High-dose therapy and autologous stem cell transplantation
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Disclaimer: The information in this publication is not meant to replace the advice of your medical team. They are the best people to ask if you have questions about your individual situation.

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

Infoline: 0800 980 3332
Basic facts

Amyloid can build up in the kidneys, heart, liver, spleen, nerves, or digestive system

Amyloid can affect two or more organs at the same time

AL amyloidosis does not affect the brain

AL amyloidosis is a relatively rare condition, with approximately 500 - 600 people diagnosed in the UK each year
What is AL amyloidosis?

The term ‘amyloidosis’ is a general term used for a group of conditions where an abnormal protein, called amyloid, accumulates in the tissues. The build-up of amyloid protein is called an ‘amyloid deposit’ which 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).

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.

Figure 1. Immunoglobulin structure
AL amyloidosis and myeloma

Although the amyloid deposits in AL amyloidosis are not themselves cancerous, the disease may occasionally be associated with myeloma (a plasma cell cancer).

You may have been diagnosed with AL amyloidosis alone or, less commonly, you may have developed AL amyloidosis after being diagnosed with myeloma. It is rare, but possible, for someone diagnosed with AL amyloidosis to later develop myeloma in addition to their AL amyloidosis.

Regardless of whether or not a patient has myeloma associated with their amyloidosis, the treatments for AL amyloidosis are similar to those for myeloma.

For more information about myeloma, see Myeloma An Introduction from Myeloma UK
Treatment of AL amyloidosis – the basics

Treatments for AL amyloidosis can be effective at controlling the condition, reducing symptoms and improving quality of life. Unfortunately, though, there is no cure for AL amyloidosis.

In general, treatment is given to:

- Reduce the levels of abnormal plasma cells responsible for producing the amyloid protein, as far as possible
- Prevent further tissue or organ damage
- Control the AL amyloidosis if it has come back again (relapse)
- Improve quality of life
- Prolong life

Treatment for AL amyloidosis is often most effective when two or more drugs, with different but complementary mechanisms of action, are given together.

In the past the number of treatment options for AL amyloidosis was somewhat limited, but with the development of newer treatments in the last couple of decades, there are now more options available.

Before starting treatment, each option must be considered carefully so that the benefits of treatment are weighed against the possible risks of side-effects.

In most patients, overall health, age, fitness and any previous treatments will be taken into account.

The length of treatment varies depending on the type of treatment(s) being used and the stage at which the treatment is being given. Treatment is usually given over a number of weeks which may or may not be followed by a rest period. This pattern constitutes one cycle of treatment and a series of treatment cycles is referred to as a course of treatment.
The principle behind stem cell transplantation

Treatment of AL amyloidosis involves the use of chemotherapy, steroids and other drugs such as thalidomide, bortezomib (Velcade®) and lenalidomide (Revlimid®).

**Standard chemotherapy**, such as that used in combination with thalidomide and/or **steroids** is an effective way of treating AL amyloidosis. In the majority of cases these combination treatments are relatively easy to administer and can often be taken at home.

However, a major drawback of chemotherapy is that it is not safe to give in high doses. This is because high doses of chemotherapy kill 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 (HDT) and stem cell transplantation (SCT)** offers a solution to this problem. HDT-SCT 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. This is called **autologous stem cell transplantation**.

HDT-SCT 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 fewer than two organs affected by amyloid.

Figure 2 outlines the stem cell transplant process. This is explained later on in more detail, starting on page 12.
The whole process of HDT-SCT can take several months. The table overleaf outlines the time it may take for the steps involved in the stem cell transplant. This will be explained in more detail later on.

**Figure 2.** Steps involved in high-dose therapy and autologous stem cell transplantation
Table 1. The HDT-SCT process

**1-2 Weeks**
- Mobilisation, collection and storage of stem cells

**2-3 Weeks**
- Treatment with high-dose chemotherapy
- Recovery of bone marrow function
- Stem cells returned to the blood (transplant) and restored in the bone marrow (engraftment)

**Variable, typically 3-6 Months**
- General recovery, supportive care, regular outpatient appointments
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 are mainly found in the bone marrow and have the capacity to divide and develop into the three main types of cell found in the blood: red blood cells, white blood cells and platelets. Stem cells can also divide to produce new stem cells, which maintains the supply of these vital cells. Each of the types of blood 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 function of the stem cells, their ability to divide into blood cells (see Figure 3), and the fact that they can be collected safely, that makes HDT-SCT a possible treatment option for AL amyloidosis patients.

