Induction treatment for acute lymphoblastic leukaemia (ALL)

Induction is the first main phase of treatment for acute lymphoblastic leukaemia (ALL). It usually involves having chemotherapy and steroids, sometimes with targeted treatment. Most people stay in hospital to have it. Find out more about what induction treatment is, what it involves and some of the more common side effects.

This information is aimed at people in the UK. We do our best to make sure it is accurate and up to date but it should not replace advice from your health professional.

This leaflet includes addresses and QR codes that link to webpages for further support. If you cannot access the webpages, please email **information@leukaemiacare.org.uk** or call **08088 010 444**.

Summary

- Treatment of ALL happens in phases. The first main phase is induction.
- There are a few different treatment options. Your team will recommend the most suitable one for you on an individual basis.
- Your team may fit a central line so it is easier for you to have treatment and blood tests.
- Before treatment tell your team if you have any other medical conditions, or if you are taking any other medicines.
- You usually stay in hospital for several weeks to have induction treatment.
- You have a course of steroids for a few days before starting induction.
- Then you usually have two cycles of induction treatment. Each cycle involves a few weeks when you have treatment most days. You have different medicines on different days.
- You usually have a combination of chemotherapy medicines, by mouth or through a drip. You usually also have a steroid, and medicines through an injection in your lower back.
- Depending on the type of ALL you have, you may also have targeted treatment or antibody therapies.
- You'll also have medicines to prevent or manage symptoms or side effects.
- You will have blood and bone marrow tests to check how well your ALL is responding to treatment.
- You may get some side effects while you are having your treatment. Some people have very few side effects, whereas other people experience more serious side effects.
- **Tell your haematology team about any side effects you have. They may be able to suggest things you can do or give you medicines to help.**

What is induction treatment?

Treatment of ALL happens in phases. The first main phase is induction therapy. Induction aims to kill as many leukaemia cells as possible. Some people call it ‘remission induction’ because it aims to get your leukaemia into remission.

> Remission is when tests or scans after treatment can find little or no cancer left in your body.

There are a few different treatment options for induction treatment. Your medical team will work out the most suitable one for you based on many factors. These include:

- Your age and overall fitness
- Your subtype of ALL
- The genetic changes and proteins in your leukaemia cells
- Any other medical conditions you have
- Your preference on how you wish to be treated

They will tell you what treatment they recommend for you and what you can expect.

> “Induction is intensive, often scary, but the hospital staff and my CNS really helped me to understand the treatment, side effects and how my disease was responding, which made it all worthwhile.”
>
> **Tara, diagnosed with ALL in 2023**

Before treatment

Before starting induction treatment, you'll have tests and scans to make sure it's suitable for you and that you're fit enough to have it. This might include:

- Blood tests to check your blood cell counts, liver and kidney function and to check for any infections that could flare up during treatment.
- A lumbar puncture to check for leukaemia cells in the fluid around your brain and spinal cord. Depending on your symptoms, you might have this test after a few weeks.
- A heart tracing (ECG) and heart scan.
- A pregnancy test because some treatments can be harmful to unborn babies.

Your team might suggest other tests or scans. They will let you know what they recommend and what you can expect.

The NHS have more **information on lumbar punctures**. Scan the QR code, or search 'lumbar puncture' at **nhs.uk**.

Having a central line fitted

Your treatment will involve a lot of medicines you have as an injection or through a drip into a vein. You'll also have regular blood tests.

If you don't already have one, your haematology team may fit a central line to make this easier. You might hear your team call it a PICC or Hickman line. This might not happen until your second cycle of induction therapy, to reduce the risk of blood clots.

You'll need to keep your central line clean and dry to reduce the risk of it getting infected. It needs to be flushed with sterile fluid once a week to stop it getting blocked. While you are at hospital, a nurse will do this. Once you are at home, your team will arrange for someone to do it for you. This may be during your outpatient appointments at hospital.

Macmillan have more **information on central lines**. Scan the QR code, or search 'central lines' at **macmillan.org.uk**

Fertility options

Some treatments used for induction therapy may affect your fertility. If you might want to have children in the future, and you have not already discussed your fertility, tell your doctor or nurse. They can talk to you about your options. Your haematology team may refer you to a fertility specialist. This may not be possible for everyone.

