

Management of low birth weight babies

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Introduction

The normal birth weight of newborns in our country is around 2800 to 3000 gm. Low birth weight or LBW, as it is abbreviated, denotes birth weight of less than 2500 gm. In India over 30 percent infants born are LBW.

Nearly 75 percent neonatal deaths and 50 percent infant deaths occur among the low birth weight neonates. Even after recovering from neonatal complications, some LBW babies may remain more prone to malnutrition, recurrent infections, and neurodevelopmental handicaps. Low birth weight, therefore, is a key risk factor of adverse outcome in early life.

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Types of LBW

The newborn baby can be LBW because of two reasons. First, the baby may be *preterm or premature*. A preterm baby has not yet completed 37 weeks of gestation. Since fetal size and weight are directly linked to gestation, it is obvious that if the delivery takes place prematurely, the baby is likely to have less weight. The second situation that leads to low birth weight is *intrauterine growth retardation or IUGR*. This condition is similar to malnutrition. Here, gestation may be full term or preterm, but the baby is undernourished, undersized and therefore, low birth weight. Such a baby is also called *a small-for-date or SFD neonate*. Two thirds of our LBW neonates fall in this category. At times, a LBW neonate may be both *preterm* as well as *small-for-date*.

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Etiology of LBW

Poor nutritional status of the mother and frequent pregnancies are the major causes of intrauterine growth retardation. Mothers with a weight of less than 40 kg and a height of less than 145 cm often give birth to small-for-date babies. Insufficient nutritional intake during pregnancy also has an adverse effect on fetal weight. Maternal hypertension, pre-eclampsia, post-maturity, frequent pregnancies, multiple pregnancy, anemia, malaria and tobacco use are other causes of intrauterine growth retardation. Chronic maternal diseases of heart, kidneys, lungs or liver may also lead to intrauterine growth retardation.

Preterm labour occurs in teenage mothers and in the setting of low maternal weight, cervical incompetence, antepartum hemorrhage, previous fetal loss, previous preterm delivery. Sometimes, preterm labor is medically induced for the sake of the baby as in the case of Rh isoimmunisation or maternal diabetes mellitus. The cause of a majority of preterm deliveries, however, remains unknown.

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How to recognize preterm and SFD infants?

It is desirable and of practical relevance to make clinical distinction between the two types of LBW babies. Preterm baby is diagnosed on the basis of period of gestation calculated from the last menstrual cycle of the mother. If it is less than 37 completed weeks, the baby in question is preterm. Preterm babies also have distinct physical features which help in their recognition. If you examine their soles, you notice that the deep skin creases on them are present only on the anterior one third. The external ear or the pinna is soft and devoid of cartilage. Hence, it does not recoil back promptly on being folded. In males, the scrotum does not have rugae and testes are not descended into the scrotum. In females infants, the labia are widely separated, not covering the labia minora, resulting in the prominent appearance of the clitoris. The back of the preterm babies has abundant growth of fine hair called lanugo.

Small-for-dates neonates have an emaciated look and loose folds of skin because of lack of subcutaneous tissue. These are particularly prominent over the buttocks and the thighs. They look alert and often plethoric. If you compare the head circumference with chest circumference, it is easy to identify a small-for-dates baby. Normally, the head is bigger than the chest by about 2 cm. In small-for-date babies, the head circumference exceeds the chest circumference by more than 3 cm. The small-for-date babies are often full term or borderline term in gestation. When their birth weight is plotted on the intrauterine growth chart, it falls below the 10th centile. Any baby at birth may be classified based on gestation into preterm, term or postterm and on the birth weight into small-for-dates (SFD) appropriate-for-dates (AFD), and large-for-dates (LFD).(see intrauterine growth chart).

Remember that if a baby is preterm as well as small-for-dates, he/she would have a combination of the above mentioned features.

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Problems of preterm neonates

The LBW babies are predisposed to a number of neonatal problems. These are somewhat different in the preterm and the small-for-dates infants. Let us first look at the problems of the preterm babies.