**Figure 3.** Bone marrow – responsible for production of blood cells
What are the possible advantages and disadvantages of HDT-SCT?

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

The potential advantages of HDT-SCT include:

- Achieving a longer remission period than when using standard-dose chemotherapy
- The potential for improvement in quality of life after the transplant as less residual disease means production of amyloid is reduced. Over time, the body may then be able to break down the existing amyloid deposits resulting in gradual improvement in organ function and symptoms

Nonetheless, HDT-SCT 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-SCT
- The success of this or any other treatment cannot be guaranteed, as not all patients will achieve the desired response
- HDT-SCT is unable to cure AL amyloidosis; most people will have recurrence of their disease over time
- The effects of HDT-SCT 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
What are the criteria for HDT-SCT?

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 there are a number of criteria that patients should meet before undergoing this treatment.

HDT-SCT may be considered in selected AL amyloidosis patients, including those who have:

- No significant heart involvement
- Fewer than two organ systems affected by amyloid
- Adequate kidney function, not requiring dialysis
- Not had a good response to initial treatment

HDT-SCT is not recommended in patients with any of the following:

- Evidence of amyloid deposits in the heart (shown by the NT-proBNP and cTnT test results)
- Amyloid deposits in the nervous system causing autonomic neuropathy
- Previous bleeding in the gastrointestinal tract caused by amyloid
- Kidney failure requiring dialysis
- Age over 70 years
- More than two organ systems affected by amyloid
HDT-SCT – the process

The whole process, from the initial discussion with your doctor to recovery after the transplant, can take several months and may seem like a daunting prospect. Therefore, you may find it easier to prepare for and take each stage of the process as it comes rather than all together.

What follows is an overview of the various stages involved in the transplant process.

Considering the options and making a decision

The process begins with looking at your treatment options and making a decision to have the transplant. The option of HDT and SCT may sometimes be broached by your doctor quite soon after diagnosis, whilst you are still learning about your disease. For others, it may be discussed a little later, when initial chemotherapy treatment is underway, after your first treatment has finished, or when the AL amyloidosis has started to come back.

When considering the option of HDT-SCT, 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 will 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-SCT 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. You must be sure that this is the right treatment for you before giving your consent.

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.

Although there is no rigid age cut-off for this procedure, it is not generally recommended in patients over the age of 70. This is primarily because the possible benefits are often outweighed by the potential risks to older and/or less fit patients.

In those patients who, for whatever reason, are not able to have this procedure, the best and most appropriate alternative treatment options will be discussed.

**Pre-transplant investigations and procedures**

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

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, so that you are able
to make an informed decision. It may also be possible to meet the nursing staff and look around the transplant department, which can help to relieve some of the anxieties you may face about having the transplant.

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 SCT.

You may be able to have all your tests and investigations done on the same day or you might have to make more than one visit to the hospital to get them all completed.

**Bone marrow biopsy** involves putting a needle into a bone (usually your hip bone) to get a small sample of the bone marrow. This is done under local anaesthetic and you may also choose to have a light sedative. This sample is then examined to establish the presence of abnormal plasma cells in your bone marrow.

**Blood tests** 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.

The **Serum Free Light Chain Assay** measures the amount of **free light chains** in your blood and/or urine. The **difference Free Light Chain (dFLC)** indicates the difference between the amounts of involved (amyloid-forming) light chains and the non-involved light chains in your blood.

**24-hour urine collection** tests the function of your kidneys. For this test you will be given a large bottle to collect all the urine you pass for 24 hours.

**Lung function tests** 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** is a simple X-ray of your chest which serves as a baseline to compare with future X-rays.

**Endoscopy** examination with biopsy may be used to determine amyloid deposition in the gastrointestinal (GI) tract. Clinical experience has shown that patients with amyloid deposition in the GI tract are at higher risk of complications during HDT-SCT.

**ECG (electrocardiogram)** is a trace of your heart rhythm. A series of electrodes (like sticky plasters) will be placed on your chest, ankles and wrists. A graph of the electrical currents in your heart is printed on a long strip of paper.

Again, this test is not painful, but you will need to lie still for 5 – 10 minutes.

