MyelomaUK

# High-dose therapy and autologous stem cell transplantation

Treatments and tests in AL amyloidosis
Infoguide

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**Disclaimer:** The information in this Infoguide is not meant to replace the advice of your healthcare team.
They are the best people to ask if you have questions about your individual situation.

This Infoguide is intended for a UK audience. It therefore may not provide relevant or accurate information for a non-UK setting.

You will find a definition of the terms highlighted in **bold** throughout this booklet in the 'Medical terms explained' section on page 45.

# AL amyloidosis – an overview

**The term 'amyloidosis' is a general term used for a group of conditions where an abnormal protein, called amyloid, accumulates in the tissues. The buildup of amyloid protein is called an 'amyloid deposit' – this can occur in various organs or tissues and cause problems.**

Different types of **amyloidosis** are named according to the type of **amyloid** protein which is produced. All begin with the initial 'A' which stands for amyloidosis, followed by another letter(s) which identifies the particular amyloid protein, for example: **AL amyloidosis,** AA amyloidosis and ATTR amyloidosis.

In AL amyloidosis it is abnormal **plasma cells** in the **bone marrow** that produce the amyloid protein. In AL amyloidosis the amyloid proteins are **light chains** (the 'L' in 'AL' stands for 'light chain').

Light chains are normally part of healthy **antibodies**, also known as **immunoglobulins**, produced by healthy plasma cells (see Figure 1). In AL amyloidosis they are called **free light chains** because they are not attached to the rest of the antibody.

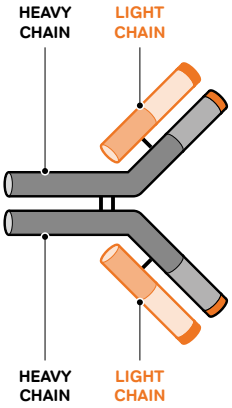


**Figure 1.** Immunoglobulin structure

The amyloid protein is only broken down very slowly by the body and starts to build up in the tissues and organs – gradually damaging their function and causing symptoms. This build-up can happen almost anywhere in the body. Each patient has a different pattern of amyloid deposition, with different organs affected.

For this reason, the symptoms patients can experience vary widely. Possible symptoms can include fatigue, weight loss, swollen legs and abdomen, shortness of breath, dizziness, tingling or pain in the hands and feet, digestive symptoms, bruising, and swollen tongue.

## AL amyloidosis treatment

The aim of AL amyloidosis treatment is to reduce the production of amyloid protein, prevent further tissue or organ damage, allow gradual organ recovery, manage symptoms, and improve and prolong life.

Unfortunately, though, there is currently no cure for AL amyloidosis. Patients will experience periods of **remission** when their abnormal plasma cells are not producing light chains and treatment is not needed, and **relapses** when their AL amyloidosis comes back and is treated.

A range of treatments is available for AL amyloidosis patients. Many treatments used to control the AL amyloidosis are similar to those used in a related cancer called **myeloma**. AL amyloidosis is not a cancer, but some patients may be diagnosed with both myeloma and AL amyloidosis.

For more information about myeloma see **Myeloma – An Introduction** from Myeloma UK

Patients will often receive combinations of drugs that work in different ways, and may receive the same or different drugs during later relapses. Patients will also be given treatments to manage symptoms (**supportive treatments**). An intensive form of treatment given to some AL amyloidosis patients is **high dose therapy** and **autologous stem cell transplantation (HDT-ASCT)**, which is described in this booklet.

For more information about AL amyloidosis see **AL amyloidosis – Your Essential Guide** from Myeloma UK

# What are stem cells?

**There are various types of stem cell, but when talking about transplantation in AL amyloidosis, we are referring to blood stem cells (also called haematopoietic stem cells).**

Blood **stem cells** exist in the bone marrow and can divide and develop into the three main types of cell found in the blood: **red blood cells**, **white blood cells** and **platelets** (see Figure 2). Each of these cells carries out essential functions in the body:

- Red blood cells carry oxygen from the lungs to the body
- White blood cells fight infection by combating bacteria and viruses
- Platelets form clots and help control bleeding from injuries

It is the unique ability of blood stem cells to divide into blood cells and the fact that they can be collected safely that makes HDT-ASCT a treatment option for AL amyloidosis patients.

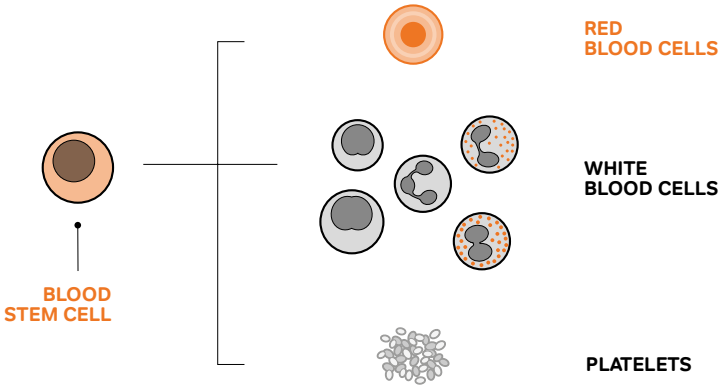


**Figure 2.** Blood cell development from stem cells

# What is HDT-ASCT?

**Treatment of AL amyloidosis involves the use of combinations of drugs, but sometimes a more intensive treatment is appropriate for certain patients.**

Drug combinations, which are given in relatively low doses, provide an effective way of treating AL amyloidosis.

However, a major problem with **chemotherapy** is how to give high doses safely. This is because high doses of chemotherapy not only kill the abnormal plasma cells but also the blood-forming stem cells in the bone marrow. This severely affects blood cell production, with **blood counts** falling to dangerously low levels.

High-dose therapy and autologous stem cell transplantation (HDT-ASCT) was developed as a solution to this problem. It involves giving high doses of chemotherapy to kill the abnormal plasma cells, and then giving back your own previously collected healthy stem cells.

This effectively 'rescues' your bone marrow, allowing blood cell production to continue. The treatment is called **autologous** because it is your own stem cells which are given back to you.

HDT-ASCT is a relatively intensive procedure with a number of potential risks. It is therefore not suitable for everyone. It is generally limited to patients under 70 years old, who are willing to undergo an intensive treatment, meet strict criteria involving heart and kidney function and who have two organs or fewer affected by amyloid.

Read more about who can have HDT-ASCT on page 10.

## Overview of the treatment

Each step of the treatment will be covered in more detail from page 17 onwards. The steps are:

1. **Induction treatment** – a course of treatment which may be given to reduce the number of abnormal plasma cells if they are present in high numbers
2. **Stem cell mobilisation** – healthy stem cells are encouraged to multiply and move from the bone marrow into the blood
3. Stem cell collection – healthy stem cells are filtered from the patient's blood and stored
4. High-dose **melphalan** – a large dose of the chemotherapy drug melphalan is given with the aim of killing as many as possible of the abnormal plasma cells. This is sometimes called **conditioning treatment**
5. Autologous stem cell transplant – the previously collected healthy stem cells are infused back into the patient

These treatment steps are shown in figure 3.

