

[Newborn Care Manual: Contents](#)

**27-1 WHAT IS INFECTION?**

INFECTION is the invasion of the body by organisms such as bacteria, viruses, fungi, spirochaetes and protozoa. This results in disease by causing inflammation, abnormal growth, damage or death of tissues. In contrast, COLONIZATION is simply the growth of organisms on a body surface, such as the skin, gut or airways, without the invasion of tissues.

**27-2 HOW DOES THE BODY PREVENT INFECTION?**

The immune system, which helps protect the body against infection, can be divided into 4 different parts:

1. ANTIBODIES (immunoglobulins), such as IgG, IgA and IgM, which damage organisms and attract phagocytic cells.
2. LYMPHOCYTES that produce antibodies and kill organisms.
3. PHAGOCYtic CELLS, such as macrophages and polymorphs, that ingest and, thereby, kill organisms.
4. COMPLEMENT. This is a group of proteins that help antibodies to damage organisms and attract phagocytic cells.

These different parts of the immune system all function together to destroy invading organisms and, thereby, protect the infant from infection.

**27-3 IS INFECTION COMMON IN NEWBORN INFANTS?**

Yes. Newborn infants often become infected and the risk of infection in the newborn infant is much higher than in older children or adults. Infection is important as it is one of the commonest causes of death in infants during the first few months of life. Infection is particularly common and dangerous in preterm infants.

**INFECTION IS AN IMPORTANT CAUSE OF DEATH IN YOUNG INFANTS****27-4 WHY DO NEWBORN INFANTS OFTEN BECOME INFECTED?**

Infection is common in newborn infants because their immune system is immature. The following deficiencies in the immune system make newborn infants susceptible to infection:

1. The ANTIBODIES IgA and IgM are too big to cross the placenta from the mother. The fetus and newborn infant, therefore, do not have maternal IgA and IgM to protect them from infection. However, during the first 6 months of life the infant gradually produces its own IgA and IgM.
2. The ANTIBODY IgG does cross the placenta but most crosses in the last weeks of pregnancy. Preterm infants, therefore, have very little IgG. After birth the infant starts to produce its own IgG as the amount of maternal IgG decreases.
3. Both term and preterm infants have LYMPHOCYTES. However, these lymphocytes are immature and, therefore, do not function well. A mature lymphocyte needs previous contact with a specific organism before it is able to recognise and kill it.
4. The PHAGOCYtic CELLS are present in both term and preterm infants but they do not function normally due to the low concentrations of complement.
5. The concentration of COMPLEMENT in the blood is low in newborn infants, especially if born preterm. This prevents the phagocytes from functioning normally.

With all these deficiencies in the immature immune system of the newborn infant, especially if it is born preterm, it is not surprising that infections are common. By the age of a few months the immune system functions better and the growing infant becomes less susceptible to infections as it gets older.

**27-5 HOW CAN YOU PREVENT INFECTION IN NEWBORN INFANTS?**

There are many simple ways in which infections can be prevented in the newborn infant:

1. **HAND SPRAYING and HAND WASHING** before touching an infant is the most important method of preventing infection in the nursery. Hands should be washed with a carbolic soap (e.g. LIFEBOUY) when entering the nursery or when soiled with stool. Before handling an infant in the nursery, spray your hands with an antiseptic spray containing chlorhexidine and alcohol (e.g. D-GERM). It is best to handle infants in the nursery as little as possible as most infections are spread on hands. There is no evidence that gowns or masks reduce cross infection.

**EVERYONE MUST ALWAYS WASH OR SPRAY THEIR HANDS BEFORE HANDLING AN INFANT**

2. **BREAST FEEDING.** Breast milk contains antibodies, lymphocytes, phagocytes and complement and, therefore, protects the gut of the infant from infections. Breast milk also encourages the growth of harmless bacteria in the gut and, thereby, lessens the growth of harmful bacteria.

**BREAST MILK PROTECTS INFANTS AGAINST INFECTIONS**

3. The **ASEPTIC PREPARATION OF FORMULA FEEDS**, and the boiling of bottles and teats, in the milk kitchen is essential to prevent contaminated feeds. Clean preparation of formula at home is also important.
4. **VERNIX** has antibacterial properties and, therefore, should not be washed off routinely at delivery. After a few hours it is absorbed by the skin.

**DO NOT ROUTINELY WASH OFF VERNIX AFTER DELIVERY**

5. **BATHING** infants with a carbolic soap (e.g. LIFEBOUY) or chlorhexidine (e.g. BIOSCRUB) reduces colonization with harmful bacteria. Sweet smelling, white or coloured soaps are often not antibacterial.
6. **STETHOSCOPES** and other instruments should be sprayed with an antiseptic spray (e.g. D GERM) before an infant is examined.
7. **ROUTINE CARE OF THE UMBILICAL STUMP** with alcohol (surgical spirits) prevents infection.
8. **IMMUNIZATION** of all pregnant women with tetanus toxoid prevents neonatal tetanus complicating cord infection.
9. **ROUTINE PROPHYLACTIC EYE CARE** after delivery with tetracycline, chloromycetin or erythromycin ointment prevents conjunctivitis resulting from colonization with Gonococci during delivery.
10. **AVOID KISSING NEWBORN INFANTS** as this may spread harmful viruses such as Herpes simplex. Parents or staff with active herpes infection of the lips must be very careful when handling infants.
11. **AVOID OVERCROWDING** in nurseries by keeping normal infants with their mothers whenever possible.

**THE RISK OF CROSS INFECTION IN A NURSERY INCREASES WITH OVERCROWDING**

12. **SKIN TO SKIN CARE (KMC)** to colonise the infant with the mother's bacteria (rather than the hospital bacteria) is an important method of reducing serious infection.

**SKIN TO SKIN CARE REDUCES SERIOUS INFECTIONS IN HOSPITAL**

13. **ISOLATION OF INFECTED INFANTS** is usually not needed if a policy of frequent hand washing is practiced in the nursery. However, infants with gastroenteritis should not be nursed near well infants. If possible, newborn infants should not be nursed in a general children's ward but rather in a special newborn nursery.
14. It is not necessary to restrict visits of parents and family in the nursery provided that strict hand washing and hand spraying is enforced. There is no need for visitors to wear masks or gowns.

