02

Acute Myeloid Leukaemia

J A S C A P

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JASCAP is a charitable trust that provides information on various aspects of cancer. This can help the patient and his family to understand the disease and its treatment and thus cope with it better.

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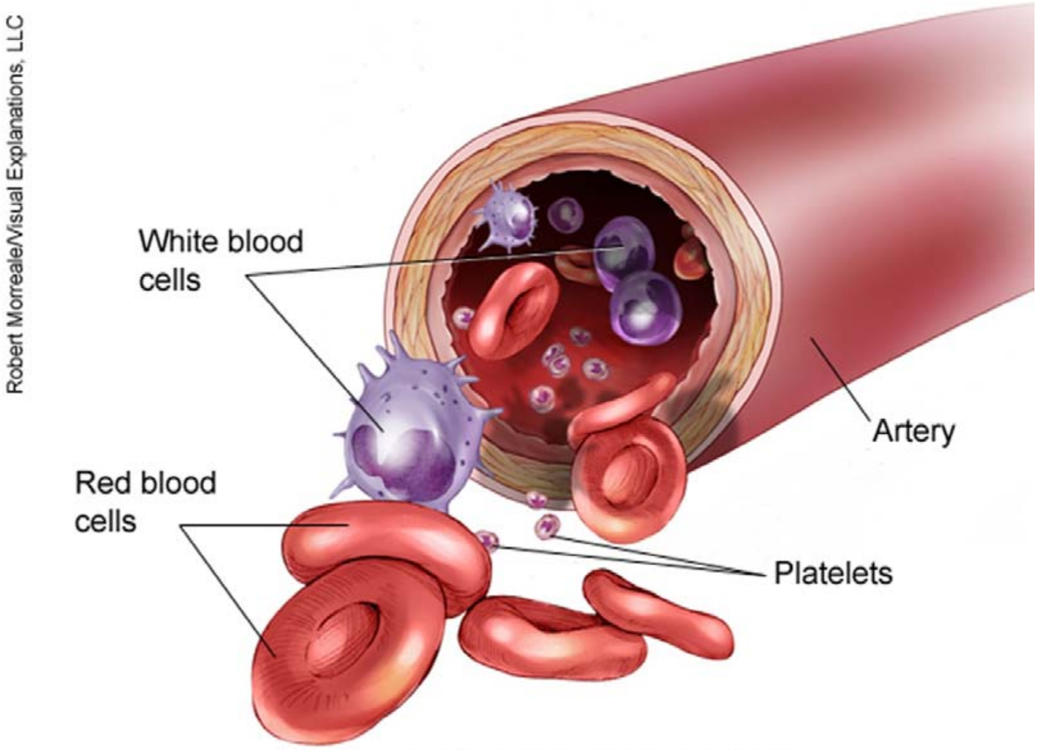
Robert Morreale/Visual Explanations, LLC
White blood cells
Red blood cells
Artery
Platelets

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ABOUT THIS BOOKLET

This booklet is an adaptation of the Cancerbackup (UK) booklet “*Understanding acute myeloblastic leukaemia”.*

It is for you if you or someone close to you has acute myeloblastic leukaemia. Please contact us for any further information you may need on this subject.

What is leukaemia?

Leukaemia is a cancer of the blood cells. Blood cells are produced by the bone marrow.

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

Each type of leukaemia has its own characteristics and treatment.

The bone marrow

Bone marrow is a spongy material that fills some of our bones and produces stem cells. Stem cells are cells at a very early stage of development. All the blood cells in the body develop from stem cells. A type of stem cell called a **myeloid** stem cell can make:

red blood cells, which carry oxygen to all cells in the body
white blood cells called granulocytes, which are essential for fighting infection
platelets, which help the blood to clot and control bleeding.

There are different types of white blood cell. The two main types are **granulocytes** and **lymphocytes** and these work together to fight infection.

Blood cells go through various stages of development before they are fully mature and able to work properly. Normally, while blood cells are developing, they stay inside the bone marrow. Once they are mature, they leave the bone marrow and enter the bloodstream.

Some types of blood cells only live for a few hours or a few days, so the bone marrow is constantly making new cells. The bone marrow normally makes millions of blood cells every day. This process is usually controlled - with cells dividing to produce new cells as they are needed.

What is acute myeloblastic leukaemia?

Normally, blood cells are made in the bone marrow in an orderly and controlled way. In acute myeloid leukaemia (AML), this process gets out of control and many abnormal leukaemia cells are made. These cells are immature and aren’t able to develop into normal functioning blood cells. They are sometimes called **blast cells**.

AML is an overproduction of an early myeloid cell. In most types of AML the leukaemia cells are immature white cells. But, in some less common types of AML, too many immature platelets or immature red blood cells are made.

The immature cells fill up the bone marrow, taking up space that is needed to make normal blood cells. Some leukaemia cells 'spill over' into the blood and circulate around the body in the bloodstream. These leukaemia cells don’t mature, and so don’t work properly. This leads to an increased risk of infection as well as symptoms such as anaemia and bruising caused by fewer healthy red blood cells and platelets being made.

Your feelings about having AML

Most people feel overwhelmed when they are told they have leukaemia. Many different emotions arise which can cause confusion and frequent mood swings. You might not have all the feelings discussed below or experience them in the same order. This does not mean, however, that you are not coping with your illness.

These emotions are part of the process that many people go through in trying to come to terms with their illness. Partners, family members and friends often experience similar feelings and frequently need as much support and guidance in coping with their feelings as you do.

Reactions differ from one person to another - there is no right or wrong way to feel. Some of the common emotional effects are mentioned below, however, reactions vary and people have different emotions at different times.

