areas of application). Firm pressure should be applied to the paddles.

**Correct energy selection**
The recommended level in VF or pulseless VT cardiac arrest is 4 joules/kg (with no patient sedation).

In arrhythmias with a pulse, the dose is 0.5 joules/kg, then 1 joule/kg, then 2 joules/kg if the previous doses were unsuccessful (always with sedation).

**Automatic external defibrillators (AEDs)**
Automatic external defibrillators (AEDs) are used in adults both to assess cardiac rhythm and to deliver defibrillation (see Section 1.13 for details). In children, AEDs can accurately detect ventricular fibrillation at all ages, but there is concern about their ability to identify tachycardic rhythms in infants correctly. At present, therefore, AEDs can be used to identify rhythms in children but not in infants.

Many AEDs now have paediatric attenuation pads which decrease the energy to a level more appropriate for the child (aged 1–8 years), or leads that reduce the total energy to 50–80 joules. This means that AEDs can be used for all children over the age of 1 year. Institutions that treat infants who might need defibrillation must provide manual defibrillators.

**Guidance**
- With a manual defibrillator use 4 joules/kg to defibrillate patients of all ages.
- With an unattenuated AED (see above), children over 8 years of age can be defibrillated.
- With an AED with paediatric pads or paddles, children aged 1–8 years can be defibrillated.

### 8.5 Other procedures

#### Insertion of an orogastric or nasogastric tube

**FIGURE 8.5.1** Inserting a nasogastric tube. (a) The distance from the nose to the ear and then to the epigastrium is measured. (b) The tube is then inserted to the measured distance.

The nasogastric tube is used to feed any child who is unable to take food by mouth.

**Preparation of kit**
The following equipment is needed:
- nasogastric tube
- lubricant
- pH indicator paper or litmus paper
- syringe
- stethoscope
- adhesive tape.

In preterm infants:
- 4 French gauge tube is used for infants who weigh ≤ 1000 grams
- 6 French gauge tube is used for infants who weigh > 1000 grams (and most neonates)
- 8 to 10 French gauge tube is used for abdominal decompression (e.g., in infants with ileus or who are receiving continuous positive airway pressure).

**Procedure**
1. Place the child supine with their head in the “sniffing” position.
2. Measure the length of the tube from the nose via the earlobe to the midpoint between the xiphoid and the umbilicus. Mark the tube at this point with indelible pen.
3. Feed the tube lubricated with KY Jelly or saline through either the nose or the mouth directly backwards. (The neonate is a nose breather, and therefore if there is respiratory distress the oral route may be preferred.) Try to advance the tube as the child swallows. If a baby has respiratory distress, a gastric tube is best passed through the mouth.
4. Check the position of the tube by very gently aspirating 0.2–0.5 mL of stomach contents using a small (2- or 5-mL) syringe (larger ones can damage the gastric mucosa) and checking the change in the pH indicator.
paper (the pH should be 5.5 or less, or the litmus paper should change colour from blue to pink), or flush the tube with 2–3 mL of air (only 1 mL in the neonate) and listen over the stomach area with the stethoscope. If in doubt, X-ray the chest and/or abdomen. (Note that the acidity of the gastric fluid may be reduced in preterm infants.)

5. If there is any doubt about the location of the tube, withdraw it and start again. Withdraw immediately if the child starts coughing, as the tube may then be in the airway.

6. Secure the tube by taping it to the cheek, and record the length of tube outside the nose or mouth.

7. When the tube is in place, fix a 50-mL syringe (without the plunger) to the end of the tube, and pour food or fluid into the syringe, allowing it to flow by gravity.

The nasal route is more comfortable and secure, but if the infant has respiratory distress or is receiving CPAP, an orogastric tube is best (if passed through the nose the tube increases upper airway resistance).

Never pass a nasogastric tube in a head-injured patient. An orogastric tube is safe. If there is a base-of-skull fracture, a nasal tube could be pushed into brain tissue.

Cervical spine immobilisation

All patients with major trauma should have full spinal stabilisation if feasible from the moment of injury, and should be treated as if they have a cervical spine injury until proven otherwise. Immobilisation can be achieved:

- by holding the head still and in line (manual in-line immobilisation)
- or by applying a semi-rigid collar (which has been correctly fitted), sandbags on either side of the head, and tape across the forehead and the chin piece of the collar to prevent the head from being lifted upward from the bed.

FIGURE 8.5.2 Immobilisation of the cervical spine using head blocks and straps with a cervical collar in place.