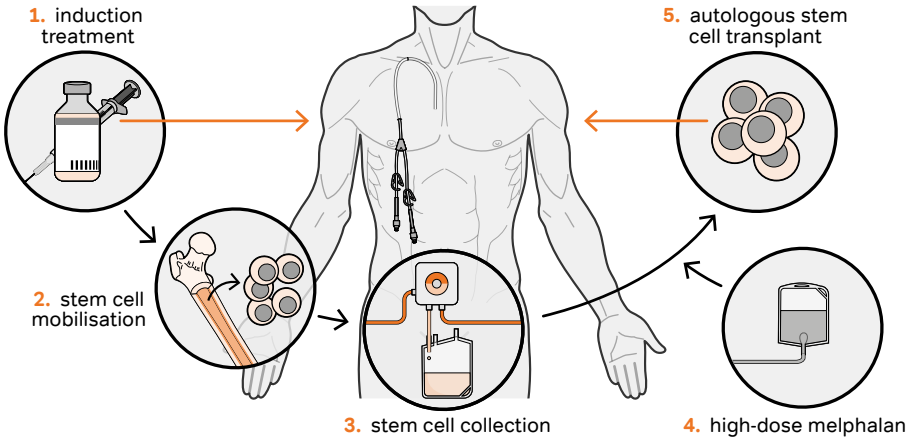


**Figure 3.** Overview of HDT-ASCT process

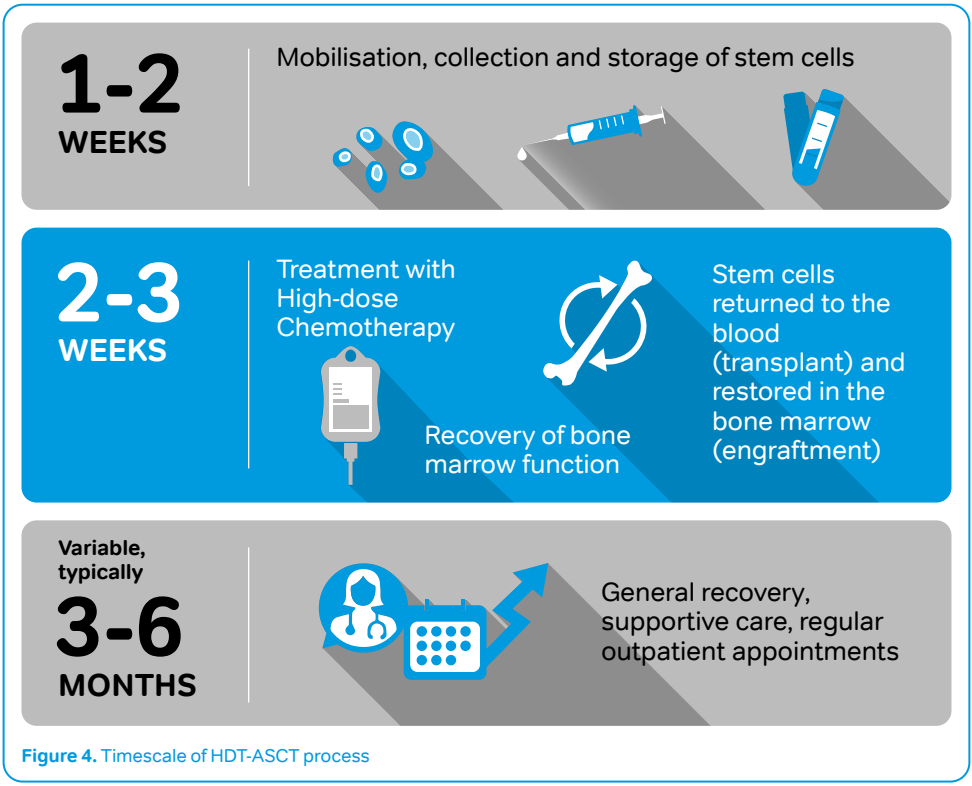


**Figure 4.** Timescale of HDT-ASCT process

The HDT-ASCT process takes a few weeks and will be followed by some months of recovery (see Figure 4).

## Types of stem cell transplantation

Autologous stem cell transplant (using the patient's own stem cells) is the type of transplant normally carried out in AL amyloidosis, and is the type discussed in this Infoguide.

If the stem cells come from a donor (**allogeneic** stem cells), the transplant is called an **allogeneic stem cell transplant**. This type of transplant is rarely used in the treatment of AL amyloidosis, so is not covered in this Infoguide. If you need more information about allogeneic stem cell transplant, call the Myeloma UK Infoline on 0800 980 3332.

# What are the possible advantages and disadvantages of HDT-ASCT?

**Understanding the potential advantages and disadvantages of any treatment is an important step in the decision-making process.**

When used for the right patients, HDT-ASCT can be a very effective treatment, with the potential for long survival times and long periods before the next treatment is needed.

Nonetheless, HDT-ASCT may not benefit everyone and there are some potential disadvantages:

- High-dose chemotherapy is more toxic than standard doses of chemotherapy and carries the likelihood of more **side effects**
- There is a long recovery period following HDT-ASCT
- The success of this or any other treatment cannot be guaranteed, as not all patients will achieve the desired response
- HDT-ASCT is unable to cure AL amyloidosis; most people will have recurrence of their disease over time
- The effects of HDT-ASCT may affect fertility. If this is a concern for you, you should discuss this with your doctor before starting treatment as options such as sperm banking or egg storage may be considered
- As with all procedures, there is a small risk of death

The safety of HDT-ASCT has improved considerably over time. This has been as a result of very careful selection of suitable patients for the procedure (see next page).

However, at the same time, newer and highly effective drug treatment combinations for AL amyloidosis have been developed. This means that a large proportion of patients are likely to receive these treatments instead of HDT-ASCT.

Your medical team will be in the best position to discuss the balance of advantages and disadvantages that apply to you, so that you can make the right decision for you.

# What are the criteria for HDT-ASCT?

**As already mentioned, high dose therapy and stem cell transplantation is an intensive treatment option, with higher risks than standard-dose chemotherapy.**

For this reason, this treatment is not suitable for all patients. HDT-ASCT may be considered in selected AL amyloidosis patients, including those who have no significant heart involvement, and adequate kidney function, not requiring dialysis.

The following factors are likely to make HDT-ASCT unsuitable for a patient:

- Evidence of amyloid deposits in the heart (shown by tests called **NT-proBNP** and **cTnT** which detect damage to the heart muscle)
- Amyloid deposits in the nervous system causing **autonomic neuropathy**
- Previous bleeding in the gastrointestinal tract caused by amyloid
- Kidney failure requiring dialysis
- More than two organ systems affected by amyloid

Older patients are not completely excluded from HDT-ASCT, but age is taken into account together with other factors that affect a patient's medical fitness for the procedure. Patients aged over 70 are unlikely to undergo HDT-ASCT.

Some patients who are not well enough for HDT-ASCT at the time of diagnosis may be able to undergo it at a later stage. This may be once they have improved sufficiently after initial treatment (for example with **bortezomib (Velcade®)** and chemotherapy).

# Considering the options and making a decision

**The whole process of HDT-ASCT, from the initial discussion with your doctor to recovery after the transplant, can take several months and may seem like a daunting prospect.**

The process begins with looking at your treatment options and making a decision to have the transplant. The option of HDT and ASCT may sometimes be raised by your doctor quite soon after diagnosis, whilst you are still learning about your disease. For others, it may be discussed at a later stage.

When considering the option of HDT-ASCT, it is important to understand what this treatment option involves and to get the information that you need in order to make an informed decision.

Making an informed decision is a vital part of giving your consent (permission) for the hospital staff to perform the transplant.

Before making any decision, information should be provided on the treatment, its potential advantages, disadvantages, risks and likely side effects, and all possible alternatives and options that may be available. Every patient is different, and the medical factors making HDT-ASCT more or less suitable will vary. Every patient will also have their own priorities, concerns and lifestyle preferences – all of which can play a significant part in the decision-making process.

For some, the decision to have HDT-ASCT is not an easy one and you should take your time to make a decision. This is normally possible and you should use this time to find out as much as you can, seek more than one opinion and speak to other patients who have had this type of treatment.

This type of treatment is not for everybody. If you choose not to proceed for whatever reason, even if you are a suitable candidate, you can discuss all other options with your doctor.

If you and your doctor decide that this treatment is not right for you at this time, it may be worthwhile collecting and storing stem cells if

you can, as it may be possible to have a transplant at a later stage in the disease.

Due to the nature of this treatment option, only approved hospitals with appropriate medical and nursing experience perform HDT-ASCT.

If your hospital is not an approved transplant centre, you will be referred to the nearest hospital that is. This appointment is a further chance to discuss the transplant and ask questions.

It may also be possible to meet the nursing staff and look around the transplant department.

If you would find it useful to speak to one of our Information Specialists, call the **Myeloma UK Infoline** on **0800 980 3332** or **1800 937 773** from Ireland

# Pre-transplant tests and investigations

**Depending on your individual medical history and any tests you have had done recently, you may have some or all of the tests and investigations below before starting the process of HDT and ASCT.**

Some of the tests and investigations listed are done to ensure that your body systems are working well enough for the transplant to proceed and may include testing your kidney, heart and lung function.

In addition, tests done at this stage provide a baseline against which post-treatment tests can be compared to determine your response to treatment.