Our booklet on the emotional effects of cancer discusses the feelings and emotions that you may experience and has advice on how to cope with them.

Shock and disbelief
Fear and uncertainty
Denial
Anger
Blame and guilt
Resentment
Withdrawal and isolation

Shock and disbelief

'I can't believe it' / 'It can't be true'

This is often the immediate reaction when leukaemia is diagnosed. You may feel numb, unable to believe what is happening or to express any emotion. You may find that you can take in only a small amount of information and so you have to keep asking the same questions over and over again, or you need to be told the same bits of information repeatedly. This need for repetition is a common reaction to shock.

Some people may find that their feelings of disbelief make it difficult for them to talk about their illness with their family and friends. Other people may feel an overwhelming urge to discuss it with those around them.

You might find our booklet on talking about your cancer helpful.

Fear and uncertainty

'Am I going to die?'/ 'Will I be in pain?'

Leukaemia is a frightening word surrounded by fears and myths. One of the greatest fears expressed by almost all newly diagnosed patients is 'Am I going to die?'.

In fact, nowadays some people with CML are cured with treatment. Many people with CML have the leukaemia controlled for many years and live an almost normal life for most of that time.

'Will I be in pain?' and 'Will any pain be unbearable?' are other common fears. In fact, many people with leukaemia feel no pain at all. For those who do, there are many modern drugs and other techniques which are very successful at relieving pain or keeping it under control. Our booklet on controlling cancer pain describes these methods.

Many people are anxious about their treatment: whether or not it will work and how to cope with possible side effects. It is best to discuss your individual treatment and possible outcomes in detail with your doctor.

You may like to take a close friend or relative to the appointment with you. If you are feeling upset, they may be able to remember details of the consultation which you might have forgotten. You may want them to ask some of the questions you yourself might be hesitant of putting to the doctor.

Some people are afraid of the hospital itself. It can be a frightening place, especially if you have never been in one before, but talk about your fears to your doctor, who should be able to reassure you.

You may find that doctors can't answer your questions fully, or that their answers sound vague. It is often impossible to say for certain whether someone can be cured or whether the leukaemia may come back. Doctors know from past experience approximately how many people will benefit from a certain treatment, but it is impossible to predict the future for a particular person. Many people find this uncertainty hard to live with - not knowing whether or not you are cured or how long the leukaemia can be controlled for can be disturbing.

Uncertainty about the future can cause a lot of tension, but fears are often worse than the reality. Gaining some knowledge about your illness can be reassuring. Discussing what you have found out with your family and friends can help to relieve tension caused by unnecessary worry.

Denial

'There's nothing really wrong with me' / 'I haven't got leukaemia'

Many people cope with their illness by not wanting to know anything about it, or not wanting to talk about it. If that's the way you feel, then just say quite firmly to people that you would prefer not to talk about your illness, at least for the time being.

Sometimes, however, it is the other way round. You may find that it is your family and friends who are denying your illness. They appear to ignore the fact that you have leukaemia, perhaps by playing down your anxieties and symptoms or deliberately changing the subject. If this upsets or hurts you because you want them to support you by sharing what you feel, try telling them. Start perhaps by reassuring them that you do know what is happening and that it will help you if you can talk to them about your illness.

Anger

'Why me of all people?'/ 'And why right now?'

Anger can hide other feelings such as fear or sadness and you may direct your anger at the people who are closest to you and at the doctors and nurses who are caring for you.

It is understandable that you may be deeply upset by many aspects of your illness and there is no need to feel guilty about your angry thoughts or irritable moods. However, relatives and friends may not always realise that your anger is really directed at your illness and not against them. If you can, it may be helpful to tell them this at a time when you are not feeling quite so angry; or if you would find that difficult, perhaps you could show them this booklet.

Blame and guilt

'If I hadn't... this would never have happened'

Sometimes people blame themselves or other people for their illness, trying to find reasons why it should have happened to them. This may be because we often feel better if we know why something has happened, but since in most cases it is impossible to know exactly what has caused a person’s leukaemia, there is no reason for you to feel that you are to blame.

Resentment

'It's all right for you, you haven't got to put up with this'

Understandably, you may be feeling resentful and miserable because you have leukaemia while other people are well. Similar feelings of resentment may crop up from time to time during the course of your illness and treatment for a variety of reasons. Relatives too can sometimes resent the changes your illness makes to their lives.

It is usually helpful to bring these feelings out into the open so that they can be aired and discussed. Keeping your resentment to yourself can make everyone feel angry and guilty.

Withdrawal and isolation

'Please leave me alone'

There may be times during your illness when you want to be left alone to sort out your thoughts and emotions. This can be hard for your family and friends who want to share this difficult time with you. It will make it easier for them to cope, however, if you reassure them that although you may not feel like discussing your illness at the moment, you will talk to them about it when you are ready.

Sometimes depression can stop you wanting to talk. If you or your family think you may be depressed, discuss this with your GP, who can refer you to a doctor or counsellor who specialises in the emotional problems of people with cancer or prescribe a course of antidepressant drugs.

Causes of acute myeloid leukaemia

The exact causes of acute myeloid leukaemia are unknown and in most cases it is unclear why leukaemia has developed. Research into possible causes is going on all the time.

Large doses of radiation may increase the risk of leukaemia. People exposed to high levels of radiation, such as nuclear industry accidents, have a higher risk of developing leukaemia than people who have not been exposed to radiation.

Smoking increases the risk of developing AML. It is thought that this may be due to the concentrated levels of benzene in cigarette smoke. In very rare cases, AML may occur after long-term exposure to benzene (and possibly other solvents) used in industry.