**27-6 WHAT ARE THE SOURCES OF INFECTION?**

The infant may be colonized or infected:

1. **BEFORE DELIVERY.** This may be due to infection crossing the placenta from the mother's blood stream to cause a chronic intra-uterine infection (non bacterial) in the fetus, e.g. syphilis, or due to an acute infection (bacterial) spreading from the vagina into the membranes and liquor, i.e. chorioamnionitis.
2. **DURING DELIVERY.** The infant is colonized as it passes through the cervix and vagina during delivery and may present with infection hours or days after delivery, e.g. Gonococcal conjunctivitis.
3. **AFTER DELIVERY.** When the newborn infant becomes colonized and later infected in the home or nursery, e.g. Staphylococcal infection of the umbilical cord.

*\*\*\* Nosocomial infections are infections acquired in hospital when organisms are spread from one infant to another. They usually present at 72 hours or more after birth. Earlier infections usually result from colonization during labour or delivery.*

Infants that are born at home and then brought to hospital are often incorrectly regarded as infected and, therefore, not allowed into the nursery. These infants are only rarely infected and do not spread infection to the infants born in hospital.

**27-7 HOW ARE INFECTIONS CLASSIFIED?**

For convenience, infections in the newborn infant can be divided into:

1. Minor infections, which usually do not kill the infant.
2. Major infections, which may kill the infant.
3. Chronic intra-uterine infections where the fetus has been infected across the placenta.

**MINOR INFECTIONS****27-8 WHAT ARE THE COMMON, MINOR INFECTIONS?**

The common minor infections in the newborn infant are:

1. Conjunctivitis.
2. Infection of the umbilical cord.
3. Skin infection.
4. Oral thrush.

**27-9 WHAT ARE THE SIGNS OF CONJUNCTIVITIS?**

Conjunctivitis presents with:

1. An exudate (discharge) from the eyes.
2. Redness of the conjunctivae.
3. Oedema of the eyelids.

The degree of conjunctivitis can be divided into mild, moderate and severe:

1. **MILD CONJUNCTIVITIS** consists of a slight muco-purulent discharge causing a dry exudate on the eyelashes. The eyelids tend to stick together.
2. **MODERATE CONJUNCTIVITIS** presents with redness of the conjunctivae with an obvious purulent discharge. Pus is present in the eye when the lids are separated.
3. **SEVERE CONJUNCTIVITIS** has a marked purulent discharge with oedema of the eyelids. Pus spurts from the eye and runs down the cheeks when the eyelids are opened. In the most severe cases, it is not possible to separate the eyelids due to the oedema.

Mild conjunctivitis is the most common while severe conjunctivitis the least common form of conjunctivitis.

### 27-10 WHAT ARE THE CAUSES OF CONJUNCTIVITIS?

In the newborn infant conjunctivitis is usually caused by:

1. **CHLAMYDIA TRACHOMATIS.** This is an organism with features of both bacteria and viruses. It is sexually transmitted and causes infection of the cervix. During vaginal delivery the eyes of the infant may be colonized with Chlamydia as the infant passes through the cervix. Chlamydial conjunctivitis, which is usually mild, develops in one or both eyes a few days after delivery. The infection lasts a few weeks and then resolves spontaneously if not treated. Chlamydia is probably the commonest cause of conjunctivitis in the newborn infant.

\*\*\* *In some infants the Chlamydia organisms spread and infect the upper airways via the nasolacrimal duct. From here the infection spreads to the lungs and can cause pneumonia a few weeks after birth.*

2. **GONOCOCCUS (Neisseria gonorrhoeae).** This Gram negative bacteria causes mild, moderate or severe conjunctivitis. The latter is most important as it can result in very severe infection of the eye and may cause blindness. Like Chlamydia, the Gonococcus is sexually transmitted and causes a cervicitis. The eyes of the infant are colonized during vaginal delivery and conjunctivitis develops hours or days thereafter.

#### THE GONOCOCCUS CAUSES SEVERE CONJUNCTIVITIS WHICH MAY RESULT IN BLINDNESS

3. **STAPHYLOCOCCUS.** This, and other bacteria acquired in the nursery after delivery, can cause conjunctivitis.

It is very difficult to identify the cause of the conjunctivitis by clinically examining the eye, although most cases of severe infection are caused by the Gonococcus. Gonococci and Staphylococci can be seen on a Gram stain of pus wiped from the eye. They can also be cultured in the laboratory. Unfortunately Chlamydia is not seen on a Gram stain and is very difficult to culture. The clinical diagnosis of Chlamydia conjunctivitis, therefore, is rarely confirmed.

\*\*\* *Chlamydial infection can be confirmed by an immunofluorescent test performed on pus swabbed from the eye.*

### 27-11 WHAT IS THE MANAGEMENT OF CONJUNCTIVITIS?

The choice of treatment depends on the severity of the conjunctivitis as the causative organism is often not known at the time of diagnosis.

1. **MILD CONJUNCTIVITIS** can usually be treated by cleaning the eye with saline or warm water when the lashes become sticky. A local antibiotic is frequently not needed. However if the infection does not recover in a few days, tetracycline or chloromycetin ointment should be used 6 hourly. Tetracycline, chloromycetin and erythromycin ointment will kill Gonococcus but only erythromycin and tetracycline will treat Chlamydia.
2. **MODERATE CONJUNCTIVITIS** should be treated by cleaning the eye and then instilling tetracycline or chloromycetin drops 3 hourly or more frequently if needed.
3. **SEVERE CONJUNCTIVITIS** is a medical emergency as it can lead to blindness if not promptly and efficiently treated. The infection is usually due to the Gonococcus and treatment consists of **IRRIGATING** the eye and giving intramuscular **CEFTRIAXONE**.
  - (i) The pus must be washed out of the eye with saline, warm water or penicillin drops. This must be started immediately and repeated frequently enough to keep the eye clear of pus. The simplest way of irrigating the eye is to use a vacolitre of normal saline via an administration set. Penicillin drops can be made up in the nursery by adding 1 ml of benzyl penicillin to 50 ml sterile water or normal saline. The mixture must not be kept for more than 24 hours.

- (ii) Intramuscular Ceftriaxone daily for 3 days must be given. Many strains of Gonococcus are now resistant to penicillin. Local antibiotic drops alone are inadequate for treating a severe conjunctivitis as the infection will have already spread to involve the whole eye.
- (iii) Only when this treatment has been started should the infant be referred urgently to hospital for further management.
- (iv) If possible a pus swab should be taken before treatment is started to confirm the diagnosis of Gonococcal conjunctivitis. When positive, the mother and her partner must be treated. Also look for other sexually transmitted diseases such as syphilis.