Tests that may be done include:

- Bone marrow test – this involves putting a needle into a bone (usually your hip bone) to get a small sample of the bone marrow. This may be a small amount of liquid bone marrow (called a **bone marrow aspirate**), or a small core of solid bone marrow (called a **bone marrow biopsy or trephine biopsy**). Bone marrow tests are done under local **anaesthetic** and you may also be offered a sedative. This sample is then examined to establish the presence of abnormal plasma cells in your bone marrow
- Blood tests – these are a regular part of monitoring your general health and how your body has responded to treatment. Tests may include: blood count; blood group; kidney, liver, bone and thyroid function; clotting; iron and glucose levels
- **Serum Free Light Chain Assay** – this measures the amount of free light chains in your blood and/or urine. Free light chains in the urine are also called **Bence Jones proteins**. The **difference Free Light Chain (dFLC)** indicates the difference between the amounts of normal and abnormal light chains

For more information see the **Serum Free Light Chain Assay (AL amyloidosis) Infosheet** from Myeloma UK

- Urine tests to test the function of your kidneys. For some tests you will be asked for a 24-hour urine collection. For this test you will be given a large bottle to collect all the urine you pass for 24 hours
- Lung function tests — these involve breathing into different machines, which work out how big your lungs are and how well they are working. Sometimes a sample of blood is taken to assess how much oxygen is in your blood. Some tests may involve walking on a treadmill
- Chest X-ray – a simple way to screen the health of your lungs, heart and bones of the rib cage
- **Endoscopy** – an examination to check for any amyloid deposits in the **gastrointestinal** tract. This involves a long, thin tube being inserted either through your mouth and down your throat, or through your anus (bottom), to look at part of your gastrointestinal tract. The tube has a light and camera at the end, and a small attachment to remove a small sample of tissue **(biopsy)**. The procedure can be uncomfortable, and you may be offered a local anaesthetic and a sedative
- **Echocardiogram (Echo)** – a scan that uses ultrasound to show an image of your heart on a screen. The doctor or technician performing the scan will put some gel on your chest and move a probe around on the skin
- **Electrocardiogram (ECG)** – a simple test that records the rhythm and electrical activity of the heart. A series of electrodes (like sticky plasters) are placed on your chest, ankles and wrists. The ECG picks up the electrical signals that make your heart beat, and draws them as as a graph

For more information about tests and investigations in AL amyloidosis, see **AL amyloidosis – Your Essential Guide** from Myeloma UK

# Catheter insertion

**During your transplant you will need a number of intravenous (into a vein) drugs and regular blood tests.**

The easiest way to manage this is to have a **central line**, which is often put in before the stem cells are collected and will likely remain in place until after you have recovered from the transplant. The central line is a catheteer (tube) which is inserted under the skin in the chest into a large vein just above the heart. The most common type of central line is a **Hickman® catheter/line**. Figure 5 shows the positioning of the central line.

Your nurse will show you how to care for your central line. Below are some useful things to remember when you have a central line:

- Always wash your hands thoroughly before and after touching your central line or the site where the line goes under your skin
- Cover your central line site when showering
- Re-dress your central line site after showering, or at least twice a week if you are not showering daily
- Inspect the area of skin around the central line site daily, checking for any redness, pus or bleeding
- Seek advice from your nurse if the dressing is irritating your skin
- Do not clean your central line site with anything other than the solutions your nurse recommended
- Do not leave a wet dressing on your central line site
- Do not swim or immerse the central line in water

Most patients will have a central line but some may prefer to have a **Peripherally Inserted Central Catheter (PICC) line** instead. A PICC line is inserted into a vein on the inside of the elbow and slowly advanced until the end of the catheter sits in one of the large veins that feed the heart.

The line is stitched in place and then a special X-ray, called fluoroscopy, is used to confirm that the PICC line is correctly positioned. The principles of caring for a PICC line are the same as for a central line.

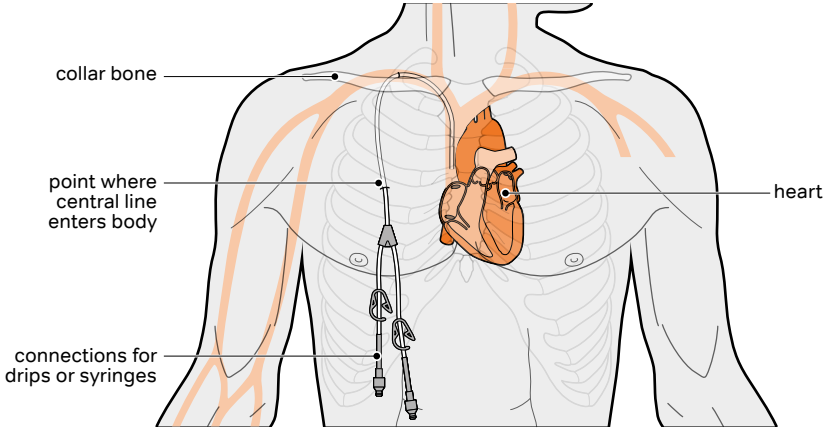


**Figure 5.** Central line

# Initial drug treatment

**Many patients receive initial drug treatment after diagnosis, before undergoing HDT-ASCT at a later stage. This initial treatment is usually with a combination of drugs, which may include chemotherapy, bortezomib or thalidomide, and a steroid such as dexamethasone.**

Other patients may undergo HDT-ASCT as their first line of treatment after diagnosis.

Patients undergoing HDT-ASCT may also receive drug treatment called induction treatment before their stem cells are collected. The aim of this is to reduce the number of abnormal plasma cells in the bone marrow before the stem cell collection. Induction treatment may be a combination such as **cyclophosphamide**, bortezomib or thalidomide, and dexamethasone. However, in some patients induction treatment may not be considered necessary, if the number of plasma cells is already low.

For more information about drugs used for initial treatment and induction treatment, see the **AL amyloidosis Treatment Guides** from Myeloma UK

# Stem cell mobilisation

**In preparation for HDT-ASCT, you must first have enough stem cells collected from your blood. Normally the number of stem cells in the blood is very small.**

The aim of stem cell mobilisation is to increase the number of stem cells being produced and to stimulate the bone marrow to release the stem cells into the blood.

Stem cell mobilisation can be achieved by a number of different methods.

## Mobilisation with growth factor

The most common method of stem cell mobilisation is to give a synthetic form of a **growth factor** called **granulocyte-colony stimulating factor (G-CSF)**. G-CSF is the main protein that controls the growth, division and maturation of blood stem cells in the bone marrow.

Treatment with G-CSF (e.g. Neupogen®, Ratiograstim®, lenograstim) increases the number of stem cells in the bone marrow, causing them to 'spill over' into the blood where they can be collected. It is given as an injection under the skin (**subcutaneous**) daily for 5–7 days prior to collection of stem cells.

The nurses at the hospital will teach you, or a family member, how to administer the G-CSF injections at home. If this is not possible for any reason, community nurses can come to your home to give the injection. It is important to have the injection around the same time each day and to store the G-CSF as directed.

## Side effects of G-CSF

Treatment with G-CSF can cause side effects in some patients. They are usually mild and get better once the G-CSF treatment stops. Your medical team will give you information about possible side effects with the G-CSF type you have been given.

Some of the more common possible side effects include:

- Pain in the joints or bones
- Redness of the skin around the injection site

- Headache
- Fever
- Feeling sick or not feeling like eating
- Bruising or bleeding gums

In rare cases patients can have an allergic reaction to G-CSF. Signs of a severe allergic reaction include a widespread rash, difficulty swallowing or breathing, or swelling of the lips, throat or tongue. If you experience any of these symptoms, or if you experience any problem that is concerning or doesn't improve, you should get urgent help.

## Mobilisation with a chemotherapy drug and growth factor

Most AL amyloidosis patients are given G-CSF alone for stem cell mobilisation. Sometimes a cycle of a chemotherapy drug, usually cyclophosphamide, is given before the G-CSF to make the G-CSF more effective.

Cyclophosphamide temporarily reduces the number of stem cells in the bone marrow. When the bone marrow recovers, it goes into stem cell production 'overdrive'. With the addition of G-CSF, it is usually much easier to collect the stem cells needed.

### Side effects of cyclophosphamide and G-CSF

The most common side effects of cyclophosphamide include loss of appetite, skin rash, sickness, nausea and general weakness.

Some patients may experience a side effect called febrile neutropenia (fever combined with reduced levels of a type of white blood cell called neutrophils).

The side effects associated with G-CSF are described in the previous section.

For more information see the **AL amyloidosis Cyclophosphamide Treatment Guide** from Myeloma UK

## Mobilisation with a combination of growth factor and plerixafor

Mobilising stem cells with G-CSF or G-CSF and cyclophosphamide is successful in most patients. However, in a small number of patients, not enough stem cells for a transplant are collected. In this case, you may be given a drug called **plerixafor (Mozobil®)**.

This works by disrupting the way stem cells are anchored to the bone marrow, resulting in release of stem cells into the blood. The effect of plerixafor combined with G-CSF greatly increases the number of stem cells that can be collected from the blood.

