Acute myeloid leukaemia (AML)

Acute myeloid leukaemia (AML) is a type of blood cancer. A third of all childhood cancers are leukaemia, with approximately 400 new cases occurring each year in the UK. Less than a quarter of these are acute myeloid leukaemia (AML). AML can affect children of any age; girls and boys are equally affected.

More children than ever are surviving childhood cancer. There are new and better drugs and treatments, and we can now also work to reduce the after-effects of having had cancer in the past.

It is devastating to hear that your child has cancer, and at times it can feel overwhelming but there are many healthcare professionals and support organisations to help you through this difficult time.

Understanding more about the cancer your child has and the treatments that may be used can often help parents to cope. We hope you find the information here helpful. Your child’s specialist will give you more detailed information and if you have any questions it is important to ask the specialist doctor or nurse who knows your child’s individual situation.

This factsheet is published in conjunction with CCLG’s booklet entitled: ‘Children and Young People with Cancer: A Parent’s Guide’.

Leukaemia

Leukaemia is a cancer of the white blood cells. All blood cells are produced in the bone marrow, the spongy substance at the core of some of the bones in the body.

Bone marrow contains:
- red blood cells, which carry oxygen around the body
- platelets, which help the blood to clot and control bleeding
- white blood cells, which help to fight infection

Acute myeloid leukaemia (AML)

Acute myeloid leukaemia is an overproduction of immature myeloid white blood cells (blast cells).

There are two different types of white blood cells: lymphocytes and myeloid cells (including neutrophils). These white blood cells work together to fight infection. Normally, white blood cells develop, repair and reproduce themselves in an orderly and controlled way. In leukaemia, however, the process gets out of control and the cells continue to divide in the bone marrow, but do not mature.

These immature dividing cells fill up the bone marrow and stop it from making healthy blood cells. As the leukaemia cells are not mature, they cannot work properly. This leads to an increased risk of infection.

There are four main types of leukaemia:
- acute lymphoblastic (ALL)
- acute myeloid (AML)
- chronic lymphocytic (CLL)
- chronic myeloid (CML)

Chronic leukaemias occur mostly in adults. CLL is exclusively an adult condition, whereas CML does occur rarely in children and young people. Each type of leukaemia has its own characteristics and treatment.

This factsheet is about acute myeloid leukaemia (AML).
of white blood cell are known as undifferentiated.

There are different sub-types of AML, depending upon exactly which type of cell has become leukaemic, the stage of development (maturation) the cells are at and whether the cells are differentiated. Knowing the sub-type of AML is important, as it helps doctors decide on the best treatment.

There are several classification systems for the sub-types of AML. The most commonly used system in the UK is the French-American-British (FAB) system.

**FAB classification of AML**

- M0 - AML with minimal evidence of myeloid differentiation
- M1 - AML without maturation
- M2 - AML with maturation
- M3 - Acute promyelocytic leukaemia (APL)
- M4 - Acute myelomonocytic leukaemia
- M5 - Acute monocytic/monoblastic leukaemia
- M6 - Acute erythroleukaemia
- M7 - Acute megakaryoblastic leukaemia

A newer system known as the WHO (World Health Organisation) classification system is also sometimes used.

**Causes**

The exact cause of AML is unknown. Research into possible causes of this disease is ongoing. Children with certain genetic disorders, such as Down's syndrome or Li-Fraumeni syndrome, are known to have a higher risk of developing leukaemia. Brothers and sisters of a child with AML have a slightly increased risk of developing it, although this risk is still small. Other non-cancerous conditions, such as aplastic anaemia or the myelodysplastic syndromes (MDS), may increase a child’s risk of developing AML.

AML, like all types of cancer, is not infectious and cannot be passed on to other people.

**Signs and symptoms**

As the leukaemia cells multiply in the bone marrow, the production of normal blood cells is reduced. Children may therefore become tired and lethargic because of anaemia, which is caused by a lack of red blood cells.

Children may develop bruises, and bleeding may take longer to stop because of the low number of platelets present in their blood. Sometimes they may suffer from infections because of low numbers of normal white blood cells. A child is likely to feel generally unwell and may complain of aches and pains in the limbs or may have swollen lymph glands.

At first, the symptoms are just like those of a viral infection, but when they continue for more than a week or two, the diagnosis usually becomes clear.

**How AML is diagnosed**

A blood test usually shows low numbers of normal white blood cells and the presence of abnormal leukaemia cells. A sample of bone marrow is needed to confirm the diagnosis. Bone marrow samples are also sent to the genetics department to look for any abnormal chromosomes and for a test called MRD (minimal residual disease).

A test called a lumbar puncture is done to see if the spinal fluid contains any leukaemia cells. A chest x-ray is also done, which will show if there are any enlarged glands in the chest. Other tests may be necessary, depending on your child's symptoms. These tests will help to identify the precise type of leukaemia, and help doctors to decide on the best treatment.

**Treatment**

The aim of treatment for AML is to destroy the leukaemia cells and enable the bone marrow to work normally again. Chemotherapy is the main treatment for AML. Usually a combination of chemotherapy drugs is given, according to a treatment plan (often called a protocol or regimen).

The treatment usually has different phases, explained below:

**Induction**

This phase involves intensive treatment, aimed at destroying as many leukaemia cells as possible. It usually involves two courses (cycles) of a combination of chemotherapy drugs.

