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Care of extremely low birth weight babies

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Abstract
A neonate weighing less than 1000g at birth irrespective of the gestational age is called as extremely low birth weight babies. In India about 30 to 40 percent neonates are born LBW. Approximately 80% of all neonatal deaths and 50% of infant's death are related to LBW. Some clinical features are muscle tone is poor, plantar creases are not visible before 32 weeks, the testis is undescended and the labia minor is exposed, and there is a tendency of herniation. The necessary interventions that are required in order to manage babies with IUGR are management of hypothermia, hypoglycemia, fluids and electrolyte, nutrition, hyperbilirubinemia, respiratory distress and infection.

Keywords: Low birth weight, hyperbilirubinemia, respiratory distress

Introduction [1]
Previously, the birth weight of 2500gm or less was taken as index of prematurity without taking any consideration of the gestational period or any other factor. But infants born at term or post term may weigh less than 2500gm and occasional a baby of diabetic mother may weight much more than 2500gm even before 37 weeks. Thus, the inclusion of all the babies weighing less than 2500gm without due consideration to the gestational period seems inappropriate.
The high risk newborns can be classified as a newborn regardless of gestational age or birth weight who has a greater average chance of morbidity and mortality because of conditions or circumstances associated with and the adjustment to or extra uterine existence. The high risk infants are classified according to birth weight, gestational age and predominant pathophysiological problems.
Therefore the classification according to the size includes:
1. Low birth weight babies
2. Very Low birth weight babies
3. Extremely Low birth weight babies
4. Appropriate for gestational age
5. Small for gestational age
6. Large for gestational age
7. Intrauterine growth restriction
8. Symmetric IUGR
9. Asymmetric IUGR

Definition
A neonate weighing less than 1000g at birth irrespective of the gestational age is called as extremely low birth weight babies (ELBW) [2].
An extremely low birth weight (ELBW) infant is defined as one with a birth weight of less than 2 lb or 3 oz or 1kg or 2.2 pounds. Most extremely low birth weight infants are also the youngest of premature newborns, usually born at 27 weeks' gestational age or younger. Infants born with a birth weight less than 1500 g are defined as very low birth weight (VLBW) infants [3].

Incidence
1. In US 2010, infant mortality rates were 24 times higher for infants with low birth weight (< 2500g) and 100 times higher for those with very low birth weight (VLBW) (< 1500g) than for infants with birth weights of 2500g or more. First year survival was 15.5% for infants with a birth weight less than 500g. Infants with extremely low birth weight

(ELBW) are more susceptible to all complications of premature birth, both in the immediate neonatal period and after discharge from the nursery [4].

2. In India about 30 to 40 percent neonates are born LBW. Approximately 80% of all neonatal deaths and 50% of infant's death are related to LBW.

- High incidence of LBW babies in our country is due to higher number of babies with IUGR (SMALL FOR DATE) rather than preterm.
- The baby with a birth weight of less than 2000gm is more vulnerable and need special care.
- About 10% of all LBW babies require admission to the special care nursery [5].

Clinical Features [6]

- Head circumference disproportionately exceeds than that of the chest.
- Weight is less than 1000 gram or 1kg.
- The skin is thin, red and shiny, due to lack of subcutaneous fat and covered by plentiful lanugos and vernix caseosa.
- Pinnae of the ear are soft.
- The eyes are kept closed.
- Muscle tone is poor.
- Plantar creases are not visible before 32 weeks.
- The testis is undescended,
- The labia minor is exposed, and there is a tendency of herniation.
- The nail is not grown up to the finger tips.
- Reflexes are poor.

Management

Medical Management

Thermoregulation

As a result of a high body surface area–to–body weight ratio, decreased brown fat stores, nonkeratinized skin, and decreased glycogen supply, infants with extremely low birth weight (ELBW) are particularly susceptible to heat loss immediately after birth. Hypothermia may result in hypoglycemia, apnea, and metabolic acidosis.

Heat loss can occur in infants with extremely low birth weight in following 4 ways:

- Conduction - The transfer of energy from the molecules of a body to the molecules of a solid object in contact with the body, resulting in heat loss
- Convection - The similar loss of thermal energy to an adjacent gas
- Evaporation - Evaporative heat loss is the total heat transfer by energy-carrying water molecules from the skin and respiratory tract to the drier environment
- Radiation - Radiant loss is the net rate of heat loss from the body to environmental surfaces not in contact with the body

Extremely preterm infants are especially prone to these losses secondary to the poor barrier provided by their thin, poorly keratinized skin.