Rarely, some anti-cancer treatments such as chemotherapy or radiotherapy can cause leukaemia to develop some years later. The risk is increased when certain types of chemotherapy drugs are combined with radiotherapy. When leukaemia develops because of previous anti-cancer treatment this is called secondary leukaemia or treatment-related leukaemia.

People with certain blood disorders, such as myelodysplasia, or some genetic disorders, including Down's syndrome, have a higher risk of developing AML. It is not caused by an inherited faulty gene.

Acute myeloid leukaemia isn't infectious and can’t be passed on to other people.

Symptoms of acute myeloid leukaemia

Most of the symptoms of acute myeloid leukaemia are due to the effects of the leukaemia cells in the bone marrow, which leave it unable to produce enough normal blood cells.

The main symptoms are:

- Looking pale, feeling tired and breathless, which is due to **anaemia** caused by a lack of red blood cells.
- **Having more infections than usual**, because of a lack of white blood cells.
- **Unusual bleeding**, caused by too few platelets. This may include bruising easily without any obvious cause, bleeding gums, frequent nosebleeds, and heavy periods in women. Some people have a rash of tiny, flat red spots on the skin of the legs or in the mouth. These are called **petechiae**.
- **Feeling generally unwell and run down**.
- **Having a fever and sweats**. This may be due to an infection or to the leukaemia itself.

Other, less common, symptoms may be caused by a build up of leukaemia cells in a particular area of the body, such as:

- **Aching bones**, caused by pressure from a build up of immature cells in the bone marrow.
- **Raised bluish-purple areas under the skin** - due to leukaemia cells in the skin.
- **Swollen gums**, caused by leukaemia cells in the gums.

Occasionally, a person has no symptoms and the leukaemia is discovered during a routine blood test.

The symptoms of acute myeloid leukaemia may appear over a few weeks, and people often feel ill quite quickly. Treatment needs to be given as soon as possible. If you have any of the above symptoms you should have them checked by your doctor - but remember, they are common to many illnesses other than leukaemia.

How AML is diagnosed

Usually you will see your GP. They will examine you and take a blood test. If the results of the test are abnormal, your GP will refer you to hospital for advice and treatment from a doctor who specialises in the treatment of blood problems (a **haematologist**).

- At the hospital
- Bone marrow sample/biopsy
- Other tests

At the hospital

Most people with AML are referred for treatment at a haematology unit, where a group of specialist doctors work together. This is known as a **multidisciplinary team** and normally includes:

one or more haematologists
a clinical oncologist (a doctor who specialises in radiotherapy and chemotherapy)
specialist nurses who give information and support
pathologists who advise on the type and extent of the leukaemia.

Other staff will be available to help you if necessary, such as:

social workers
dietitians
counsellors and psychologists
physiotherapists.

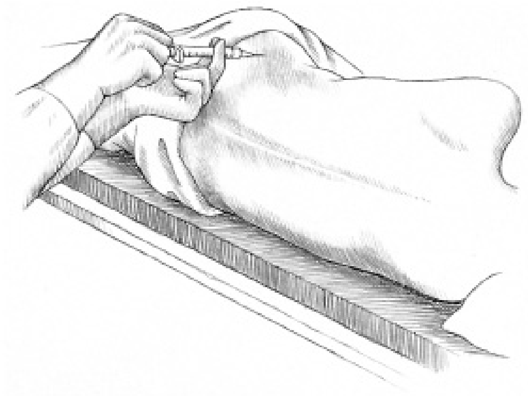
The doctor at the hospital will ask you questions about your health and about any previous illnesses you have had. They will also examine you to find out how you are physically. You will have a blood sample taken to check the numbers of all the different types of blood cell in your blood (a full blood count).

If the blood test shows that leukaemia cells are present, your doctor will want to take a sample of your bone marrow. This is an important test for finding out about the leukaemia. It gives the doctors information to help them plan the best treatment for you.

Bone marrow sample/biopsy

A small sample of bone marrow is usually taken from the back of your hipbone (pelvis). The sample is looked at under a microscope by a pathologist, who will identify the type of leukaemia. They will also count the number of immature blood cells (blasts) in the sample. Other tests will also be carried out on the bone marrow sample to help confirm the diagnosis.

The bone marrow sample is taken under a local anaesthetic. You will be given a small injection to numb the area and the doctor will gently pass a needle through the skin into the bone. The doctor will draw a small sample of liquid marrow into a syringe to be looked at later under the microscope (bone marrow aspirate). The doctor will then take a small core of marrow from the bone (a trephine biopsy).



A sample of bone marrow is usually taken from the back of the hipbone

The test can be done on the ward or in the outpatients department. The whole procedure takes about 15-20 minutes. It may be uncomfortable as the marrow is drawn into the syringe but this should only last for a few seconds. You may be offered a short-acting sedative to reduce any pain or discomfort during the test. You may feel bruised after the test and have an ache for a few days. This can be eased with mild painkillers.

Other tests

Your doctor may arrange for you to have other tests to check that your lungs, heart, liver and kidneys are healthy.

Classification of acute myeloid leukaemia

Why AML is classified
Cytogenetics
WHO and FAB classification of AML

Why AML is classified

Acute myeloid leukaemia (AML) can be divided up (or classified) into various sub-types. This is important as not all types of AML are treated in the same way. Your doctors need to know which type of AML you have to help them plan the most appropriate treatment for you.