The basic underlying feature of the preterm LBW infant is immaturity of their organ systems. They may not establish respiration satisfactorily at birth and develop asphyxia necessitating expert resuscitation. Newborn babies keep themselves warm by active metabolism in the brown fat stores. The preterm babies lack brown fat and therefore become hypothermic at the usual ambient temperature unless specific measures are taken to keep them warm. Preterm neonates less than 34 weeks of gestation cannot coordinate sucking and swallowing. Therefore, they are unable to feed from the breast. Preterm LBW infants, especially those less than 30 weeks of gestation may not tolerate any enteral feeds initially because of gut immaturity. Preterm babies especially those less than 34 weeks have immature lungs which do not expand well after birth and are

therefore unable to perform the function of gas exchange. They develop respiratory distress syndrome characterised by rapid and labored respiration, indrawing of the chest, grunting, and cyanosis. Because of the immature respiratory control mechanisms these babies also have a tendency for apneic spells. In an apneic spell the baby stops breathing, develops slow heart rate and turns blue. Preterm infants also have immature vascular bed around the brain ventricles. These delicate vessels may rupture and cause intraventricular hemorrhage. Immature metabolic pathways of preterm infants predispose them to develop hypoglycemia, metabolic acidosis and hyperbilirubinemia. Infection is another major problem among preterm babies and indeed an important killer because they are immunocompromised hosts. These babies do not have efficient humoral, cellular and mucosal immune mechanisms to protect themselves against bacteria. Besides, interventions such as needle pricks and intravenous lines, especially in the setting of a contaminated environment, predispose them to potentially fatal bacterial infections. Preterm infants given excess oxygen may develop blindness because of damage to the immature retina, a condition called Retinopathy of Prematurity.

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Problems of SFD neonates

The neonatal complications in the small-for-date babies are slightly different. The basic underlying problem among them is in-utero undernutrition and hypoxia. They have small placentae. The stress of labor may lead to fetal distress, meconium passage in utero and birth asphyxia. Since, they are chronically undernourished in utero, they also lack adequate brown fat stores. This predisposes them to hypothermia. They also develop hypoglycemia because of insufficient energy stores. They too are candidates for neonatal sepsis because of the ill effects of chronic intrauterine stress on the immune system. Small-for-dates infants are more likely to have malformations than their normal counterparts. They also face feeding difficulties, though to a lesser extent than the preterm babies.

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MANAGEMENT

Delivery of low birth weight babies

Ideally, the delivery of an anticipated LBW baby should be conducted in a hospital. Premature labor as well as intrauterine growth retardation are indications for referral of the pregnant mother to a well-equipped facility. This in-utero transfer of a low weight *fetus* is far more desirable, convenient and safe than the transport of a low weight *baby* afterbirth. Delivery should be conducted by trained health professionals, of whom, at least one should be well-versed with the art of neonatal resuscitation. The standard procedure of resuscitation should be followed efficiently. Resuscitation equipment like suction catheters, bag and mask, oxygen cylinder, laryngoscope etc. should be kept ready beforehand. Baby must be provided warmth from a heat source like a heater or a lamp with 200 W bulb to prevent hypothermia.

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Deciding the place where a LBW baby should be managed

An otherwise healthy LBW newborn with a birth weight of 1800 gm or above and gestation of 34 weeks or more can be managed at home by the mother and the family under the supervision of a health worker or a family physician. The indications for hospitalization of a neonate include the following:

- (a) Birth weight less than 1800 gm
- (b) Gestation less than 34 weeks
- (c) Neonate who is not able to take feeds from the breast or by katori-spoon (irrespective of birthweight and gestation)
- (d) A sick neonate (irrespective of the birthweight or gestation)

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Keeping LBW babies warm

Provision of warmth to prevent hypothermia is one of the cardinal principles of newborn care. A baby under cold stress wastes energy and oxygen in trying to maintain temperature. Hypothermia can lead to

hypoglycemia, bleeding diathesis, pulmonary hemorrhage, acidosis, apnea, respiratory failure, shock and even death. All this can be entirely prevented by adhering to the following simple measures:

At home

First and foremost, the mother herself is a source of warmth for the baby. It is of immense help to nurse the baby next to the mother, day and night. Further, the room where a LBW baby is nursed should be kept rather warm (temperature between 28°C to 30°C in all seasons). This temperature is slightly uncomfortable for adults, but this discomfort has to be accepted for the sake of the baby. While in summer months no extra effort is required to maintain this temperature, in winter months a room heater may have to be used.

The baby should be clothed well. Two or three layers of clothes are generally required. If the room is not warm enough, woolen sweater should also be put on. Feet should be covered with socks, hands with mittens and head with a cap. Besides, a blanket should be used to cover the baby.

In a rural set-up, it may be a necessary to use hot water bottle (filled with lukewarm water at about 39°C) wrapped in double layered clothes to keep baby warm. However, extreme caution should be exercised to prevent accidental burn of the baby while using the hot water bottle.