Temperature control is paramount to essential for survival, and it is typically achieved with the use of radiant warmers or double-walled incubators. Hypothermia (< 35°C) has been associated with poor outcome, including chronic oxygen dependency. Immediately after birth, the infant should be dried and placed on a radiant warmer, and a hat or another covering should be placed on his or her head, as the scalp is a site of large heat loss. Studies have shown that placing a plastic film over the baby immediately after drying or placing the infant on a warming mattress can further minimize evaporative and convective heat losses [7-8].

For transport to the neonatal intensive care unit (NICU) from the delivery room, the infant should be covered with either warmed blankets or cellophane wrap, or the top of the warmer should be lowered to prevent heat loss. To transport the infant to other hospital areas, he or she should be placed in a double-walled, heated incubator.

The delivery room and NICU should be kept warm to aid in the prevention of hypothermia in the preterm infant. Architectural designs should facilitate adjacent location of delivery rooms and NICUs or at least provide separately heated resuscitation rooms. Although chemical heating pads are commonly used to provide a warm surface on which to place the baby, the unregulated heat source may burn the very fragile skin of the infant; therefore, such pads are not recommended. Caution is due when using any of the currently available methods to prevent hypothermia; frequent monitoring of temperature is necessary to prevent overheating given any combination of approaches.

Hypoglycemia

Fetal euglycemia (maintenance of normal blood glucose levels) is maintained during pregnancy by the mother via the placenta. Infants with ELBW have difficulty maintaining normal glucose concentrations after birth, when the maternal source of glucose has been lost. In addition, these infants are usually under increased stress compared with their term counterparts, and they have insufficient levels of glycogen stores. Preterm infants are generally considered hypoglycemic when plasma glucose levels are lower than 45 mg/dL [9].

Because symptoms of hypoglycemia (seizures, jitteriness, lethargy, apnea, poor feeding) may be less obvious in preterm infants, hypoglycemia may be detected only on routine sampling.

One form of accepted treatment consists of an immediate intravenous (IV) dextrose infusion of 2 mL/kg of 10% dextrose-in-water solution (200 mg/kg), followed by a continuous IV infusion of dextrose at 6-8 mg/kg/min to maintain a constant supply of glucose for metabolic needs and to avoid further hypoglycemia.

Rapid infusion of glucose concentrations of greater than 10% should be avoided because of the hyperosmolarity of the solution and the risk of cerebral hemorrhage. Increased insulin secretion that leads to a "rebound" hypoglycemia is a concern when the insulin is administered through an umbilical artery catheter.

Fluids and Electrolytes

Maintenance of fluid and electrolyte balance is essential for normal organ function.

These infants also have compromised renal function stemming from a decreased glomerular filtration rate and a decreased ability to reabsorb bicarbonate. Immature renal tubular function results in decreased ability to secrete potassium and other ions with a relative inability to concentrate urine. In addition, they reabsorb creatinine via the tubules following birth; thus, serum creatinine levels are elevated for at least the first 48 hours of life and do not reflect renal function for the first few days following birth. In ELBW infants, the serum creatinine peak is higher, and

the subsequent decline is slower, than that of term equivalents. In ELBW infants, sustained high creatinemia correlates with immaturity and morbidity [10].

Fluid status is commonly monitored with daily (or sometimes twice daily) body weight measurement, strict monitoring of fluid intake and output, including estimated insensible water loss, and frequent monitoring of electrolytes.

Fluid requirement for LBW babies

Days	<1000gm	1000 -1500gm	>1500gm
1st and 2nd	100-120ml	80-100ml	60-80ml
3ed and 4th	130-140ml	120-130ml	90-100ml
5th and 6th	150-160ml	140-150ml	110-120ml
7th and 8th	170-180ml	10-170ml	130-140ml
9th day on wards	190-200ml	180-190ml	150-160ml

Nutrition

Initiating and maintaining the growth in ELBW infants is a continuing challenge. These infants should be weighed daily, and body length and head circumference are usually measured weekly to track growth. The growth rate often lags because of complications such as pulmonary disease and sepsis, which may compromise the ability to provide optimal nutrition.

The most common factor contributing to poor growth is inadequate caloric and protein intake. Concern that early feeding may be a risk factor for necrotizing enterocolitis (NEC) often deters initiation of enteral feeding, although nutritional management of such infants is marked by a lack of uniformity of practice. Starting with trophic feedings within 24-48 hours of life and regularly increasing the volume of enteric nutrition along with appropriate total parenteral nutrition (TPN) will result in optimal growth.