Your bone marrow sample will be tested to find out which sub-type of AML you have. Tests that may be done include:

Examining the leukaemia cells under the microscope - to see what type of blood cell has become abnormal and at what stage of its development.
Testing leukaemia cells with antibodies to look for specific proteins on their surface. This is called **immunocytochemistry**, and also helps doctors to identify what type of cell has become abnormal.
Looking for particular types of changes in the chromosomes of leukaemia cells. This is called **cytogenetics**. It can help doctors to predict how well the leukaemia may respond to treatment.

Cytogenetics

Almost all the cells in our body contain chromosomes. Chromosomes are made up of genes, which control the activities of the cell. There are often changes in the structure of the chromosomes in leukaemia cells. A test on the bone marrow sample, called a cytogenetic test, looks for these changes.

Different types of AML are associated with particular genetic changes. So these tests can help doctors to decide on the best treatment and predict how well the leukaemia may respond to it.

WHO and FAB classification of AML

In the UK, doctors usually classify AML according to the World Health Organisation (WHO) system and the French American British (FAB) system. The WHO system classifies AML according to the type of cell that has become abnormal and whether:

there are particular chromosomal changes (cytogenetics)
there are abnormal changes in more than one type of blood cell
the leukaemia has developed from a previous blood disorder called myelodysplasia
the leukaemia is related to previous cancer treatment (treatment-related AML).

This system is important as it is useful for planning treatment and predicting response.

The FAB system looks at the appearance of the leukaemia cells under a microscope (morphology). Each type of AML is named according to the cell type and given a number from M0 to M7.

Doctors may classify AML with the FAB system while waiting for the results of other tests.

Treatment for acute myeloid leukaemia

The aim of treatment for acute myeloid leukaemia (AML) is to destroy the leukaemia cells and allow the bone marrow to work normally again. When there is no sign of the leukaemia and the marrow is working normally this is called **remission**. For many people with AML the remission lasts indefinitely and the person is said to be cured.

Types of treatment
AML trials
Second opinion
Giving your consent
Benefits and disadvantages of treatment

Types of treatment

Chemotherapy is the main treatment used. Research has shown that certain types of chemotherapy drugs can be very effective in treating AML. These drugs are usually given in combination. Most people with acute myeloid leukaemia go into remission after chemotherapy, and many people are cured.

In some situations high-dose chemotherapy and a stem cell or bone marrow transplant are used to improve the chances of curing the leukaemia.

People who have a type of AML called **acute promyelocytic leukaemia (APL)** are usually treated with a drug called ATRA (All Trans-Retinoic Acid). It is a specialised form of vitamin A and is also known as tretinoin (Vesanoid®).

ATRA is given for up to three months alongside chemotherapy treatment. It makes the leukaemia cells mature (**differentiate**), and so can reduce leukaemia symptoms very quickly.

Your doctor will plan your treatment by taking into account a number of factors, including your age, general health, and the type of abnormal genes that are present in the leukaemia cells.

AML trials

Most people who are under 60 with AML will be asked if they would like to take part in the AML-15 trial. This trial is comparing the effectiveness of the current treatments used for AML. People aged 60 and over may be invited to take part in this trial if they are fit enough for intensive chemotherapy.

There is also a trial designed for people over 60 with AML: the AML-16 trial. It is comparing the effectiveness of a number of different treatments for AML and uses slightly less intensive treatment.

Other trials are also underway looking into the use of newer drugs to treat AML. Your doctor may ask you to take part in one of these trials. You will be given written information about any trial in which you are invited to take part.

See the clinical trials booklet for more information about acute myeloid leukaemia trials.

If you have any questions about your treatment, don't be afraid to ask your doctor or nurse. It is often useful to make a list of questions for your doctor and to take a relative or close friend with you. The fill-in form on the last page may help.

Second opinion

Some people find it reassuring to have another medical opinion to help them decide about their treatment. Most doctors would normally be pleased to refer you to another specialist for this. However, a second opinion can sometimes take time to arrange. As treatment for AML should usually be started as soon as possible there may not be time to arrange this for you.

If you would like a second opinion, it is a good idea to discuss this with your specialist when you first see them.

Giving your consent

Before you have treatment a doctor will explain its aims to you. Medical treatment can't be given to someone without their permission, so you will usually be asked to sign a form giving permission (consent) for the hospital staff to give you treatment. Before signing this, you should have been given full information about:

the type and extent of the treatment you are advised to have
the advantages and disadvantages of the treatment
any other treatments that may be available
any significant risks or side effects of the treatment.

If you don't understand what you have been told, ask for things to be explained again. Treatments for leukaemia can be complex, so it is not unusual for people to need to go over things more than once.

There may be written information about your treatment, which you can take away and read in your own time. It often helps to have a friend or relative with you when the treatment is explained. They can help you to remember what has been said. You may also find it useful to write down a list of questions you want to ask before seeing the doctor.

You are also free to choose not to have treatment. It is important that you understand what may happen if you do not have treatment. The medical staff will need to record your decision in your medical notes.

The staff will be able explain what support may be available if this is your choice.

Benefits and disadvantages of treatment

The possible benefits of treatment vary depending on each individual situation.

Most people under 60 with AML are offered intensive chemotherapy. For many people this will cure the leukaemia, but it involves spending periods of time in hospital and can cause side effects. Most of these side effects are temporary and can usually be controlled with medicines. However some, such as effects on fertility, may be permanent for some people.

Some people over the age of 60 will have intensive chemotherapy to try to cure the leukaemia. However, not everyone will be fit enough to undergo intensive treatment. Also, some people may not want to have it. Instead they may have lower doses of chemotherapy to control the leukaemia cells in the bone marrow rather than to try to get rid of them completely. This treatment can often be given as an outpatient so less time is spent in hospital. The chances of the disease going into remission are lower with this type of treatment.

