Objectives

When you have completed this unit you should be able to:

- Identify and manage low birth weight infants.
- Define preterm and underweight for gestational age infants.
- List the complications of low birth weight infants.
- Prevent hypothermia and hypoglycaemia.
- Prevent recurrent apnoea.
- Manage anaemia of prematurity.
- Provide kangaroo mother care (KMC).
- Keep good patient notes.
- Assess patient care.

Low birth weight infants are at an increased risk of problems and may need special care.

3-1 What is a low birth weight infant?

A low birth weight (LBW) infant is an infant that weighs less than 2500g at birth. The weight of all infants must be measured at birth so that low birth weight infants can be identified.

3-2 Why is it important to identify all low birth weight infants?

Because these infants are at an increased risk of problems and may need more than primary care. All low birth weight infants must be carefully assessed after birth.

3-3 Why are some infants born with a low birth weight?

Most infants weigh between 2500 and 4000g at birth. However, some infants have a low birth weight (less than 2500g) as a result of one or both of the following 2 important problems during pregnancy:

- They are born too soon.
- They weigh less than expected for the duration of pregnancy (i.e. they are underweight for their gestational age).

3-4 Which infants are born too soon?

The gestational age of an infant is measured from the first day of the mother’s last normal menstrual period to the day of delivery. The average gestational age is 40 weeks (280 days) with a range of 37 weeks (259 days) to 42 weeks (293 days). Infants with a gestational age between 37 and 42 weeks are called term infants. Preterm infants are born before 37 weeks while post term infants are born after 42 weeks.
Any infant born before 37 weeks (i.e. preterm) is regarded as being born too soon. About 5% of all infants are born preterm in a wealthy community and often more than 20% in a poor community.

### 3.5 What is an underweight for gestational age infant?
Infants with a birth weight which is less than expected for their gestational age are called **underweight for gestational age** infants. When plotted on a birth weight for gestational age chart (a ‘fetal growth chart’), underweight for gestational age infants have a birth weight which falls below the 10th centile. Normally grown infants (appropriate for their gestational age) have a birth weight between the 10th and 90th centiles.

**Underweight for gestational age infants have a birth weight below the 10th centile.**

Infants may be underweight for gestational age because of one or both of the following:
- They have grown too slowly during pregnancy.
- They have lost weight during the last weeks of pregnancy.

### 3.6 Which infants have grown too slowly during pregnancy?
Infants that have been growing too slowly during pregnancy, have a birth weight, length and head circumference that fall below the 10th centile (length is not routinely recorded as it is difficult to measure accurately). Therefore, all their measurements are less than would be expected for their gestational age.

These small infants are called **growth restricted** (or **growth retarded**) infants as they have suffered fetal growth restriction (intrauterine growth retardation). It is very useful to measure the head circumference of all underweight for gestational infants because it helps to identify those infants who are growth restricted (grown too slowly).

In poor communities the commonest cause of low birth weight is slow fetal growth.

### 3.7 Which infants have lost weight during the last weeks of pregnancy?
Some infants lose weight in the last few weeks of pregnancy because the placenta is not supplying them with enough food from the mother. As a result of the weight lost, these infants have loose, dry, peeling skin and thin arms and legs at birth. They look as if they have been starved and are called **wasted** infants. Post term infants are often wasted.

Weight loss (wasting) during the last weeks of pregnancy can, therefore, be identified by examining the infant.

If only the infant’s weight, but not head circumference, is below the 10th centile then the infant is wasted but not growth restricted. Therefore, they are thin and underweight for their size.

Some infants have a low birth weight because of 2 or more of these fetal problems, e.g. they may be born too soon (preterm) and also have grown too slowly (growth restricted). Other low birth weight infants may have grown too slowly and then lost weight in the last few weeks of pregnancy (wasted).

Infants are no longer described as premature, post mature or dysmature as these descriptions are difficult to define and only cause confusion.

### 3.8 How do you assess the gestational age of an infant?
1. If possible the gestational age should be determined before delivery from the mother’s menstrual history and clinical (or ultrasound) examination in early pregnancy.
2. If the duration of pregnancy is unknown or uncertain, the gestational age can be roughly estimated by simply observing the newborn infant's appearance and behaviour.

3. The Ballard method can be used to score an infant's gestational age. This scoring method is based on the infant's physical appearance and behaviour.

3-9 What are the clinical features of preterm infants?

1. They have decreased muscle tone and, therefore, lie flat with straight arms and legs or in a frog position.
2. If their arms are gently pulled into an extended position and then released, they do not immediately flex back at the elbow into a bent position.
3. They suck poorly.
4. Their skin is thin and blood vessels can be seen through their skin.
5. They have few creases on the soles of their feet.
6. They have no or small nipple nodules.
7. Boys have undescended testes and girls have poorly formed labia majora.

3-10 What are the common causes of an infant being born preterm?

1. The mother may develop preterm labour or prelabour rupture of the membranes. This is usually due to chorioamnionitis, which is a bacterial infection of the amnion and chorion cause by the spread of vaginal bacteria through the cervical canal. Many of these women do not have the clinical signs of severe chorioamnionitis (i.e. fever, abdominal tenderness or an offensive vaginal discharge) and there is no obvious cause of the preterm labour or prelabour rupture of the membranes. Most of these women have mild chorioamnionitis. The reason why some women develop chorioamnionitis is not understood.
2. Maternal illness such as hypertension, diabetes or heart disease. Many of these women have an induced labour or caesarean section before term.
3. Problems with the pregnancy such as placenta praevia, placental abruption or cervical incompetence.
4. Multiple pregnancy or polyhydramnios.