Exceptions

Two groups of patients may prove to be difficult:

- the frightened uncooperative child (most common)
- the hypoxic combative patient.

In both of these cases, over-enthusiastic efforts to immobilise the neck may increase the risk of spinal injury as the patient struggles to escape. The area of greatest mobility in the cervical spine is the C7/T1 junction, and this is at increased risk in the combative patient.

It is best to try to apply just a collar and then address the patient’s other clinical needs (see Section 7.3).

Log roll

When examining the back of the patient with major injury, it is important to minimise the risk associated with unrecognised spinal injury. It is essential to examine the back of the patient at the end of the primary survey (or even during it if there is suspicion of serious injury to the back of the chest or abdomen).

The aim of the log roll is to maintain the orientation of the spine during turning of the patient. It requires four people for a mother or child and three for an infant. In addition, one person is required for the examination of injuries.

TABLE 8.5.1 Position of staff for log roll

<table>
<thead>
<tr>
<th>Staff number</th>
<th>Infant or small child</th>
<th>Larger child or mother</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Examination of back</td>
<td>Examination of back</td>
</tr>
<tr>
<td>2</td>
<td>Stabilisation of head and neck – in charge of the procedure</td>
<td>Stabilisation of head and neck – in charge of the procedure</td>
</tr>
<tr>
<td>3</td>
<td>Chest</td>
<td>Chest</td>
</tr>
<tr>
<td>4</td>
<td>Pelvis and legs</td>
<td>Pelvis</td>
</tr>
<tr>
<td>5</td>
<td>Legs</td>
<td></td>
</tr>
</tbody>
</table>

FIGURE 8.5.3 Log rolling a child.

FIGURE 8.5.4 Log rolling an infant.

Incision and drainage of abscess

Indications

- The collection of localised infection.
- If there is uncertainty whether a hot red mass is an abscess, aspirate for pus before proceeding to incision and drainage.
- Multiple/recurrent abscesses may be associated with HIV, TB, malnutrition, diabetes mellitus, anaemia or foreign bodies.
Preparation of kit
The following equipment is needed:
- skin preparation materials
- scalp
- microbiology swab
- curette
- sterile gauze.

Procedure
The procedure must be sterile.

1. Decompress the bladder and stomach with a urinary catheter and nasogastric tube.
2. Prepare the abdomen (from the costal margin to the pubis). Drape the area with sterile towels, exposing the peri-umbilical region.
3. If the patient is conscious, infiltrate local anaesthetic in the midline (a third of the distance between the umbilicus and the pubis). If pelvic trauma is suspected, infiltrate above the umbilicus.
4. Insert the catheter over needle. Remove the needle and aspirate.
5. If more than 10 mL of fresh blood or turbid or bile-stained fluid or faeces or food debris are present in the aspirate, there is a serious problem, possibly indicating the need for a laparotomy.
6. If laparotomy is indicated, withdraw the catheter and cover the wound with a sterile dressing. Then transfer the patient to theatre.

Abdominal paracentesis

Indications
- To detect intra-abdominal injury after blunt trauma in the haemodynamically unstable child in the absence of CT or ultrasound scanning facilities. Haemodynamic instability after penetrating trauma always requires a laparotomy.
- To identify peritonitis.
- To identify ruptured bowel.

Preparation of kit
The following equipment is needed:
- local anaesthetic (ideally with adrenaline)
- sterile drapes
- over-needle catheter, 16- to 20-gauge
- 20-mL syringe
- warmed normal saline and infusion set
- urinary catheter and nasogastric tube
- skin prep (iodine/alcohol).

Procedure
1. Insert a curette spoon or finger to break down any necrotic material.
2. Irrigate the cavity with 0.9% saline to flush out necrotic material. Needed. Remove the wick after 48 hours.
3. As the cavity discharges pus it should heal from a depth to superficially through the open skin incision.

Lumbar puncture

Preparation of kit
The following equipment is needed:
- iodine
- sterile gloves
- sterile dressings pack
- spinal needle with stylet
- colloidion
- small adhesive dressing
- local anaesthetic
- sedation (in some cases).

Indications
- As part of septic screen in case meningitis is present.
- For investigating the possible cause of seizures.
- For investigating the possible cause of apnoic episodes due to meningitis.
- As therapy in post-haemorrhagic hydrocephalus.
- For administration of drugs in leukaemia.

Contraindications
- Signs of raised intracranial pressure, such as deep coma (P or U on the AVPU scale), unequal pupils, rigid posture or paralysis in any of the limbs or the trunk, or irregular breathing.
- Skin infection in the area through which the needle will have to pass.
- Significant bleeding disorder.