If the leukaemia is at an advanced stage and treatment to control it is no longer helpful, or if you choose not to have treatment, you can still be given supportive (palliative) care, with medicines and transfusions to help to control symptoms.

Your haematologist is the best person to discuss your situation with. In some hospitals, specialist nurses are available to talk over all the possible benefits and side effects of treatment.

Chemotherapy for acute myeloid leukaemia

What is chemotherapy?

Chemotherapy is the use of anti-cancer (cytotoxic) drugs to destroy the leukaemia cells. It works by disrupting the way leukaemia cells grow and divide. As the drugs circulate in the blood they can reach leukaemia cells all over the body.

The main aim of treatment for acute myeloid leukaemia is to try to cure it. The first step is to achieve a **remission**. This means that the abnormal, immature cells, or blasts, can no longer be detected in your blood or bone marrow, and normal bone marrow has developed again.

When you are in remission there may still be a small number of abnormal cells in your body, even though doctors can no longer detect any signs of the leukaemia, so you will need to have further chemotherapy to reduce the risk of the leukaemia coming back.

The doctors will monitor you closely to see how well your leukaemia is responding to the chemotherapy. They will plan what further treatment is necessary depending on how the leukaemia responds.

Our booklet on chemotherapy discusses the treatment and its side effects in more detail. Factsheets about individual drugs and their particular side effects is also available.

How chemotherapy is given

The chemotherapy drugs are usually given by drip or injection through a thin, flexible plastic tube. The tube is inserted under the skin and into a vein near the collarbone (central line or Hickman® line), or passed through a vein in the arm (PICC line). Your doctor or nurse will explain more about this to you, and there is more information in this booklet.

Chemotherapy is usually given as several sessions (cycles) of treatment. Each session lasts for 5-10 days and is followed by a rest period of three to four weeks. This rest period allows your body to recover from the side effects of the treatment. Most people have four or five cycles of chemotherapy. The complete course of treatment can last about six months.

Induction chemotherapy

The first cycles of chemotherapy are called induction chemotherapy. Most people have two cycles of induction chemotherapy. You may be able to go home between treatments if you are well enough.

The most commonly used induction chemotherapy drugs are cytarabine (Ara-C), daunorubicin, etoposide (Etopophos®, Vepesid®), fludarabine (Fludara®) and idarubicin (Zavedos®).

Currently two national trials (AML-15 and AML-16) are being carried out. One of the things the trials are trying to find out is whether giving a monoclonal antibody called gemtuzumab, (Mylotarg®) with chemotherapy is better than chemotherapy alone. See newer treatments for information about gemtuzumab.

If the induction chemotherapy does not destroy all of the leukaemia cells, you will be given further cycles of chemotherapy aimed at getting the leukaemia into remission.

Consolidation chemotherapy

If there is no sign of the leukaemia in your bone marrow after induction chemotherapy, you will be given further cycles of chemotherapy to reduce the risk of the leukaemia coming back. This is known as consolidation treatment. The most commonly used drugs for consolidation chemotherapy are cytarabine, etoposide, daunorubicin and mitoxantrone.

High-dose treatment

For some people, high-dose chemotherapy with a stem cell or bone marrow transplant may be helpful. The doctor will consider whether chemotherapy alone is likely to cure the leukaemia.

If there is a high risk that your leukaemia will come back after chemotherapy, your doctor may suggest that you have high-dose chemotherapy, or chemotherapy with radiotherapy, followed by a transplant. The transplant may be carried out using either your own, or a donor's, stem cells or bone marrow.

Low-dose treatment

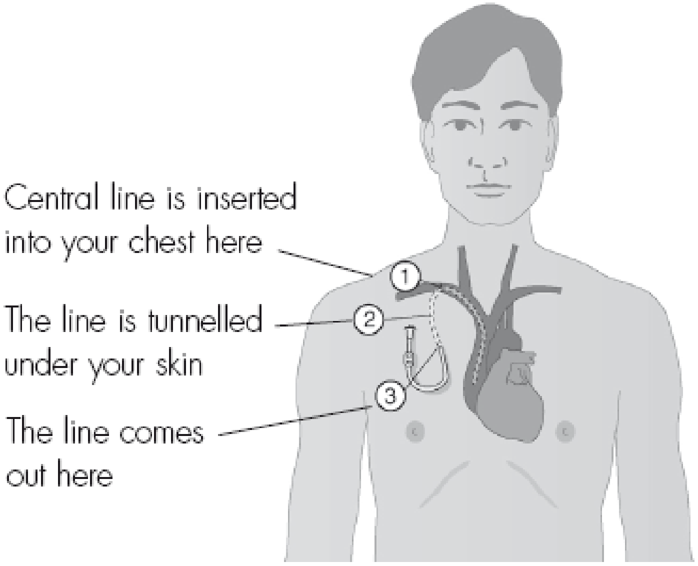
This may be the best option for people who are not fit enough to have intensive chemotherapy and for people who choose not to have intensive treatment. It is aimed at controlling the number of leukaemia cells in the bone marrow but gives a lower chance of remission. The chemotherapy drugs may be given by mouth or by injection under the skin (subcutaneous). It can often be given on an outpatient basis.

One part of the AML-16 trial is looking at ways to improve the effectiveness of low-dose treatment by adding other newer types of drugs to the most commonly-used drug cytarabine (Ara-C). See newer treatments for more information.

