

Intensive Care Nursery House Staff Manual

Very Low and Extremely Low Birthweight Infants

INTRODUCTION and DEFINITIONS: Low birth weight infants are those born weighing less than 2500 g. These are further subdivided into:

- Very Low Birth Weight (VLBW): Birth weight <1,500 g
- Extremely Low Birth Weight (ELBW): Birth weight <1,000 g

Obstetrical history (LMP, sonographic dating), newborn physical examination, and examination for maturational age (Ballard or Dubowitz) are critical data to differentiate premature LBW from more mature growth-retarded LBW infants. Survival statistics for ELBW infants correlate with gestational age. Morbidity statistics for growth-retarded VLBW infants correlate with the etiology and the severity of the growth-restriction.

PREVALENCE: The rate of VLBW babies is increasing, due mainly to the increase in prematurely-born multiple gestations, in part related to assisted reproductive techniques. The distribution of LBW infants is shown in the Table:

Table. Prevalence by birth weight (BW) of LBW babies.

<u>Birth Weight (g)</u>	<u>Percentage of Total Births</u>	<u>Percentage of Births with BW <2,500 g</u>
<2,500	7.6%	100%
2,000-2,500	4.6%	61%
1,500-1,999	1.5%	20%
1,000-1,499	0.7%	9.5%
500-999	0.5%	7.5%
<500	0.1%	2.0%

CAUSES: The primary causes of VLBW are premature birth (born <37 weeks gestation, and often <30 weeks) and intrauterine growth restriction (IUGR), usually due to problems with placenta, maternal health, or to birth defects. Many VLBW babies with IUGR are preterm and thus are both physically small and physiologically immature.

RISK FACTORS: Any baby born prematurely is more likely to be very small. However, other factors that can contribute to the risk of VLBW include:

- Race:** African-American babies are twice as likely as Caucasian to be VLBW. Black infants (16% of US live births) account for 37% of ELBW infants.
- Age:** Teen mothers (especially if <15 years old) have a much higher risk of having VLBW infant.
- Multiple birth** babies are at increased risk of being VLBW because they often are premature. More than 50% of twins and other multiple gestations are VLBW.
- Maternal health:** Women exposed to drugs, alcohol, and cigarettes during pregnancy are more likely to have LBW or VLBW babies. Mothers of lower socioeconomic

status are also more likely to have poorer pregnancy nutrition, inadequate prenatal care, and complications of pregnancy. All are factors that can contribute to VLBW.

NEONATAL COMPLICATIONS are markedly increased in VLBW, and especially ELBW, infants. Because most VLBW infants are also premature, it may be difficult to differentiate problems due to prematurity from those due to very small size. In general, the lower a baby's birthweight, the greater are the risks for complications. However, some complications of prematurity (e.g., risk of RDS) are lessened by the stress of mild to moderate intrauterine growth restriction. Clinical problems associated with VLBW and ELBW include:

- 1. Hypothermia:** LBW infants have higher body surface area:body weight ratios, decreased stores of brown fat and glycogen, and may not be able to conserve or generate body heat. Clinical problems associated with hypothermia include hypoglycemia, apnea, increased O₂ consumption and metabolic acidosis. Prevention of hypothermia increases survival of the infants. Methods of preventing heat loss include:
 - Drying the infant at birth to prevent evaporative heat loss
 - Warmed blankets or plastic wrap to prevent convective and radiant heat loss during transport
 - Swaddling to preserve body heat in larger infants, and radiant heater or a heated incubator to maintain a neutral thermal environment for smaller infants.
- 2. Hypoglycemia** due to decreased stores of glycogen and fat. Hypothermia and hypoxia aggravate this due to increased metabolic demands and anaerobic glycolysis.
- 3. Perinatal asphyxia**, especially among growth retarded infants because of compromised O₂ delivery *in utero*.
- 4. Respiratory problems:**
 - Respiratory Distress Syndrome, due to surfactant deficiency (see P. 79)
 - Apnea of prematurity (see section on Apnea, P. 91)
- 5. Fluid and electrolyte imbalances** due to increased insensible water loss (due to ↑ surface area/body weight, thin skin), impaired renal function. They are at risk for dehydration, fluid overload, hypernatremia, hyponatremia, hyperkalemia (especially ELBW), hypocalcemia, hypermagnesemia (iatrogenic from maternal treatment). Compromised renal function may impair tolerance of free water, bicarbonate resorption, potassium secretion, or urinary concentrating capacity.
- 6. Hyperbilirubinemia** (see section on Jaundice, P. 118)
 - Indirect (unconjugated) hyperbilirubinemia due to bruising or hemorrhage, ↓ RBC survival, hepatic immaturity, delayed enteric feedings and ↓ gut motility. With IUGR, risk factors may include infection and/or polycythemia.
 - Direct (conjugated) hyperbilirubinemia as a complication of parenteral nutrition.
- 7. Anemia** due to:
 - Phlebotomy for laboratory tests and small total blood volume
 - Anemia of prematurity
- 8. Impaired nutrition**, feeding difficulties and slow rates of weight gain due to:
 - Gut immaturity with decreased motility, enzyme deficiencies and ↑ risk of necrotizing enterocolitis (see P. 133)
 - Delayed enteric feeding due to respiratory disease, PDA, indomethacin treatment
 - Infants <32-34 weeks gestation are developmentally not ready to nipple feed
 - Increased caloric needs (↑surface area/body weight)

9. Infection: Risks are increased because of immunologic immaturity, prolonged invasive treatments (*e.g.*, endotracheal tube, intravascular catheters, parenteral nutrition and prolonged, recurrent treatment with antibiotics).

