

[Newborn Care Manual: Contents](#)**MEASURING THE PACKED CELL VOLUME**

The packed cell volume (PCV or haematocrit) is the percentage of red cells in a sample of whole blood. The normal packed cell volume is 45 to 65% at birth (i.e. just over half the volume of blood consists of red cells). In the newborn nursery the packed cell volume, rather than the haemoglobin concentration, is measured as it is more accurate. It is also more convenient as often the blood has to be spun in order to measure the total serum bilirubin concentration. The packed cell volume is approximately 3 times the haemoglobin concentration (Hb), i.e. a PCV of 30% would be expected if the Hb was 10 g/dl.

24-A EQUIPMENT THAT IS NEEDED TO COLLECT A SAMPLE OF CAPILLARY BLOOD.

1. A plastic dish of warm water or a warm, wet towel.
2. An alcohol swab or gauze swab soaked with surgical spirits.
3. A jar of Vaseline (petroleum jelly).
4. A sterile lancet.
5. A container for sharps.
6. A heparinised 75 mm capillary tube.
7. Plasticine.
8. A dry swab to stop the bleeding.

24-B COLLECTING A BLOOD SAMPLE TO MEASURE THE PACKED CELL VOLUME.

The packed cell volume may be measured on a sample of arterial, venous or capillary blood. If capillary blood is used, very careful attention must be paid to the correct method of collecting the sample. Usually blood is sampled from the side of the infant's heel (as illustrated in skills workshop 23). The infant's foot must be warm so that the blood flows easily without the need to squeeze the heel. If the heel is cold and has to be squeezed, an incorrectly high packed cell volume reading may be obtained.

The method of obtaining a capillary blood sample for a packed cell volume measurement is as follows:

1. If possible, the infant's foot should be placed in a plastic dish of warm (NOT hot) water or wrapped in a warm towel for 1-2 minutes.
2. Dry the foot, clean the skin with an alcohol swab and smear a thin layer of Vaseline over the heel.
3. Pierce the skin with a lancet and then immediately place the lancet in the sharps container.
4. A large drop of blood should form on the skin. Touch the drop of blood with a heparinised glass capillary tube and the blood will run into the tube if it is held horizontally or slightly downwards.
5. Close one end of the capillary tube with plasticine.
6. Stop the bleeding by applying pressure with a dry swab for a few minutes.

23-C DO NOT PRICK YOUR FINGER BY MISTAKE.

Be very careful not to prick your finger by mistake when obtaining a sample of capillary blood from an infant. Immediately after piercing the infant's skin, the lancet must be placed in a special container for "sharps". It is very important to dispose of the lancet as soon as possible as most people prick themselves while removing the used equipment after the procedure. Therefore, never leave a used lancet or needle lying exposed. Viruses such as hepatitis B and HIV can be transmitted as a result of a finger prick with a lancet or needle if the patient is infected.

PLACE THE LANCET IN A SPECIAL CONTAINER FOR "SHARPS" IMMEDIATELY AFTER PIERCING THE SKIN

If possible, clear plastic rather than glass capillary tubes should be used. This avoids the risk of a tube breaking in the microcentrifuge. Blood stained broken glass is dangerous as it may cut the operator's finger and spread HIV.

A safety lancet is expensive and only used once. However it avoids the risk of a "needle stick injury".

24-D USING A MICROCENTRIFUGE.

The sample of blood in the capillary tube must be spun down in a microcentrifuge for 2 minutes. All level 2 and 3 nurseries should have a microcentrifuge.

A microcentrifuge should be used as follows:

1. The power lead can be left plugged in and switched on all the time.
2. Open the lid of the microcentrifuge and unscrew the cover.
3. Place the capillary tube in one of the radiating grooves in the centrifuge plate so that the end of the tube, which is blocked with plasticine, is right up against the outside edge of the plate. Many capillary tubes can be centrifuged (spun) at the same time if needed. The capillary tube must be balanced by another tube (filled with water if necessary) placed in the groove opposite it.
4. Replace the cover and screw it tightly closed.
5. Close the lid.
6. Set the timer for 2 minutes.
7. Switch the microcentrifuge on.
8. After 2 minutes the microcentrifuge will automatically switch off. Allow it to stop. Some microcentrifuges can be manually slowed down with a brake.
9. When the microcentrifuge has stopped completely, open the lid, unscrew the cover and remove the spun capillary tube.

You will notice that the red cells have all been spun to one end of the tube. The rest of the tube is filled with serum. Where the red cells and the serum meet, you will see a 1 mm white band. This is formed by the white blood cells.

24-E DETERMINING THE PACKED CELL VOLUME.