### **27-12 WHAT ARE THE SIGNS OF AN INFECTED UMBILICAL CORD?**

A healthy umbilical cord stump is white and soft at delivery. With good cord care it becomes dark brown and dehydrated within a few days, and at no stage does it smell offensive or have an exudate.

Infection of the umbilical cord (omphalitis) presents with:

1. An offensive (smelly) discharge over the surface of the cord.
2. Failure of the cord to become dehydrated (i.e. the cord remains wet and soft).
3. Erythema of the skin around the base of the cord (a flare).

The commonest site of infection is at the base where the cord meets the skin. There is no oedema of the skin around the base of the cord with an uncomplicated cord infection. The infant is generally well when the infection is localized to the cord only.

Umbilical cord infection may spread to the anterior abdominal wall (cellulitis) from where it may cause a peritonitis or septicaemia. Signs that the infection of the umbilical cord has extended to the abdominal wall are:

1. Redness and oedema of the skin around the base of the cord.
2. Abdominal distension often with decreased bowel sounds and vomiting (peritonitis).
3. The infant is generally unwell with the features of septicaemia.

Cellulitis, peritonitis and septicaemia are not minor but major infections and the infant may die if not treated immediately. Infection of the umbilical cord may also cause tetanus in the newborn infant if the mother has not been fully immunised.

### **27-13 WHAT ARE THE CAUSES OF UMBILICAL CORD INFECTION?**

Infection of the umbilical cord usually is caused by:

1. Bacteria that colonize the infant's bowel such as E.coli.
2. Staphylococcus.
3. Clostridium tetani that causes tetanus.

### **27-14 HOW DO YOU TREAT UMBILICAL CORD INFECTION?**

With good preventative cord care, infection of the umbilical cord should not occur. Prevention consists of routine applications of alcohol (surgical spirits) to the cord every 6 hours until it is dehydrated. Antibiotic powder is not used. Never cover the cord as this keeps it moist.

If the infection is localized to the umbilical cord, and there are no signs of cellulitis, peritonitis, septicaemia or tetanus, then treatment consists simply of cleaning the cord frequently with surgical spirits. Neither local nor systemic antibiotics are needed. The cord should be carefully cleaned with a swab and copious amounts of spirits every 3 hours to clear the infection and hasten dehydration. Special attention must be paid to the folds around the base of the cord which often remain moist. Within 24 hours the infection should have resolved. Keep a careful watch for signs that the infection may have spread beyond the umbilicus.

Cellulitis of the abdominal wall around the base of the cord (redness and oedema of the skin), peritonitis or septicaemia must be treated with parenteral antibiotics.

**27-15 WHAT IS TETANUS?**

Tetanus in the newborn infant (tetanus neonatorum) is caused by the bacterium, *Clostridium tetani*, which infects dead tissues such as the umbilical cord. *Clostridium tetani* usually occurs in soil and faeces, which may be placed on the cord or other wounds as a traditional practice. It produces a powerful toxin that affects the nervous system.

Tetanus presents with:

1. Increased muscle tone, especially of the jaw muscles and abdomen.
2. Generalized muscle spasms and convulsions, often precipitated by stimulation such as handling or loud noises.
3. Respiratory failure and death in untreated infants, due to spasm of the respiratory muscles.

**27-16 HOW DO YOU MANAGE TETANUS?**

Tetanus can be prevented by:

1. Good cord care.
2. Immunizing all pregnant women with tetanus toxoid if tetanus is common in the region.

The emergency treatment of tetanus consists of:

1. Keeping the airway clear and giving oxygen.
2. Not stimulating the infant.
3. Stopping spasms with 1 mg diazepam (Valium) intravenously or rectally, repeatedly until the spasms stop. You may have to mask ventilate the infant.
4. Transferring the infant urgently to the nearest level 2 or 3 hospital.

\*\*\* *Hospital management of tetanus includes penicillin, human anti-tetanus immunoglobulin, tracheotomy, paralysis and ventilation.*

**27-17 WHAT ARE THE SIGNS AND CAUSES OF SKIN INFECTION?**

The 2 commonest forms of skin infection in the newborn infant are:

1. BULLOUS IMPETIGO caused by the *Staphylococcus* which presents as pus filled blisters usually seen around the umbilicus or in the nappy area.
2. MONILIAL RASH caused by the fungus *Candida albicans*. This almost always occurs in the nappy area and presents as a red, slightly raised, "velvety" rash which is most marked in the skin creases.

Rashes that frequently mimic skin infections are:

1. ERYTHEMA TOXICUM which usually appears on day 2 or 3 after delivery as red blotches which develop small yellow pustules in the centre. The rash is most marked on the face and chest and disappears after about a week. The cause is not known, the infants remain generally well and no treatment is needed. This rash is important as it may look like a *Staphylococcal* infection.
2. NAPPY RASH is due to irritation of the skin by stool and urine and, unlike a monilial rash, usually spares the creases.
3. SWEAT RASH may present as small, clear blisters on the forehead or a fine red rash on the neck and trunk. Both are due to excessive sweating due to the infants being kept too warm. Blisters are caused by the droplets of sweat that are not able to get through the upper layer of the skin while the red rash is due to the irritant effect of the salty sweat on the skin. Treat both rashes by washing the infant, to remove the sweat, and prevent overheating.
4. PUSTULAR MELANOSIS is usually present at birth as small blisters that soon burst to leave a small, peeling, pigmented area of skin. Sometimes the blisters have already burst before delivery. The infants are well and the rash slowly disappears without treatment.

\*\*\* *The blisters in bullous impetigo are filled with Gram positive cocci and pus cells while the pustules in erythema toxicum are filled with eosinophils only.*

### **27-18 HOW DO YOU TREAT SKIN INFECTIONS?**

If vernix is not routinely washed off immediately after birth and strict attention is paid to hand washing and spraying, skin infection should not be a problem in a nursery.

1. BULLOUS IMPETIGO is treated by washing the infant in chlorhexidine (e.g. Bioscrub) twice a day for 5 days. Do not cover the infected area with a nappy. Treat any cord infection. Wash hands well after handling the infant to prevent the spread of infection to other infants. If the infant remains generally well, local or systemic antibiotics are not needed. However, if the infant should become unwell and show any signs of septicaemia, then urgent treatment with parenteral antibiotics is indicated.
2. MONILIAL RASH should be treated with topical mycostatin (Nystatin) cream and the area should not be covered. Allow the infant to sleep prone on a nappy to keep the infected area of skin exposed to the air. A little sunshine will also help but do not let the infant get too hot or sunburned. If the rash does not improve in 48 hours, give oral mycostatin drops also to decrease the number of monilial spores in the stool.