If a child is maintaining normal body temperature, the trunk feels warm to touch while the soles and the palms are pink and warm. In early stages of hypothermia, the trunk is warm but the soles and palms are cold to touch. This condition, cold stress, is not normal and baby requires additional warmth immediately.

In the hospital

Apart from the above methods, overhead radiant warmer or incubator may be used to keep the baby warm. Regular monitoring of axillary temperature should be carried out in all hospitalized babies. *Refer to topic*

on hypothermia in newborn.

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NUTRITION AND FLUIDS

Mode of providing fluids and feeds

Birth weight, gestation, presence or absence of sickness and individual feeding effort of the baby determine the decision as to how a LBW neonate should be provided fluids and nutrition (Table 1). Ultimate goal is to meet both these needs from direct and exclusive breast feeding.

Neonates weighing less than 1200 g or of a gestation of less than 30 weeks, or those having sickness should receive intravenous fluids initially. Enteral feeds should be introduced gradually by gavage as the baby's acute problems begin to settle. In due course, the baby is shifted to katori-spoon feeds and then to direct breast feeds.

Infants weighing 1200-1800 g (or 30-34 weeks gestation) and not having significant illness should be put on gavage feeds initially. In a couple of days, it should be possible to shift them to katori-spoon feeds, and then gradually to breast feeds.

In order to promote lactation and enable the baby to learn sucking, all babies on gavage or katori-spoon feeds should be put on the breasts before each feed for 5 to 10 minutes. With improvement in their overall condition, the infants would start meeting part and later, all of their nutritional needs from direct breastfeeding. Breast milk is the best milk for a LBW baby.

TABLE 1: Guidelines for the modes of providing fluids and feeding

Age	Categories of neonates		
	Birth weight (gm)	1200-1800	>1800
Gestation (wks)	<30	30-34	>34
Condition			
Initial	Intravenous fluids Try gavage feeds, if not sick	Gavage	Breast feeding. If unsatisfactory, give katori-spoon feeds
After 1-3 days	Gavage	Katori-spoon	Breast
Later (1-3 wks)	Katori-spoon	Breast	Breast
After some more time (4-6 wks)	Breast	Breast	Breast

Note:

1. For gavage and katori-spoon feeds, use expressed breast milk only. Start with small volume and gradually build up.
2. When the baby is on gavage or katori-spoon feeds, it is important that he is put to the breast before every feed. Although the baby may not obtain much milk, it will help promote lactation and enable the baby to learn how to suck.
3. When shifting a baby from one mode of feeding to another be very careful. Introduce the new mode for only some of the feeds to begin with.
4. The feeding of every baby should be individualized. The above recommendations should only serve as broad guidelines.

Most LBW babies weighing more than 1800 g or over 34 weeks of gestation are able to feed directly from the breast. However, some of them may not be able to suck satisfactorily during the first few days of life. During this period, the feeds may be provided by katori-spoon.

Enteral feeds

Breast milk is the ideal feed for the low birth weight babies. Those unable to feed directly on the breast can be given fresh expressed breast milk (EBM) by gavage or katori-spoon.

It is well to remember that the breast milk of the mother of the LBW baby contains appropriately higher protein and calories and is uniquely suited to

provide optimum nutrition to her LBW baby. The milk is thus not only species specific, it is also baby specific. If lactation is inadequate inspite of the best efforts, the baby should be carefully evaluated for supplementary feeding with top milk. *This decision however should be taken after careful thought. Feeding with milk other than breast milk should be reserved essentially for the hospitalized babies and resorted to for the minimum necessary period until breast milk feeding can be ensured.* Any formula providing (per dl) about 2g protein (preferably whey-dominant), 4.0 g fat (containing polyunsaturated fatty acids and medium chain triglycerides), 10-12 g of carbohydrate (as lactose and maltodextrins) and 70-80 K calories is quite suitable. If it is not possible to afford a formula milk, any milk obtained for household use may be fed without dilution.

It is emphasized again that a decision to feed a milk other than breast milk is a major decision and must not be taken lightly. Only when all avenues for obtaining breast milk are exhausted, should one resort to this as an interim unavoidable choice.

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Amount and scheduling of enteral feeds

For infants on gavage or katori-spoon feeds, total daily requirements can be estimated from the table on the fluid requirements (Table 2). In a stable, growing LBW baby daily intake of feeds should be gradually built upto 180-200 ml/kg. LBW babies should be fed every 2 hours starting at 2 hours of age. Two hourly feeds are also applicable to LBW receiving direct breast feeding. LBW babies may take longer on the breast as compared to their normal weight counterparts.