If contraindications are present, the potential value of the information gained from a lumbar puncture should be carefully weighed against the risk of the procedure. If in doubt, it
might be better to start treatment for suspected meningitis, and delay performing a lumbar puncture.

**Precautions**

- Do not perform a lumbar puncture in the very sick patient (it may precipitate apnoea in an infant and shock in an older child).
- Excessive neck flexion when positioning can lead to hypoxaemia and acute respiratory deterioration.
- If a spinal needle is unavailable and a normal (non-stylet) needle is used, the needle bore may become blocked with skin on insertion and therefore obstruct flow. There is also the risk of tissue implantation leading to a dermoid cyst.

**Procedure**

There are two possible positions:

- the child lying down on the left side (particularly for young infants)
- the child in the sitting position (particularly for older children).

When the child is lying on their side a hard surface should be used. Place the child on their side so that the vertebral column is parallel to this surface and the transverse axis of the back is vertical (see Figure 8.5.5).

It is helpful to have an experienced assistant present to hold the patient. Flex the spine maximally, but avoid excessive neck flexion. Make sure that the airway is not obstructed and the child can breathe normally. Take particular care when holding young infants. The assistant should not hold a young infant by the neck or flex the neck to avoid airway obstruction.

**Prepare the site**

- Use aseptic technique. Scrub your hands and wear sterile gloves.
- Prepare the skin around the site with an antiseptic solution.
- Sterile towels may be used.
- In older children who are alert, give a local anaesthetic (1% lignocaine) infiltrated in the skin and subcutaneous tissue over the site.

**Identify site of insertion**

Locate the space between the third and fourth lumbar vertebrae or between the fourth and fifth lumbar vertebrae. (The third lumbar vertebra is at the junction of the line between the iliac crests and the vertebral column.)

Use an LP needle with a stylet (22 gauge for a young infant, and 20 gauge for an older infant and child; if these are not available, routine hypodermic needles may be used). Insert the needle into the middle of the inter-vertebral space and aim the needle towards the umbilicus.

Advance the needle slowly. The needle will pass easily until it encounters the ligament between the vertebral processes. More pressure is needed to penetrate this ligament, and less resistance is felt as the dura is penetrated. In young infants this decrease in resistance is not always felt, so advance the needle very carefully.

Stop advancing when a ‘give’ or puncture sensation is felt on entering the subarachnoid space (this is often not felt in neonates). Frequent stylet withdrawals during the procedure should be undertaken to see if the CSF flows, indicating that the subarachnoid space has been successfully entered. The subarachnoid space is only 0.5–0.7 cm below the skin in premature infants and 1 cm below it in term infants, so it is easy to over-penetrated by mistake. Over-penetration leads to puncturing of the anterior vertebral venous plexus and a bloody sample, so that CSF microscopy is less informative or perhaps impossible. The needle should be withdrawn and the procedure repeated in another disc space.

Withdraw the stylet. Obtain a sample of 0.5–1 mL of CSF and place it in sterile containers, allowing six drops of CSF to drip into each sample container.

Replace the stylet.

Withdraw the needle and stylet completely and apply pressure to the site for a few seconds. Put a sterile dressing over the needle puncture site, and cover the whole site with adhesive dressing.

Send samples for the following:

1. microscopy, cell type and counts, Gram and Ziehl-Neelson staining, culture and sensitivity (including for TB) and virology.
2. biochemistry (glucose, protein).
Section 8.5

Suprapubic aspiration of urine

**Indications**

Usually in sick infants where urgent diagnosis is required and there is a palpable bladder that does not respond to manual expression for a clean catch.

**Procedure**

Use a sterile technique throughout. Advance a 23- to 24-gauge needle attached to a syringe to a depth of 3 cm in the midline at the proximal transverse crease above the pubis. Withdraw the urine into a sterile syringe and transfer it to a sterile urine container. Do this only in a child with a bladder containing sufficient urine, which can be demonstrated by percussion. Do not use urine bags to collect urine, as the specimens may become contaminated. Have a clean urine jar ready in case the child passes urine during the procedure.

**Microscopy of urine**

- Urinary tract infections (UTIs) are common in children.
- Although many of these infections are not serious, some of them cause kidney damage and lead to scarring.
- Kidney scars can lead to high blood pressure, and to kidney failure later in life.
- A child with a UTI can develop kidney damage very fast, in just a few days. The only way to prevent this is to make the diagnosis and treat it at once.
- Urine microscopy is the only way to diagnose UTIs immediately and reliably.