### **27-19 WHAT IS THE CAUSE AND CLINICAL PRESENTATION OF ORAL THRUSH?**

Oral thrush (or moniliasis) is caused by the fungus *Candida albicans*, which may also cause skin infections. Oral thrush presents as patches of white coating on the tongue and mucous membrane of the mouth. Unlike a deposit of milk curds, sometime seen after a feed, thrush can not be easily wiped away. The degree of infection varies from mild to severe:

1. With MILD INFECTION there are only scattered areas of thrush with the remainder of the mucous membrane appearing healthy. The infant also sucks well. Mild thrush is very common, especially in breast fed infants.
2. In contrast, with SEVERE INFECTION there are extensive areas of thrush. The tongue and mucous membrane are red and the infant feeds poorly due to a painful mouth. The infant appears miserable and may lose weight or even become dehydrated.

Repeated, severe oral thrush in a young infant should always suggest AIDS.

### **27-20 HOW WOULD YOU TREAT ORAL THRUSH?**

The treatment of oral thrush depends on the degree of infection:

1. MILD THRUSH usually does not need to be treated as it does not cause discomfort and the infant feeds normally. The infection usually clears spontaneously. Sometimes the infection may become severe.
2. SEVERE THRUSH requires treatment as it interferes with feeding. The treatment of choice is 1 ml mycostatin drops (Nystatin) into the mouth after each feed. Mycostatin ointment can also be used and should be wiped onto the oral mucous membrane with a swab or clean finger. Treatment should be continued for a week. Gentian violet can be used if mycostatin is not available. It is very messy however and may occasionally cause mucosal damage.

It is essential to also look for and TREAT THE SOURCE OF THE INFECTION:

1. In a breast fed infant the source usually is monilial colonization of the mother's nipples. Mycostatin ointment should be smeared on the nipple and areola after each feed. If the mother has a monilial vaginal discharge, this should be treated with mycostatin vaginal cream to reduce skin colonization with *Candida*.
2. In bottle fed infants, the bottles and teats must be boiled after the feed. Disinfectant solutions such as MILTON and JIK are very useful to prevent bacterial contamination of bottles but may not kill *Candida*. Dummies should be boiled also.

If the infant is treated, but the source is not correctly managed, the oral thrush will return once the treatment is stopped.

## MAJOR INFECTIONS

### 27-21 WHAT ARE THE MAJOR INFECTIONS?

The most frequent major infections in newborn infants are:

1. Septicaemia.
2. Pneumonia.
3. Meningitis.
4. Necrotizing enterocolitis.

Other less common major infections include urinary tract infections and osteitis.

### 27-22 WHAT CAUSES SEPTICAEMIA?

Septicaemia is infection of the blood stream with bacteria which may have colonized the infant before, during or after birth. Septicaemia is often a complication of a local infection, e.g. pneumonia, umbilical cord or skin infection.

Septicaemia can be caused by either Gram positive bacteria (e.g. Staphylococcus and Group B Streptococcus) or Gram negative bacteria (e.g. Escherichia coli, Klebsiella and Pseudomonas).

*\*\*\* Bacteria are divided into 2 groups depending on their appearance under the microscope after exposure to Gram's stain. If they take up the stain and appear purple, they are called Gram positive. In contrast, Gram negative bacteria do not take up the stain and, therefore, appear pink.*

### 27-23 WHAT ARE THE CLINICAL SIGNS OF SEPTICAEMIA?

The clinical signs of septicaemia are often non-specific, making the early diagnosis of septicaemia difficult. The common clinical signs are:

1. LETHARGY. The infant appears less active than before and is generally unwell. This usually is the earliest sign of septicaemia but unfortunately needs experience to recognise and may be caused by many other conditions.
2. POOR FEEDING or SUCKING. The infant may also fail to gain or even lose weight. These signs are of particular importance if the infant had previously been feeding well.
3. ABDOMINAL DISTENSION, VOMITING and decreased bowel sounds (ileus).
4. PALLOR. This is only partially explained by anaemia.
5. JAUNDICE, which may be due to both unconjugated and conjugated bilirubin.
6. PURPURA due to too few platelets. Often also bleeding from puncture sites (due to a disseminated intravascular coagulopathy). This indicates that the infant is severely ill.
7. Recurrent APNOEA.
8. HYPOTHERMIA. Fever is far less common.
9. OEDEMA OR SCLEREMA (a woody feel to the skin).

The infant may also have signs of a local infection, e.g. umbilical cord infection, pneumonia or meningitis.

A septicaemic infant may present with one or more of these signs. Once most of the clinical signs are present and the diagnosis is easily made, it is often too late to save the infant. An early clinical diagnosis is, therefore, essential.

### THE EARLY DIAGNOSIS OF SEPTICAEMIA IN A NEWBORN INFANT IS OFTEN DIFFICULT

The diagnosis of septicaemia is confirmed by blood culture. Treatment must be started immediately however as the results may take a few days before they are available.

\*\*\* Unfortunately laboratory investigations are not of much help. The results of a blood culture may only be available after a day or two. A total white count of less than 5000, or an immature to total neutrophil ratio of more than 20%, is highly suggestive of septicaemia. A normal CRP (C-reactive protein) does not exclude septicaemia as it may take many hours to become positive. Testing the urine for Streptococcal group B antigen (Wellcogen Strep B kit) is only of limited help in diagnosing septicaemia caused by the group B Streptococcus as false positives are common.

### 27-24 HOW SHOULD YOU TREAT SEPTICAEMIA?

Management of septicaemia consists of:

1. GENERAL SUPPORTIVE CARE of a sick infant.
2. ANTIBIOTICS. When culture and sensitivity results are available, the most appropriate antibiotic is chosen. While awaiting these results, however, the antibiotics most commonly used are either:
  - (i) Benzyl penicillin 50 000 units/kg/dose plus gentamicin (GARAMYCIN) 5 mg/kg/dose or cloxacillin 50mg/kg/dose plus amikacin (AMIKIN) 5 mg/kg/dose are usually the first drug combinations of choice.
  - (ii) Cefotaxime (CLAFORAN) 50 mg/kg/dose or ceftriaxone (ROCEPHIN) 50 mg/kg/dose are usually the second choice of antibiotic..