Plerixafor may be used if:

- A previous attempt at collecting a sufficient number of stem cells has failed
- You are considered by your doctor not to have a reasonable chance of collecting sufficient stem cells based on your low blood stem cell count during the mobilisation process, or
- Your previous AL amyloidosis treatments mean that you may not mobilise stem cells well (for example if you have previously received melphalan)

If you are being given plerixafor, you will first be given G-CSF injections daily for four days. After this you will be given a subcutaneous injection of plerixafor as well for several days, before the stem cells are collected. If the number of stem cells collected at this stage is not enough, you will be able to have further attempts at collection. Before each attempt, you will receive the G-CSF and plerixafor injection as before.

### Side-effects of plerixafor

The most common side effects associated with plerixafor include diarrhoea, nausea (feeling sick), dizziness, headache, pain in your joints and irritation or redness at the injection site. These are temporary and should disappear when the injections stop.

# Collection and storage of stem cells

**If you have been referred to a specialist transplant centre for your transplant, this is where the collection of your stem cells will take place.**

Collecting stem cells from the peripheral blood can be done as an outpatient, so an overnight stay in hospital is not normally needed and no anaesthetic is involved.

To make sure that there are enough stem cells in the blood for collection to take place, a blood test is required. This is called a **CD34+ blood test** and is done towards the end of the course of G-CSF treatment.

CD34+ is the name for a protein found on stem cells. Measuring CD34+ is a useful way of 'tagging' stem cells which enables the number in the blood to be counted.

If the cell count is high enough, collection will take place using a special machine known as a cell separator or **apheresis** machine. Apheresis is the process of collecting the cells using this machine.

Collecting the stem cells usually takes about three to four hours. You will be asked to lie down on a bed, or sit in a chair and a line will be inserted into a vein in each arm. If you have a central line already in place, this may be used.

Blood is taken from one arm and goes through the line into the apheresis machine. The blood is spun in the machine, which separates out various cell components. Stem cells are drawn off and the remaining blood returned to you through a line into your other arm (see Figure 6).

It is a common concern of patients that the stem cell collection might contain some abnormal plasma cells that will then be re-infused with their stem cells following the high-dose therapy. The apheresis machine is programmed to 'skim off' stem cells, separating them out from other blood cells. Any remaining abnormal plasma cells – a different cell type entirely from stem cells – should therefore not be collected or re-infused.

The minimum number of stem cells needed for a successful transplant is two million per kilogram of body weight. However, it is desirable to collect a higher number of stem cells and it is almost always the aim to collect enough for two transplants (over four million stem cells per kilogram of body weight), even though most patients will only receive one.

Sometimes enough cells will be collected in just one session. Commonly, two or three sessions over consecutive days may be needed to achieve the number of cells required.

Unfortunately, for a very small number of patients, it is not possible to collect enough stem cells. In this situation, you would not be able to proceed safely to HDT-ASCT and other treatment options for the future would be discussed.

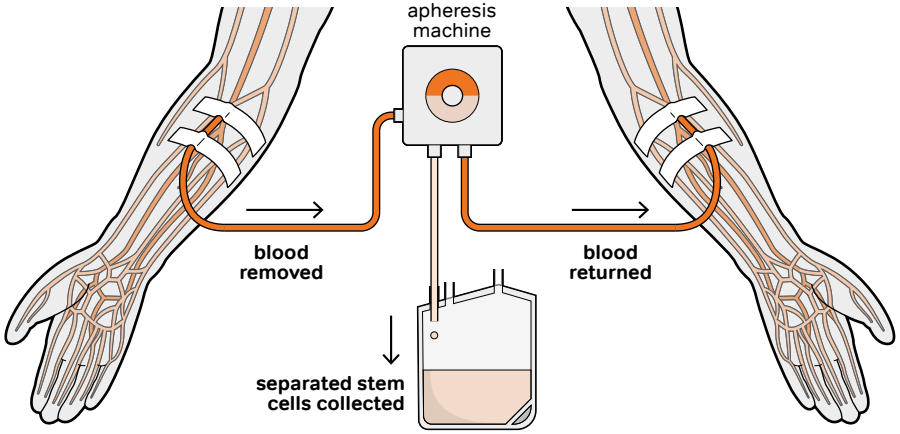


**Figure 6.** Apheresis process to collect stem cells

## Side effects of stem cell collection

During the stem cell collection process, the most common side effect is a cramp-like or tingling sensation in the hands, feet or around the mouth.

This happens because your blood is mixed with an anticoagulant drug that stops the blood from clotting in the machine and, when the blood is returned to you, this can cause a drop in your body's calcium levels. This is usually easily corrected by drinking some milk. You will feel tired after the collection and will probably need to rest for the remainder of the day.

Changes in the volume of blood in your body during apheresis can also cause side effects, including dizziness and heart rhythm changes. You will be carefully monitored during apheresis to minimise the risk of these side effects.

## Storage of stem cells

After collection, the stem cells are carefully labelled and taken to the processing laboratory in the hospital. The stem cells are then frozen and placed in special bags before being stored in liquid nitrogen until your transplant.

A chemical called **dimethyl sulphoxide (DMSO)** is mixed with the stem cells before freezing. DMSO prevents the water in the cells from forming ice crystals, which would permanently damage the cells as they are being frozen.

Stem cells can be stored for many years and therefore you may be able to store your stem cells for future use. However, not all hospitals have the facilities to store stem cells and local hospital policy will dictate if stem cells can be stored and if so, for how long.

# Hospital admission or outpatient care

**Depending on a number of factors including how far away you live from the hospital and your general fitness, you may stay in hospital during your HDT-ASCT or be treated for some parts of it as an outpatient (ambulatory care).**

If you are to be treated as an inpatient, you may be in hospital for approximately 2–3 weeks after receiving the high-dose therapy, although this can vary from patient to patient.

Some patients may have out-patient care for part of the HDT-ASCT process. This depends on a number of factors. The patient may be able to stay at home or in accommodation near the hospital for part of the time, attending regularly as an out-patient, and then go into hospital for part of the process. Patients treated as out-patients in this way can still be admitted to hospital at any time if it is necessary, for example in the case of an infection or other side effects developing.

# Receiving the high-dose therapy

**In most cases, you will receive high-dose therapy followed by a transplant of your stem cells within 4–6 weeks of your stem cell collection.**

The high-dose therapy is a chemotherapy drug called melphalan given intravenously, usually via the central line or PICC. This aims to kill as many as possible of the abnormal plasma cells in your body. High-dose therapy is also known as **conditioning treatment**.

Before receiving the high-dose therapy, you will be given extra fluid through a drip, which aims to prevent any dehydration and kidney damage which the melphalan might cause. If your kidneys are not working well, the dose of melphalan may be adjusted.

The dose of melphalan given will affect the blood cells and stem cells within your bone marrow and within a few days of receiving the melphalan, your blood counts will start to drop.

## Side effects of high-dose therapy

High-dose melphalan can cause various side effects. You will be given supportive treatments to help with these.

### Nausea and vomiting

When you begin your high-dose therapy you will be prescribed an anti-sickness (**anti-emetic**) drug to prevent nausea and vomiting. This may be given orally (as a tablet) or intravenously (into a vein via your central line). Tell your nurse if your nausea or vomiting is not well controlled as a different anti-emetic can be prescribed.

### Diarrhoea

This is a common side effect of the high-dose therapy. You will need to drink extra fluids to keep hydrated; alternatively, intravenous fluids can be given. You may be prescribed a drug to help stop the diarrhoea, and

a sample will be taken to make sure the diarrhoea is not being caused by an infection.

### Sore mouth

It is quite common to have a sore mouth (also called **mucositis**) after receiving high-dose therapy.

This is because melphalan attacks fast dividing cells, which include the abnormal plasma cells in your bone marrow but also the cells lining your mouth and digestive system. Mucositis can vary from mild soreness of the mouth and taste changes, to being more painful, perhaps causing difficulty in eating and drinking.

To help reduce the risk of mucositis you may be given ice cubes to suck when the high-dose therapy is administered.

Your nurse will show you how to care for your mouth during the transplant procedure. This may include using antibacterial and antifungal mouthwashes, brushing your teeth frequently (generally with a soft toothbrush) and inspecting your mouth for signs of infection.

If the mucositis is painful, you may require painkillers and your doctor or nurse will assess and review this on a daily basis.

### Fatigue

You may feel very tired and worn-out and find you are unable to concentrate or that you're sleeping more than usual whilst you're recovering in hospital. This is quite common and it may be some time before your energy levels return to normal.

Fatigue may persist longer than the other side effects noted above and you may notice that you still feel very tired even during your recovery period when you are at home.

### Effects on fertility

If you or your partner are receiving melphalan, you should take contraceptive precautions.

Melphalan may harm your eggs or sperm, and may also affect your ability to become pregnant or father a child in the future. Talk to your healthcare team about how this may affect you and what your options are for storage of eggs or sperm.