In a patient with a UTI the urine contains:

- one species of bacterium at a concentration of at least 100,000/mL
- an excess of white blood cells.

**Bacterial numbers**

Most children with a UTI have in the range of 10–1000 million bacteria/mL. In fact, 100,000/mL is a very small number of bacteria. When urine is collected from children, it often becomes contaminated with a very small number of bacteria, and these are often of just one species. This means that if you rely on laboratory culture to make the diagnosis of UTI, you are likely to have many false-positives, perhaps one for every genuine case. Remember that every child diagnosed as having a UTI in this way will undergo investigations, sometimes including invasive procedures.

**White blood cells**

Children frequently have extra urinary white blood cells without a UTI.

- Around 10% of febrile children have hundreds of extra white blood cells.
- Girls void some urine into the vagina, so vaginal white blood cells are readily washed into the urine (as are vaginal epithelial cells, which are seen in the urine of most girls after puberty).

Children with UTIs often have no excess of white blood cells.

- White blood cells do not last long in urine, especially if it is alkaline, so it must be examined soon after collection.
- Ill infants may be unable to mount a white blood cell response.

Therefore white blood cells alone are an unreliable and potentially misleading sign.

**How to count bacteria**

**Laboratory culture**

This is the most widely used method, and the traditional approach. It remains acceptable, but if you use it you will:

- have to accept that some positive reports will be false
- have to wait at least 48 hours for the result. In real life, it is often several days or a week before a positive lab report reaches the doctor, and treatment starts. Remember that kidney damage can become permanent within 3 days
- have to recall patients a few days later if the culture grows a mixture of bacteria. This is usually caused by the contamination of urine as it is collected, and is common. It must be repeated in case a UTI was present as well
- miss the occasional UTI caused by anaerobes.

**Advantages of urine microscopy**

If you use this method you can:

- discard sterile urines, and reassure the child’s family at once
- repeat a contaminated urine sample at once
- treat children with UTIs immediately
- diagnose anaerobic UTIs as easily as aerobic ones
- save time and money because it is quicker and cheaper than urine culture.
**Choice of microscope**

With an ordinary light microscope, bacteria are only easy to see after they have been stained.

**Phase-contrast microscopes** enable you to see unstained bacteria very easily, just using a drop of fresh urine on a glass slide. They look and work exactly the same as ordinary light microscopes, except that the lens (objective) and the condenser (underneath) are specially modified.

**How to do urine microscopy**

You can microscope fresh urine on a slide with a counting chamber. There is no need to stain or spin the urine.

The slide has two chambers, each of which has a grid etched on to the glass surface. In certain clinical situations, such as examination of peritoneal dialysis fluid for suspected peritonitis, the grid can be used to make accurate counts of the concentrations of elements present.

Usually this degree of accuracy is unnecessary. However, the grid is always useful because it confirms that the microscope is focused on the urine. If you examine a specimen with no cells or bacteria on a plain slide it is impossible to be certain otherwise.

Clean the slide and a coverslip with a tissue. Breathe over the slide to create a ‘mist’ on it, and quickly push the coverslip into place. This creates a chamber 0.1 mm deep with a grid etched on the bottom (see Figure 8.5.8).

**Bacteria**

- Most bacteria that cause UTIs are bacilli (rod-shaped).
- They are easy to identify, as they look like straight lines, usually about 3 mm long.
- Mostly they remain still, or just move slightly, like a shimmer. This movement is caused by Brownian motion (which occurs when they are hit by water molecules), and is not due to them swimming.
- Rarely will you see moving bacteria.

Infections also sometimes occur with streptococci, which are bacteria that resemble strings of beads. There are always some strings that are four or more cocci long. If you think that you can see ‘cocci’ individually, or in clumps, these are in fact phosphate crystals. If they appear to be moving, this is just the result of Brownian motion.

**White blood cells**

These are round, and between 3 and 5 mm in diameter. All white blood cells have a “granular” appearance to their cytoplasm. In the case of the larger ones you can often make out the individual granules shimmering and moving within the cell, and the nucleus (which is lobed in neutrophils).

**Red blood cells**

These are smaller than white blood cells, and do not have any content or granular appearance.

If the red cells are present because of trauma (e.g. after an injury, or post surgery) or a UTI, they will either look just like red cells in the blood (i.e. biconcave disc), or they will all appear slightly shrunken and wrinkled, or slightly swollen. The important thing is that they all look the same.