Penicillin, cloxacillin and cefotaxime are given in divided doses either intravenously or intramuscularly every 12 hours for under one week and every 8 hours after one week of age. Ceftriaxone has the advantage of being given once a day intravenously or intramuscularly. Gentamicin and amikacin are given intravenously daily. Antibiotics should be continued for 10 days.

### 27-25 WHAT CAUSES PNEUMONIA?

Pneumonia may be acquired as the result of colonization of the upper airways before, during or after delivery:

1. Before delivery the fetus may be infected by inhaling liquor that is colonized by bacteria that have spread from a chorioamnionitis.
2. The lungs may be infected by organisms that colonize the infant's upper airways during delivery.
3. Most pneumonia in the nursery is due to bacteria that are spread to the infant on the hands of the mother and staff.

\*\*\* Anaerobic bacteria, *E. coli* and the group B Streptococcus are the commonest organisms infecting the fetus before delivery while the group B Streptococcus and *Chlamydia* may colonize the infant during delivery. In the nursery, *Staphylococcus aureus* and bowel organisms are important.

### 27-26 HOW SHOULD YOU DIAGNOSE PNEUMONIA?

1. The diagnosis is usually made by observing typical clinical signs.
  - (i) The infant develops signs of respiratory distress (tachypnoea, cyanosis, recession and grunting).
  - (ii) Signs of pneumonia may be heard with a stethoscope.
  - (iii) There are usually also signs of septicaemia.
2. A chest X-ray will show the typical features of pneumonia with areas of consolidation.

**27-27 HOW SHOULD YOU TREAT PNEUMONIA?**

1. GENERAL SUPPORTIVE CARE is important.
2. Usually oxygen is needed.
3. Give intravenous or intramuscular ANTIBIOTICS. Usually cefotaxime or ceftriaxone, or penicillin and an aminoglycoside are given.

**27-28 HOW DO YOU DIAGNOSE BACTERIAL MENINGITIS?**

The diagnosis of meningitis in the newborn infant is often very difficult as it usually does not present with the signs of neck stiffness, full fontanelle, photophobia, vomiting and headache common in older children with meningitis. The infant is usually generally ill and may have signs of septicaemia. In addition the infant may:

1. Be irritable with a high pitched cry.
2. Have abnormal movements or convulsions.
3. Tend to stare and keep the fists clenched.
4. Have recurrent apnoea or cyanotic spells.

If meningitis is suspected, a lumbar puncture must be done to confirm or exclude the diagnosis. The sample of cerebrospinal fluid (CSF) must be examined for its chemistry and cells, and it must be cultured for bacteria.

\*\*\* In the first week of life the normal values are:

(i)	Protein	0,25 – 2.5 g/l
(ii)	Glucose	2,2 - 3,3 mmol/l
(iv)	Polymorphs	0 - 15 per mm <sup>3</sup>
(v)	Lymphocytes	0 - 15 per mm <sup>3</sup>

**27-29 HOW DO YOU TREAT BACTERIAL MENINGITIS?**

1. Bacterial meningitis in the newborn infant is usually caused by Gram negative bacilli (e.g. E. coli or Klebsiella) or the Group B Streptococcus. The choice of antibiotics must cover both these groups of bacteria and also cross well from the blood stream into the cerebrospinal fluid. The drugs usually used are either cefotaxime 50 mg/kg/dose intravenously or intramuscularly every 12 hours or ceftriaxone 100 mg/kg/dose as a daily dose. The antibiotic should be given for 14 days. Half the infants with bacterial meningitis die despite treatment while half the survivors have permanent brain damage.
2. To prevent or treat convulsions give phenobarbitone 20 mg/kg intravenously or intramuscularly, then follow with 5 mg/kg orally daily until the infant is clinically well.
3. These ill infants need good supportive care.

**27-30 WHAT IS NECROTIZING ENTEROCOLITIS?**

Necrotizing enterocolitis (NEC) is necrosis (death) of part or all of the small and large intestine. It is usually seen in 2 groups of newborn infants:

1. Term infants who have had SEVERE PRENATAL HYPOXIA which has caused ischaemia and damage to the gut.
2. PRETERM INFANTS who have been infected in the nursery. This form of necrotizing enterocolitis may occur in epidemics.

**27-31 WHAT ARE THE CLINICAL SIGNS OF NECROTIZING ENTEROCOLITIS?**

Either ischaemia or infection damages the bowel wall, and the infant presents with:

1. Signs of septicaemia and often shock.
2. Abdominal distension and ileus. The abdomen is tender when palpated.
3. Vomiting which is often bile stained.
4. Blood in the stool. This may only be detected when the stool is tested for occult blood.

An X-ray of the abdomen may show air in the bowel wall. This finding will confirm the clinical diagnosis of necrotizing enterocolitis. All infants with one or more clinical signs of necrotizing enterocolitis should have an X-ray taken of the abdomen.

**ALWAYS THINK OF NECROTIZING ENTEROCOLOITIS WHEN AN INFANT PRESENTS WITH A DISTENDED ABDOMEN**

While some infants with necrotizing enterocolitis recover with treatment, others develop complications that can lead to death:

1. Bowel perforation.
2. Massive haemorrhage from the gut.
3. Septicaemia.
4. Malabsorption and multiple strictures as late complications after the acute illness.

**27-32 WHAT IS THE MANAGEMENT OF NECROTIZING ENTEROCOLITIS?**

These are extremely ill infants who must be referred to a level 2 or 3 hospital. Before transferring them, the following management is needed:

1. A nasogastric tube must be passed to relieve the bowel distension.
2. Keep nil per mouth and start an intravenous infusion. Stabilized human serum or fresh frozen plasma may be needed to treat shock.
3. Give general supportive care.
4. Give penicillin, an aminoglycoside and metronidazole intravenously.

*\*\*\* At the referral unit, parenteral nutrition is usually needed for a week or 2 while the damaged gut recovers. Bowel resection may be needed for extensive necrosis or perforation. Mortality following surgery is high. Metronidazole (Flagyl) 25 mg/kg/day is given orally or intravenously 8 hourly.*

**CHORIOAMNIONITIS****27-33 WHAT IS CHORIOAMNIONITIS?**

Chorioamnionitis is a common acute inflammation of the chorion, amnion and placenta. Normally the intra-uterine cavity is sterile during pregnancy. However, bacteria from the vagina sometime spread through the cervical canal and infect the chorion, amnion and placenta, resulting in chorioamnionitis. The infection may then spread to the amniotic fluid (amniotic fluid infection syndrome) and colonize the fetus. Fortunately most bacteria causing chorioamnionitis are anaerobes which colonize but usually do not infect the fetus. However, some bacteria, such as E. coli and the group B Streptococcus, may infect the fetus causing pneumonia and septicaemia.