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Technique or methods of feeding

(a) Gavage feeds

For gavage feeding, size 5 Fr feeding catheter is required for nasogastric or orogastric placement. Polythene catheters being soft, are preferable to the red rubber catheters. For nasogastric insertion, the catheter is

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measured from the external nares to the tragus of the ear and from there to the ansiform cartilage and marked. This length of the tube should be inserted through the nose. For the orogastric catheter the distance between angle of mouth to tragus and then to the ansiform cartilage is used for insertion. During nasogastric or orogastric insertion, the head is slightly raised and a wet (not lubricated) catheter is gently passed through the nose (nasogastric) or mouth (orogastric) down through esophagus to the stomach. Its position is verified by aspirating the gastric contents and by injecting air and auscultating over the epigastric region. At the time of feeding, the outer end of the tube is attached to a 10 ml syringe (without plunger) and milk is allowed to trickle by gravity. At the end, about 2 ml of sterile water should be poured and allowed to trickle to rinse the tube. The baby should be placed in the right lateral position for 15 to 20 minutes to avoid regurgitation. There is no need to burp a gavage-fed baby. The polythene nasogastric or orogastric tube may be inserted before every feed or left in situ for 2 to 3 days. While pulling out a feeding tube, it must be kept pinched and pulled out gently while applying constant negative pressure with a syringe to avoid trickling of gastric mucus into the trachea.

Gavage feeding may be risky in very small babies. They have small stomach capacity and the gut may not be ready to tolerate feeds. Stasis may also result from paralytic ileus due to several conditions. Thus, gavage-fed babies are candidates for regurgitation and aspiration. It is important therefore to take precautions. Before each feed, the abdominal girth (just above the umbilical stump) should be measured and residual feed should be aspirated and measured. If the abdominal girth increases by more than 2 cm from the baseline or if the pre-feed aspirate is more than 25 percent of the last feed, the baby should be evaluated carefully for any illness. The feeds may have to be suspended till the abdominal distension improves.

(b) Katori-spoon feeds

Feeding with a spoon (or a similar device such as 'paladay') and katori (or any other receptacle such as cup) has been found to be safe in LBW babies. This mode of feeding is a bridge between gavage feeding and direct breast feeding. It is based on the premise that neonates with a

gestation of 30-32 weeks or more are in a position to swallow the feeds satisfactorily even though they may not be good at sucking or coordinated sucking and swallowing. Use a medium sized katori and a small (1-2 ml size) spoon. Both utensils must be washed and cleaned. Take the required amount of expressed breast milk in the katori. Place the baby in an upright posture with a napkin around the neck to mop up the spillage. Fill the spoon with milk, a little short of the brim, place it at the lips of the baby in the corner of mouth and let the milk flow into the baby's mouth slowly avoiding the spill. The baby will actively swallow the milk. Repeat the process till the required amount has been fed. While estimating the intake, account for the milk spilled. Weighing the napkin will provide exact amount of milk spilled.

If the baby does not actively accept and swallow the feed, try to activate the baby with gentle stimulation. If he is still sluggish, do not insist on this method. It is better to switch back to gavage feeds till the baby is ready.

(c) Breast feeding

The method of breast feeding is essentially the same as for the normal weight babies. LBW babies may be slow in sucking and take longer to feed.

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Intravenous fluids

The fluid requirements of LBW neonates are summarized in Table 2.

TABLE 2: Fluid requirements of neonates (ml/per kg body weight)

Day of life	Birth weight	
	>1500 g	1000 to 1500 g
1	60	80
2	75	95
3	90	110
4	105	125
5	120	140
6	135	155
7 onward	150	170

Note:

- (i) On the first day the fluid requirements range from 60 to 80 ml/kg, the difference between the two categories being 20 ml.
- (ii) The daily increment in all groups is around 15 ml per kg till day 7.
- (iii) Extra 20-30 ml/kg fluid should be added for infants nursed naked under a radiant warmer. For those receiving phototherapy add extra 15 ml/kg fluid.
- (iv) These are general guidelines; fluid therapy of each baby should be individualized.

For the initial 2 days, intravenous fluids should consist of 10 percent dextrose only. After that, sodium (2-4 mEq/kg) and potassium (2-3 mEq/kg) is also added to dextrose. These requirements are generally met by preparing one fifth isotonic saline (N/5 saline is -one fifth saline and it is prepared by adding four parts of Dextrose to one part of normal saline). If intravenous fluids are mixed in the nursery, full aseptic precautions must be taken.