**Epithelial cells**

These are very large flat cells with an easily visible round nucleus. They are from the vagina, and are only seen in the
urine of older girls, in which they are common. If large numbers of epithelial cells are present this suggests particularly heavy vaginal contamination.

**FIGURE 8.5.13** Epithelial cells.

**Casts**
These indicate kidney inflammation (glomerulonephritis). Casts consist of abnormal kidney tubule contents that have solidified and have retained the shape of the tubule as they passed into the urine.

Pure protein casts look glass-like, and are described as hyaline. Those consisting of debris (e.g. dead tubule cells in acute tubular necrosis) are called granular casts. Some casts are composed of red or white cells. Many casts consist of a mixture of these.

**FIGURE 8.5.14** Casts.

**Debris**
Contaminated urine samples often contain a variety of debris. Some elements have an obvious origin, such as cotton fibres, but others cannot be identified.

**FIGURE 8.5.15** Debris.

**Crystals**
Urine samples often contain obvious crystals, whose shape allows their chemical origin to be identified. However, this is rarely of clinical significance.

The commonest ‘crystals’ in fact look more like small black dots, either singly, or in clumps (and even in casts). They move slightly (or ‘shimmer’) as a result of Brownian motion, and can be mistaken by the unwary for small round bacteria (cocci).

**FIGURE 8.5.16** Crystals.

**Diagnosing urinary tract infections (UTIs)**
UTIs are primarily diagnosed by looking for bacteria.

**Infected urine**
About 99% of urine infections are caused by rod-shaped bacteria known as *bacilli*.

In most UTIs, every field you view will have many bacteria (in some cases thousands), and they all look the same. Therefore when you see many bacteria in fresh urine, all with the same appearance, you can be sure that the child has a UTI.

If you see at least one rod, but less than 10 rods in the centre of the grid (square 5), you have to consider the possibility of contamination, so collect another sample to see whether the finding persists (and think about vaginal lactobacilli; see below).

**What to do if you find a positive microscopy**
You can start treatment immediately with an appropriate antibiotic. In addition, send the urine for culture with direct sensitivities.

The laboratory will grow the bacteria to confirm which species they are, and to test their sensitivity to a range of different antibiotics. Without direct sensitivity testing this takes 2 days, but with it you will usually obtain the result the next day.

**Sterile urine**
Most urine samples will be sterile. If you see no bacteria or cells, check by looking at five ‘size-A’ squares (i.e. about five fields).

If you see nothing in that area, then you can be certain that the urine is not infected.

Even if you can see other elements, if there are no bacteria, it is not a UTI. Remember that you will see white blood cells in the urine of many children with fever (e.g. due to tonsillitis or pneumonia). Also remember that many girls have white blood cells in their urine from the vagina (and often epithelial cells, too).

**Contaminated urine**
If you see any of the following, collect a repeat sample, as the first sample is likely to have been contaminated:
- more than one shape of bacterium
some bacteria, but also a large amount of debris (e.g.,
cotton fibres or many epithelial cells)
many bacteria in a urine sample that was collected
several hours ago, or from a nappy that had been on
the baby for several hours.

If necessary, you need to go on collecting repeat urine sam-
ples until one is either definitely sterile or definitely infected.

Vaginal contamination
Girls void some of their urine into the vagina, so normal
female urine will contain vaginal washings. In young girls
this makes little difference to the microscopy findings. In
older girls it is normal to see some epithelial cells (see
Figure 8.5.13).
Also, in many older girls lactobacilli are washed into
the urine. These are long rods, up to 4 mm or more. It is
unusual for there to be large numbers, but they can cause
confusion with a UTI. If you are uncertain, ask the lab either
to Gram stain them or to culture them. Unlike the bacteria
that cause UTIs, lactobacilli are Gram-positive.
They do not grow in conventional UTI culture media, so
the lab will report a sterile urine. If you want to be absolutely
certain, ask the lab to culture the urine anaerobically.