A bone marrow test is taken at the end of induction treatment to confirm whether or not the child still has leukaemia. When there is no evidence of leukaemia, the child's condition is referred to as being in remission.

**Post-remission treatment**

When there are no signs of the leukaemia in the blood or bone marrow, further treatment is often given. This phase of the treatment aims to destroy any leukaemia cells that may be left and to help stop the AML from coming back. This treatment usually involves two more courses of chemotherapy.

**Bone marrow transplant**

This treatment is usually only used for children with AML that is likely to come back or has come back (recurred) following standard chemotherapy.

**Central nervous system (CNS) treatment**

AML may sometimes develop in the brain and spinal cord. This can be prevented by injecting chemotherapy drugs directly into the spinal fluid during a lumbar puncture (intrathecal chemotherapy). Intrathecal chemotherapy is usually given with the lumbar puncture performed at the time of diagnosis and before the second course of chemotherapy. Sometimes a more intensive treatment is needed, and the intrathecal drugs are given more frequently until all the regular chemotherapy has been completed. Occasionally, radiotherapy to the brain is also necessary.

**Side effects of treatment**

Many cancer treatments will cause side effects. This is because while the treatments are killing the cancer cells, they can also damage some normal cells.
Some of the main side effects are:
• hair loss
• reduction in the number of blood cells produced by the bone marrow. This can cause anaemia, low platelets can lead to risk of bruising and bleeding, and low white cells can lead to increased risk of infection.
• loss of appetite and weight
• feeling sick (nausea) and being sick (vomiting)

Most side effects are temporary, and there are ways of reducing them and supporting your child through them. Your child’s doctor or nurse will talk to you about side effects.

Late side effects of treatment
A small number of children may develop late side effects, sometimes many years later. These include possible problems with puberty and fertility, a change in the way the heart works, and a small increase in the risk of developing a second cancer in later life. Your child’s doctor or nurse will talk to you about any possible late side effects.

Clinical trials
Many children have their treatment as part of a clinical research trial. Trials aim to improve our understanding of the best way to treat an illness, usually by comparing the standard treatment with a new or modified version. Specialist doctors carry out trials for AML. If appropriate, your child’s medical team will talk to you about taking part in a clinical trial and will answer any questions you have. Written information is often provided to help explain things.

Taking part in a research trial is completely voluntary, and you’ll be given plenty of time to decide if it’s right for your child.

Treatment guidelines
Sometimes, clinical trials are not available for your child’s cancer. This may be because a recent trial has just finished, or because the cancer is very rare. In these cases, you can expect your doctors and nurses to offer treatment which is agreed to be the most appropriate, using guidelines which have been prepared by experts across the country. The Children’s Cancer and Leukaemia Group (CCLG) is an important organisation which helps to produce these guidelines.

Follow-up care
Many children with AML are cured. If the leukaemia comes back after initial treatment, it usually does so within the first three years. Most children with AML grow and develop normally.

If you have specific concerns about your child’s condition and treatment, it’s best to discuss them with your child’s doctor, who knows the situation in detail.

Your feelings
As a parent, the fact that your child has cancer is one of the worst situations you can be faced with. You may have many emotions, such as fear, guilt, sadness, anger and uncertainty. These are all normal reactions and are part of the process that many parents go through at such a difficult time. It’s not possible to address in this factsheet all of the feelings you may have. However, the CCLG booklet ‘Children & Young People’s Cancer; A Parent’s Guide’, talks about the emotional impact of caring for a child with cancer and suggests sources of help and support.

Your child may have a variety of powerful emotions throughout their experience of cancer. The Parent’s Guide discusses these further and talks about how you can support your child.

USEFUL ORGANISATIONS

Children’s Cancer and Leukaemia Group (CCLG)  www.cclg.org.uk
CLIC Sargent  www.clicsargent.org.uk
CLIC Sargent offers practical support to children and young people with cancer or leukaemia, and to their families.

Macmillan Cancer Support  www.macmillan.org.uk
Offers support and advice to those affected by cancer.

Leukaemia CARE  www.leukaemiacare.org.uk
Leukaemia CARE is a national charity that provides care and support to patients, their families and carers, through the diagnosis and treatment of leukaemia or an allied blood disorder.

Leukaemia & Lymphoma Research  www.beatingbloodcancers.org.uk
Supports research into the treatment of leukaemia and other related blood disorders in both children and adults.

References
This factsheet has been compiled using information from a number of reliable sources, including:
• Cardiff University. AML17: Working parties on leukaemia in adults and children in acute myeloid leukaemia or high risk myelodysplastic syndrome. Version 7.1. 2011
• Neville K, Steuber P. Clinical assessment of the child with suspected cancer. www.uptodate.com
Children’s Cancer and Leukaemia Group is a leading children’s cancer charity and the UK and Ireland’s professional association for those involved in the treatment and care of children with cancer. Each week in the UK and Ireland, more than 30 children are diagnosed. Two out of ten children will not survive their disease.

We bring together childhood cancer professionals to ensure all children receive the best possible treatment and care. We fund and support research into childhood cancers, and we help young patients and their families with our expert, high quality and award-winning information resources.

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CCLG makes every effort to ensure that information provided is accurate and up-to-date at the time of printing. We do not accept responsibility for information provided by third parties, including those referred to or signposted to in this publication. Information in the publication should be used to supplement appropriate professional or other advice specific to your circumstances.

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