Chorioamnionitis may occur with intact membranes, although it is most common after prolonged rupture of the membranes. Chorioamnionitis weakens the membranes and, therefore, is often the cause rather than the complication of preterm or prelabour rupture of the membranes.

Most bacteria causing chorioamnionitis stimulate the chorion and amnion to produce prostaglandins and, thereby, induce labour. Chorioamnionitis is the commonest cause of preterm labour and, therefore, should be suspected in all preterm infants born after the spontaneous onset of labour or prelabour rupture of the membranes.

**CHORIOAMNIONITIS CAN CAUSE PRETERM LABOUR AND PRELABOUR RUPTURE OF THE MEMBRANES**
**27-34 HOW CAN YOU DIAGNOSE CHORIOAMNIONITIS AFTER DELIVERY?**

Chorioamnionitis is usually asymptomatic in the mother and, therefore, is often not diagnosed before delivery. Only if the infection is severe will the mother develop fever, abdominal tenderness and possibly an offensive vaginal discharge. If the infection has spread to the amniotic fluid, the infant may smell offensive at delivery. Most of these colonized infants will be clinically well but some will develop signs of infection at or soon after delivery. Severe chorioamnionitis may also cause placental oedema and result in fetal hypoxia.

*\*\*\* The diagnosis of chorioamnionitis can be made at birth by examining a sample of gastric aspirate, collected within 30 minutes of delivery, under the microscope. The presence of pus cells indicates chorioamnionitis while bacteria on a Gram stain indicates amniotic fluid colonization as well. The stripped amnion appears cloudy. Whether the infant is infected or only colonized must be decided on clinical examination.*

**27-35 HOW DO YOU MANAGE AN INFANT WITH CHORIOAMNIONITIS?**

Usually the infant appears well and does not need to be treated. However parenteral antibiotics should be given if:

1. The infant is clinically ill with signs of pneumonia or septicaemia.
2. The infant weighs less than 1500 g.

*\*\*\* A gastric aspirate with Gram positive cocci in pairs suggests infection with the group B Streptococcus. These infants should be treated with parenteral ampicillin for 48 hours if the infant appears well, and for a full course if clinically ill.*

**CHRONIC INTRAUTERINE INFECTION**
**27-36 WHAT IS A CHRONIC INTRA-UTERINE INFECTION?**

A chronic intra-uterine infection is an infection of the fetus that is present for weeks or months before delivery and is caused by organisms which cross the placenta from the mother to the fetus during pregnancy. The infection may result in either:

1. Miscarriage.
2. Stillbirth.
3. An ill infant that may die after delivery. Ill infants that survive may recover completely or have permanent damage.
4. An apparently healthy infant that is, however, infected and will develop signs of disease weeks or months after delivery.

**27-37 WHAT CAUSES CHRONIC INTRA-UTERINE INFECTIONS?**

The important causes of chronic intra-uterine infection are:

1. SYPHILIS.
2. RUBELLA (German measles), which is very important because it causes congenital malformations if the infection takes place during the first 16 weeks of pregnancy (e.g. heart defects, deafness and blindness). Thereafter it only causes fetal infection with damage to many organs. As there is no treatment for congenital rubella, it must be prevented by immunizing all children especially girls before puberty.
3. CYTOMEGALOVIRUS (CMV) infection is usually asymptomatic. However it may cause infection of many organs, especially severe damage to the fetal brain resulting in mental retardation and cerebral palsy. Congenital CMV infection is more common if the mother has AIDS.
4. TOXOPLASMOSIS, which is rare and causes the same problems as CMV infection.

**27-38 WHAT IS CONGENITAL SYPHILIS?**

Congenital syphilis is a chronic intra-uterine infection caused by the spirochaete, *Treponema pallidum*. If the mother has untreated syphilis during pregnancy, the fetus has a 50% chance of becoming infected.

Syphilis causes infection and damage to many organs but, unlike rubella infection, does not cause congenital malformations. Stillbirth is common.

Maternal treatment for syphilis consists of 2,4 million units of benzathine penicillin given intramuscularly weekly for 3 weeks.

**27-39 WHAT ARE THE SIGNS OF CONGENITAL SYPHILIS?**

An infant born with congenital syphilis may have 1 or more of the following signs:

1. Low birth weight.
2. Blisters and peeling of the hands and feet.
3. Enlarged liver and spleen.
4. Pallor due to anaemia.
5. Petechiae due to too few platelets.
6. Jaundice due to hepatitis.
7. Respiratory distress due to pneumonia.
8. A heavy, pale placenta weighing more than a fifth of the weight of the infant.
9. An X-ray of the legs showing osteitis of the bones around the knee.

\*\*\* *Osteitis (a metaphysitis) of the lower femur, upper tibia and upper fibula, is a very common X-ray finding and useful diagnostic sign in congenital syphilis.*

**27-40 DO ALL INFANTS WITH CONGENITAL SYPHILIS HAVE CLINICAL SIGNS OF DISEASE AT BIRTH?**

No. Some infants that have recently acquired congenital syphilis may have no clinical signs and a normal X-ray of the legs at birth. If untreated, most of these asymptomatic infants will develop clinical signs of syphilis within a few months.

**27-41 HOW CAN YOU CONFIRM THE CLINICAL DIAGNOSIS OF CONGENITAL SYPHILIS IN AN INFANT AFTER BIRTH?**

1. If the infant has clinical or X-ray signs of syphilis and the VDRL or RPR is positive in either the mother or infant, then the clinical diagnosis of congenital syphilis is confirmed.
2. It is often difficult to confirm a diagnosis of congenital syphilis if the infant appears clinically well at delivery and the X-ray is normal. If the mother has untreated or partially treated syphilis, or syphilis treated during the last few months of pregnancy, the VDRL or RPR blood tests will be positive in both the mother and the infant at delivery. Even if the infant has not been infected the maternal IgG antibodies that give positive tests cross the placenta. A positive result in an asymptomatic infant, therefore, does not prove that the infant has congenital syphilis.
3. If the VDRL or RPR is negative in the mother or infant, then congenital syphilis is excluded.