**Central venous catheter insertion**

During your transplant you will need a number of **intravenous** drugs, infusions, 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 venous catheter is a flexible, hollow tube, which is inserted into a large vein in your chest. The catheter is tunnelled under the skin,
so that while it exits the skin around 5 – 10 centimetres below the collarbone, the tip of the catheter actually sits in one of the large veins that lead into your heart. The catheter has a cuff under the skin that stops it falling out, and it will also be secured initially with a couple of stitches. You may hear the line being called a HICKMAN® catheter/line, a GROSHONG® catheter/line or a central line (see Figure 4). We will use the term central line throughout this publication when referring to either of the two catheters.

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
- 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

The majority of patients will have a central line but some may prefer to have a PICC (peripherally inserted central catheter) line instead. A PICC line is inserted in 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 4. Central line
Induction chemotherapy

Induction chemotherapy is the term used to describe the initial standard-dose chemotherapy that can be given which aims to reduce the abnormal plasma cells before the stem cells are collected.

However, many AL amyloidosis patients going through the HDT-SCT procedure do not receive induction chemotherapy, as it is not deemed necessary for the majority of patients. If you are to receive induction therapy this will be explained to you by your doctor or nurse.

Induction combinations used in the UK include, cyclophosphamide, bortezomib and dexamethasone (which can be referred to as CVD or CyBorD), or cyclophosphamide, thalidomide and dexamethasone (referred to as CTD).

For more information on any of the above named drugs, visit www.myeloma.org.uk/amyloidosis
Stem cell mobilisation

In preparation for HDT-SCT, you must first have an adequate amount of stem cells collected from your blood.

Normally the levels of stem cells present in the blood are very low and to collect enough for a transplant, it is necessary to have treatment to increase the number of stem cells being produced and to stimulate their release from the bone marrow into the blood. This process, known as 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

G-CSF injections can cause side-effects for some patients. The most common side-effect is flu-like symptoms (fever, aches and joint pain). These symptoms are temporary and should disappear when the injections stop. It may be necessary to take pain-killers to relieve the joint pain.

Mobilisation with a chemotherapy drug and growth factor

Although it is possible to mobilise stem cells using G-CSF alone, a cycle of a chemotherapy drug, usually cyclophosphamide, is sometimes given before the G-CSF injections.

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 required number of stem cells.

G-CSF is given consecutively over approximately 10 days when used after cyclophosphamide treatment.

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, but they usually resolve quickly. The side-effects associated with G-CSF are described above.

Mobilisation with a combination of growth factor and plerixafor

Although attempts to mobilise stem cells with G-CSF and cyclophosphamide are successful in the majority of patients, a small proportion of patients fail to collect enough stem cells required for a transplant.
If so, you may benefit from a new drug called plerixafor (also known as Mozobil®) which works by disrupting the way stem cells are anchored to the bone marrow. This results in the release of stem cells from the bone marrow and in combination with G-CSF greatly improves the amount in blood.

Plerixafor can only be used if you:

- Have failed a previous attempt at collecting a sufficient number of stem cells
- 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
- Are deemed to be a poor mobiliser based on your previous treatments e.g. if you have previously received melphalan

If you are eligible to receive plerixafor you will first be given the G-CSF injections daily for four consecutive days. On the fourth day you will also be given a subcutaneous injection of plerixafor before the stem cells are collected on the fifth day. If the number of stem cells collected at this stage is not enough, you will be able to have a further three separate attempts at collection. Before each attempt, you will receive the same G-CSF and plerixafor injection schedule as described above.

**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 of 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 may be taken. This blood test is called a CD34+ blood test and is performed towards the end of the course of G-CSF treatment. CD34+ is the technical name given to surface markers on the stem cell. It allows the number of stem cells 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 5).

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-SCT and other treatment options for the future would be discussed.

Figure 5. Apheresis or stem cell collection
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.

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-SCT or be treated for some or all parts of it as an outpatient.

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.

Different scenarios are being trialled for outpatient care (ambulatory care) during the HDT-ASCT process, for example:

- patients staying at home (or a self-catering flat in the hospital grounds if they live at a distance) but admitted to hospital a few days after having their stem cells returned

- patients staying in a hotel or self-catering accommodation nearby to the hospital for the entirety of the process, attending the hospital as an outpatient on a regular basis (possibly daily) for treatment and tests patients staying at home for the entirety of the HDT-SCT process, attending the hospital as an outpatient regularly (possibly daily) for treatment and tests

Patients being treated as an outpatient can be admitted to hospital at any time throughout the HDT-SCT process, for example in the case of an infection or other side-effects developing.