A special instrument called a packed cell volume reader (or a micro-haematocrit reader) is used to measure the packed cell volume. Two different types of PCV reader are available. One type measures the PCV while the capillary tubes are still in the microcentrifuge while the other type is completely separate from the microcentrifuge.

MEASURING THE PACKED CELL VOLUME ON THE MICROCENTRIFUGE:

1. Centrifuge (spin) the capillary tube as described above.
2. Place the perspex reader over the plate holding the capillary tubes.
3. While holding the plate still with one hand so that it does not turn, twist the knob on the reader with the other hand until the baseline (i.e. 0) crosses the capillary tube at the point where the red cells meet the plasticine.
4. Now hold the knob still with one hand and rotate the perspex reader with the other hand until the top line (i.e. 100%) crosses the capillary tube at the top of the serum (not the top of the tube).
5. Determine which line crosses the capillary tube at the point where the red cells meet the serum. Follow that line along to either the left or the right and read the PCV.

MEASURING THE PACKED CELL VOLUME OFF THE MICROCENTRIFUGE:

1. Remove the capillary tube from the microcentrifuge and place it in the vertical groove of the reader so that the junction of the plasticine and the red cells lies on the bottom line.
2. Slide the capillary tube holder to the left or the right until the top of the serum (not the top of the tube) falls on the top line.
3. Move the perspex arm up so that the line falls on the junction of the red cells and the serum.
4. Read the PCV.

24-F USING A BILIRUBINOMETER

Before the total serum bilirubin (TSB) can be measured with a bilirubinometer, a sample of blood has to be collected into a capillary tube and spun down as described above. A number of different types of bilirubinometers are available. Some measure the TSB in the serum while still in the capillary tube. Others require that the tube has to be snapped at the junction of the serum and the red cells so that the serum can be run into a special glass measuring chamber. This type is dangerous if the HIV prevalence is high as it is very easy to cut one's finger when snapping a glass tube. It is safest to use clear plastic capillary tubes with a bilirubinometer which measures the TSB in intact tubes. Both types of bilirubinometer are electrically powered, expensive and have to be carefully standardized at least once a week. The care and use of a bilirubinometer, therefore, should be the responsibility of a trained medical technologist. Staff wishing to use a bilirubinometer should get personal instructions from the local technologists. The method is simple but differs depending on the model of bilirubinometer available.

USING A PHOTOTHERAPY UNIT

A phototherapy unit is used to provide a source of bright light to treat jaundice in newborn infants. The light alters the bilirubin in the skin of the infant allowing the infant's liver to excrete the altered bilirubin.

24-G COMPONENTS OF A PHOTOTHERAPY UNIT.

A number of commercial or hospital-made phototherapy units are available. Their main components are:

1. THE FLUORESCENT TUBES.

Most phototherapy units contain 4 or more white or blue fluorescent tubes. Increasing the number of fluorescent tubes improves the efficiency of the phototherapy. Ultraviolet tubes are NEVER used as they will burn the infant very seriously. Usually 60 cm long white "Daylight" tubes are used (labelled SABS No. 2; SABS stands for South African Bureau of Standards). Daylight tubes are also used in hospitals for lighting rooms and passages. To increase the amount of blue light produced by the phototherapy unit, Daylight tubes are often mixed with special blue tubes (TI 20 Watt/03T produced by Philips). Fluorescent tubes have a limited life span and, therefore, must be replaced every 1000 hours (or 6 months if the hours in service are not recorded). A special photometer can be used to measure the light output of a phototherapy unit. This helps in deciding when to replace the tubes.

2. THE LIGHT BOX.

The fluorescent tubes are fixed into a special light box which usually has a fan to keep the tubes cool. Otherwise the tubes and the infant will overheat. Most light boxes have a time counter which indicates how many hours the tubes have been used.

A thick sheet (1 cm) of clear perspex (plastic) must be placed under the tubes to protect the infant from falling glass if a tube explodes. The perspex does not lessen the effect of the phototherapy but it does reduce the amount of heat reaching the infant.

3. THE STAND.

All phototherapy units have some form of stand to support the lighting box. Usually the stand allows the height of the light box to be raised or lowered. The tubes usually are placed 40 cm above the infant. The closer the tubes are to the infant the more effective is the treatment as more light is provided. Therefore the tubes are often moved closer if the infant is severely jaundiced. However, the infant may overheat if the tubes are brought too close. Some phototherapy units also have a platform on which to stand the bassinet. Others can be moved over the incubator or bassinet. The stand should be as small as possible so as not to take up too much space in the nursery or ward. Sometimes more than one phototherapy unit is used for an infant with a high TSB.

Some overhead radiant heaters (intensive care cribs) have spot lights which can be used to give phototherapy.