\*\*\* *A positive VDRL (or RPR) plus TPHA (or FTA) in the mother or infant confirms that the mother has syphilis. Special tests on the infant's blood for IgM antibodies, such as the total IgM or the rheumatoid factor (i.e. IgM against the anti-spirochaetal IgG), are only of limited help in diagnosing congenital syphilis as there are many false positive and false negative results. A specific IgM test will show whether the infant is producing antibodies against the *Treponema* as maternal IgM antibodies do not cross the placenta. If tests for specific IgM antibodies are positive in the infant then infection of the infant is confirmed. However some infants with early infection may not produce IgM.*

**27-42 HOW DO YOU TREAT CONGENITAL SYPHILIS?**

The method of treatment depends on whether the infant has or has not clinical signs of congenital syphilis:

1. If the infant has CLINICAL SIGNS OF SYPHILIS give 50 000 units/kg of procaine penicillin daily by intramuscular injection for 10 days. Ten days of treatment should be given to these infants even if the mother has been fully treated. Benzathine penicillin is not adequate to treat infants with clinical signs of congenital syphilis. These infants are often very sick and need good general supportive care in a level 2 hospital.
2. If the mother has untreated syphilis, has not received a full course of treatment, or was only treated in the last month of pregnancy and the infant has NO CLINICAL SIGNS OF SYPHILIS, then the infant can be treated with a single intramuscular dose of 50 000 units of benzathine penicillin.
3. If the mother has received a full course of penicillin and the infant has no signs of syphilis, then the infant usually requires no treatment.

*\*\*\* Occasionally infants with no clinical signs of syphilis have a metaphysitis on X-ray. These infants should be treated with 10 days of procaine penicillin. Erythromycin given to the mother for syphilis does not cross the placenta and treat the fetus.*

Do not forget to also treat the parents if an infant has congenital syphilis. Always look for other sexually transmitted diseases.

**INFANTS WITH CLINICAL SIGNS OF CONGENITAL SYPHILIS  
MUST BE TREATED WITH 50 000 UNITS OF PROCAINE PENICILLIN  
INTRAMUSCULARLY DAILY FOR 10 DAYS**

**27-43 WHAT IS AIDS?**

AIDS (Acquired Immune Deficiency Syndrome) is a clinical illness caused by the Human Immunodeficiency Virus (HIV). In adults the virus is usually sexually transmitted and causes asymptomatic infection for months or years before the clinical signs of AIDS appear. HIV infection usually is confirmed by finding antibodies to the virus in the patient's blood. In South Africa, more than 25% of pregnant women are infected with HIV.

Common clinical signs of AIDS in pregnant women include:

1. Weight loss and general lethargy.
2. Chronic fever.
3. Generalized lymphadenopathy (enlarged lymph nodes).
4. Persistent diarrhoea.
5. Repeated acute bacterial infections (e.g. pneumonia), tuberculosis or unusual (opportunistic) infections.
6. Recurrent oral thrush.
7. Dementia (loss of memory and changes in behavior).

There is no treatment to cure AIDS and the illness is eventually fatal. However, this chronic illness can be successfully controlled for many years with antiretroviral therapy (ART) while many of the complicating infections can be treated. Every effort must be made to prevent the sexual spread of HIV. Education, safer sex practices and the use of condoms are important.

**27-44 CAN AN INFANT GET AIDS?**

Yes. If a woman with AIDS or an asymptomatic HIV infection falls pregnant, or gets infected with HIV during pregnancy, then her fetus or newborn infant may also become infected. The risk of HIV crossing the placenta from the mother to her fetus is 5%. There is an additional risk of 15% that the infant will be infected by contact with the virus in maternal blood and secretions during vaginal delivery. The risk is much less with an elective caesarean section.

The risk of HIV infection in the infant from mixed breast feeding for two years is 15% (5% for the first 6 months, 5% for the second 6 months and 5% for the second year). The risk from exclusive breast feeding for 6 months only is much less. In a poor community the advantages of exclusive breast feeding for 6 months are greater than the risk of HIV infection. Therefore exclusive breast feeding is still recommended in HIV positive women from poor communities. They should stop breast feeding at 6 months. In affluent communities, however, breast feeding in HIV positive mothers should probably be discouraged and exclusive formula feeding be used.

An infant with HIV infection usually appears normal and healthy at delivery. Between 2 months and 2 years after birth, most infants infected with HIV before or during delivery will present with failure to thrive and repeated bacterial infections. Most of these infants will die before 3 years of age if they are not treated. Infants infected with HIV via breast milk present later.

A positive HIV rapid test after 18 months, or a positive PCR (polymerase chain reaction) test at 14 weeks (or 6 weeks after the last breast feed is given) will confirm HIV infection in an infant. A positive HIV rapid test before 18 months may only indicate HIV exposure but not necessarily infection.

The transmission of HIV and the management of the HIV exposed infant are fully discussed in the Perinatal HIV/AIDS manual of the Perinatal Education Programme.

The risk of mother-to-child transmission of HIV during pregnancy, labour and infant feeding can be significantly reduced with the use of prophylactic antiretroviral agent, such as nevirapine and zidovudine (AZT), and changes in clinical practice.

#### **27-45 CAN THE MOTHER TO CHILD TRANSMISSION OF HIV BE PREVENTED?**

Yes. The risk of transmission can be reduced from 20% (if exclusively formula fed) or 35% (if mixed breast fed) to 5% with antiretroviral therapy to the mother during the last trimester and labour, and to the infant for the first week of life. Usually two or more drugs are used (e.g. zidovudine and nevirapine). Treatment follows voluntary counselling and testing early in pregnancy. The screening and management of HIV positive mothers and the prevention of mother to child transmission (PMTCT) are very important parts of perinatal care.

#### **27-46 CAN THE MEDICAL AND NURSING STAFF BE INFECTED WITH HIV AT DELIVERY?**

Yes. The maternal blood and vaginal secretions are infectious if the woman has AIDS or an asymptomatic HIV infection. The placenta and blood stained infant are also infectious. Proper infectious precautions must be taken for vaginal examinations and deliveries. Gloves should be worn when handling both the infant and placenta at birth.