Central lines

To make it easier to give the chemotherapy drugs, and to avoid having to have frequent injections, a plastic tube (called a central line or Hickman® line) can be put into a vein in the chest. The line is put in under a general or local anaesthetic and, apart from a stiff shoulder, which you may have for a couple of days, should be completely painless.

Once it is in place, the central line is either stitched or taped firmly to your chest to prevent it from being pulled out of the vein. Drugs are given through the tube directly into your bloodstream. The line can stay in for many months. The nurses will show you how to care for it to prevent blockages or infection. Blood can be taken from the line for testing and blood transfusions can also be given through it.



PICC lines

Sometimes a PICC (peripherally inserted central catheter) line can be used instead of a central line. A thin tube is inserted into a vein in the crook of your arm. This can stay in place for several months.

Supportive care

During your treatment you will also have supportive care. This treats the symptoms that are caused by a lack of normal blood cells and often involves having transfusions of red blood cells and platelets from time to time.

See the factsheets on blood transfusions and platelet transfusions for further information.

Possible side effects

Lowered resistance to infection

While the chemotherapy drugs are acting on the leukaemia cells in your body, they also reduce the number of normal cells in your blood for a while. When white blood cells are in short supply, you are more likely to get an infection. During chemotherapy your blood will be tested regularly. You will probably be given tablets or other medicines to reduce the risk of certain types of infection.

If you get an infection, you will be treated for it straight away. Most infections are caused by bacteria, fungi or viruses already present in your own body, or in the environment. These do not normally cause infection, but when your immunity is low they are more likely to cause a problem.

It is best to avoid coming into contact with people who may have an infection. You may also be advised to be careful about what you eat, in order to guard against the risk of infection from raw, undercooked or contaminated food. The hospital will give you information on how to prepare foods and which foods to avoid.

If your temperature goes above 37.5ºC (100ºF) or you suddenly feel unwell, even with a normal temperature, contact your doctor or nurse at the hospital straight away.

Anaemia

If the level of red blood cells in your blood is low you may become very tired and lethargic. You may also become breathless. These are all symptoms of anaemia - a lack of red blood cells in the blood.

Anaemia can be treated by blood transfusions.

Increased risk of bruising and bleeding

Platelets help your blood to clot. When you have leukaemia, the number of platelets in your blood is lower than normal, and chemotherapy may temporarily reduce the numbers even more. This means that you may bruise very easily, and may bleed heavily from even minor cuts and grazes.

You may need to have a transfusion of platelets before your chemotherapy begins, and at times during your treatment, to increase the number of platelets.

If you develop any unexplained bruising or bleeding, contact the hospital immediately.

Tiredness (fatigue)

This is a very common side effect of chemotherapy. The fatigue may be caused by anaemia, but may also be due to chemotherapy, even if your blood count is normal. You may be especially aware of this when you are at home between cycles of chemotherapy, and for a few months after the treatment has finished.

Changes to the way that your heart works

Some of the drugs used to treat acute myeloid leukaemia may affect the heart muscle. The doses of the chemotherapy drugs are carefully monitored, and heart tests may be done from time to time to check your heart function.

Sore mouth

Some chemotherapy drugs can make your mouth sore and cause mouth ulcers. Regular mouthwashes are important and the nurses will show you how to use these properly. If you don't feel like eating during treatment, you could try replacing some meals with nutritious drinks or a soft diet. A nurse or dietitian at the hospital can give you advice about how to eat well during your chemotherapy if your mouth is sore.

Feeling sick

Some of the drugs used to treat acute myeloid leukaemia may make you feel sick and may sometimes cause vomiting. There are now very effective anti-sickness drugs (anti-emetics) to prevent or greatly reduce nausea and vomiting. Your doctor will prescribe these for you. If you still feel sick, despite the anti-emetics, let your doctor or nurse know so that they can change them for other drugs, which may be more effective.

Hair loss

Hair loss is another common side effect of these drugs. This can be very upsetting. If your hair falls out it should start to grow back over a period of 3-6 months once the treatment ends. There are many ways of covering up, including, wigs, hats or scarves. You may be entitled to a free wig from the NHS and your doctor or one of the nurses on the ward can arrange for a wig specialist to visit you.

Chemotherapy affects different people in different ways. Some find they are able to lead a fairly normal life during their treatment, but many find they become very tired and have to take things much more slowly. Do as much as you feel like and try not to overdo it.

Although they may be hard to deal with at the time, most of these side effects will disappear once your treatment is over.

Stem cell and bone marrow transplants for AML

Chemotherapy treatments reduce the production of blood cells by the bone marrow. The rest periods between courses of chemotherapy allow your bone marrow to recover. However, there is a limit to how much chemotherapy you can have without it causing permanent damage to your bone marrow.

Bone marrow and stem cell transplants are a way of allowing much higher doses of chemotherapy to be given, to improve the chances of completely curing the leukaemia. They are not suitable treatments for everyone with acute myeloid leukaemia. If your doctor thinks that a transplant is necessary or possible for you, they will discuss it with you in detail.

Having a transplant
Autologous transplants
Allogeneic transplants

Having a transplant

Very high doses of chemotherapy, with or without radiotherapy, are given, which destroy all the cells in your bone marrow. Soon afterwards, stem cells (the immature blood cells which develop into red cells, white cells and platelets) are given back into your blood through your central or PICC line. These cells make their way into the bone marrow and start to make healthy blood cells.

The stem cells may be your own (taken before your high dose treatment), or donated by someone else (usually a brother or sister). The new stem cells take a few weeks to settle in your bone marrow and produce the blood cells that you need. During this time you will have very low immunity. You will probably need to stay in hospital and be nursed in isolation. This is done to reduce your risk from infection until your white blood cell count has recovered.