### Hair thinning or loss

You will probably find that you begin to lose your hair 2–3 weeks after your high-dose melphalan. However, your hair should re-grow after 3–6 months.

### Altered taste and smell

The high-dose therapy can alter your taste and sense of smell. You may find you dislike the smell of some foods which you normally enjoy or that you don't have an appetite. This is quite normal and your taste and sense of smell will return to normal, although this may take some time.

For more information about melphalan see the **AL amyloidosis Melphalan Treatment Guide** from Myeloma UK

# Having your stem cells returned – the transplant

**Within a day or so of receiving the high-dose therapy, you will need to have your stem cell transplant so that your bone marrow can start to produce blood cells again.**

At this point the frozen stem cells are brought to the ward, thawed in a warm water bath and returned to your blood system via an intravenous infusion. This process, which takes on average about an hour, is relatively straightforward.

The most common temporary side effects are caused by the DMSO the stem cells have been stored in, and may include nausea and vomiting, abdominal cramping, feeling chilled and experiencing an unusual odour/taste of garlic.

In rare cases, the infusion may cause low blood pressure, a fast heart rate and shortness of breath.

Treatments are given before the infusion process to prevent or lessen some of the potential effects of DMSO infusion.

## Engraftment

Once the stem cells are put back into the bloodstream, they travel to the bone marrow, where they settle and develop into new blood cells – a vital process known as **engraftment**. The engraftment process signals the beginning of the bone marrow recovery period.

It takes 10–14 days for adequate numbers of newly formed blood cells to be produced from the engrafted stem cells and to enter the blood. During this time you will remain severely **immunocompromised**. This means you will need to stay in a clean 'isolated' environment such as a single room, or specialist ward until engraftment is fully established. During this time, regular blood tests will be done to check your blood counts. Further precautions you will need to take during this time are covered in the next section.

Very rarely, stem cells do not engraft well and this is apparent in prolonged low blood counts. If this happens, treatment can be carried out with injections of growth factors (G-CSF) and in some cases a 'top-up' of stem cells may be given if they are available. There are a number of reasons for stem cells not engrafting well, including certain viral infections and side effects caused by drugs used to treat particular types of infection that you may have had in the past.

# Supportive care during recovery

**The period of time waiting for the new cells to grow can be daunting and difficult to face; it is possibly the toughest period of the transplant process for the patient.**

Until the new blood cells are produced and show up in your bloodstream, you will be at risk from infection, **anaemia** and bleeding. Special precautions and supportive measures are therefore necessary during this time.

## Protection against infection

Until your white cell count rises, you will be vulnerable to infection. Several precautions are taken to help reduce this risk, and you will be observed and monitored very closely during this time by the doctors and nurses to check for signs of infection.

Sometimes infections originate from your own body, not from your environment or another individual. They are termed 'opportunistic' infections and occur because your **immune system** is significantly weakened.

You will be asked to bath or shower daily and to wear clean clothes. You will be given fresh towels and bedding each day.

Some hospitals recommend that you follow a special diet, which avoids foods that may cause a stomach bug. This diet is sometimes called a **'clean diet'** and, if this is the policy at your transplant centre, it will be discussed with you before admission so that you know what to expect. Some centres no longer insist on clean diets, but you will be given advice on the importance of general hygiene during food preparation.

Your mouth will be more prone to infection after your transplant, so you should gently clean your teeth with a soft brush after meals and use any mouthwashes as directed by your nurse.

**Antibiotics** and other drugs to help prevent fungal and viral infections are prescribed, usually as tablets, so there can be a number of pills to

take. It is quite common to develop an infection at some point when your white cell count is low and a raised temperature is a typical sign that you have an infection. If an infection does occur, you will need intravenous antibiotics. Occasionally an infection can be very serious, sometimes life-threatening.

There will be restrictions on visitors, and any visitors you are allowed will be asked to take precautions to prevent infections.

## Protection against anaemia and bleeding

Until your red blood cell and platelet counts start to rise, you may be at risk of anaemia or bleeding. Blood transfusions will help to reduce the symptoms of anaemia and platelet transfusions will help to reduce the risk of bleeding.

You will find that your mouth feels dry and your gums may bleed easily if your platelet count is low, so remember to brush your teeth with a soft toothbrush.

If needed, blood transfusions can help reduce the side effects of anaemia and platelet transfusions can help reduce the risk of bleeding. Blood and platelets are treated before you receive them to destroy any white cells in the blood products.

This is to prevent a possible reaction associated with blood transfusion after a stem cell transplant. This process is called 'irradiation' and it is important that you receive only irradiated blood products following your transplant.

## General measures

In the initial period after the transplant you may be given fluids by mouth or through a tube. You may feel weak, and you may experience vomiting, diarrohoea and/or a loss of appetite.

Because high-dose melphalan may cause hair thinning or loss, many patients choose to have their hair cut short or shaved before receiving the high-dose therapy and/or have a wig fitted. There are a number of specialist suppliers and their details will be available from your nurse.

During your recovery period in hospital you may find that TV, music and books or DVDs can help keep you occupied.

It is common to feel a lack of concentration during this time, so it is a good idea to bring things in to do that are relaxing and that you can pick up and put down easily.

Exercise bikes may be available in some hospitals and using a bike or doing regular gentle exercises can help to reduce the loss of muscle tone that can occur during this period of reduced activity. You may also have the opportunity for complementary therapies that are suitable for you while in hospital, such as aromatherapy.

# Continuing recovery and follow-up care

**When your blood counts are high enough, you are free from signs of infection and generally feeling better, you should be able to leave hospital, or be seen less regularly as an outpatient by the transplant team.**

Your blood counts may not be at normal, pre-transplant levels but they will be at a safe level to allow you to begin your next phase of recovery. The recovery period may last for months but can vary greatly, depending on the individual.

You may have a mixture of emotions when you are discharged from hospital. The excitement of going home and relief that the transplant is over may be mixed with anxiety about coping at home and wondering how successful the treatment has been.

You may feel vulnerable and nervous about managing without nurses and doctors at hand.

Before you are discharged, you should make sure:

- You know what signs side effects you need to look out for and report
- You are clear about any precautions you need to take to reduce the risks of infection
- You have the correct telephone numbers of the hospital and that you know who to call if you are worried about anything

The recovery time at home can be challenging. Attempts to get back to normal life have to be balanced against some possible physical and emotional difficulties that commonly occur during this time.

The following pages provide a few guidelines and pointers to help you manage this recovery period at home.

## Treatment follow-up and appointments

For the vast majority of patients, there is a gradual recovery following the return of adequate blood counts and rarely do new health issues occur. However, for at least the first six months following your transplant

it is important that any problems are picked up early. Therefore you will need to attend the hospital where you had your transplant for regular follow-up appointments.

These appointments, in the outpatient department, are often about once a week to begin with. If you live a long way from hospital, or have difficulty travelling to your appointments, talk to the staff in the outpatients department as it may be possible to get hospital transport or help towards travel costs.

At these appointments your continuing recovery will be monitored and you will have your blood tested to check that your blood counts are getting back to normal. Sometimes your blood counts recover more slowly than expected and blood or platelet transfusions may be needed, which are usually given as an outpatient.

Antibiotics and other tablets to prevent viral and fungal infection may be continued for a period of time, usually about three months.

Other drugs that may be needed are anti-sickness drugs, supplements such as potassium and magnesium, and drugs that protect the stomach.

The doctors and nurses are there to help you, so remember to report any new problems or raise any worries you have.

Some months after a stem cell transplant, certain vaccinations to protect against infections will be necessary. This may include vaccinations you have had before. Your doctor will discuss this with you.

If you have had a transplant, you should only receive irradiated blood products, as described earlier. The hospital may give you a card to carry in case of an accident, to help ensure only irradiated blood products are used. Some patients wear MedicAlert® bracelets, particularly if they also have drug allergies.

When the transplant team is satisfied that you are recovering well, you will go back to your local consultant for routine appointments and monitoring.

## Reducing the risk of infection at home

As already mentioned, it can take many months after HDT-ASCT for your blood counts and therefore your immune system and energy levels to recover fully.

During this time, you may need to take precautions at home and when you are out and about, in order to reduce the risk of infection.

Below are some things to remember when recovering at home:

### Food and diet

Your doctor or nurse will advise you regarding any food restrictions. Good common sense is essential with regard to what you should and should not eat. A healthy diet is important to allow your body to recover from the effects of the HDT-ASCT.

Always remember to wash your hands before eating and to keep your kitchen clean. Food should be cooked properly and eaten by the 'use by' dates. You should buy from reputable stores and avoid foods that may have been left out for some time.