Things to tell your haematology team

Before starting treatment, you should tell your haematology team if you:

- Have any allergies or have ever had an allergic reaction
- Have or think you have an infection, or have been in recent contact with someone who has an infection
- Are due to have or recently had any vaccines
- Are pregnant or breastfeeding
- Have any other health problems, including physical or mental health conditions
- Have ever had chemotherapy, radiotherapy or surgery
- Have any genetic or inherited medical condition

Some medicines or drugs may interact with your induction therapy. It is important to tell your haematology team about any medicines or supplements you're taking. This includes prescribed medicines or medicines you've bought yourself without a prescription.

Having treatment

Most people stay in hospital for several weeks to have the first phase of induction treatment for ALL. Some people may need to stay in hospital for longer to manage side effects or complications. You usually have the second phase of induction treatment as an outpatient.

We have more **information if you have just been diagnosed with leukaemia**, including what to pack for a hospital stay. Scan the QR code, or search 'just diagnosed'at **leukaemiacare.org.uk**

- You have a course of steroids for up to 7 days before starting induction. You might hear some people call this 'pre-induction' treatment.
- Then you usually have two cycles or phases of induction treatment. Each cycle or phase involves treatment you have over a few weeks. You have treatment on some days, and no treatment on others.
- Once your blood cell counts have recovered, you start your next cycle or phase.

Induction phase 1

Induction phase 1 usually lasts around 4 weeks. You have different medicines on different days. These usually include:

- **A combination of chemotherapy medicines.** The exact medicines vary. You have some through a drip and some as tablets or capsules to take by mouth. Common medicines include:
  - Vincristine
  - Daunorubicin or idarubicin
  - Pegasparaginase
  - Mercaptopurine
- **Intrathecal medicines.** These are medicines you have through an injection in your lower back. They prevent or treat ALL in your central nervous system. Most people have a chemotherapy medicine called methotrexate. Some people might also have a steroid called dexamethasone as an injection into their lower back.
- **A steroid.** This might be dexamethasone or prednisolone. You have it as tablets to take by mouth.

Depending on your type of ALL, you might also have:

- **A targeted medicine called a tyrosine kinase inhibitor (TKI).** Examples include imatinib, dasatinib and ponatinib. These are tablets or capsules that you take by mouth. You might have one of these medicines if you have Philadelphia chromosome-positive ALL.
- **An antibody therapy called rituximab.** You have this through a drip into a vein. You might have it if you have B-cell ALL and your leukaemia cells make a protein called CD20.

Your haematology team might suggest a different combination of medicines. They will tell you what they recommend and what you can expect.

At the end of induction phase 1, you have blood and bone marrow tests to check how well your ALL has responded. This helps your team decide on the most appropriate approach in induction phase 2.

Induction phase 2

Once your blood cell counts have recovered, you usually start the second phase of induction treatment. This may last up to 9 weeks.

Like phase 1 induction, you have different medicines on different days. But the medicines might be different from the ones you had in phase 1. They usually include:

- **A combination of chemotherapy medicines.** You have some of these through a drip and some as tablets or capsules to take by mouth. Common medicines include:
  - Cyclophosphamide
  - Cytarabine
  - Mercaptopurine
  - Vincristine
- **Intrathecal medicines.** These are medicines you have through an injection in your lower back. They prevent or treat ALL in your central nervous system. Most people have a chemotherapy medicine called methotrexate. Some people might also have a steroid called dexamethasone.
- **A steroid called dexamethasone.** Most people, but not all, have this. You take it as tablets by mouth.

Depending on your type of ALL, you might also have:

- **A targeted medicine called a tyrosine kinase inhibitor (TKI).** Examples include imatinib, dasatinib and ponatinib. These are tablets or capsules that you take by mouth. You might have one of these medicines if you have Philadelphia chromosome-positive ALL.

> Your haematology team might suggest a different combination of medicines. They will tell you what they recommend and what you can expect.

At the end of induction phase 2, you have blood and bone marrow tests to check how well your ALL has responded. This helps your team decide on the next step.