3-11 What are the common complications of preterm infants?

These infants have immature organs because they are born too soon. Most of the complications in preterm infants are because of organ immaturity. They are also small and fragile and can, therefore, be easily damaged during labour and delivery.

The common neonatal complications in infants born preterm are:

- Asphyxia (breathing poorly at birth)
- Hypothermia
- Hypoglycaemia
- Recurrent apnoea
- Poor feeding
- Respiratory distress
- Jaundice
- Anaemia
- Separation from parents

Less common complications are infection, periventricular haemorrhage in the brain, bruising and patent ductus arteriosus.

Preterm infants are, therefore, at high risk of many complications after birth and need special care. Many preterm infants die as a result of these complications, especially if they are not correctly managed.

Preterm infants often have immature organs.

3-12 What are the clinical features of underweight for gestational age infants?

1. Their weight is less than that expected for their gestational age (i.e. their weight falls below the 10th centile on a weight for gestational age chart.
2. Infants who have been growing slower than expected during pregnancy, will also with a head circumference below the 10th centile.
3. Infants who have lost weight during the last few weeks of pregnancy will be wasted with loose, dry, peeling skin and thin arms and legs.
4. They are often meconium stained, especially if born at term or post term.

3-13 What are the causes of infants being born underweight for gestational age?

There are both maternal and fetal causes, which may result in the birth of an underweight for gestational age infant:

1. Maternal causes
   1. Low maternal weight
   2. Poverty and manual labour
   3. Smoking
   4. Excess alcohol intake
   5. Hypertension or pre-eclampsia

2. Fetal causes
   1. Multiple pregnancy
   2. Chromosomal abnormalities, e.g. Down syndrome
   3. Severe congenital abnormalities
   4. Chronic intra-uterine infections, e.g. syphilis
   5. Post term delivery

However, in many cases no obvious cause can be found. Maternal height and race alone probably have little effect on fetal growth. An abnormal placenta is rarely the primary cause of slow fetal growth or wasting.

Pregnant women should not smoke or drink alcohol.

3-14 What are the common complications of an underweight for gestational age infant?

All underweight for gestational age infants, whether they have grown too slowly or are wasted or both, are at an increased risk during the first weeks of life because they have often received too little food and oxygen during pregnancy. As a result, underweight for gestational age infants commonly have the following complications:

1. Asphyxia
2. Organ damage due to lack of oxygen before delivery (fetal hypoxia)
3. Meconium aspiration
4. Hypothermia
5. Hypoglycaemia

3-15 Why is it important to decide whether a low birth weight infant is born preterm or underweight for gestational age?

Because the causes and the complications of these two conditions may be different. Therefore, they often have different clinical problems, which need different forms of management. However, some complications, such as asphyxia, hypothermia and hypoglycaemia, are common in both preterm and underweight for gestational age infants.

3-16 What is the management of a low birth weight infant?

1. Good resuscitation if the infant has asphyxia.
2. Prevent hypothermia.
3. Prevent hypoglycaemia.
4. Start early feeds or an intravenous 10% dextrose infusion.
5. Prevent apnoea.
6. Monitor the infant carefully and treat any of the common complications of low birth weight infants.
7. Keep the mother and infant together and promote bonding.
8. Decide whether the infant needs to be transferred to a level 2 or 3 unit.

Unless the infant is extremely small with fused eyes, it should be regarded as possibly viable and actively managed. With good emergency management and good transport many very small infants can survive without long term complications.
PREVENTION OF HYPOTHERMIA

3-17 What is hypothermia?
The normal temperature of a newborn infant is 36.0 °C to 36.5 °C, if the abdominal skin temperature is taken, and 36.5 °C to 37.0 °C, if a digital (or low reading mercury) thermometer is placed in the axilla (armpit). If either temperature is lower than the normal range (36.0 °C for skin temperature or 36.5 °C for axillary temperature) the infant has hypothermia. A body temperature below 35 °C is particularly dangerous. It is very important to prevent hypothermia, which causes many clinical problems and can kill the infant if it is severe.

3-18 Which infants are at an increased risk of hypothermia?
1. All low birth weight infants
2. Infants who are not dried well after birth
3. Infants in a cold room or cool incubator
4. Infants lying near cold windows
5. Starved infants

3-19 How can you prevent hypothermia?
1. Identify all infants at high risk of hypothermia.
2. Provide energy (calories) by giving milk feeds or intravenous fluids. This is very important in low birth weight infants who are born with little body fat. Early feeding with breast milk or undiluted formula feeds helps to reduce the risk of hypothermia by providing the infant with energy needed to produce heat.
3. Provide a warm environment for all infants. The smaller the infant, the warmer the required environment. Most infants under 1800 g need an incubator or skin-to-skin care (kangaroo mother care). You should:
   • Never place an infant in a cold incubator.
   • Keep the incubator ports closed.

4. Insulate the infant. Dress the infant and use a woollen cap. The naked head of a newborn infant loses a lot of heat. A woollen cap is particularly important if an infant is receiving headbox oxygen. Infants in incubators should wear a woollen cap.
5. All wet infants must be dried immediately and then wrapped in another, warm, dry towel. Do not leave an infant in a wet towel. Remember to dry the infant’s head.
6. Monitor the temperature in all infants who are at an increased risk of hypothermia. It is essential to detect any drop in skin temperature as soon as possible.