### Personal hygiene

You should continue to have a daily bath or shower, and wash your hands before eating, preparing food and after going to the toilet. You should use a clean towel every day and allow your towel to dry before you use it again.

If you have a central line or PICC, make sure you know how to care for it and what you should do if you suspect problems.

It is important to continue to keep your mouth clean and to use any mouthwashes that are prescribed. You may find that it takes a few weeks before your sense of taste returns to normal. Remember to tell your dentist that you have had a transplant before having any dental treatment so they remain vigilant for signs of infection.

For more information see the **Diet and nutrition (AL amyloidosis) Infosheet** from Myeloma UK

## Shingles

Some patients may develop **shingles** in the weeks following HDT-ASCT. Shingles is a virus infection which can begin as a painful or tingling sensation in an area of skin, followed by a rash. The affected area is often the chest or round your middle, but shingles can appear anywhere on your body, including your face, eyes or genitals. The rash appears on one side of your body only.

You can only get shingles if you have had chickenpox in the past. Shingles can be treated with anti-viral drugs. Treatment should be started as soon as possible, so you should get any symptoms checked out quickly.

Pain and fatigue from shingles can sometimes go on for a few weeks or more, which can be difficult to cope with after going through so much treatment.

## Out and about and socialising

In the early period following HDT-ASCT you will be advised to avoid crowded public areas where you could find yourself in a confined space with others (such as buses, trains, pubs and cinemas) to limit your risk of catching an infection.

You are also likely to have to avoid meeting family and friends in person for a time after your HDT-ASCT to reduce your risk of infection. If so, it is good to keep in touch by phone or video call, so you can feel less at a distance from them.

Dust from building work, renovation or decoration may carry a fungus called 'Aspergillus'. It is therefore wise to suspend any work on your house until you get your doctor's approval.

## Pets and gardening

Pets should never be allowed on the table or in areas where food is prepared. Do not handle cat litter trays or dog faeces, as they can be a source of serious infection. When gardening, wear gloves as soil can harbour organisms that could be harmful.

Any cuts you get from gardening must be cleaned thoroughly and dressed if necessary, and you should be vigilant for signs of infection. If a cut does become infected, you may need antibiotic treatment.

## Coping with fatigue

Fatigue is a major issue for many during the recovery period and this may continue for some time. Patients often worry that there is something wrong and are reassured to find that their fatigue is a normal and expected side effect. There is no time limit on fatigue, each patient is different and will recover in their own time, so try not to compare yourself with other patients you see in the clinic. When asked, patients who have had HDT-ASCT, have said it took as much as a year to recover to their pre-transplant health.

Fatigue can also be related to the AL amyloidosis itself and prolonged fatigue can sometimes be because of this rather than the impact of HDT-ASCT. Talk to your doctor or nurse about the fatigue you are experiencing as there may be ways of improving energy levels through treatments or advice on lifestyle such as diet and exercise.

For more information see the **Fatigue (AL amyloidosis) Infosheet** from Myeloma UK

## Work, driving and holidays

You may be uncertain about when you should return to work. It may be possible to go back to work sooner if you can work from home, have a sitting or desk job, or if you are able to start back on a part-time basis. Talk to your doctor or nurse about when it is advisable to return to work, or if you have concerns about any risks there may be within your work or workplace.

It is usually safe to start driving as soon as you feel well enough, but again do check with your doctor.

It is not advisable to plan a holiday outside the UK for six months after HDT-ASCT. You should always inform your doctor about any travel plans before booking a trip and discuss issues such as safety to fly and vaccinations.

When you are on holiday, it is important to use adequate skin protection and avoid prolonged exposure to the sun as your skin will be much more sensitive after high-dose therapy.

For more information see the **Travelling and travel insurance (AL amyloidosis) Infosheet** from Myeloma UK

# Emotional effects of HDT-ASCT

**Treatment with HDT-ASCT from initial discussions to recovery can be a long process and will include ups and downs for patients and their families.**

Each stage of HDT-ASCT can cause a variety of emotions but you may find the period of recovery afterwards brings additional or surprising challenges.

For most patients and their families there is a huge sense of relief when it is over. Adjusting to life after having HDT-ASCT, however, is not always easy. There is often a balance to be struck between dealing with the effects of the treatment whilst trying to return to doing some of the things you have been unable to do for a while.

The side effects of HDT-ASCT, and fatigue in particular, can be very draining, last longer than expected and may make you feel unable to live life as you would like to. It can be frustrating to have months of recuperation, but you should try not to be too hard on yourself or push yourself too far while you are still recovering. Although all patients are different, it is normal for energy levels to take several months to return. As your energy levels increase and other side effects diminish, your mental and emotional wellbeing is likely to improve too.

It is important to regain some 'normality' in your life. However, it may be necessary to modify the type or amount of work you do. It may be an opportunity to make some beneficial changes to your life and for some it can be a positive turning point.

For others the changes are not so easy to come to terms with and it is not uncommon for both you and your family members to have feelings of anger, resentment, depression and anxiety over the unknown future, a sense of a lack of control and knowledge that things will not be the same as before.

The reduction in care and support from your healthcare team can be daunting and may cause a sense of abandonment. However, as you recover over the weeks and months following HDT-ASCT, you will adjust to seeing your healthcare team less

often. They will still be available to support you so if you have any worries or concerns, you should contact them.

## Sources of support

There are a number of things that can be done to help you and your family if you're facing difficulties or challenges during this time.

Seek practical and financial help if you feel you need it. You may be able to talk to your family about how you are feeling, but you may also find it useful to see people outside your immediate family, such as friends, healthcare professionals and support organisations.

Complementary therapies such as relaxation, visualisation and art therapy may also be helpful.

Many patients and carers find speaking to someone who has been through a similar situation comforting and valuable for sharing tips and experiences.

Myeloma UK Support Groups provide the opportunity to meet other patients, carers and family members to share experiences and information in an informal and supportive setting.

There are a number of Support Groups for AL amyloidosis patients and families in different parts of the UK. If there is not a group near you, there may be a myeloma or haematology Support Group you could join.

For up to date information about Support Groups, email **support@myeloma.org.uk** or phone **0131 557 3332**

There is also a Discussion Forum on the Myeloma UK website where you can connect with others affected by AL amyloidosis, post messages to the group, ask questions and help to support each other.

To join the Discussion Forum go to **forum.myeloma.org.uk**

# Long-term effects of HDT-ASCT

**Although HDT-ASCT can be an effective treatment, there are several possible long-term effects, which patients should be aware of when considering this treatment option.**

These include:

- Organ damage – in particular, damage to the lungs can occur in rare cases. Always tell your doctor if you develop symptoms such as breathlessness or a persistent dry cough, or if existing breathing problems get worse
- Eye changes – your eyes may become dry and irritated, and eye drops can help with this. You may also have more chance of developing a cataract, and it is important to have your eyes checked regularly
- Infertility – see page 27 for further information
- Second cancers – all chemotherapy drugs work by damaging the **DNA** in cells and can potentially cause second or new cancers. Although very effective against abnormal plasma cells, melphalan used in the high-dose therapy can also damage normal cells. While most normal cells are able to repair the damage, occasionally the damage cannot be repaired causing these cells to become cancerous

# How do I know if my treatment has worked?

**The aim of treatment is to destroy the abnormal plasma cells in order to prevent the build-up of further amyloid deposits in the organs.**

Over time, the body may then be able to break down existing amyloid deposits resulting in a gradual improvement in organ function, reduction in symptoms and improvement in quality of life.

To find out how a patient is responding to treatment, several tests will be carried out on a regular basis. These tests may vary from patient to patient, but generally will include regular blood and urine tests and occasional bone marrow aspirates and SAP scans. The earliest sign that treatment may be working is a fall in the free light chain level measured by the Serum Free Light Chain Assay.

For more information see the **Serum Free Light Chain Assay (AL amyloidosis) Infosheet** from Myeloma UK

There are two main ways that response to treatment is measured:

- Haematological response measures the response of the free light chains (and **paraprotein** level, when present) to treatment
- Organ response looks at whether the function of organs affected by amyloid has improved following treatment

There is nearly always a substantial delay between the haematological response and the organ response. A combination of patient symptoms, blood tests and imaging tests may be used to assess the function of different organs affected by AL amyloidosis. Appendix 1 on page 51 shows how haematological and organ response to treatment are measured.

# Future directions

**High-dose therapy and stem cell transplantation is an effective treatment for selected AL amyloidosis patients and research is ongoing to make the transplant procedure as safe and effective as possible.**

The place of the procedure as an option alongside other treatments continues to be investigated.