Being treated as an outpatient for some or all of the HDT-SCT process is becoming more common in the UK, although it is by no means the norm for every patient and it is dictated by many factors.
Receiving the high-dose therapy

In most cases, you will receive HDT followed by a transplant of your stem cells within 4 – 6 weeks of your stem cell collection.

The HDT is a chemotherapy drug called melphalan given intravenously, usually via the central line. Before receiving the HDT, 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.

Common side-effects of HDT

Nausea and vomiting
When you begin your HDT 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 HDT. 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 HDT.
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 HDT 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 and inspecting your mouth for signs of infection. If the mucositis is painful, you may require pain-killers and your doctor or nurse will assess and review this on a daily basis.

**Altered taste and smell**

The HDT 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.

**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.
Having your stem cells returned – the transplant

Within a day or so of receiving the HDT, you will need to have your stem cell transplant in order 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 and may include nausea and vomiting, abdominal cramping, feeling chilled and experiencing an unusual odour and taste of garlic or sweetcorn. In rare cases, the infusion may cause low blood pressure, a fast heart rate and shortness of breath.

Medicines 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 and until this time you will remain 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.
Very rarely, stem cells do not engraft well and this is apparent in prolonged low blood counts. In the event of this happening, 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.

Fresh fruits, vegetables and flowers will not be allowed in your room, as they can carry bacteria and fungi.

Some hospitals recommend that you follow a special diet, which avoids foods that may cause a stomach bug. This diet is known as a ‘clean diet’ and should be discussed with you before admission so that you know what to expect. Most hospitals will have a booklet or factsheet on clean diets.

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. If an infection does occur, you will need intravenous antibiotics. Occasionally an infection can be very serious, sometimes life-threatening.

If you are in hospital during the HDT-SCT process, visitors are usually allowed to come and see you unless they have an infection themselves. All visitors will be asked to wash their hands and wear protective aprons when they come in. There may be restrictions on child visitors – you should ask your doctor or nurse about this.

**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.

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 and emotional support

You will probably find that you lose your hair after the HDT. This happens about 2 – 3 weeks after the melphalan has been given, but your hair should re-grow after 3 – 6 months. Many patients choose to have their hair cut short or shaved before receiving the HDT and/or have a wig fitted before they return home. There are a number of specialist suppliers and their details will be available from your nurse.

If you are an in-patient for your HDT-SCT, whilst you are in the recovery period in hospital, you will usually have a phone and a TV in your room and will be allowed to bring in books, magazines, DVDs, CDs – things to help keep you occupied. You may even be able to use your computer. You should check beforehand what you can bring in – you should avoid too much clutter as this may make it difficult to keep your room clean.

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.
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 allowed 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.

If you have been in hospital for the duration, you may have a mixture of emotions when you are discharged. 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 and symptoms of the side-effects of HDT 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 outpatients’ 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 Medic Alert™ 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-SCT 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 food restrictions and will tell you when to return to normal eating as your blood counts increase. 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-SCT.

Always remember to wash your hands before eating and to keep your kitchen clean. Food should be cooked properly and eaten by the ‘best before’ or ‘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, 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, 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 AL amyloidosis – Diet and Nutrition and Mouthcare Infosheets from Myeloma UK

Shingles – Some people may develop shingles in the weeks following a transplant. Shingles is an infection that results from the re-emergence of the chickenpox virus and can begin as a painful or itchy sensation and rash, often on the chest or back. It can be treated with antiviral drugs, which should be started as soon as possible after shingles is diagnosed.

You can only develop shingles if you have already been exposed to the chickenpox virus, but you may have had few or no signs of infection if this happened when you were a child. You cannot “catch” shingles from contact with someone who has chickenpox.

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 – When you first go home, it is often advised that you avoid crowded public areas, where you are in a confined space with others (such as buses, trains, pubs and cinemas), to limit your chance of catching an infection. Visiting family and friends can be a good way to start getting out
and about, so long as they are free from colds or flu.

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 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.

**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 a transplant, 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-SCT. 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 AL amyloidosis – Fatigue 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. Again, 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-SCT. 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 HDT.

For more information see the AL amyloidosis – Travelling and Travel Insurance Infosheets from Myeloma UK

Your emotions and relationships

Treatment with HDT-SCT from start to finish can put an enormous physical, emotional and financial strain on the whole family.

For most patients and their families there is a huge sense of relief when it is over. Adjusting to life after having HDT-SCT, 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.