3-20 What is the best environmental temperature?
The best environmental (room or incubator) temperature depends on:
1. The weight and gestational age of the infant. The lower the weight and the earlier the gestational age, the higher is the required environmental temperature. Small, preterm infants need a very warm environment.
2. The postnatal age of the infant. The lower the postnatal age, the higher is the required environmental temperature, i.e. a younger infant needs a warmer environmental temperature.
3. Illness. Sick infants need a higher environmental temperature.

The environmental temperature for each infant should be adjusted in order to give a normal abdominal skin or axillary temperature. This can be achieved automatically if a servo-controlled incubator is used. Skin-to-skin care will also provide the infant with the correct temperature. Infants of 1500 g need an
CARE OF LOW BIRTH WEIGHT INFANTS

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The incubator temperature of about 35.0 °C during the first few days after delivery.

The infant's energy and oxygen needs are lowest when the skin temperature is normal and the infant is nursed at the correct environmental temperature. Both energy and oxygen needs increase if the infant's skin temperature is either above or below normal.

The environmental temperature should be adjusted to give a skin temperature of 36–36.5 °C.

3-21 How can you keep an infant warm?

There are a number of ways to keep an infant warm:

1. A warm room. Most healthy infants above 1800 g can be nursed in a cot in a warm nursery, ward or home. The room temperature should be about 20 °C. The infant should be dressed in a nappy, jacket, woollen hat and booties to prevent heat loss. A woollen cap is most important. Most infants below 1800 g can be kept warm in a cot if they are nursed in a room where the temperature is kept at 25–30 °C. The smaller the infant, the higher the required room temperature will be. Do not let the infant get too hot.

2. A closed incubator (or radiant warmer). This is the way most small or sick infants are nursed in hospital as the temperature can be carefully controlled. Often infants in closed incubators are also dressed. A transparent perspex shield can be placed over an infant in an incubator to help reduce heat loss.

3. Maternal skin-to-skin care (kangaroo mother care). Many low birth weight infants can be kept warm by placing them naked against the mother's naked breasts. This method is very successful and particularly useful when closed incubators are not available. The mother's skin will become warmer or cooler to keep the infant's temperature normal.

4. Thermal blanket. An infant can be kept warm for hours if wrapped in a thermal blanket, silver swaddler or heavy gauge aluminium foil normally used for cooking. This is an effective method of preventing heat loss during transport if the mother cannot give skin-to-skin care and a transport incubator is not available. The infant must be warm and dry before being wrapped in a thermal blanket. Never put a cold infant into a thermal blanket or use a thermal blanket in an incubator.

A woollen cap and perspex heat shield reduces heat loss when infants are nursed in an incubator.

The most appropriate method should be chosen for each individual. There is no excuse for an infant ever becoming hypothermic because hypothermia is preventable.

Hypothermia can be prevented by skin-to-skin care.

PREVENTION OF HYPOGLYCAEMIA

3-22 What is the normal concentration of glucose in the blood?

The normal concentration of glucose in the blood of newborn infants is 2.0 mmol/l to 7.0 mmol/l. (These levels are less than those for serum glucose). It is best to keep the blood glucose concentration above 2.5 mmol/l.

3-23 What is hypoglycaemia?

A blood glucose concentration below 2.0 mmol/l (or serum glucose concentration below 2.5 mmol/l) is abnormal and, therefore, defined as hypoglycaemia.

Hypoglycaemia is defined as a blood glucose concentration below 2.0 mmol/l.
3-24 How is blood glucose measured in the nursery?

The quickest, cheapest and easiest method to measure the blood glucose concentration in the nursery is to use reagent strips such as Haemoglukotest, Glucotrend or Dextrostix. Only a drop of blood is needed for a reagent strip. After a minute it is either wiped off with cotton wool or washed off with water and then blotted dry, depending on the regent strip used. The colour of the reagent strip is then compared to the colour range on the bottle to determine the blood glucose concentration. A far more accurate method to screen for hypoglycaemia is to read the colour of the reagent strip with a glucose meter such as reading Haemoglukotest strips with a Reflolux meter.

3-25 Which infants are at an increased risk of developing hypoglycaemia?

Infants that have reduced energy stores or reduced intake and infants with increased energy needs are at risk of hypoglycaemia.

Infants with reduced energy stores of glycogen in the liver, protein in muscles, and fat under the skin include:

1. **Preterm infants**. They are born too soon before adequate amounts of glycogen, protein and fat are stored in the tissues. The fetus gets most of its energy stores from the mother in the last 6 weeks of pregnancy.

2. **Underweight for gestational age** or **wasted infants**. They have used up most of their own energy stores before delivery because they have not been getting enough glucose from their mother.

3. **Starved infants**. Infants that are not fed, either orally or intravenously soon after delivery, rapidly use up their energy stores.

Infants with increased energy needs include:

1. **Infants with respiratory distress**. Their respiratory muscles require a lot of glucose to provide the energy needed for respiration.

2. **Hypothermic infants**. These infants use large amounts of glucose to produce heat in an attempt to correct their body temperature.

3. **Infants of diabetic mothers**. Before delivery these infants get used to receiving large amounts of glucose across the placenta, especially if the maternal diabetes is poorly controlled. Often the fetus becomes obese. At delivery the supply of glucose from the mother suddenly stops when the umbilical cord is clamped. As a result, these infants commonly develop hypoglycaemia because their high energy needs are no longer being provided for.