The safety of HDT-ASCT has improved greatly over time, particularly due to careful selection of suitable patients, Clinicians and researchers are continuing to refine this selection process. At the same time newer and highly effective drug treatments for AL amyloidosis continue to be developed, and these may be a better option for many patients. Large-scale studies comparing HDT-ASCT with these newer drug combinations are needed.

The timing of HDT-ASCT is also an area of research. It has been found that some patients who are not well enough to undergo HDT-ASCT when they are diagnosed, may improve after drug treatment. These patients may then be well enough to undergo HDT-ASCT at a later stage.

An early stage clinical trial is looking at using targeted radiotherapy to replace the high-dose chemotherapy in the HDT-ASCT process. The targeted radiotherapy is designed to target the bone marrow directly, so avoiding exposure of healthy organs to radiation. The aim is to destroy the abnormal plasma cells effectively, but with less severe side effects.

A number of centres (including the National Amyloidosis Centre) have followed up their HDT-ASCT patients over many years, to get insights into all aspects of the treatment (patient selection, treatment procedures, and the patients' outcomes). This research has been very important in the continued development of HDT-ASCT over the past decades.

# Questions for your doctor/medical team

**It can be helpful to write your questions down and give a copy to your doctor at the start of your consultation. You might want to carry a piece of paper with you so you can make a note of questions as they occur to you.**

These are some questions that you may want to ask your doctor or healthcare team, so that you can understand what HDT-ASCT means for your situation:

- What are the objectives of the treatment?
- What exactly does this treatment involve?
- Why are you recommending this treatment for me?
- How long will the entire treatment take (from referral to recovery)?
- What are the alternatives to this treatment?
- How ill might I feel before, during and after treatment?
- What about side effects? What will they be? How long will they last? What is the likelihood of getting them? Are they serious? What can be done to treat side effects?
- In the event of relapse, what would the options be, recognising that they may change in the future?
- Which doctor will be responsible for my care whilst I am having the transplant?
- Will I see my consultant during this time?
- How can I best prepare myself for a transplant?

# Medical terms explained

**AL amyloidosis:** A condition in which abnormal proteins are deposited in the tissues and organs of the body, disrupting their function and causing symptoms.

**Allogeneic:** A word used In transplants to mean taken from a donor.

**Allogeneic stem cell transplant:** A procedure in which stem cells from a compatible donor (usually a sibling) are given to the patient following high-dose chemotherapy.

**Ambulatory care:** medical care provided on an outpatient basis.

**Amyloid:** An abnormal protein that is deposited in tissues and organs.

**Amyloidosis:** A group of conditions where an abnormal protein called amyloid is produced.

**Anaemia:** A condition in which the amount of haemoglobin in the blood or the number of red blood cells is below the normal levels, causing shortness of breath, weakness and tiredness.

**Anaesthetic:** A type of drug used to temporarily reduce or take away sensation so that otherwise painful procedures or surgery can be performed. A general anaesthetic makes the patient unconscious and therefore unaware of what is happening. A local anaesthetic numbs the part of the body that would otherwise feel pain.

**Antibiotic:** A drug used to prevent or treat an infection caused by bacteria.

**Antibodies (immunoglobulins):** Proteins found in the blood produced by cells of the immune system, called plasma cells. Their function is to bind to substances in the body that are recognised as foreign, such as bacteria and viruses, enabling other cells of the immune system to destroy and remove them.

**Anti-emetic:** A type of drug used to prevent or minimise nausea and vomiting.

**Apheresis:** A procedure used to collect stem cells from the blood using a machine which separates the stem cells and returns the remainder of the blood components to the patient or donor.

**Autologous:** Something taken from and given back to the same person. For example, in an autologous stem cell transplant the patient's own stem cells are given back to them.

**Autologous stem cell transplant:** A procedure in which a patient's own stem cells are collected, stored and then given back following high-dose chemotherapy.

**Autonomic neuropathy:** A group of symptoms caused by damage to the nerves that control the internal organs.

**Bence Jones proteins:** Free light chains that have been filtered from the blood by the kidneys and are found in the urine. The presence of any Bence Jones protein in urine is abnormal.

**Biopsy:** The removal of a sample of living tissue for examination.

**Blood count:** The number of red blood cells, white blood cells and platelets in a sample of blood.

**Bone marrow:** The soft, spongy tissue in the centre of bones that produces blood cells.

**Bone marrow aspirate:** A procedure to remove a sample of fluid and cells from the bone marrow for examination and testing.

**Bone marrow biopsy/trephine:** A procedure to remove a small sample of bone marrow tissue (for examination under a microscope).

**Bortezomib (Velcade®):** A proteasome inhibitor drug which is given either as an intravenous infusion or subcutaneous injection.

**CD34+ blood test:** A test used to measure the number of stem cells in the blood.

**Central line:** A catheter (tube) which is inserted under the skin in the chest into a large vein just above the heart. It can be kept in for several months and is used to administer treatments and to take blood samples. Also known as a Hickman® line or a central venous access device.

**Chemotherapy:** A type of drug intended to kill cancer cells. Chemotherapy drugs can be injected into a vein (intravenous or IV) or swallowed as tablets (orally).

**Clean diet:** A diet sometimes recommended for people who have a compromised immune system. Excludes 'higher risk' foods e.g. soft cheeses, live yogurts and pâté.

**Conditioning treatment:** Treatment with high-dose chemotherapy and/or radiotherapy before a stem cell transplant, to kill myeloma cells.

**cTnT:** A protein which is released into the blood when the heart muscle is damaged.

**Cyclophosphamide:**
A chemotherapy drug which is given orally or as an intravenous infusion.

**Dexamethasone:** A steroid which is given orally or as an intravenous infusion.

**Difference Free Light Chain (dFLC):**
A measurement which calculates the difference between the amounts of normal and abnormal light chains in the blood. This is one way of reporting the results of the Serum Free Light Chain Assay. It can be used to monitor the response to treatment.

**Dimethyl sulphoxide (DMSO):**
A chemical used to preserve and store collected stem cells.

**DNA (deoxyribonucleic acid):**
The material inside every cell of a living organism that carries all the instructions the organism needs to grow, reproduce and function. DNA is organised into genes.

**Echocardiogram (Echo):**
A procedure which uses high frequency sound waves (ultrasound) to create images of the heart and surrounding tissues.

**Electrocardiogram (ECG):** A test used to detect and record the electrical impulses that the heart uses to make it beat.

**Endoscopy:** A procedure that looks inside hollow organs (e.g. the colon) using a small camera attached to a tube. Can also include taking a biopsy using a tool fitted to the end of the tube.

**Engraftment:** The process, following HDT-ASCT, by which transplanted stem cells travel to the bone marrow, where they begin to grow and develop into new blood cells.

**Free light chain:** A molecule which normally makes up part of an antibody. Called 'free' light chain when it is not attached to the rest of the molecules that make up the antibody.

**Gastrointestinal:** The term used to refer collectively to the stomach, small and large intestine.

**Granulocyte-colony stimulating factor (G-CSF):** A growth factor which is used to stimulate the production of stem cells.

**Growth factor:** A protein produced by the body that stimulates the development and growth of cells. Growth factors can also be made synthetically and given as a treatment in some circumstances.

**Hickman® catheter/line:** The brand name for the catheter (tube) which is inserted under the skin in the chest into a large vein just above the heart. It can be kept in for several months and is used to administer treatments and to take blood samples. Also known as a central line and a central venous access device.

**High-dose therapy:** Treatment with high doses of chemotherapy given intravenously, usually via a central line (such as a Hickman® line or a PICC line), or a PICC line, prior to patients receiving healthy stem cells as part of the stem cell transplantation procedure. Also known as conditioning treatment.

**Immune system:** The complex group of cells, tissues and proteins (including antibodies), that protect the body against infection and disease.

**Immunocompromised:** The term used to describe a person whose immune system is impaired and unable to fight infection or disease as normal.

**Immunoglobulins (antibodies):** See "Antibodies (immunoglobulins)"

**Induction treatment:** The initial standard-dose chemotherapy that patients may receive before a stem cell transplant procedure. it aims to reduce the amount of abnormal plasma cells in the bone marrow before the stem cells are collected.

**Intravenous:** Into a vein.

**Light chain:** The smaller of two components that make up the structure of antibodies (or immunoglobulins). There are two types of light chain, kappa and lambda.

**Melphalan:** A chemotherapy drug which is given orally or intravenously.

**Mucositis:** Pain and inflammation of the lining of the mouth and/or gastrointestinal tract.

**Myeloma (multiple myeloma):** A cancer of the bone marrow caused by abnormal plasma cells which results in bone damage, low blood cell counts, increased infections and kidney damage.