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. These feelings can become stronger, especially when support and care is reduced as you are deemed to be ‘on the road to recovery’. All of this can have a big impact on family life.

However, there are a number of things that can be done to help you and your family through this difficult and challenging time.

Seek practical and financial help if you feel you need it. You may be able to talk to your family about your problems 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.

A patient Support Group is another way of sharing your experiences and gaining advice and support by listening to the experiences of others.

As AL amyloidosis is a rare condition, there are few AL amyloidosis-specific Support Groups in the UK. However, you may find a myeloma or general haematology Support Group that meets locally.

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 Group go to [www.myeloma.org.uk/amyloidosis](http://www.myeloma.org.uk/amyloidosis)

**Long-term effects of HDT-SCT**

Evidence suggests patients who have received HDT-SCT, together with the newer treatments available, are living longer and, with better supportive treatment
and care, have an improved quality of life.

However, as survival increases, patients may be at greater risk of some of the more long-term and late effects associated with HDT-SCT.

Although very rare so far, these long-term effects may include:

- **Organ damage** – in particular, damage to the lungs caused by interstitial lung disease as a result of the HDT itself or from recurring chest infections after HDT-SCT.

- **Infertility** – in some cases infertility may occur and you will be offered the choice of having your eggs or sperm stored. Younger women may find that their menstrual cycle is temporarily affected but this normally recovers over time.

- **Second cancers** – all chemotherapy drugs work by damaging the DNA in cells and can potentially cause second or new cancers. Although very effective against myeloma cells, melphalan used in the HDT 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. In AL amyloidosis, second cancers tend to be other blood cancers such as leukaemias and lymphomas.

For more detailed information about living with AL amyloidosis, see the AL amyloidosis – Your Essential Guide from Myeloma UK.
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 the existing amyloid deposits resulting in a gradual improvement in organ function, reduction in symptoms and improvement in quality of life.

In order 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.

Measuring response to treatment

In general, your doctor will measure your response to treatment based on haematological and organ response according to set rules (see Appendix 1).

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 (see Appendix 1).

For more information see the AL amyloidosis - Serum Free Light Chain Assay Infosheet from Myeloma UK
The type of transplant discussed in this publication is called an autologous transplant where the patient’s own stem cells are used.

Another type of transplant called an **allogeneic transplant** may be an option for a very small number of AL amyloidosis patients. This is a donor transplant where the stem cells come from a matched donor, usually a brother or sister. The principle behind an allogeneic transplant is to allow the donor’s immune system to kill any residual abnormal plasma cells. However, the risk of this procedure is that the donor’s immune cells also attack the patient’s healthy cells, leading to **graft-versus-host disease**, which can be serious and potentially life-threatening. This type of transplant is only an option for younger fitter patients who have had a relapse and who have good kidney function.

Allogeneic transplants are rarely used in the treatment of AL amyloidosis so have not been covered here. If you would like more information about allogeneic transplants, call the *Myeloma UK Infoline on 0800 980 3332*. 
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.

Many advances are also being made in supportive care, such as more effective antibiotics and anti-sickness medication, better fatigue management and multidisciplinary support. This may not only make transplants safer, but may also improve quality of life both during and after the procedure.
Questions for your doctor/medical team

When meeting your doctor/medical team, it is often difficult to remember every question you would like to ask.

Below are some questions that you might want to ask in order to fully understand what high-dose therapy and stem cell transplantation means for your individual 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?

Tips

- Write questions down and give a copy to your doctor at the beginning of your consultation.
- Carry a piece of paper with you to write down questions as they occur to you.
- Report any side-effects early to your doctor or nurse.
**Medical terms explained**

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

**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 diseases 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.

**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 (known as antigens), 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 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.

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

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

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

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

Cancer: The term given to a group of diseases in which a type of cell in the body multiplies in an uncontrolled way.

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

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).

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

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.

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

**Ejection fraction**: The amount of blood the heart pumps out each time it beats.

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

**Endoscopy**: A procedure which 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-SCT, 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.

**Graft-versus-host disease (GVHD)**: A complication that can occur after an allogeneic stem cell transplant in which the newly transplanted donor cells attack the patient’s own tissue.

**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, 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 and organs that protect the body against infection and disease.

Immunocompromised: The term used to describe when the immune system is impaired and unable to fight infection or disease as normal.