Insufficient and delayed nutritional support results not only in significant postnatal growth failure [11] but also directly impacts neurodevelopmental outcome. Hence, nutritional goals in ELBW infants should aim to quickly establish caloric and protein intake that is equivalent to, or at least very similar to, the in utero delivery rate with early introduction and maximization of both parenteral and enteral nutrition.

Parenteral nutrition

Parenteral nutrition may provide the primary source of energy and protein in infants with ELBW in the first few weeks after birth. Optimal parenteral nutrition of approximately 80-100 kcal/kg/day is achieved by the use of a specialized solution consisting of amino acids, dextrose (sugar), minerals, and electrolytes, called TPN. A 20% lipid emulsion is provided to complete the nutrition of the infant. Lipid intake should be given, even initially, at approximately 3 g/kg/day in the first 24 hours of life for optimal nutrition [12].

Enteral nutrition

Enteral feeding is often begun when the infant is medically stable, using small-volume trophic feeding (approximately 10mL/kg/day) to stimulate the gastrointestinal (GI) tract and prevent mucosal atrophy. Bolus feedings every 2-4 hours may begin as early as day 1. If tolerated, as evidenced by minimal gastric residuals and clinical stability, feeding may increase by as much as 10-20mL/kg/day, although feeding practices widely vary [13]. Although bolus feeding may appear to be more physiologically appropriate, infants who do not tolerate the volume of the bolus may be continuously fed.

Clinical studies have consistently demonstrated that infants who are fed earlier and are advanced according to a feeding plan have less incidence of infection and achieve full enteral feeds sooner than their counterparts who are less systematically treated [14].

Hyperbilirubinemia

Most infants with ELBW develop clinically significant hyperbilirubinemia (jaundice) that requires treatment. Hyperbilirubinemia develops as a result of increased red blood cell (RBC) turnover and destruction in the context of an immature liver that has physiologically impaired conjugation and elimination of bilirubin. In addition, most preterm infants have reduced bowel motility due to inadequate oral intake, which delays elimination of bilirubin-containing meconium, coupled with increased enterohepatic circulation of conjugated bilirubin that enters the intestinal tract [15].

These complications of extreme prematurity, in addition to typical conditions that cause jaundice (eg, ABO incompatibility, Rh disease, sepsis, inherited diseases), are thought to place these infants at higher risk for kernicterus at levels of bilirubin far below those in more mature infants, [16] although specific serum bilirubin levels that are safe versus toxic have never been elucidated.

Kernicterus occurs when free, unconjugated bilirubin crosses the blood-brain barrier (BBB) and stains the basal ganglia, pons, and cerebellum; diminished serum protein levels and the occurrence of acidosis in ELBW infants may potentiate the proportion of unbound bilirubin available to cross the BBB. Infants with kernicterus who do not die may have sequelae such as deafness, mental retardation, and cerebral palsy.

Respiratory Distress and Chronic Lung Disease

An early complication of extreme prematurity is respiratory distress syndrome (RDS) caused by surfactant deficiency. Clinical signs include tachypnea (>60 breaths/min), cyanosis, chest retractions, nasal flaring, and grunting. Untreated RDS results in increasing difficulty in breathing and increasing oxygen requirement over the first 24-72 hours of life. Chest radiography reveals a uniform reticulogranular pattern with air bronchograms.

As a result of surfactant deficiency, the alveoli collapse, causing a worsening of atelectasis, edema, and decreased total lung capacity. Surfactants decrease the surface tension of the smaller airways so that the alveoli or the terminal air sacs do not collapse, which results in less need for supplemental oxygen and ventilatory support.

Surfactant agents may be administered as prophylaxis or as rescue intervention for RDS.

Noninvasive ventilation

Infants who are not immediately intubated are usually maintained with nasal CPAP, which has been shown to improve endogenous surfactant production. These infants are intubated and given surfactant only if the initial trial of CPAP failed, as evidenced by increasing $PaCO_2$, increasing respiratory distress, or persistently high oxygen requirement [17-18].

Infection

Infection remains a major contributing factor to the morbidity and mortality of infants with extremely low birth weight (ELBW). Early-onset infection (occurring within the first 72 h of life) may present with immediate respiratory distress shortly after birth or after an asymptomatic period.