**Hypothermia causes hypoglycaemia**.

3-26 How can you prevent hypoglycaemia?

The following steps must be taken to prevent hypoglycaemia:

1. Identify all infants at high risk of developing hypoglycaemia, e.g. low birth weight infants as they have little fat, muscle and glycogen stores.

2. Monitor the blood glucose concentration of these infants with reagent strips so that a falling blood glucose can be detected before hypoglycaemic levels are reached.

3. Feed all infants as soon as possible after delivery, especially low birth weight infants and infants of diabetic women. If possible, feed the infant within the first hour.

4. Whenever possible, milk feeds should be given. Sometimes nasogastric feeds may be needed. Both clear feeds and oral 5% dextrose feeds should not be used in newborn infants as they have less energy than milk.

5. If milk feeds cannot be given, then an intravenous infusion of 10% glucose (Neonatalyte) should be started.

6. Prevent hypothermia.

**Early feeding with milk usually prevents hypoglycaemia.**
RECURRENT APNOEA

3-27 What is apnoea?
Apnoea is the stopping of respiration for long enough to cause bradycardia together with cyanosis or pallor. Usually apnoea for 20 seconds or longer is needed to produce these clinical signs. The infant may have a single apnoeic attack but usually the episodes of apnoea are repeated.

In some preterm infants the respiratory centre in the brain is immature and this results in repeated attacks of apnoea. This is called *apnoea of immaturity*. These infants are usually less than 34 weeks of gestation. Less commonly, apnoea may be caused by respiratory distress, infection, hypoxia, hypothermia, hypoglycaemia or convulsions.

Apnoea should not be confused with periodic breathing, which is a normal pattern of breathing in preterm infants. Infants with periodic breathing frequently stop breathing for less than 20 seconds, which is not long enough to cause bradycardia, cyanosis or pallor.

Apnoea can be detected with the aid of an apnoea monitor, which is usually set to trigger if the infant does not breathe for 20 seconds.

3-28 How should you manage apnoea of immaturity?
Apnoea of immaturity can be largely prevented and treated with the use of oral theophylline or caffeine. Theophylline is usually given via a nasogastric tube as Nuelin liquid. A loading dose of 4 mg/kg is given, followed by a maintenance dose of 2 mg/kg every 12 hours. Prophylactic theophylline is given routinely to all infants born before 34 weeks of gestation and can usually be stopped at 35 weeks.

An overdose of theophylline presents with tachycardia, vomiting or convulsions.

During an attack of apnoea, breathing can be restarted in most cases by simply stimulating the infant. Infants with repeated apnoea, in spite of theophylline, should be referred to a level 2 or 3 hospital for investigation. They may need mask and bag ventilation before being transported.

It is dangerous to give head box oxygen to infants with apnoea of immaturity, as they do not need oxygen.

FEEDING LOW BIRTH WEIGHT INFANTS

3-29 What determines an infant’s fluid needs?
The daily fluid requirements of an infant depends on:

1. **The body weight.** Fluid requirements are expressed in ml per kg of body weight. Heavy infants, therefore, need more fluid than do light infants.
2. **The age after delivery.** Fluid requirements increase gradually from birth to 5 days and then remain stable.

3-30 How much fluid do most infants need?
Most infants need:

- 60 ml/kg on day 1
- 75 ml/kg on day 2
- 100 ml/kg on day 3
- 125 ml/kg on day 4
- 150 ml/kg on day 5 and thereafter.

Note that the fluid requirements are given in ml per kg body weight, and that they increase gradually from day 1 to day 5. After day 5 there is no further increase in the daily fluid needs per kg body weight. As the infant’s weight increases, so the total amount of fluid a day will increase although the amount of fluid per kg remains constant at 150 ml/kg. Only rarely do infants need more than 150 ml/kg if they are kept warm and well dressed.

These daily fluid volumes meet the need of both normal and low birth weight infants. They are used when infants receive either oral or intravenous fluids. The fluid volumes
needed by breast feeding infants do not need to be calculated as they are met by the increasing milk production by the mother during the first few days after delivery.

The fluid requirements per day increase from 60 ml/kg on day 1 to 150 ml/kg on day 5.

3-31 Why do the daily fluid needs increase during the first 5 days?
For the first few days after delivery the mother's breasts do not produce a lot of milk. To prevent dehydration, the kidneys of the newborn infant, therefore, produce little urine during this period. As a result the infant does not need a lot of fluid in the first few days of life. However, the infant's fluid needs gradually increase from day 1 to 5. By day 5 the kidneys are functioning well and a lot of urine is passed. Giving 150 ml/kg during the first 4 days to infants may result in overhydration.

3-32 What milk feeds should be given to a low birth weight infant?
Whenever possible, every effort should be made to feed a low birth weight infant with breast milk. Infection, especially in preterm infants, can be largely prevented by using breast milk.

If breast milk is not available, then formula (powdered milk) should be used. Infants weighing 1500 g or more can be given a standard newborn formula such as Nan 1 or S26. However, infants weighing less than 1500 g should be given a special preterm formula such as Prenan or S26 LBW. Cows milk is not suitable for newborn infants.

If the correct volume of breast milk or formula is given, the infant will receive the correct amount of nutrients and energy. Diluted feeds are not used.

