Procedures

Before your child receives treatment for cancer, there are a number of tests that will be done, and it may be several days before results are obtained. These tests enable medical staff to:

- correctly diagnose cancer (in some cases, opinions may be sought from doctors from other hospitals), and
- find the exact location of a tumour and detect any spread of the tumour.

Some of the tests used prior to and during treatment are outlined below.

Bone Marrow Biopsy

What is bone marrow?

Bone marrow is the tissue that forms the blood cells. It is found within the hollow cavities of many of the bones within the body. It is most plentiful in the flat bones such as the sternum and hip bones. Bone marrow contains stem cells from which all blood cells are derived. (For example, red cells, white cells and platelets.) Bone marrow is easy to obtain within the soft, flat hipbones.

What is a bone marrow biopsy and how is it performed?

(Also known as bone marrow aspirate). A procedure performed by your Doctor using a sterile technique, which allows the bone marrow to be looked at. This test is always performed under a general anaesthetic in this hospital.

A needle is put through the skin into the hipbone and a sample of the soft marrow in the centre of the bone is sucked out into a syringe. It is then sent off to the laboratory where it is spread onto slides and stained with dyes. This allows different characteristics of the cells to be seen simply under a microscope. The dye helps each type of cell to appear differently.

Some children may also need an extra test called a trephine biopsy. A small ‘core’ of bone marrow is removed under general anaesthetic. It is used to assess bone marrow structure, the number and distribution of all the many blood cells. A trephine allows the bone marrow to be examined and adds a different perspective on the structure of the cells. Trephines are often
useful when looking at solid tumours as they help determine a definitive diagnosis. If the bone marrow is unable to be removed using the aspirate technique a trephine is often needed.

**Will my child need to fast?**

It is essential for your child to fast for the bone marrow biopsy. Remember not to give your child anything to eat (including milk fluids) for 6 hours prior to the anaesthetic. Clear fluids (water, cordial) can be consumed up to 2 hours beforehand.

**Why do we do bone marrow biopsy?**

By looking at the bone marrow cells under the microscope your doctor is able to see how well the bone marrow is working (making blood cells) and whether or not it contains any cancer cells.

**Are there any risks involved?**

- **General Anaesthetic** – there is a very small risk for problems to occur with any anaesthetic. Prior to the operation the doctor who puts your child to sleep (anaesthetist) will explain these risks further.

- **Bleeding** - there is also a risk of bleeding after a biopsy and this can be simply controlled by placing pressure over the biopsy site. In most cases your doctor will ensure that your child has plenty of platelets (cells that clot the blood) before a bone marrow biopsy is performed.

- **Infection** - sometimes biopsy sites have known to become infected. Infection can be a risk with any operation, as there is an opening site for germs to invade the body. When your child returns to the ward there will be a small bandaid placed over
the site. To help reduce the risk of infection the bandaid needs to be removed after 24 hours.

Is it painful?
Adults often have bone marrow aspirates done while awake, but this can be very painful. Therefore, an anaesthetic is given, as the procedure can be painful and scary for children. Your child will not feel or remember the procedure, as they will be asleep. There may be some mild soreness when your child wakes, and they may complain of a sore back. This can be well controlled with simple pain relief, such as paracetamol. Younger children tend to improve faster than teenagers do, as their bones are less dense.

How often will they need a bone marrow biopsy?
This will depend on your child’s treatment protocol. Your doctor will advise you when your child needs a bone marrow biopsy.

When do we get the results?
Your doctor will advise you of the results, generally within 24 hours. They may contact you to discuss the results or wait until your next clinic appointment. It takes at least a couple of hours to stain, prepare and observe a bone marrow slide. Trephines bone marrow biopsy (core sample of marrow) will take at least a few days to process. Parents are welcome to telephone the doctor for the results, but generally the doctors will contact you as the results can often be delayed.

Will my child need to stay overnight?
After the bone marrow biopsy you will not be required to stay overnight, unless your child is in hospital for other treatment. Your child can go home when they are stable, can tolerate food and drink and have passed urine.

Important things to remember before the bone marrow biopsy?
- You need to ensure that your child is fasted properly for the procedure.
- Your child needs to wear loose fitting clothing, as they are able to go to operating theatre in their own clothes.
Important things to remember after the bone marrow biopsy?

1) Remember to take the bandaid off your child’s back within 24 hours to reduce the risk of infection.

2) Observe the biopsy sites for signs and symptoms of infection. Contact the hospital straight away if;
   - the site is red or inflamed
   - warm to touch
   - there is discharge oozing from the site
   - your child has a temperature

This is very important if your child is neutropenic (low white cells), as your child may not have a working immune system to fight any infection.

