal disease)
Infection (Listeria monocytogenes, group B streptococcus, urinary tract infection, bacterial vaginosis, chorioamnionitis)
Drug abuse (cocaine)

Factors Often Associated with Intrauterine Growth Restriction

Fetal
Chromosomal disorders (autosomal trisomies)
Chronic fetal infections (cytomegalic inclusion disease, congenital rubella, syphilis)
Congenital anomalies—syndrome complexes
Irradiation
Multiple gestation
Pancreatic hypoplasia
Insulin deficiency
Insulin-like growth factor type I deficiency
Placental
Decreased placental weight or cellularity, or both
Decrease in surface area
Villous placentitis (bacterial, viral, parasitic)
Infarction
Tumor (chorioangioma, hydatidiform mole)
Placental separation
Twin transfusion syndrome
Maternal
Toxemia
Hypertension or renal disease, or both
Hypoxemia (high altitude, cyanotic cardiac or pulmonary disease)
Malnutrition (micro- or macronutrient deficiencies)
Chronic illness

Sickle cell anemia
Drugs (narcotics, alcohol, cigarettes, cocaine, antimetabolites)

IUGR is often classified as reduced growth that is symmetric (head circumference, length, and weight equally affected) or asymmetric (with relative sparing of head growth) . Symmetric IUGR often has an earlier onset and is associated with diseases that seriously affect fetal cell number, such as conditions with chromosomal, genetic, malformation, teratogenic, infectious, or severe maternal hypertensive etiologies. Asymmetric IUGR is often of late onset, demonstrates preservation of Doppler waveform velocity to the carotid vessels, and is associated with poor maternal nutrition or with late onset or exacerbation of maternal vascular disease (preeclampsia, chronic hypertension).

Problems of IUGR (SGA) Infants

PROBLEM	PATHOGENESIS
Intrauterine fetal demise	Hypoxia, acidosis, infection, lethal anomaly
Perinatal asphyxia	↓ Uteroplacental perfusion during labor ± chronic fetal hypoxia-acidosis;meconium aspiration syndrome
Hypoglycemia	↓ Tissue glycogen stores, ↓ gluconeogenesis, hyperinsulinism, ↑ glucose needs of hypoxia, hypothermia, large brain
Polycythemia-hyperviscosity	Fetal hypoxia with ↑ erythropoietin production
Reduced oxygen consumption/hypothermia	Hypoxia, hypoglycemia, starvation effect, poor subcutaneous fat stores
Dysmorphology	Syndrome anomalads, chromosomal-genetic disorders, oligohydramnios-induced deformation, TORCH infection

ASSESSMENT OF GESTATIONAL AGE AT BIRTH.

When compared with a premature infant of appropriate weight, an infant with IUGR has a reduced birthweight and may appear to have a disproportionately larger head relative to body size; infants in both groups lack subcutaneous fat. Neurologic maturity (nerve conduction velocity), in the absence of asphyxia, correlates with gestational age despite reduced fetal weight. Physical signs may be useful in estimating gestational age at birth. Commonly used, the Ballard scoring system is accurate to ±2 wk. An infant should be presumed to be at high risk for mortality or morbidity if a discrepancy exists between the estimation of gestational age by physical examination, the mother's estimated date of her last menstrual period, and fetal ultrasonic evaluation.

Neonatal Problems Associated with Premature Infants

Respiratory
Respiratory distress syndrome (hyaline membrane disease)[*]
Bronchopulmonary dysplasia

Pneumothorax, pneumomediastinum; interstitial emphysema
Congenital pneumonia
Pulmonary hypoplasia
Pulmonary hemorrhage
Apnea[*]
Cardiovascular
Patent ductus arteriosus[*]
Hypotension
Hypertension
Bradycardia (with apnea)[*]
Congenital malformations
Hematologic
Anemia (early or late onset)
Subcutaneous, organ (liver, cranial, adrenal) hemorrhage[*]
Disseminated intravascular coagulopathy
Vitamin K deficiency
Hydrops—immune or nonimmune
Gastrointestinal
Poor gastrointestinal function—poor motility[*]
Necrotizing enterocolitis
Hyperbilirubinemia—direct and indirect[*]
Congenital anomalies producing polyhydramnios
Spontaneous gastrointestinal isolated perforation
Metabolic-Endocrine
Hypocalcemia[*]
Hypoglycemia[*]
Hyperglycemia[*]
Late metabolic acidosis
Hypothermia[*]
Euthyroid but low-thyroxine status
Central Nervous System
Intraventricular hemorrhage[*]
Periventricular leukomalacia

Hypoxic-ischemic encephalopathy Seizures Retinopathy of prematurity Deafness Hypotonia[*] Congenital malformations Kernicterus (bilirubin encephalopathy) Drug (narcotic) withdrawal
Renal
Hyponatremia[*] Hypernatremia[*] Hyperkalemia[*] Renal tubular acidosis Renal glycosuria Edema

PROGNOSIS.

Infants born weighing 1,501–2,500 g have a 95% or greater chance of survival, but those weighing less still have significantly higher mortality . Intensive care has extended the period during which a VLBW infant is at increased risk of dying of complications of prematurity, such as bronchopulmonary dysplasia, necrotizing enterocolitis, or nosocomial infection . The postdischarge mortality rate of LBW infants is higher than that of term infants during the 1st 2 yr of life. Because many of these deaths are attributable to infection (respiratory syncytial virus [RSV]), they are at least theoretically preventable. In addition, premature infants have an increased incidence of failure to thrive, sudden infant death syndrome, child abuse, and inadequate maternal-infant bonding. The biologic risk associated with poor cardiorespiratory regulation because of immaturity or complications of underlying perinatal disease and the social risk associated with poverty also contribute to the high mortality and morbidity of these infants. Congenital anomalies are present in approximately 3–7% of LBW infants.

TABLE 97-8 -- Sequelae of Low Birthweight

IMMEDIATE	LATE
Hypoxia, ischemia	Mental retardation, spastic diplegia, microcephaly, seizures, poor school performance
Intraventricular hemorrhage	Mental retardation, spasticity, seizures, hydrocephalus
Sensorineural injury	Hearing, visual impairment, retinopathy of prematurity, strabismus, myopia

IMMEDIATE	LATE
Respiratory failure	Bronchopulmonary dysplasia, cor pulmonale, bronchospasm, malnutrition, subglottic stenosis, iatrogenic cleft palate, recurrent pneumonia
Necrotizing enterocolitis	Short-bowel syndrome, malabsorption, malnutrition, infectious diarrhea
Cholestatic liver disease	Cirrhosis, hepatic failure, hepatic carcinoma, malnutrition
Nutrient deficiency	Osteopenia, fractures, anemia, vitamin E, growth failure
Social stress	Child abuse or neglect, failure to thrive, divorce
Other	Sudden infant death syndrome, infections, inguinal hernia, cutaneous scars (chest tube, patent ductus arteriosus ligation, intravenous infiltration), gastroesophageal reflux, hypertension, craniosynostosis, cholelithiasis, nephrocalcinosis, cutaneous hemangiomas