Recording the results
Labels can be printed to stick on the clinical notes. This
is important because negative urine samples will be dis-
carded, and this will be the only record of the test.
A typical format is as follows:

**URINE PHASE CONTRAST MICROSCOPY**
Name: ………………………… Date: ………
MICRO – Bacteria: ………………………….. WBC: ………. RBC: ………………….
Casts, etc.: ………………………………
STICKS – Protein: ……… Blood: …………
Glucose: …………… Other: ……………………………
ACTION – (tick one of the three options)
Urine not infected: sample discarded
Urine contaminated: sample repeated
UTI: urine sent for culture and direct sensitivities, and
antibiotics started
SIGN and PRINT NAME:………………………

Counting what you see
For most clinical purposes it is not necessary to count
the exact concentration of cells or bacteria that you
see, and estimates such as ‘many’ or ‘few’ are enough.
Sometimes it is helpful to quantify the findings more
carefully (e.g. to monitor the numbers of casts in a child
with glomerulonephritis).
Occasionally it is essential to count the exact numbers
(e.g. the number of white blood cells is critical for the
diagnosis and treatment of peritonitis in children on
peritoneal dialysis from a dialysis sample).

Calculate all the counts per microlitre (µL). Count at least
10 of each element of interest. The number and size of the
squares you need to count will therefore depend on the
concentration of the elements in the urine.

Figure 8.5.17 shows the etched counting grid for
microscopy:
The central square (‘3’) is 1 x 1 mm.
With the cover-slip on, the chamber is 0.1 mm deep, so
the central square has a volume of 0.1 µL.
Therefore the whole grid of nine similar squares has a
total volume of 0.9 µL.
Note that 1 microlitre is one-thousandth of a mL.
Therefore a count of 100 000 bacteria/mL is equivalent
to 100/µL, so a ‘significant’ culture in a urinary tract
infection would mean at least 100 bacteria/µL, or 10
bacteria in the central square of the grid.

**FIGURE 8.5.17** Counting grid for microscopy.

How to count
Very infrequent elements
Count all those in squares 1, 2, 3, 4 and 5, and multiply by 2.

Infrequent elements
Count all those in square 5, and multiply by 10.

Frequent elements
Count all those in five smaller squares (e.g. squares A, B,
C, D and E), and multiply by 50.

Very frequent elements
Count all those in one of the smallest squares and multiply
by 400 (for ease
of calculation, multiply by 1000 and divide by 4).

Overwhelmingly frequent elements (usually bacteria)
Count all those in one of the smallest squares and multiply
by 4000.

Measuring blood glucose levels
Blood glucose levels can be measured with rapid diagnost-
ic tests (e.g. Dextrostix, BM Stix) at the bedside, which
provide an estimate of blood glucose concentration within
a few minutes. There are several brands on the market,
which differ slightly in how they should be used. Therefore
it is important to read the instructions on the box and the package leaflet before using these tests. Generally, a drop of blood is placed on the reagent strip and left for 30 seconds to 1 minute, depending on the brand of strip. The blood is then wiped off, and after another fixed period of time (e.g. a further 1 minute), the colour change on the reagent field of the strip is read. For this, the resulting colour is compared with a colour scale printed on the box. This allows the user to estimate the glucose level to be within a certain range (e.g. between 2 mmol/litre and 5 mmol/litre), but it does not provide exact values.

Some strips come with a battery-powered electronic reading machine. After the blood has been wiped off, the strip is inserted into the reading machine, which provides a more accurate value.

As the reagents deteriorate with exposure to ambient humidity, it is important that they are kept in a closed box, and that the box is closed immediately after a strip has been removed.

**8.6 Assessing nutrition, growth and development**

**Measuring nutritional status**

**Calculating the child’s weight for length**
This is the most relevant measurement in nutritional assessment.

**Measuring length**

**At ≤ 2 years**
Ideally two people are needed to take this measurement, and the child should be supine on a flat surface.

The first person should:
- assist in positioning the child face up on the measuring board, supporting the head and placing it against the headboard
- position the crown of the head against the headboard, compressing the hair
- check that the child lies straight along the centre line of the board and is not slanted, and does not change position (it is usual for this person to stand or kneel behind the headboard).

The second person should:
- support the trunk as the child is positioned on the board
- lie the child flat along the board
- place one hand on the shins above the ankles or on the knees and press down firmly, and with the other hand place the foot-piece firmly against the heels
- measure the length (to the nearest 0.1 cm) and record it immediately.

The measuring board should be checked for accuracy every month.

**At ≥ 3 years**
- This measurement should be taken without the child wearing shoes.
- The child should stand with their heels and back in contact with an upright wall.
- The head is held to look straight forward with the lower eye sockets in line with the ears. The nose must not be tilted upward.
- A weighted block at right angles to the wall is then lowered on to the head and a scale fixed to the wall is read.
- During measurement the child should be asked to stretch their neck to be as tall as possible, but their heels must not leave the ground. The measurer should help to stretch the neck by firm pressure upward under the mastoid processes.
- Measure the height immediately to within 0.1 cm.