3) Give your child pain relief every four to six hours as needed.
Lumbar Puncture

What is a Lumbar Puncture (LP) and why are they required?
This procedure is also known as a ‘spinal tap’. It can be done to test for infections or to see if there are cancer cells in the fluid that surrounds the brain and spinal cord. This fluid is known as cerebro-spinal fluid (CSF). Most importantly it is also done to give anti-cancer drugs into the CSF to prevent or remove cancer cells in the CSF. These drugs are known as intrathecal chemotherapy.

Is my child sedated?
Most lumbar punctures are performed under sedation using drugs called midazolam and fentanyl. The aim of sedation is for your child to be relaxed, but not necessarily asleep. Most children usually do not remember the procedure happening.

How is a lumbar puncture performed?
Your child is asked to lie on one side and curl up into a ball. This allows the backbones to spread apart. To help perform this test it is important that your child keeps still, as this makes the lumbar puncture easier for your doctor to perform. The skin is cleaned with antiseptic and a lumbar puncture needle is then slipped in between two of the lower back vertebrae. When the tip of the needle is in the spinal canal, CSF is removed and collected for testing. Intrathecal chemotherapy can also be injected through the same needle before it is removed.
Your child will need to be held by a nurse to keep them in the right position for the lumbar puncture to be performed. Most children do not like being held and they often become upset and distressed by being held tight. Parents are often distressed seeing their child upset and some parents may wish to wait outside the room. Many parents have commented that this is the most stressful part of treatment. It is important to keep in mind that your child will have no memory of the lumbar puncture, so they will not remember whether you are there or not.

**Will my child require a general anaesthetic?**

Most children have some lumbar punctures done under a general anaesthetic when another procedure, such as a bone marrow biopsy, is done at the same time. General anaesthetics may also be needed if your child becomes very distressed while sedated, or for the rare child who cannot be placed in the right position while awake.

**Will my child need to fast?**

Your child will need to fast for 6 hours before the lumbar puncture. This is because vomiting while sedated, while very rare, can be dangerous if the vomit is inhaled into the lungs. Remember to not give your child anything to eat (including milk fluids) for 6 hours prior to the lumbar puncture. Clear fluids (water & cordial) can be consumed up to 2 hours beforehand.

If your child is having their lumbar puncture in Ronald Mc Children’s Clinic, the rules are no solid food or milk after 4 am, and no clear fluids after 8:30 am.

**Does it hurt?**

Lumbar punctures do hurt in adults and children who are awake; therefore, a drug called fentanyl is given to help stop any pain. Your child will be sedated with midazolam and have no memory of the lumbar puncture! Both midazolam and fentanyl work together to help sedate your child.

You will need to place a local anaesthetic cream prior to the lumbar puncture on your child’s back. This cream will help to numb the area where the needle is inserted. There are two types of creams that are used;
• **EMLA** (Lignocaine and Prilocaine) – must be on for an hour before it begins to work. May stay on your child’s skin for up to 4 hours.

• **ANGEL** (Amethocaine) – must be on for 30-60 minutes before it works. It needs to be removed 30 minutes after it is applied, as some children may get a rash if it stays on longer.

Please follow the diagram below for the correct placing of the local anaesthetic cream.

If you are not confident applying the cream on your child’s back before the lumbar puncture, ask the nursing staff for help when you arrive for your appointment. It is important to do this as soon as you arrive, as time needs to be allowed for the cream to work. The nursing staff will be happy to show you exactly when to put the cream.

**Are there any side effects?**

• **Headaches** - Some children get headaches when sitting, standing, and/or vomiting, but these should go away with rest. Headaches can be controlled with simple pain relief, such as paracetamol. It may help older children to lie flat for two hours after the LP to reduce the risk of a headache starting.

• **Pain** - Some children have soreness around the needle site or leg aches and pains, which usually resolve within a day. Paracetamol can be given to help reduce pain but if it is very severe or does not settle, your child should be seen at the hospital.

• **Vomiting** - Some children vomit after lumbar punctures, especially if more than one intrathecal drug is given. These
effects can sometimes be a problem for 2-3 days. Medication can be given to help settle nausea and vomiting.

- Medication side effects - The midazolam given to sedate your child will make them very sleepy and therefore, unsteady on their feet. It may take about two hours for the drug to wear off; therefore, they need to be observed closely to reduce the risk of hurting themselves. Midazolam can make younger children very grumpy and irritable as it wears off. The other drug given called Fentanyl can also make children cough. This form of sedation may often briefly cause double vision.

Are there any risks involved?