Signs of infection are myriad and may be nonspecific; they include the following:

- Temperature instability: Hypothermia or hyperthermia
- Tachycardia
- Decreased activity
- Poor perfusion
- Apnea
- Bradycardia
- Feeding intolerance
- Increased need for oxygen or higher ventilatory settings
- Metabolic acidosis

Prevention

Infection prevention [19]

Skin care practices in the NICU have a particularly heavy encumbrance of risk versus risk, especially when infection prevention is considered.

Central line-related bloodstream infections (CLABSIs) in the NICU carry a 25% mortality risk, as well as increased morbidities, including poor neurodevelopmental outcomes. One of the main risk factors for line-related sepsis is the concentration of skin flora at the insertion site; therefore, effective skin antisepsis before a central line insertion is paramount in preventing CLABSI. The Centers for Disease Control and Prevention (CDC) recommends cleansing the skin with chlorhexidine gluconate (CHG) before placement of central venous lines, as CHG has been shown to have reduced infection rates when compared with iodine-based solutions but preterm infants do absorb CHG into their bloodstream after a single exposure to aqueous CHG before central line placement, and that serum levels peak at 2 to 3 days after exposure.

A commonly used alternative to CHG in the NICU is povidone-iodine. In addition to having poor barrier function, preterm infants are at higher risk for iodine overload due to decreased renal clearance and the inability to regulate the uptake of iodine into the thyroid. The ability to control the uptake of iodine matures at about 36 to 40 weeks' gestational age, leaving preterm infants at risk for transient hypothyroidism, goiter, and possibly altered neurodevelopmental outcomes.

Although preterm infants are largely overlooked for best practice regarding skin antisepsis, careful application technique of iodine or CHG-based products is essential to protect preterm infants from skin breakdown. Gentle, nonaggressive application can be done to decrease friction-related breakdown. Not allowing product to pool on skin surfaces, especially skin creases, may decrease the risk of chemical burns.

Petrolatum-based emollients are commonly used in wound healing for superficial injuries and burns, and it seems perfectly reasonable that the practice of using petrolatum-based products may facilitate a similar therapeutic healing environment for the skin of preterm neonates.

Routine bathing is often thought of as beneficial to reducing the overall number of microbes and also necessary for the removal of physiologic skin debris.

Gentle and early stimulation, Prevention, early detection and prompt management of complication

- The baby should be observed for respiration, skin temperature, heart rate and skin color, activity feeding behavior, passage of meconium or stool and urine, condition of umbilical cord, eyes and oral cavity and any abnormal signs like edema, bleeding, vomiting, etc. biochemical and electronic monitoring should be done if needed.
- Weight recording should be done daily in sick babies or at alternative days. Position should be checked at every 2 hours. Baby should be placed in right side after feeding to prevent regurgitation and aspiration.
- Mother should be allowed to take care of baby whenever condition permits.

Vaccination of ELBW

- If the ELBW baby is not sick, the vaccination schedule is the same as for the normal babies. BCG, OPV, and HBV vaccine should be given at the time of discharge.

Transport of Sick ELBW Babies

- It is essential to provide warmth during transport cold injury.
- The baby should be clothed and placed in a pre-warmed basket or box. But a transport incubator is ideal.
- Hot water rubber bottle may be used as heat source. However make sure to cap them tightly and wrap 2 layers of towel to avoid direct contact with the baby.
- Mother of the baby should also be transferred to the hospital along with the baby as for as possible. This will allay her anxiety and ensure breast milk feeding of the baby.

Prognosis

Prognosis for survival is directly related to the birth weight and quality of neonatal care. Long term complications may be found as neurological handicap in the form of cerebral palsy, seizure, hydrocephalus, microcephaly, blindness, deafness, and mental retardation. Minor neurological disabilities are found as, behavior problem, language problems and learning disabilities.

Nursing Diagnosis

1 Altered breathing dyspnea related to poor lung maturity secondary to respiratory distress
2 Altered body temperature hypothermia related to immature thermoregulation centre secondary to less subcutaneous fat.
3 Altered nutrition less than body requirement related to poor sucking reflex.
4 Fluid volume deficit hypovolemia related to poor intake.
5 Parental fear and anxiety related to NICU procedures and child condition
6 High risk for complication like hypoglycemia related to poor feeding.
7 High risk for infection related to poor immunity.
8 Parental knowledge deficit regarding care of low birth weight babies related to lack of exposure.

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