Stem cell transplants use stem cells which are taken from the blood. This is collected through a small tube (cannula) which is put into a vein. The stem cells are then removed, and the blood is then returned through another cannula.

For a bone marrow transplant, some of the bone marrow is taken from the bones under general anaesthetic. The bone marrow contains stem cells.

Stem cell and bone marrow transplants carry some risk, and are generally carried out in major cancer treatment hospitals, so you may have to be treated at a hospital some distance from your home.

Autologous transplants

Autologous transplants use your own stem cells. They are collected from your blood while you are free of any signs of leukaemia (in remission).

To collect the stem cells from the blood, you will be given daily injections of a **growth factor** - a protein that stimulates the bone marrow to produce lots of stem cells. These 'spill over' into the blood and can then be collected. This growth factor will be given immediately following a course of chemotherapy, which is the time when it is most effective.

Allogeneic transplants

This type of transplant uses stem cells or bone marrow donated by someone else. Usually, you can only have this type of transplant if you have a brother or sister whose bone marrow is a close match to your own.

Sometimes it is possible to use an unrelated donor for a stem cell transplant if tests have shown that their white blood cells are a good match with yours. This type of transplant is called a MUD (Matched Unrelated Donor) transplant.

We have a booklet on stem cell and bone marrow transplants which describes these treatments in detail.

Radiotherapy for acute myeloid leukaemia

Radiotherapy treats cancer by using high-energy rays to destroy the cancer cells, while doing as little harm as possible to normal cells.

If you need a bone marrow or stem cell transplant you may have a type of radiotherapy called **total body irradiation**, or **TBI**. Radiotherapy is given to the whole body to destroy the bone marrow cells. This is described in our booklet on stem cell and bone marrow transplants.

ATRA (All Trans-Retinoic Acid)

ATRA is given alongside chemotherapy to people with a type of acute myeloid leukaemia called **acute promyelocytic leukaemia (APL)**. It works by making the leukaemia cells mature.

ATRA is also known as tretinoin (Vesanoid®). It is based on the natural substance vitamin A and is not a chemotherapy drug. However, it does have some side effects, which can include:

- headaches
- dry skin and mouth
- feeling sick (nausea)
- bone pain
- dry eyes.

ATRA in pregnancy

It is important not to become pregnant while taking ATRA. ATRA shouldn't be given to women who are under 12 weeks pregnant as this can cause damage to the baby.

After 12 weeks it can be given safely. Usually it's given without chemotherapy as this is safer for the baby and still effective.

Newer treatments for AML

The following treatments are not licensed for use in the UK for acute myeloid leukaemia and so are not generally available outside of research trials. If you take part in a clinical trial you may be offered one or more of these drugs as part of your treatment.

- Clofarabine (Evoltra®)
- Gemtuzumab
- CEP701
- Tipifarnib (Zarnestra®)
- Arsenic trioxide (ATO, Trisenox®)

Clofarabine (Evoltra®)

Clofarabine is very similar to another drug commonly used to treat people with AML called fludarabine. It is thought that as clofarabine has fewer side effects than fludarabine it may be more suitable for older people who are less able to have intensive chemotherapy.

Clofarabine is given by infusion and is only available for AML as part of research trials. Some people taking part in the AML-16 trial will be given clofarabine.

Gemtuzumab

Gemtuzumab also known as Mylotarg® is given as a drip into a vein (intravenously).

Gemtuzumab is a treatment made up of a combination of an antibody and a chemotherapy drug. The antibody attaches itself to a protein (CD33) found on the surface of leukaemia cells. In this way the antibody carries the chemotherapy directly to the leukaemia cells. Because CD33 is found mainly on leukaemia cells, it is hoped this drug will target the chemotherapy against leukaemia cells while causing less damage to healthy cells.

This drug is not licensed in the UK and so is not generally available outside of research trials. Some people taking part in the research trials AML-15 and AML-16, will be given gemtuzumab as part of their treatment.

CEP701

CEP701 is an experimental new treatment designed to act against cells that have a change called a FLT3 mutation. It is a liquid that is drunk and can be taken as an outpatient.

About 1 in 3 people diagnosed with AML have a FLT3 mutation (change) in the leukaemia cells. This mutation can increase their risk of the leukaemia coming back in the future. It is hoped that by giving CEP701 between courses of chemotherapy this risk can be reduced.

Some people taking part in the AML-15 trial who have the FLT3 mutation will be offered CEP701.

Tipifarnib (Zarnestra®)

Tipifarnib is designed to block the messages that tell cells to grow, from reaching leukaemia cells. It is a tablet you swallow.

Tipifarnib belongs to a group of drugs called farnesyl transferase inhibitors (FTIs). Farnesyl transferase is a special protein that stimulates acute myeloid leukaemia cells to grow. FTI's block this protein. It has fewer side effects than the high-dose chemotherapy usually used to treat AML, because it is a targeted therapy. Doctors therefore hope that when it is given with lower doses of chemotherapy it will improve the effectiveness of treatment for older people who aren’t able to have intensive chemotherapy.

Some people taking part in the AML-16 trial will be given tipifarnib along with their chemotherapy treatment.

Arsenic trioxide (ATO, Trisenox®)

Arsenic trioxide is licensed to treat people who have acute promyelocytic leukaemia (APL) that has come back after treatment, or has not gone into remission with treatment. This drug is made from the poison arsenic, but is given at low, safe doses.

Although it is licensed to treat APL we don’t yet know how well it might work for other types of AML. Some people taking part in the AML-16 trial will be given arsenic trioxide along with their chemotherapy treatment. Arsenic trioxide is given as a drip into a vein (intravenously). It may be given as an outpatient.