Medicines for symptoms or side effects

During induction therapy, you'll also have medicines to prevent or manage symptoms or side effects. These might include:

- Blood transfusions
- Growth factor injections to boost your blood counts
- Anti-sickness medicines
- Medicines to prevent or treat infections
- Medicines to protect your bladder, kidneys and gut

Monitoring your treatment

You will have regular blood tests, to check your blood cell counts and liver and kidney function, to see how your body is coping with treatment. You may also have other tests and scans to check and monitor side effects from treatment.

> "Treat each day of your treatment process as a small victory. The recovery from all three treatment regimens I experienced was a marathon, not a sprint."
>
> **Julie, diagnosed with ALL in 2019**

Measuring your response to treatment

After each induction cycle you will have blood and bone marrow tests to check how well your ALL is responding.

The tests will measure:

- Your blood cell counts. This is sometimes called your **haematological response**. It checks if your blood cell counts have returned to normal and whether specialists can see any leukaemia cells under a microscope.
- The level of leukaemia markers or leukaemia genetic changes in your white blood cells. This is called your **molecular response**. It can detect very low levels of leukaemia cells. This is called **measurable residual disease (MRD)**.

The results of these tests help your haematology team work out the most suitable next treatment for you.

If you are MRD negative, it means sensitive molecular tests cannot find any leukaemia cells in your body.

Precautions during treatment

There are some precautions to be aware of when you are having induction therapy.

- Some treatments can cause side effects like dizziness, drowsiness, blurred vision, or make you feel tired or confused. Take care if you are driving or operating tools or heavy machinery.
- Some treatments can change the colour of your pee. This should only last for a few days. If you are worried, or have other problems with your pee, tell your haematology team.
- Some treatments can make your skin more sensitive to the sun. Try to avoid the sun at peak times, if you can. If you need to go outside, try to cover up, wear protective clothing and use sunscreen with a high protection factor (SPF 50) on exposed areas.
- Some treatments can increase your risk of developing another type of cancer. Tell your team if you develop any signs or symptoms of cancer. It is important to go to any screenings you may be invited to.

Cancer Research UK have more **information on the signs and symptoms of cancer**. Scan the QR code, or search 'signs and symptoms' at **cancerresearchuk.org**

Contraception

The medicines used for induction treatment may harm unborn babies.

- If you could get pregnant, it is important to use effective contraception. You need to do this while you are having treatment, and possibly for some time after you stop treatment.
- If you could make someone pregnant, it is important to use effective contraception. This should include a barrier method like a condom, diaphragm or cap. You need to do this while you are having treatment, and possibly for some time after you stop treatment.
- If you think you might be pregnant, tell your haematology team as soon as possible. They may recommend stopping treatment for a while. They could also recommend switching to a different treatment.
- If you are planning to get pregnant, or make someone pregnant, tell your haematology team. They can discuss your treatment options with you.

How long you need to use contraception for varies based on what treatment you are having. Your haematology team will let you know how long to use contraception and what to do if you are pregnant or planning to get or make someone pregnant.

Breastfeeding

Scientists are not sure if medicines used for induction treatment pass into breast milk. If they do, they could be a risk for breastfed babies and children. You should not breastfeed while you are having treatment and possibly for some time after you stop treatment.

How long to avoid breastfeeding can vary depending on what treatment you are having. Your haematology team will let you know.

Possible side effects

Like all medicines, induction treatment can cause side effects. Some of these may be serious. Side effects are different for everyone, and we cannot predict what side effects you may or may not get.

Your team can give you information about the specific treatments you are having and what to expect. They will also give you more information about side effects and what to look out for. Make sure to ask them any questions you have if you are unsure.

Tell your doctor or nurse straight away about any side effects you have. They may be able to suggest things you can do or give you medicines to help.

If you are getting side effects that are difficult to cope with, your haematology team might suggest:

- Treatment to help manage your side effects
- Lowering your dose of treatment
- Changing how often you have treatment
- Stopping one or more of your medicines

Short term side effects

Here we cover some of the common short-term side effects of ALL treatment. You may experience some of these side effects, or none at all. You may have different side effects altogether.

Ask your team about side effects if you are worried. They can provide you with help and support to manage side effects.

Infections

ALL and its treatment can cause a low level of white blood cells called neutrophils. This is called neutropenia. It means your body can't fight infections as well as usual. So you have a higher chance of getting infections, and any infections you do get may be more serious.