Healthy term infants of normal birth weight should be demand fed at the breast.

3-33 What route should be used to feed a low birth weight infant?
Most preterm infants born after 35 weeks are able to suck well and, therefore, take all their feeds by mouth. If possible, they should be breast fed. A cup rather than a bottle should be used to give feeds if expressed breast milk or formula is used.

Preterm infants that are not able to suck should be fed via a nasogastric tube. They usually start to suck between 32 and 34 weeks.

If the infant is fed via a nasogastric tube, the mother must manually express her milk every 4 hours during the day. A breast pump, if available, can also be used. The milk can be safely stored for 48 hours in a household fridge. It should stand at room temperature for 15 minutes to warm before feeding.

3-34 How often should a low birth weight infant be fed?
1. If below 1500 g: feed every 2 hours (i.e. 12 feeds a day).
2. If 1500–1800 g: feed every 3 hours (i.e. 8 feeds a day).
3. If above 1800 g: feed every 4 hours (i.e. 6 feeds a day).

Infants below 1500 g or sick infants may need intravenous fluids for the first few days before milk feeds are started.

3-35 What are the dangers of milk feeds in low birth weight infants?
Giving too big a feed may cause:
1. Vomiting
2. Abdominal distension
3. Aspiration of the feed

It is best to nurse infants on their backs as this lowers the risk of 'cot deaths'. Raising the mattress below the head of the infant and giving smaller, more frequent feeds usually prevents vomiting. Any infant that continues to vomit or develops a distended abdomen should be referred as it may be infected.
3-36 What supplements are needed by low birth weight infants?

Infants who have a gestational age below 37 weeks are often deficient of both vitamins and iron and should receive the following:

1. Multivitamin drops 0.6 ml daily should be started when the infant reaches 150 ml/kg milk feeds. This should be continued until the infant is 6 months old. Vitamin drops can be given into the infant’s mouth with breast feeding or into the formula feed. The extra vitamins prevent vitamin deficiencies such as rickets.
2. Iron drops 0.3 ml daily should be started when the infant is old enough to suck well. When the infants is discharged from hospital, the dose should be increased to 0.6 ml daily. This should be continued until the infant is 6 months old. The added iron prevents iron deficiency anaemia.

Low birth weight infants born at term usually do not need any nutritional supplements.

ANAEMIA

3-37 What is anaemia?

Anaemia is defined as a haemoglobin concentration (Hb) or packed cell volume (PCV) which is below the normal range. The normal PCV at birth is 45–65% and the Hb 15–25 g/dl. After delivery the PCV and Hb fall slowly until about 8 weeks of age and then slowly increase again. The Hb should not fall below 10g/dl and the PCV below 30%. If the Hb and PCV fall below these levels the infant has anaemia.

The commonest cause of anaemia in newborn infants is anaemia of prematurity. Less common causes are bleeding, infection and haemolytic disease of the newborn.

3-38 What is anaemia of prematurity?

The PCV and Hb of the preterm infant are normal at birth but fall faster and to lower levels than those in the term infant. Therefore, preterm infants after a few weeks of age may have a PCV below 30% and a Hb below 10 g/dl. This condition is called anaemia of prematurity as it caused by an immature bone marrow, which does not produce enough red blood cells.

3-39 How should you manage anaemia of prematurity?

There is no simple, cheap way of preventing anaemia of prematurity. Giving oral iron to preterm infants does not help prevent or treat anaemia of prematurity. These infants should be discussed with the referral hospital, as they may need a blood transfusion, especially if the PCV falls to below 25% and the Hb below 8g/dl or they stop gaining weight. Most infants with anaemia of prematurity recover after a few weeks without any treatment.

KANGAROO MOTHER CARE (KMC)

3-40 What is kangaroo mother care (KMC)?

Kangaroo mother care is a method of nursing infants skin-to-skin against the mother’s chest. The infant, who is kept naked except for a woollen cap and nappy, is placed vertically between the mother’s bare breasts. The infant is then covered with a blanket, towel or the mother’s clothing. The mother can wear a belt, or tuck her vest, shirt, T-shirt or blouse into her trousers, to prevent the infant from falling. Special clothes are not needed although a KMC baby carrier can be used. Other members of the family should also be encouraged to give the infant KMC. This is particularly important for the father.

3-41 Which infants should receive KMC?

1. Small infants in incubators who are still too immature to be nursed in a cot. The parents can give KMC while they visit the infant in the nursery. Even very small infants can be safely given KMC once their condition is stable.
Continuous KMC should be given to small infants when they reach about 1600 g and start to breast feed. They are taken out of the incubator and the mother provides KMC day and night. These mothers and infants should be cared for in a special KMC ward. The mother and infant can be discharged home when the infant breast feeds well and the mother is confident to manage her infant. These infants should continue to be given KMC at home until they weigh 2000 g.

KMC can also be given to normal infants.

**3-42 What are the advantages of KMC?**

1. It keeps the infant warm.
2. It allows the mother (and father) to play a major role in caring for the infant.
3. It promotes breast feeding.
4. It reduces the risk of infection in the infant.
5. It allows the mother and infant to be discharged home earlier.
6. It reduces the work load of the nursing staff.
7. It improves weight gain.

Many studies have shown that the infant’s temperature, respiration and heart rate remain very stable with KMC. Apnoea is reduced. Serious infection in hospital is uncommon as the infant is colonised with bacteria from the mother’s skin and breast milk rather than by dangerous nursery bacteria which are often resistant to many antibiotics. KMC is safe and should be widely practised.