Effects of treatment for AML on fertility

Some of the drugs used to treat acute myeloid leukaemia can cause temporary or permanent infertility. Your doctor will talk to you about this in more detail before you start your treatment. If you have a partner, you may want them to be with you so you can discuss any fears or worries together.

Some drugs have less effect on your fertility than others, and couples have had normal, healthy babies after one partner has been treated for leukaemia. Unfortunately, people who have had intensive chemotherapy and radiotherapy, and a stem cell or bone marrow transplant, are likely to be permanently infertile.

It may be possible for men to store sperm before starting treatment, so it can be used later if they want to have a family. Rarely, a woman's eggs or fertilised eggs (embryos) can be stored before chemotherapy, so that she may have the chance to have a child after treatment. However, as treatment for AML usually needs to start as quickly as possible, there is not always enough time to store sperm or embryos.

As your doctor knows the details of the treatment you are having, they are the best person to answer your questions. You can write down any questions that you have so you are clear about your treatment, and the effect it is likely to have on you, before it starts.

Coping with infertility

If chemotherapy has made you infertile, it can be very difficult to come to terms with the fact that you can no longer have children. Talking about your feelings with your partner, family or a close friend can help to clarify your thoughts and give the people close to you the opportunity to understand how you are feeling.

If it would be easier to talk to someone outside the circle of your immediate friends and family, you may find it helpful to talk to your doctor, nurse, social worker or a trained counsellor (see organisations). Our cancer support service can give information on how to contact a counsellor in your area.

Our booklet on sexuality and cancer looks at the effects cancer and its treatment can have on sexuality and fertility. It also suggests ways to keep love and sex alive during this difficult time.

Follow-up after treatment for AML

Once your treatment is finished, you will have regular check-ups. These will continue every three to six months for several years, but will become less frequent as time goes on. You will continue to have appointments at the hospital for up to 10 years. Many people find that they get very anxious before their appointments. This is natural and it may help to get support from family, friends or a support organisation.

If you have any problems, or notice new symptoms between your appointments, let your doctor know as soon as possible.

We have a booklet on adjusting to life after cancer treatment, which gives useful advice on how to keep healthy and adjust to life after cancer.

If the leukaemia comes back (relapse)

Chemotherapy may cure the leukaemia. Sometimes however, the acute myeloid leukaemia does come back. This is called **relapse**, which can be very disappointing and upsetting. If this happens, your specialist will advise you on how best to treat the leukaemia, and work out the most positive approach for you.

Your leukaemia may be resistant to the drugs that you had initially, so different drugs or new combinations of different drugs may be needed to give you further remissions.

Research - clinical trials for AML

Research trials are carried out to try to find new and better treatments for leukaemia. Trials that are carried out on patients are known as clinical trials.

Clinical trials may be carried out to:

- test new treatments, such as new chemotherapy drugs, gene therapy or cancer vaccines
- look at new combinations of existing treatments, or change the way they are given, in order to make them more effective or to reduce side effects
- compare the effectiveness of drugs used for symptom control
- find out how cancer treatments work
- see which treatments are the most cost-effective.

Trials are the only reliable way to find out if a different type of chemotherapy, radiotherapy, or other treatment is better than what is already available.

Taking part in a trial

You may be asked to take part in a treatment research trial. There can be many benefits in doing this. Trials help to improve knowledge about cancer and develop new treatments. You will also be carefully monitored during and after the study. Usually, several hospitals around the country take part in these trials.

Blood and tumour samples

Many blood samples and bone marrow or tumour biopsies may be taken to help make the right diagnosis. You may be asked for permission to use some of your samples for research into leukaemia. If you are taking part in a trial you may also be asked to give other samples, which may be frozen and stored for future use when new research techniques become available. These samples will have your name removed from them (anonymised) so you can’t be identified.

The research may be carried out at the hospital where you are treated, or it may be at another hospital. This type of research takes a long time, so you are unlikely to hear the results. The samples will, however, be used to increase knowledge about the causes of leukaemia and its treatment. This research will, hopefully, improve the outlook for future patients.

JASCAP resources

Talking about your cancer
Practical advice and guidance for cancer patients to help them communicate with family, friends, carers and health professionals about emotional and practical issues arising from a diagnosis of cancer and cancer treatment.

Talking to children about cancer
Practical advice and guidance to help parents with cancer talk to their children about their cancer.

Talking to someone with cancer
Practical advice and guidance for friends, carers and family members to help them talk to their friend or relative with cancer, and provide emotional and practical support.

Note: JASCAP has booklets on each of the above subjects.

Questions you might like to ask your doctor

You can fill this in before you see the doctor or surgeon, and then use it to remind yourself of the questions you want to ask, and the answers you receive.

1. ______________________________

Answer ______________________________

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2. ______________________________

Answer ______________________________

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3. ______________________________

Answer ______________________________

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4. ______________________________

Answer ______________________________

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5. ______________________________

Answer ______________________________

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JASCAP : We need your help

We hope that you found this booklet useful.

To help other patients and their families we need and intend to extend our Patient Information Services in many ways.

Our Trust depends on voluntary donations. Please send your donation by Cheque or D/D payable in Mumbai in favour of “JASCAP”.

Note for Reader

This JASCAP booklet is not designed to provide medical advice or professional services and is intended to be for educational use only. The information provided through JASCAP is not a substitute for professional care and should not be used for diagnosing or treating a health problem or a disease. If you have, or suspect you may have, a health problem you should consult your doctor.

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