Tell your medical team straight away if you think you have an infection. Signs include:

- A high temperature (37.5°C or 38°C or higher). You may need a thermometer so you can check your temperature, especially if you feel unwell.
- Aching muscles, shivering or chills.
- Sore throat, blocked or runny nose or cough.
- Burning or stinging when you pee, or peeing more often than usual.
- Diarrhoea, being sick or tummy pain.
- Headache or stiff neck.
- Pain or redness around any cuts, wounds or drips.
- Feeling very tired or generally unwell.

Infections can get worse quickly if you have a weakened immune system, so it is important to get treatment as soon as possible.

Your haematology team should tell you who to contact if you think you have an infection. If you can't contact your team, you should go to your nearest emergency department and let them know you are having chemotherapy.

It is also important to contact your team if you feel unwell, even if your temperature is normal.

Lowering your risk of infection

If your white blood cell count is low, there are things you can do to lower your risk of getting an infection. These include:

- Washing your hands frequently
- Using hand sanitizer when entering and leaving your ward
- Avoiding touching your face with your hands
- Wearing shoes or slippers when walking around or using the bathroom
- Keeping your central line clean and telling your team if it looks red, swollen or feels painful (this may look different on black or brown skin)
- Keeping your area tidy so it is easier to keep clean
- Trying to shower or bathe daily, or if this is difficult using baby wipes or a damp flannel and soap to stay clean
- Keeping your skin moisturised to stop it from drying and cracking
- Brushing your teeth at least twice a day and rinsing your mouth with salt water regularly
- Regularly cleaning surfaces you touch a lot, like your mobile phone, bed rails or remotes
- Asking people not to visit you if they are feeling unwell
- Telling your team if you feel unwell or have any signs of an infection
- Politely asking your team to wash their hands before touching you

Your haematology team might also prescribe medicines to help prevent infections.

Low blood counts

ALL and its treatment can cause very low blood cell counts. You will have regular blood tests so your team can monitor this.

If your red blood cell count is low, you may feel tired and breathless. You might get a fast or uneven heart rate. You may have blood transfusions to top up your red blood cells.

If your platelet count is low, you might bleed or bruise easily. You might get small blood spots on your skin. You may have platelet transfusions to top up your platelets.

Tell your medical team straight away if you have signs or symptoms of low blood cell counts.

Hair loss

Some treatments can lead to hair loss. This can be very emotional because your hair may feel like an important part of you. It can be distressing, but this feeling may pass with time.

It can help to be prepared, and to tell your loved ones you might lose your hair. This can help them understand and support you better, as they know what's going on. If you have children, it can help to get them to touch your head and ask questions so they know it is normal and not something bad.

You may wish to cut your hair short or shave it when the hair loss starts. This can give you a feeling of control and reduce the emotional impact of it falling out. It can also help reduce itching and help with not having to wash your hair. You could also cover your hair loss, if you choose to. There are lots of options like hats, headscarves, wraps, turbans or wigs. Do what feels best for you and allows you to feel the most confident.

Cancer Hair Care UK has more **information on hair loss**, including how to care for Afro-textured hair during chemotherapy. Scan the QR code, or visit **cancerhaircare.co.uk**

Nerve damage

Some treatments for ALL can lead to nerve damage.

Tell your medical team straight away if you think you have nerve damage. Signs include:

- Pins and needles sensation
- Burning, tingling or numbness
- Muscle cramps
- Problems with intricate movement (like finding it hard to button a shirt)
- Struggling with your balance
- Dizziness, blurry vision
- Constipation
- Finding it hard to pee

Nerve problems can continue even after treatment finishes, but they do usually get better with time. Sometimes, they may not get better. Your team can help provide you with support and ways to manage any side effects you may get.

Mouth ulcers, oral thrush and sore mouth

Mouth problems are a common side effect of many cancer treatments. You may get mouth ulcers, sores, or oral infections, which can be painful.

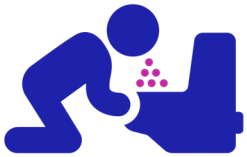
It's important to let your medical team know if your mouth is sore. They may be able to give you mouthwashes, gels or painkillers, as well as medicines to prevent mouth infections.