*\*\*\* Well infants born to HIV positive mothers should be well dried after delivery to reduce the risk of infecting the staff.*

#### **27-47 CAN THE STAFF BE INFECTED WITH HIV FROM A NEWBORN INFANT?**

Yes. The blood of an infant who has HIV infection, even if there are no clinical signs of AIDS yet, is infectious. Staff can, therefore, become infected with HIV if they prick themselves with a needle or lancet (a "sharp") that has been used to obtain a blood sample from an infected infant.

#### **27-48 HOW CAN NURSERY STAFF AVOID BECOMING INFECTED WITH HIV?**

Special care is needed when blood is sampled from any infant. Immediately after the needle or lancet has been withdrawn from the skin, it must be placed in a sharps container. Never leave the needle or lancet lying next to the patient as the nurse or doctor may prick themselves when cleaning up after the procedure. Always have a sharps container at the bedside when collecting a blood sample. While the wearing of gloves for procedures is advised, this will not always protect the person from needle pricks.

**ALL NEEDLES AND LANCETS MUST BE PLACED IN A SHARPS CONTAINER IMMEDIATELY AFTER USE**

**CASE PROBLEMS****CASE 1**

An infant is delivered at home by the grandmother. On day 3 the infant develops bilateral purulent conjunctivitis. When it is brought to the local clinic the eyelids are swollen due to oedema.

**1. What is the probable cause of the conjunctivitis?**

Gonococcus (*Neisseria gonorrhoeae*). This is the commonest cause of a purulent conjunctivitis. The infant was probably infected during delivery. The diagnosis can be confirmed by seeing Gonococci in a pus smear under a microscope.

**2. How could the conjunctivitis have been prevented?**

By placing tetracycline or chloromycetin ointment into the infant's eyes after delivery.

**3. Is the conjunctivitis mild, moderate or severe? Give your reasons.**

Severe, as the eyelids are swollen.

**4. What is the danger of a severe purulent conjunctivitis?**

The cornea may become soft and perforate, causing blindness.

**5. What is the correct treatment of a severe conjunctivitis?**

The eyes must be washed out with saline, water or penicillin drops to remove the pus. They should then be washed out or irrigated repeatedly until the pus stops forming. In addition, cefotaxime or ceftriaxone must be given by intramuscular injection daily for 3 days. Only when the eyes are clean and the first dose of antibiotic has been given should the infant be referred to hospital for further treatment.

**CASE 2**

A breast fed infant is brought to the clinic on day 10. The mother reports that the infant refuses the breast and cries when she tries to feed it. On examination the infant is generally well but has a white coating of the tongue and mucous membrane of the mouth.

**1. What is the diagnosis?**

Severe oral thrush (or moniliasis) caused by the fungus *Candida albicans*. The infant is hungry but will not feed because of a sore mouth. Oral thrush must always be differentiated from milk curds, which can easily be wiped off, leaving a healthy mucous membrane underneath.

**2. What is the danger of severe thrush?**

The infant can become dehydrated due to not feeding.

**3. What is the correct treatment?**

Mycostatin (Nystatin) drops 1 ml should be placed in the mouth and repeated after every feed. Within a few hours the thrush should be improving. Continue treatment for a week. If the infant is dehydrated, nasogastric feeds or intravenous fluid may be needed for a few hours. The mother should put mycostatin cream on her nipples to prevent reinfecting her infant.

**CASE 3**

A 5 day old preterm infant becomes lethargic and has a short apnoeic attack. The abdomen is mildly distended and bowel sounds are absent. The skin temperature is 35,5°C.

**1. What do you think is wrong with this infant?**

It probably has septicaemia as this can present with lethargy, apnoea, an ileus and hypothermia. However, it may also have meningitis which can present with apnoea, or necrotizing enterocolitis which can present with lethargy and an ileus.

**2. What investigations are needed?**

A blood culture to diagnose septicaemia, a lumbar puncture to diagnose bacterial meningitis, and an abdominal X-ray and stool examination for occult blood to diagnose necrotizing enterocolitis are essential.

**3. What is the management of septicaemia?**

Benzyl penicillin 50 000 units/kg/day and gentamicin 7,5 mg/kg/day are usually given in divided doses intravenously or intramuscularly every 8 to 12 hours. The choice of antibiotic may be changed when the sensitivity results of the blood culture are obtained. Antibiotics are usually continued for 10 days.

Good supportive care is also essential. This infant will need intravenous fluids, nasogastric drainage, incubator care and careful observations. Skin temperature and respiration rate must be carefully monitored in this infant.

**CASE 4**

An unbooked patient delivers a 2000 g infant with peeling skin on the hands and feet and an enlarged liver and spleen. The placenta is pale and weighs 680 g.

**1. What is the clinical diagnosis?**

Congenital syphilis. This is suggested by the peeling rash on hands and feet, the hepatosplenomegaly and the heavy, pale placenta in a low birth weight infant. Syphilis should also be suspected in all unbooked patients.

**2. How would you confirm the diagnosis?**

The VDRL and TPHA in both mother and infant will be positive. An X-ray of the legs will almost certainly show the typical features of syphilitic osteitis.

**3. What is the treatment of an infant with clinical signs of congenital syphilis?**

Procaine penicillin 100 000 units intramuscularly each day for 10 days.

**4. What is the treatment if the infant appears well but the mother has untreated syphilis?**

If the infant has no clinical signs of syphilis the treatment is a single dose of 100 000 units benzathine penicillin.

**5. How can congenital syphilis be prevented?**

All pregnant women must be screened by using VDRL (or RPR) and TPHA (or FTA) blood tests, in the first trimester if possible, and be fully treated with benzathine penicillin if found to have syphilis.

**CASE 5**

A mother who is known to be HIV positive but has no clinical signs of AIDS delivers at infant at term. The infant appears clinically normal but develops mild jaundice on day 5. A sample of blood is taken from the infant's heel for a total serum bilirubin measurement.

**1. What is the chance that this infant has been infected with the HIV virus?**

About 25 to 50%.

**2. Would you expect clinical signs of AIDS at birth if the infant was infected with HIV?**

No. Infants infected with HIV usually remain well for the first few months of life.

**3. How does AIDS usually present in an infant?**

After a few months the infant fails to gain weight or may lose weight. Loose stools and bacterial infections, such as pneumonia, are common early signs of AIDS.

**4. What is the danger to the staff if a sample of blood is collected from this infant?**

If the infant is infected with HIV, the nurse or doctor may also become infected with HIV if they prick their finger after collecting a sample of the infant's blood.

**5. How can the staff prevent themselves from pricking their finger?**

By placing the needle or lancet into a sharps container immediately after it has been used.