Lumbar puncture is generally a very safe procedure, however, it is important that you are made aware of any problems that may occur;

- Sedation - although rare, some children may vomit whilst sedated. They may also hold their breath for a few seconds and then return to breathing normally. This is known as an apnoea. Whilst the lumbar puncture is performed an oxygen probe will be placed on your child’s finger to check the oxygen in your child’s blood stream. If their oxygen is low they will simply need to be placed on some oxygen until their sedation wears off. If this occurs the amount of midazolam given may be reduced next time to prevent this from happening again.

- Infection - It is very rare for lumbar puncture sites to become infected, although, this can be a risk with any procedure, as there is an opening site for germs to invade the body. A bandaid will be placed over the opening site. To help reduce the risk of infection the bandaid needs to be removed after 24 hours. The risk for a lumbar puncture site to become infected compared to a bone marrow aspirate site is a great deal less.

- Neurological problems - There is a very slight risk that some children may have a seizure or feel tingling sensations in their legs due to nerve compression. This usually is not a permanent side effect and will more than likely return to normal.

- Bruising - There is a very slight risk that your child may develop some bruising. Your doctor will check your child’s platelet count (cells that clot the blood) before the lumbar puncture and make sure it is safe to go ahead.
When do we get the results?
After the CSF is obtained it is sent off to the laboratory and tested for the presence of cancer cells. Your doctor will contact you if anything unusual is found, generally the same day. The CSF is always sent to laboratory for testing with each lumbar puncture performed. It is a routine test and there is no need to worry while waiting for the results.

Will my child need to stay overnight?
After the lumbar puncture you will not be required to stay overnight, unless your child is in hospital for other treatment. Your child can go home when they are stable, can walk unassisted and can tolerate food and drink.

Important things to remember prior to the Lumbar Puncture?
1) You need to ensure that your child is fasted properly for their lumbar puncture.
2) Your child needs to wear loose fitting clothing, so their back is easy to get to.
3) You need to ensure that your child has local anaesthetic cream placed on their back before the lumbar puncture.

Important things to remember after the Lumbar Puncture
1) Remember to take the bandaid off your child’s back within 24 hours to reduce the risk of infection.
2) Observe the lumbar puncture site for signs and symptoms of infection. Contact the hospital straight away if;
   • the site is red,
   • inflamed
   • warm to touch
   • there is discharge oozing from the site
   • your child has a temperature

This is very important if your child is neutropenic (low white cells), as your child may not have a working immune system to fight any infection.

Give your child pain relief every four to six hours as needed.
**Blood Tests**

These are done to monitor the disease itself (especially if the child has leukaemia) and side effects of treatment. In particular, the blood count shows whether the child’s bone marrow has recovered sufficiently to start the next course of treatment.

Blood tests can usually be collected from a small fingerprick or central venous line, but occasionally a needle and syringe have to be used to take blood directly from a vein.

Common blood tests performed are:

- Full blood count – to check the levels of red cells, platelets and white cells in the blood.
- Electrolytes, Urea and Creatinine – to check for any chemical disturbances and that the kidneys are functioning normally
- Liver function test – to check on parts of the blood that may affect the function of the liver.

**Blood Cells**

**What is blood?**

Blood is made up of many different types of cells floating in a liquid called plasma. It carries oxygen from the lungs to the tissues; nutrients from the alimentary tract to the tissues, hormones to there target organs and waste products to the kidneys and lungs. Each of the cells has a specific role and can usually be found in certain quantities.

![Bone marrow diagram](image)

Blood cells are made in the bone marrow. (Some cells are made in the liver and spleen early in life, but most cells come from the...
marrow after birth). As the old cells wear out, new ones replace them.

Red cells are the most common blood cell. They contain the pigment haemoglobin, which carries oxygen around the body. The average life span of a red blood cell is 90-120 days. Lack of red cells and haemoglobin is called anaemia and your child may appear pale, sleepier than usual, and may become breathless after exercise or mild activity. Contact the hospital if notice any of these signs. Anaemia can be easily corrected with a blood transfusion. Red blood cells received from a transfusion have a shorter life span of about 30 days. For further information about transfusions see the ‘Transfusion section’ of the folder.

Platelets are involved in blood clotting. When the platelet count is very low (called thrombocytopenia), the child may bruise easily and some times can have nosebleeds. They may also develop petechiae, which are small red spots under the skin. If any of these occur contact the hospital. Low platelet counts can be corrected with a platelet transfusion (see transfusion section). Further information on how to manage bleeding is located in the ‘Side effects of Chemotherapy’ section of the folder.

White cells are part of the body’s defence system against infection. There are 2 important types of white cell:

- **Neutrophils** – important in fighting bacterial infections. When the neutrophil count is less than 1.0, the child is said to be neutropenic and is at risk of serious bacterial infections, often with bacteria from within their own body. The lower the white cell count falls, the greater the risk of infection.