To cope with sore mouth or other mouth problems you could try:

- Brushing your teeth with a soft toothbrush at least twice a day.
- Using an antimicrobial mouthwash. Alcohol mouthwashes can dry your mouth, so it is best to avoid these.
- Sucking on ice chips and drinking water often.
- Chewing food slowly and drinking plenty of fluid with meals.
- Avoiding hot, spicy, acidic or hard foods, like crusty breads, pineapple or lemons.

Tell your team if you are having problems with your mouth and if you are struggling to manage. They can help you and provide support.

Feeling or being sick



Feeling sick or being sick is a common side effect of many cancer treatments. Let your medical team know if you are feeling or being sick. They may be able to suggest things to help or give you medicines to prevent you feeling sick.

Anti-sickness medicines work best the sooner they are taken, so tell your team straight away.

To help with feeling or being sick, you could try:

- Drinking plenty of fluids. This can include water, broth, fruit juices, ginger ale, tea or sports drinks.
- Avoiding foods that are greasy, spicy, sweet or have a strong smell.
- Eating little but often. Having smaller meals and snacks when you are feeling hungry can help.
- Eating cold and room temperature foods. Try foods like toast, rice, plain pasta, yoghurt, crackers and biscuits.
- Avoiding lying down after eating. Try sitting upright or slightly reclined instead.

Other short-term side effects

This is not a complete list of side effects you might get. Your haematology team will give you information about your exact treatment, including possible side effects.

Other common side effects of induction therapy include:

- Changes in your liver function. Your team might notice this on blood tests. If it happens, they might adjust your treatment.
- Problems with your pancreas. You might get tummy pain, swelling or bloating. You may also be feeling or being sick.
- Changes in your blood sugar or cholesterol that your team might notice on blood tests.
- Changes in your sense of taste.
- Indigestion, heartburn, tummy pain or diarrhoea. Your team can give you medicines to help.
- Headaches.
- Changes in your mood or mood swings.
- Swelling of your hands, feet, ankles and tummy due to your body holding on to water.

- Itchy, dry, flaky or scaly skin.
- Muscle spasms, cramps or pain in your muscles, joints or bones.
- Developing hepatitis B if you have had it before.
- An allergic reaction.

Serious side effects to know about

Your medical team will closely monitor you for serious side effects so that they can treat them promptly if they happen.

The following side effects may be serious and require urgent treatment. Contact your doctor or nurse straight away if you have any of these side effects.

Tumour lysis syndrome

Chemotherapy kills cancer cells. When lots of cancer cells breakdown quickly they can release a large amount of chemicals. These chemicals can then enter your bloodstream. This is known as tumour lysis syndrome (TLS).

If you have a very high leukaemia cell count before treatment, you might have medicine to prevent TLS. Your team will also monitor you closely for signs of TLS so they can treat it quickly if it happens.

TLS can affect how well your kidneys work. It can also cause changes to your heartbeat and sometimes cause fits (seizures).

About 20 in 100 people with ALL show signs of TLS on blood tests. So about 80 in 100 do not. In about 5 in 100 people with ALL, TLS might cause symptoms. These can include:

- Pain in your sides
- Blood in your pee or not peeing as often as usual
- Fast or irregular heart rate
- Muscle cramps, spasms or weakness
- Confusion
- Feeling or being sick, or diarrhoea

If you experience any of these symptoms, tell your haematology team.

When you finish induction treatment

You will have blood and bone marrow tests after your first and second phase of induction treatment. Your team will measure your response to treatment (**page 9**).

- If you have responded well to treatment, you will move to the next phase of treatment. This is usually intensification and consolidation, which involves having chemotherapy and steroids, sometimes with targeted medicines, such as blinatumomab. If your ALL has a high risk of coming back, your haematology team might suggest a stem cell transplant.
- If induction treatment hasn't worked as expected, it is known as refractory ALL. Your haematology team will talk to you about your options.

We have more information on:

Intensification and consolidation

Stem cell transplants

Refractory ALL

Scan the QR codes, or search 'intensification and consolidation', 'stem cell transplant' or 'refractory ALL' at **leukaemiacare.org.uk**

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Email **information@leukaemiacare.org.uk** or call **08088 010 444**.

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