Immunoglobulins (antibodies): 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 (known as antigens), enabling other cells of the immune system to destroy and remove them.

Intravenous: Into a vein.

Lenalidomide (Revlimid): An immunomodulatory drug.

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.

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 produce antibodies (immunoglobulins) to fight infection.

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

**Quality of life:** A term that refers to a person’s level of comfort, enjoyment, and ability to pursue daily activities. It is a measure of an overall sense of wellbeing.

**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 or plateau (often referred to as stable disease).

**Remission:** The period following treatment when abnormal plasma cells and amyloid are no longer detectable, and there are no clinical symptoms of AL amyloidosis.

**Residual disease:** The term used to describe the low level of abnormal cells that remain after successful treatment.

**Revlimid® (lenalidomide):** An immunomodulatory drug.

**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.
**Standard chemotherapy:**
Treatment with conventional dose chemotherapy which can be given alone or in combination with other drugs.

**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.

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

**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

<table>
<thead>
<tr>
<th>Response</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete haematological response</td>
<td>Normal free light chain levels. Normal free light chain ratio&lt;br&gt;No detectable paraprotein in the blood&lt;br&gt;No detectable light chain (Bence Jones Protein) in the urine&lt;br&gt;No abnormal plasma cells on bone marrow biopsy</td>
</tr>
<tr>
<td>Very good partial response</td>
<td>A reduction in the difference free light chain (dFLC) to below 40mg/l. If the dFLC cannot be used, reduction in paraprotein is used instead</td>
</tr>
<tr>
<td>Partial response</td>
<td>At least 50% reduction in the dFLC</td>
</tr>
</tbody>
</table>

**Table 2. Measuring haematological response**

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

**Table 3. Measuring organ response**
Appendix 2: New York Heart Association (NYHA) classification of cardiac (heart) involvement

<table>
<thead>
<tr>
<th>Stage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>No symptoms from ordinary activities</td>
</tr>
<tr>
<td>Class 2</td>
<td>Some symptoms from ordinary activities – comfortable at rest or with mild exertion</td>
</tr>
<tr>
<td>Class 3</td>
<td>Marked symptoms from ordinary activities – comfortable at rest only</td>
</tr>
<tr>
<td>Class 4</td>
<td>Confined to bed or chair, any activity causes discomfort</td>
</tr>
</tbody>
</table>

*Table 4. Classification of cardiac involvement*
Useful organisations

Carers UK
0808 808 7777
Provides advice, information and support for carers.

Citizens Advice
www.citizensadvice.org.uk
England: 03444 111 444       Wales: 03444 77 20 20
Scotland: 0808 800 9060       Northern Ireland: call your local Bureau
Offers advice about debt and consumer issues, benefits, housing, legal matters and employment.

Mind
0300 123 3393
Provides advice and support to empower anyone experiencing mental health problems.

National Amyloidosis Centre (NAC)
www.ucl.ac.uk/amyloidosis/nac
020 7433 2725
Based at the Royal Free and University College Medical School, London, the NAC is the only centre in the UK specialising in amyloidosis.

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.
Myeloma UK is the only organisation in the UK dealing exclusively with myeloma.

With Myeloma UK you can...

Call the **Myeloma UK Infoline** for practical advice, emotional support and a listening ear:
- **UK:** 0800 980 3332  **Ireland:** 1800 937 773

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

**Download** our information, which covers all aspects of AL amyloidosis – visit www.myeloma.org.uk

Find your nearest **Support Group** to meet up and talk to other people face to face.

Visit **www.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** which hosts videos about AL amyloidosis presented by experts, patients and family members.

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 services 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 government funding. We rely on fundraising activities and donations.

You can support Myeloma UK by:

- **Making a donation**
  - Online at [www.myeloma.org.uk/donate](http://www.myeloma.org.uk/donate)
  - Over the phone 0131 557 3332
  - Or by posting a cheque payable 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. However you decide to raise funds, our Fundraising Team is here to support you. Contact us on 0131 557 3332 or email fundraising@myeloma.org.uk

- **Leaving a legacy** – gifts from Wills are an important source of income for Myeloma UK and will help us to continue providing practical support and advice to myeloma patients and their families. They also help us to undertake research into the causes of AL amyloidosis and investigate new treatments
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 – Chairman, Myeloma UK
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Myeloma UK thanks Dr Julian Gillmore and Dr Ashutosh Wechalekar for their invaluable help and advice in the compilation of this publication.
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