Therefore, they should be written in an orderly, logical way so that all staff members can understand them.

Whenever notes are written, it is important to give the date and the time that the record is made. It is then possible to know when the care was given.

Every time you write clinical notes you should sign your name. The rest of the health team then knows who wrote the notes.

**3-44 What is the SOAP method of writing notes?**

When an infant is examined for the first time the clinical notes should include:

1. The Story
2. The Observations
3. The Assessment
4. The Plan

In order to remember these important steps in writing clinical notes, remember the word SOAP. The letters in SOAP stand for Story, Observations, Assessment, Plan.

**3-45 What is the story?**

Good notes should always start with the story (i.e. the history of the pregnancy, labour, delivery and events after delivery). A history should always be taken before examining an infant. Include any problems recorded during the pregnancy, labour and delivery, the Apgar score and any resuscitation needed, the antenatal assessment of the gestational age and any problems that occurred since delivery.

**3-46 What are the observations?**

The observations include the findings of the physical examination and the results of any additional investigations done, e.g. temperature or blood glucose measurement.

An assessment of the gestational age should be made in all low birth weight infants.
3-47 What is the assessment?

Once you have recorded the results of the history, the physical examination and the investigations, you must make an assessment of the infant’s condition. For example, you should ask yourself:

1. Is the infant sick or well? Is it normal or abnormal?
2. Is the infant at high risk or low risk for clinical problems?
3. What clinical problems does the infant have at present?

The assessment must not be forgotten, as a carefully recorded history and examination are of little value if you are unable to assess what this information means. The management depends on an accurate assessment of the infant’s problems. If you cannot identify the problems, you will not be able to plan the correct treatment. Assessing an infant’s problems correctly takes a lot of practice. Once the assessment is made, it is very helpful to compile a problem list.

3-48 What is a problem list?

Each clinical problem that you identify from the story and observations must be listed separately. A typical problem list looks like this:

1. Unmarried, teenage mother.
2. Preterm delivery.
3. Jaundice.

You now have a good idea of the clinical problems that require management.

3-49 How should the plan of management be decided?

Once the history, examination, investigations and assessment have been completed, the plan of management must be decided. The management consists of the nursing care, the observations needed, the medical treatment, and the management of the parents. It may be important to discuss the patient with the referral hospital and decide whether transfer is needed. When deciding on the plan of management, each item on the problem list must be considered.

3-50 An example of good SOAP notes.


S
18 year old primip. Booked.
Spontaneous preterm labour. 35 weeks by dates and palpation.
No signs of fetal distress. NVD at 06:15. Apgar scores 4 and 9.
Intubation and ventilation needed for 3 minutes. Thereafter infant moved to nursery.

O
Male infant. Weight 2000g.
Assessed gestational age 36 weeks.
Active.
Skin temperature 36 °C.
RS Respiratory distress with recession and a respiratory rate of 65 breaths per minute. Infant needs 50% head box oxygen to remain pink.
CVS Heart rate 150/min.
GIT Abdomen normal.
CNS Appears normal. Fontanelle flat.
Blood glucose 3.0 mmol/l. PCV 60%.

A
1. Preterm delivery.
2. Asphyxia.
3. Respiratory distress.

P
1. Incubator.
2. Neonaltyte IVI at 4 dpm.
4. Routine observations.
5. Head box oxygen.
6. Speak to parents.
7. Arrange transfer to level 2 hospital.

Signed: Sr. Mowtana

These brief notes give all the important information in a simple and systematic manner. Try to write your notes using the SOAP method.
3-51 Why should patient care be assessed?
It is very important to regularly assess the range of problems seen in a level 1 unit and evaluate the standard of care provided. This is the best method of ensuring that the highest standard of practice is maintained. Usually the low birth weight rate, stillbirth rate, early neonatal mortality (death) rate and perinatal mortality rate of each service are recorded.

Infants weighing less than 500 g (about 22 weeks) at birth are regarded as miscarriages and, therefore, are not included in these rates. Perinatal information (data) is usually divided into 500 g categories.

3-52 What is the low birth weight rate?
The low birth weight rate is the number of liveborn infants weighing less than 2500 g at birth per 1000 liveborn deliveries. The low birth weight rate is often expressed as a percentage, e.g. 15%.

3-53 How many infants are born with a low birth weight?
In a wealthy community about 5% of infants are low birth weight. However, in poor communities up to 40% of all infants may have a low birth weight. The percentage of low birth weight infants in a community can be used to assess the socioeconomic status of that community.

3-54 What is the stillbirth rate?
The stillbirth rate is the number of stillborn infants per 1000 total deliveries (i.e. liveborn and stillborn). The international definition of stillbirth, used for collecting information on perinatal mortality, is an infant that is born dead and weighs 500 g or more. In a developed country the stillbirth rate is about 5 per 1000. In a developing country, however, the stillbirth rate is usually more than 20 per 1000.

The legal definition of stillbirth in South Africa is an infant born dead after ‘6 months of intrauterine life’ (i.e. 28 weeks since the start of the last period or 1000 g, if the gestational age is not known). Therefore, only legally defined stillborn infants require a stillbirth certificate and must be buried or cremated. However, for the collection of information on perinatal mortality, the international definition of stillbirth is used.