- **Lymphocytes** – important in fighting viral infections and in producing special proteins called antibodies, which help destroy viruses and bacteria.

For further information about neutropenia refer to infections in the ‘Side effects of Chemotherapy’ section of the folder.
Plasma

Plasma contains water, proteins, mineral salts, nutrient material, waste products, hormones, enzymes, antibodies and gases. These substances are vital for the body to function normally.

The mineral salts include sodium, potassium, chloride, calcium and magnesium and referred to as electrolytes. Electrolytes carry electrical charges that enable your heart, nerves, and muscles to work properly. The kidneys help to regulate the balance of electrolytes by selectively keeping or getting rid of each salt.

The plasma also contains proteins such as albumin and globulin, and they control the flow of fluid from the blood system to the cells.

The organic waste products of metabolism are urea, uric acid and creatinine and indicate how well the kidneys are working.

Your doctor will discuss blood results with you and how they relate to your child’s treatment.

Should I keep track of my child’s results?

It is important that you keep track of your child’s platelets, white cell count and haemoglobin levels. Your doctor will discuss all the results with you and either give a copy of the results or write them down for you to keep in the blood result record in section four of the folder.

Where can I find further information?

- Ask your doctor/nurse
- www.cancer.gov
## Normal Blood Count Values

<table>
<thead>
<tr>
<th></th>
<th>&lt; 2 years</th>
<th>2 – 12 years</th>
<th>12 years - adult</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Haemoglobin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g/L</td>
<td>10 -13</td>
<td>11 -14</td>
<td>13.0 –18 Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>11.5 – 16.5 Female</td>
</tr>
<tr>
<td><strong>White Cell Count</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X 10^9/L</td>
<td>6 -11</td>
<td>5 -11</td>
<td>4 –11</td>
</tr>
<tr>
<td><strong>Neutrophils</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X 10^9/L</td>
<td>1 - 5</td>
<td>1.5 - 7</td>
<td>2 – 7.5</td>
</tr>
<tr>
<td><strong>Lymphocytes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X 10^9/L</td>
<td>2 - 10</td>
<td>2 - 7</td>
<td>1.5 - 4</td>
</tr>
<tr>
<td><strong>Platelets</strong></td>
<td></td>
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<tr>
<td>X 10^9/L</td>
<td>150 -450</td>
<td>150 -450</td>
<td>150 -450</td>
</tr>
</tbody>
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X-Rays

To take X-rays or to perform scans your child must stay still, at times some sedation or an anaesthetic may be needed.

Ordinary x-rays simply use low dose radiation to take pictures of various parts of the body. As for any photograph, the child must keep very still. Bones show up most clearly on the x-ray picture but soft tissues can also be seen in less detail.

A CAT Scan (which stands for computerised axial tomography) is a type of x-ray which uses a computer to generate a two-dimensional image of part of the body. It is sometimes necessary for the child to swallow some special dye or have dye injected into a vein, before the x-rays are taken.

An Isotope Scan or a Nuclear Medicine scan is a diagnostic procedure for examining various organs of the body. A very small (and safe) dose of radioactive substance is injected into a vein and this is concentrated in the organs to be looked at. Special scanners then take pictures.

A PET Scan (Positron Emission Tomography) can image the whole body and is useful for the diagnosis and assessment of the spread of cancers. It is used to evaluate the cancer’s response to treatment and for detecting cancer recurrence when other tests are inconclusive.

The scan is similar to other nuclear medicine tests requiring an intravenous injection of a radioactive substance. The PET scanner is located at the Royal Adelaide Hospital.
A MRI Scan (Magnetic Resonance Imaging) produces magnetic fields to image a particular part of the body. It is particularly useful for scanning the brain and spinal cord, but can be used for almost any part of the body. A special 'substance' is sometimes injected into a vein to enhance the details of the scan pictures.

These modern, sophisticated x-ray techniques have made it possible to identify precisely the extent of a tumour, whereas in the past this was sometimes only possible by using surgery.

It may be necessary at times for some of these tests to be performed at another hospital if this is so the details will be discussed with you at the time.

Ultrasound Scans

An ultrasound scan is painless and is exactly the same procedure as is performed on pregnant women to look at their unborn babies. It involves putting some gel on the skin overlying the area to be examined and then placing a flat, microphone-like structure into the gel against the skin. Very high frequency, inaudible sound waves are transmitted into the body and their reflections are measured to build up a picture of the underlying structures.

Biopsies

At times it may be necessary for a biopsy to be taken. This may be done in the X-ray department using ultrasound or the CT Scanner to guide a fine needle to the site and remove some of the tissue. This procedure will be done using sedation or a general anaesthetic. If your child needs a biopsy your doctor will discuss the details with you.