For administering intravenous fluids to the neonate, a small volume infusion set should be used. The flow of fluids should be carefully monitored. Too rapid an infusion may result in congestive heart failure and even death in a small baby. Parenteral fluid therapy needs to be monitored carefully especially among babies weighing < 1500 g. Adequacy of fluid therapy is indicated by weight pattern in the expected range (vide infra).

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Judging adequacy of nutrition

The key measure of optimal feeding is the weight pattern of the baby. A preterm LBW baby loses upto 1 to 2 percent weight every day amounting to 10 percent cumulative weight loss during the first week of life. Birth weight is regained between 10th-14th day. Babies start gaining weight by the second week of life at a rate of about 15- 20 g per day. SFD-LBW babies who are otherwise healthy should not have any appreciable weight loss at all and they should start gaining weight early. It is desirable to weigh all LBW babies at 2 weeks (to check regaining of the birth weight), 4 weeks (to ascertain a weight gain of at least 200-300g) and then every month. Hospitalized LBW babies should be weighed every day on the same weighing machine.

Excessive weight loss, or inadequate weight gain indicates inadequate feeding, cold stress, excessive insensible water loss or systemic illness (like anemia, sepsis, late metabolic acidosis etc.).

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Vitamin supplements

All LBW babies should receive intramuscular vitamin K 1.0 mg at birth. Vitamin A and D are required in doses of 1000 i.u. and 400 i.u. respectively everyday from 2 weeks of age. Several of the available multivitamin preparations provide these doses in 0.3 ml (5 drops) volume. At 8 weeks of age, iron supplements should be started in a dose of 2 mg/kg/day. Very low birth baby (<1500 g, <32 wk gestation) need vitamin E, calcium and phosphorus supplementation till 37 wks.

Prevention of infection

LBW babies are predisposed to serious bacterial infections. Even when treated aggressively, the mortality due to sepsis is high. The importance of preventing sepsis therefore cannot be overemphasized. *Refer to topic on neonatal sepsis.*

Following measures will help prevent infections:

- (i) Hand washing by the health professional attending delivery and by the mother and family before handling the baby.
- (ii) Ensuring early and exclusive breast milk feeding and avoiding all the pre-lacteal feeds. Careful attention to the hygiene of katori-spoon feeds. Dropper/bottle/ nipple/ cotton wick should never be used for feeding the baby.
- (iii) Care of the umbilical stump.
- (iv) Avoiding unnecessary interventions such as intravenous lines and needle prick.

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Early detection of sickness and management of complications

The cornerstone of care of the newborn infants, more so for the LBW babies, is anticipation and early detection of complications. This is achieved by careful monitoring of the babies. Clinical monitoring is the most important and practical method. It involves periodic evaluation for signs of illness. These include lethargy, refusal to feed, hypothermia respiratory distress, grunt, apnea, abnormal weight gain pattern, jaundice

over soles and palms, abdominal distension, feed intolerance, cyanosis, pallor, sclerema, seizures and bleeding. A baby who shows anyone or more of the above signs/symptoms should be immediately referred for hospitalization and prompt management of the specific complications by a neonatologist.

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Transporting a sick LBW baby

Every infant should be stabilized before transport as far as possible. A doctor or nurse should accompany the baby if possible. The referring doctor should ensure sending a written note covering the antenatal, intra-natal and neonatal details along with the baby.

For more details refer to chapter on transport of sick newborn

Management of specific illnesses

LBW neonates often fall prey to complications such as hypothermia, respiratory distress syndrome, sepsis etc. The management of these conditions is covered in detail in respective chapters.

Vaccinations in LBW babies

If the LBW baby is not sick, the vaccination schedule is the same as for the normal babies. Hence BCG and OPV should be given at the earliest. A sick LBW baby however, should receive these vaccines only on recovery.

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Prognosis

Mortality of LBW babies is inversely related to gestation and birth weight and directly to the severity of complications. Because of organ system immaturity, the preterm babies fare more poorly in the immediate neonatal period than the corresponding weight SFD babies. Adequacy of management at birth also makes a major difference. A LBW who experiences significant birth asphyxia or develops hypothermia soon after birth is seriously compromised no matter what heroic measures are instituted later on.

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Long term outcome of LBW infant likewise depends on gestation, birth weight and the nature and severity of complications. In general, over 90 percent LBW babies who survive the newborn period have no neuro developmental handicaps. Therefore, it is heartening to note that essential care of the LBW neonates is a highly rewarding experience.