3-55 What is the early neonatal mortality rate?
An early neonatal death occurs if a liveborn infant dies during the first 7 days after delivery. Therefore, the early neonatal mortality rate is the number of infants that die in the first week of life per 1000 liveborn deliveries. A liveborn infant is defined as an infant that shows any sign of life at birth (i.e. breathes or moves). However, liveborn infants below 500 g at birth are usually regarded as abortions. The early neonatal mortality rate in a developed country is usually about 5 per 1000. In a developing country the early neonatal mortality rate is usually more than 10 per 1000.

3-56 What is the perinatal mortality rate?
The perinatal mortality rate is the number of stillbirths plus the number of early neonatal deaths per 1000 total deliveries (i.e. both stillborn and liveborn). The perinatal mortality rate is about the same as the stillbirth rate plus the early neonatal mortality rate. Most developed countries have a perinatal mortality rate of about 10/1000 while most developing countries have a perinatal mortality rate of more than 30/1000.

Note that the low birth weight rate and early neonatal mortality rate are expressed per 1000 live births while the stillbirth rate and perinatal mortality rate are expressed per 1000 total births (i.e. live births plus stillbirths).
3-57 What is the value of knowing these rates?

It is very important to know the low birth weight, stillbirth, neonatal and perinatal mortality rates in your service as these rates reflect the living conditions, standard of health, and quality of perinatal health care services in that region. It is far more important to know the mortality rate for the region than simply the rates for one clinic or hospital in the region.

Increased low birth weight and stillbirth rates suggest a low standard of living with many socio-economic problems, such as undernutrition, poor maternal education, hard physical activity, poor housing and low income in the community. An increased early neonatal mortality rate, especially if the rate of low birth weight infants is not high, usually indicates poor perinatal health services. Both a poor standard of living and poor health services will increase the perinatal mortality rate.

An increased low birth rate reflects poor socio-economic conditions while a high early neonatal mortality rate indicates poor perinatal health services.

3-58 What are the main causes of perinatal death?

In a developing country, the main causes of perinatal death are:

1. Preterm labour
2. Abruptio placentae
3. Syphilis
4. Fetal (intra-uterine) growth restriction
5. Bacterial infection after delivery

Many of these causes are preventable with good perinatal care in level 1 hospitals and clinics. It is essential that you determine the common causes of perinatal death in your area. The avoidable causes of perinatal death should then be identified and steps taken to correct these causes.

3-59 What is a perinatal mortality and morbidity meeting?

This is a regular meeting of staff to discuss all stillbirths and early neonatal deaths at that clinic or hospital. Clinic deaths must include infants who died after transfer to a level 2 or 3 hospital as the cause of death may be the management received at the clinic. Management problems with sick infants who survived can also be discussed.

Perinatal mortality meetings are held weekly or monthly. The aim of a perinatal mortality meeting is, not only to establish the cause of death, but also to identify problems in the service and, thereby, to improve the management of mothers and infants. Care must be taken to review the management so that lessons can be learned rather than to use the meeting to blame individuals for poor care. The disciplining of staff should be done privately and never at a perinatal mortality meeting.

Avoidable factors should be looked for whenever there is a stillbirth or neonatal death. The avoidable factors may be divided into problems with:

1. The mother, e.g. failure to attend antenatal clinic
2. The staff, e.g. the fetal heart was not monitored during labour
3. The service, e.g. there was no transport

Some causes of death are avoidable (e.g. hypothermia) while others are not avoidable (e.g. abruptio placentae). By identifying avoidable factors plans can be made to improve the perinatal care provided.

3-60 Should referred infants also be discussed?

Every infant referred from a level 1 clinic or hospital to a level 2 or 3 hospital must be recorded and reviewed. The infant’s weight, age and reason for referral must be known as well as the outcome at the referral hospital. The adequacy of resuscitation and management before transfer is important. Comment on the management and condition
of the infant on arrival at the referral hospital is very useful. With this information, problems with management and transport can be identified, protocols improved and plans made for appropriate training.

It is very helpful if staff from the referral hospital can be involved in perinatal mortality and morbidity meetings.

**CASE STUDY 1**

A female infant weighs 2200 g at birth. The mother is unbooked and does not know the date of her last menstrual period. She smokes 20 cigarettes a day. The infant has loose, wrinkled, dry skin and scores at 40.5 weeks. When plotted on a weight for gestational age chart, the infant falls below the 10th centile.

1. **What is the explanation for the appearance of this infant's skin?**
   The loose, wrinkled, dry skin suggests wasting due to a poor supply of food to the fetus during the last weeks of pregnancy.

2. **Why was it important to score the gestational age of this infant?**
   Because the infant weighed less than 2500 g and the patient did not know the duration of pregnancy.

3. **How would you classify this infant by gestational age alone?**
   The scored age of 40.5 weeks indicates that the infant was born at term.

4. **How would you classify this infant by weight for gestational age?**
   This infant is underweight for gestational age as the birth weight falls below the 10th centile.

5. **Why is it important to identify this infant as being underweight for gestational age and wasted?**
   Because it indicates that the infant is at high risk of asphyxia, meconium aspiration, hypothermia and hypoglycaemia. The infant may also have organ damage due to the lack of oxygen before delivery (fetal hypoxia).

6. **What is the probable cause of this infant being underweight for gestational age?**
   The mother's heavy smoking.