**NT-proBNP:** A protein which is released into the blood when the heart muscle is damaged.

**Paraprotien:** An abnormal antibody (immunoglobulin) sometimes produced in AL amyloidosis. Measurements of paraprotein in the blood can be used to diagnose and monitor the disease. Also known as M protein.

**Peripherally Inserted Central Catheter (PICC) line:** A catheter (tube) inserted into one of the large veins of the arm (or leg) and threaded into the vein until the end sits in a large vein just above the heart. It is used to administer treatments, commonly chemotherapy.

**Plasma cells:** A type of white blood cell that produces antibodies (immunoglobulins) to fight infection.

**Platelets:** A type of blood cell involved in blood clotting.

**Plerixafor (Mozobil®):** A drug used to help mobilise stem cells from the bone marrow into the blood.

**Red blood cells:** A type of blood cell which transports oxygen around the body.

**Relapse:** The point where disease returns or becomes more active after a period of remission.

**Remission:** The period following treatment when abnormal plasma cells are not producing free light chain, and treatment is not needed.

**Serum Free Light Chain Assay:** A test used to detect and measure the amount of free light chains in the blood.

**Shingles:** An infection of a nerve area caused by the same virus which causes chickenpox. Symptoms include painful skin rash. Shingles can affect adults with a weakened immune system, who have previously had chickenpox.

**Side effects:** The undesired effects caused by a drug or treatment, for example fatigue or nausea.

**Stem cell:** A type of cell from which a variety of cells develop. Haematopoietic stem cells give rise to red blood cells, white blood cells and platelets. They are harvested and collected for stem cell transplantation.

**Stem cell mobilisation:** The process by which the number of stem cells in the bone marrow are increased, so that they 'spill over' into the blood, where they can be easily collected and stored. Mobilisation can be achieved by G-CSF, cyclophosphamide and plerixafor.

**Stem cell transplant:** The infusion of healthy stem cells into the body. This allows the bone marrow to recover and renew its blood-forming capacity following the administration of high-dose chemotherapy.

**Steroid:** A group of hormonal substances produced by the body. They are also produced synthetically and used to treat many conditions.

**Subcutaneous:** Under the skin.

**Supportive treatment:** Treatment intended to relieve symptoms and complications, or the side effects of treatment, rather than treating the underlying disease.

**Thalidomide:** An immunomodulatory drug which is given orally.

**White blood cells:** A type of blood cell involved in the body's immune system, which help to fight infection and disease.

# Appendix 1: Measuring response to treatment

| Response | Criteria |
|---|---|
| Complete haematological response | Normal free light chain levels<br>Normal free light chain ratio<br>No detectable paraprotein in the blood<br>No detectable light chain in the urine |
| Very good partial response | A reduction in the difference free light chain (dFLC) to below 40 mg/L. If the dFLC cannot be used reduction in paraprotein is used instead |
| Partial response | At least 50% reduction in the dFLC |

**Table 1.** Measuring the haematological response to treatment

| Organ | Improvement | Worsening (also called progressing) |
|---|---|---|
| Kidneys | At least a 50% reduction in 24-hour urine protein loss (if urine protein was greater than 0.5 g/day before treatment) **or** Less than 25% worsening of creatinine and creatinine clearance | At least a 50% increase in 24-hour urine protein loss (at least 1 g/day) **or** At least a 25% worsening of serum creatinine or creatinine clearance |
| Heart | Results of specialised blood test called NT-proBNP show a response: >30% and 35 pmol/L decrease in patients with baseline NT-proBNP ≥77 pmol/L **or** A decrease by at least two points in NYHA classification in patients with baseline NYHA class 3 or 4 (see Appendix 2 on next page) | Results of specialised blood test NT-proBNP show a worsening/progression: >30% and >35 pmol/L increase **or** Results of a specialised blood test show cardiac troponin (cTnT) has increased by at least 33% **or** At least a 10% decrease in **ejection fraction** |
| Liver | At least a 50% improvement in liver function tests (decrease in abnormal alkaline phosphatase value) and reduction in liver size by at least 2cm | At least a 50% worsening in liver function tests (increase in abnormal alkaline phosphatase value) |
| Nervous system | Improvement in tests used to detect nerve injury called electromyogram or nerve conduction velocity | Worsening in tests used to detect nerve injury called electromyogram or nerve conduction velocity |

**Table 2.** Measuring organ response

# Appendix 2: New York Heart Association (NYHA) classification of cardiac (heart) involvement

| Stage | Criteria |
|---|---|
| Class 1 | No symptoms from ordinary activities |
| Class 2 | Some symptoms from ordinary activities – comfortable at rest or with mild exertion |
| Class 3 | Marked symptoms from ordinary activities – comfortable at rest only |
| Class 4 | Confined to bed or chair, any activity causes discomfort |

**Table 3.** Classification of cardiac involvement

# Useful organisations

**Carers UK** **www.carersuk.org**
**0808 808 7777**
Provides advice, information and support for carers.

**Citizens Advice** **www.citizensadvice.org.uk**
England: **0800 144 8848** Wales: **0800 702 2020**
Scotland: **0800 028 1456** Northern Ireland: **0800 915 4604**
Offers advice about debt and consumer issues, benefits, housing, legal matters and employment.

**Mind** **www.mind.org.uk**
**0300 123 3393**
Provides advice and support for anyone with mental health problems.

**National Amyloidosis Centre (NAC)** **www.ucl.ac.uk/amyloidosis/national-amyloidosis-centre**
**020 7433 2725**
The NAC is the only centre in the UK specialising in amyloidosis. It is based at the Royal Free Hospital in London, and is part of University College London.

**NHS 111 Service** **www.nhs.uk/111**
**111**
Call 111 when you need medical advice fast but it's not a 999 emergency. NHS 111 is available 24 hours a day, 365 days a year.

**Samaritans** **www.samaritans.org**
**116 123**
Listening and support free, 24 hours a day, to anyone who's struggling to cope.

# We're here for everything a diagnosis of myeloma brings

Call our **Myeloma Infoline** on **0800 980 3332** for practical advice, emotional support and a listening ear.

Get answers to your questions by emailing **AskTheNurse@myeloma.org.uk**

Learn about AL amyloidosis from experts and meet other patients at our **Patient and Family AL amyloidosis Infodays**.

Order or download our **information booklets**, which cover all aspects of AL amyloidosis – call **0800 980 3332** or visit **myeloma.org.uk/publications**

Join your nearest **AL amyloidosis Support Group** to meet up and talk to other people face to face.

Visit **myeloma.org.uk**, a one-stop-shop for information on AL amyloidosis; from news on the latest research and drug discovery to articles on support, treatment and care.

Watch **Myeloma TV**, videos about AL amyloidosis presented by experts.

Use the **Discussion Forum** for the opportunity to share experiences and advice about living with AL amyloidosis.

# We need your help

**Thanks to our generous supporters we are able to provide information and support to patients and their families, as well as fund vital research that will help patients live longer and with a better quality of life.**

Myeloma UK receives no core government funding. We rely on fundraising activities and donations.

You can support Myeloma UK by:

- **Making a single donation or setting up a Direct Debit**
  Online at **myeloma.org.uk/donate**
  Over the phone **0131 230 0429**
  Or by posting a cheque payable to **Myeloma UK** to:
  Myeloma UK, 22 Logie Mill, Beaverbank Business Park, Edinburgh, EH7 4HG
- **Fundraising** – fundraising is a positive way of making a difference and every pound raised helps. As AL amyloidosis is rare and relatively unknown, fundraising is also a great way to raise awareness
- **Leaving a gift in your will** – legacies are an important source of income for Myeloma UK and help us to continue providing practical support and advice to AL amyloidosis patients and their families.

However you decide to raise funds, our Fundraising Team is here to support you. Contact us on **0131 230 0429** or email **fundraising@myeloma.org.uk**

**Nobody ever forgets the moment they are diagnosed. Myeloma UK advances the discovery of effective treatments, with the aim of finding a cure. That is what patients want, it's what they deserve and it's what we do.**

Judy Dewinter – President, Myeloma UK

We appreciate your feedback. Please fill in a short online survey about our patient information at **myeloma.org.uk/pifeedback** or email any comments to **patientinfo@myeloma.org.uk**

For a list of references used to develop our resources, visit **myeloma.org.uk/references**

Treatments and tests in AL amyloidosis Infoguide:
High-dose therapy and autologous stem cell transplantation

MyelomaUK

## We're here for everything a diagnosis of AL amyloidosis brings

Get in touch to find out more about how we can support you

Call the Myeloma Infoline on
**0800 980 3332**

Email Ask the Nurse at
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Visit our website at
**myeloma.org.uk**

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