10. Neurological problems including:

- Intraventricular hemorrhage (see P. 144)
- Periventricular leukomalacia
- Increased long term risks for cerebral palsy, developmental delay, learning disabilities

11. Ophthalmologic complications including:

- Retinopathy of prematurity (ROP)
- Strabismus and refractive errors

12. Hearing deficits due to:

- Prematurity itself
- Hyperbilirubinemia
- Meningitis
- Hypotension
- Ototoxic drugs (*e.g.*, aminoglycosides, furosemide)

13. Sudden infant death syndrome (SIDS): Premature infants are at increased risk, but home monitoring has not been shown to be an effective preventive measure. Home monitoring is not recommended in absence of other risk factors (*e.g.*, twin sibling with SIDS, two siblings with SIDS, obstructive airway problems, or craniofacial anomalies posing risks for obstructed airways).

MANAGEMENT: Because of the increased risk for multiple problems, these infants require meticulous attention to all facets of their care. The following are but a brief summary of certain aspects of the care of these fragile infants:

1. Resuscitation: (see section on Resuscitation, P. 1)

2. Respiratory Care: The **majority of ELBW (*i.e.*, <1,000 g) will require intubation at birth** (to assist in their cardiopulmonary adaptation to extra-uterine life) and assisted ventilation for a prolonged period. They require close attention with frequent measurements of pH and blood gas tensions. In addition to surfactant deficiency, they are at risk for respiratory failure because of:

- Weak chest wall
- Weak muscles of respiration
- Smaller alveoli (↑ tendency to atelectasis)
- Decreased central respiratory drive

3. Cardiovascular: Most VLBW and almost all ELBW infants will require an umbilical arterial catheter for blood sampling and blood pressure measurement. **Hypotension is common.** The most effective therapy is **dopamine** (usual starting dose is 5 mcg/kg/min). Do not automatically give fluid boluses for “decreased perfusion,” acidosis, or hypotension. Excess fluid will worsen pulmonary function and give excess Na⁺. Reserve volume expansion for situations where there are signs of hypovolemia (see sections on Shock, P. 101, and Blood Pressures, P. 35).

3. Oxygen therapy: Maintain SpO₂ in **range of 85-92%**. If SpO₂ is > 94%, arterial oxygen tension may be high (>100 mmHg) because of the inaccuracy of the pulse oximeter at high saturations. This puts the infants at ↑ risk for ROP. **Do not write titration orders for oxygen.**

4. Fluids: On the 1st day of life, preterm infants should receive restricted fluids (*e.g.*, 60-80 mL/kg/d). However, **for ELBW infants, fluid intake should be higher (*e.g.*, 100-125 mL/kg/d).** Follow intake and output closely, at least q12h for the first several days.

- 5. Electrolytes:** On the 1st day, do not give Na⁺ or K⁺. To avoid hypocalcemia, start Ca gluconate at 200 mg/kg/d. Follow serum electrolytes closely.
- 6. Nutrition:** Feedings on the 1st day of life are unusual for VLBW infants. Do not start feeds on the 1st day of life in ELBW infants. (see section on Feeding, P. 50). **Trophic (gut stimulation) feedings** for several days facilitate later advance of feedings. Consider **early institution of TPN**. Do not give IV lipids for 3-5 d, especially if there is severe pulmonary disease. (see section on Parenteral Nutrition, P. 136).
- 7. Infection:** Obtain CBC and blood culture at birth. If there are any risk factors, begin antibiotic therapy (48 h of treatment until culture results are known).
- 8. Glucose:** Maintain blood glucose ≥ 45 mg/dL. (see section on Hypoglycemia, P. 153). Initial IV fluid should be D10W. Some ELBW infants may become hyperglycemic and require lower glucose intake and/or insulin.
- 9. Hyperbilirubinemia:** (see section on Jaundice, P. 118)
- 10. Anemia:** Assume all ELBW and many VLBW infants will need at least 1 transfusion. Obtain parental consent in advance, discussing option for designated donor blood. Type and cross match packed cells in small volume aliquots to minimize number of donors. Start erythropoietin as described in Guidelines for Use of Erythropoietin (P. 107).
- 11. Intraventricular hemorrhage** (see schedule for cranial sonograms on P. 146)
- 12. Ophthalmology examination** for ROP commencing at age 1 mo for infants born < 32 weeks.

OUTCOME:

Survival of VLBW babies is directly related to birth weight. Survival data for infants born at UCSF from 1998-2002 (inclusive) are:

<u>Birth Weight (g)</u>	<u>Survival</u>
500-750	74%
751-1,000	82%
1,001-1,250	92%
1,251-1,500	95%

Long-term outcome: VLBW and ELBW infants are at \uparrow risk for cerebral palsy, developmental delay, mental retardation, visual problems (including blindness), hearing impairment, chronic lung disease and SIDS. Risk for these \uparrow with decreasing BW and GA. Data for very preterm infants followed in the UCSF ICN Follow-Up Clinic are shown below:

<u>GA*</u>	<u>No Deficits[‡]</u>	<u>One Deficit[‡]</u>	<u>Two or More[‡]</u>
24	28%	39%	33%
25	47%	23%	30%
26	63%	34%	3%

*GA, completed gestational weeks; deficits include deficient cognitive development, cerebral palsy and visual and auditory deficits.