**CASE STUDY 2**

A 5 day old term infant is bathed in a cold ward. Afterwards the infant appears well but feels cold. A reading in the axilla with a digital thermometer gives a result of 34.5 ºC. The infant, who weighed 2400 g at birth and is clinically wasted, is rapidly warmed by placing it next to a wall heater.

1. **What is your diagnosis?**
   Hypothermia because the infant's axillary temperature was below 36.5 ºC.

2. **Give probable reasons why this infant became hypothermic.**
   The infant is underweight for gestational age and wasted. This may cause hypothermia as the infant has little fat. In addition the infant probably became cold after the bath because of the cold room.

3. **What important complication may result from the hypothermia?**
   Hypoglycaemia. A cold infant uses a lot of energy in an attempt to keep warm. This may use up the infant's energy stores and result in hypoglycaemia.
4. When should this infant be fed?
This infant should be fed as soon as possible. This will help to prevent hypoglycaemia. Feeds will also provide the infant with energy to produce heat.

5. How should the infant be kept warm during the next few days?
The infant should be dressed and given a woollen cap. If the room becomes cold at night, the infant can be kept warm with skin-to-skin care in the mother's bed.

CASE STUDY 3
A preterm infant of 1700 g is born in a level 1 hospital. The infant is nursed in a closed incubator but no feed is given for 2 hours. At 1 hour after birth the Haemoglucontest reading with a Refloluks meter is normal but at 2 hours after birth the reading indicates hypoglycaemia.

1. What is the definition of hypoglycaemia?
A blood glucose concentration below 2 mmol/l.

2. Why is this infant hypoglycaemic?
The infant is preterm and, therefore, has little energy store. In addition, the infant has not been fed for 2 hours after birth. The infant had energy stores to last 1 but not 2 hours.

3. How could the hypoglycaemia have been prevented?
Breast or formula feeds should have been started within an hour of delivery.

4. Are 5% dextrose feeds better than milk feeds at preventing hypoglycaemia?
No. Milk feeds contain more energy than 5% dextrose feeds.

5. Do all hypoglycaemic infants present with abnormal neurological signs?
No. Often hypoglycaemia is asymptomatic and can only be diagnosed with blood screening.

CASE STUDY 4
A 1900 g, healthy preterm infant is born by normal vertex delivery after a 34 week gestation.

1. What method should be used to feed this infant?
Tube feeds should be started after delivery. There is no indication to give intravenous fluids. In a week or two, when the infant starts to suck, breast or cup feeds can be introduced.

2. What type of feed would you choose?
Breast milk should be used if possible. If this is not available, then a standard infant formula (e.g. NAN 1) should be given.

3. What volume of feed will be needed on day 1?
60 ml/kg = 60 × 1.9 = 114 ml over 24 hours. Thereafter the volume will be increased daily until 150 ml/kg is reached on day 5.

4. How often should feeds be given to this infant?
4 hourly (i.e. 6 feeds a day). Therefore, the volume of each feed will be 114/6 = 19 ml.

5. What supplements does this infant need?
A multivitamin liquid 0.6 ml daily should be started on day 5, while iron drops 0.3 ml should be started when the infant feeds orally. Both should be continued for 6 months. The dose should be increased to 0.6 ml per day on discharge.
CASE STUDY 5

It is decided to determine the perinatal health and care status of a region. Therefore, all the birth weights, together with the number of live births and perinatal deaths, in the hospitals, clinics and home deliveries in that region are recorded for a year. Only infants with a birth weight of 500 g or more are included in the survey. Of the 2000 births, 50 infants were stillborn and 1950 were born alive. Of the live born infants, 25 infants died in the first week of life. One hundred and twenty infants liveborn infants weighed less than 2500 g at birth.

1. Why were infants between 500 g and 1000 g not also excluded?
Because some of these infants may live if they are given emergency management and then transferred to a level 2 or 3 hospital. Therefore, all infants with a birth weight of 500 g or more must be included in a perinatal survey.

2. What was the stillbirth rate for this region?
There were 50 stillbirths and 2000 total births. Therefore, the stillbirth rate was 50/2000 × 1000 = 25 per 1000.

3. Is this stillbirth rate typical of a developed or developing country?
It is typical of a developing country, which usually has a stillbirth rate above 20/1000. In contrast, a developed country usually has a stillbirth rate of about 5/1000.

4. What was the early neonatal mortality rate?
Of the 1950 infants who were born alive, 25 died during the first week of life. Therefore, the early neonatal mortality rate was 25/1950 × 1000 = 12.8 per 1000.

5. What is the expected early neonatal mortality rate for a developing country?
Above 10/1000. Therefore, the rate of 12.8/1000 is what you would expect in a developing country.

6. What was the perinatal mortality rate for this region?
There were 50 stillbirths and 25 early neonatal deaths with 2000 total deliveries. Therefore, the perinatal mortality rate was 50 + 25/2000 × 1000 = 37.5 per 1000.

7. What is the low birth weight rate for this region?
Of the 1950 infants born alive during the year, 120 weighed less than 2500 g at delivery. Therefore, the low birth weight rate was 120/1950 × 1000 = 61.5 per 1000 or 6.15%.

8. Is the low birth weight rate typical of a developing country?
No. Most developing countries have a low birth weight rate of more than 100/1000 or 10%.

9. How do you interpret the finding of a high perinatal mortality rate with a low birth weight rate of only 6.15%?
It suggests that the living conditions of the mothers in the study region are satisfactory but the perinatal services are poor. Every effort must be made, therefore, to improve these services.