Neutropenia means that you don’t have enough neutrophils (a type of white blood cell) in your blood. White blood cells are important in fighting infections. Many people with lymphoma are affected by neutropenia at some point during their illness. This information is for people who are neutropenic. Neutropenia is a common side effect of treatment for lymphoma. You may also be neutropenic if you have lymphoma in the bone marrow.

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What is neutropenia?

If you have neutropenia, doctors say that you are ‘neutropenic’. Having neutropenia means having a low number of neutrophils (a type of white blood cell) in your blood.

There are several different types of white blood cells, including neutrophils and lymphocytes. They work in different ways but they are all a part of our body’s immune system, which fights infections. White blood cells, including neutrophils, are made in the bone marrow (the spongy centre of some of our bones). They circulate throughout the body in the bloodstream and the lymphatic system. The bone marrow is working all the time to make new white blood cells. When you have an infection, it works even harder to make enough white blood cells to fight the infection.
You are more likely to get infections if you are neutropenic. How likely you are to develop an infection depends on how low your neutrophil levels are. If they are only slightly below your normal level, your risk of infection will not increase much. The odds of infection go up as your neutrophil levels go down.

**How many neutrophils should I have?**

The number of neutrophils in your blood is measured by a test called a full blood count (FBC). Doctors talk about a ‘range’ of normal results because some people naturally have a higher or lower number of cells than others. Ranges can also vary between groups of people (for example, between ethnicities) and different hospitals use slightly different ranges. Your doctor will be able to tell you what is considered to be a normal level.

A general guide is:

- slightly low neutrophils (1.0–2.0) – little change in your risk of infection
- low neutrophils (0.5–1.0) – slightly higher risk of infection
- very low neutrophils (0.2–0.5) – infections common
- extremely low neutrophils (up to 0.2) – infections likely.

Your doctor will probably say something like, ‘more than 2 is normal’. The ‘2’ means that there are 2,000 neutrophils in every millilitre (mL) of your blood. If you have a neutrophil count of 0.5, this means you have 500 neutrophils in every mL of your blood.

You can find out more about blood tests and the full blood count on our website at [www.lymphomas.org.uk](http://www.lymphomas.org.uk). You can also print this information at home or ask our helpline to send you a copy. Please email information@lymphomas.org.uk or ring 0808 808 5555.

**Why are neutrophils important?**

Neutrophils are a type of white blood cell. White blood cells are particularly important in fighting infections.

While neutrophils are fighting an infection, they may cause a reaction in the surrounding area. For example, the skin around a cut can become inflamed (red or swollen). It might feel very sore, even without this inflammation. You might see some leftover material from the destroyed bacteria building up as an abscess (pus). These are signs that neutrophils have been fighting an infection.

If you have a low number of neutrophils, it will be harder for you to fight infections and you may need treatment for the infection.
Why are people with lymphoma more at risk of infection?

There are various reasons your risk of infection is higher if you have lymphoma.

Lowered immunity

Lymphocytes, which are another type of white blood cell, become cancerous with lymphoma. This stops them from working properly as part of the immune system. Neutropenia (caused by lymphoma in the bone marrow or treatments such as chemotherapy) can also lower your immunity. If you have had a splenectomy (an operation to remove your spleen), your risk of getting certain infections is higher. This is because the spleen is involved in fighting infections.

Having an intravenous line in place between treatments

Keeping a peripherally inserted central catheter (PICC line) or tunnelled central line fitted between treatments makes it easier to give you chemotherapy. The downside is that it can also give bacteria a route into your bloodstream, leading to infections.

Malnutrition

If you are having difficulties eating and are not getting the nutrients your body needs, it can be harder for you to fight infections.

What causes neutropenia in people with lymphoma?

There are two main causes of neutropenia in people with lymphoma: the effects of lymphoma if it is in the bone marrow and the side effects of treatment.

Lymphoma in the bone marrow

If lymphoma cells are in the bone marrow, they take up space that is normally used to produce healthy blood cells. This can lower the number of neutrophils your body makes, which can lead to neutropenia.

Side effects of treatment

Although the aim of treatment is to kill the lymphoma cells, a side effect of many types of chemotherapy, and some radiotherapy treatments (eg radiotherapy to the pelvis), is that some healthy cells are also destroyed. This may include blood cells that are developing in the bone marrow.

Depending on the strength of your chemotherapy regimen, your neutrophil count will usually be lowest about 7–10 days after you have had chemotherapy. It is possible that it will stay low for longer.
Your doctor will check your neutrophil count before each chemotherapy cycle. If your neutrophil count is low, you might not have your next cycle of chemotherapy until you have enough neutrophils. This could just be a day or two later than planned. With some types of chemotherapy, having treatment before your bone marrow has had time to recover could increase your risk of infection.

We have more information about treatment types on our website (www.lymphomas.org.uk). You can print this information at home, or if you prefer, our helpline can send you copies. Please email information@lymphomas.org.uk or ring 0808 808 5555.

**What are the symptoms of infection?**

Infections can develop in any part of the body and can be serious. If you are neutropenic, your body is less likely to be able to fight an infection on its own. You will need antibiotics and you may need to be admitted to hospital to treat the infection.

**Contact your medical team immediately if you have any symptoms of infection, including but not limited to:**

- fever
- shivering
- chills and sweating
- feeling generally unwell, confused or disoriented
- earache, cough, sore throat or mouth
- redness and swelling around skin sores, injuries to intravenous lines
- diarrhoea
- a burning or stinging sensation when passing urine
- unusual vaginal discharge or itching
- unusual stiffness of the neck and discomfort around bright lights.

Keep a thermometer handy so that you can easily check your temperature. Call your hospital team if your temperature goes above 38°C. Remember that shivering can be a sign of infection even if you do not have a fever. This is more likely if you are taking steroids.

**Contact your medical team immediately if you have any of the above symptoms, no matter how minor or vague they seem. Remember that you can still get infections even if your neutrophil count is normal because the lymphoma alone may have lowered your immunity.**

**What is ‘neutropenic sepsis’?**

You may see or hear the term ‘neutropenic sepsis’ (also called ‘febrile neutropenia’). Sepsis is a whole-body reaction triggered by an infection. Neutropenic sepsis is a serious condition, which can be life-threatening so it must be treated urgently.
Your medical team will diagnose neutropenic sepsis if you have both of the following:

- a temperature above 38°C.
- a neutrophil count that is below 0.5.

It is also possible to have neutropenic sepsis without having a high temperature. This is more likely if your chemotherapy regimen includes steroids as these can reduce fevers and hide infection. For this reason, your doctors may also carry out other checks. They might measure your heart rate, blood pressure, breathing rate, and kidney and liver function.

**What should I do if I suspect an infection?**

Get in touch urgently with your medical team at the hospital if you suspect an infection. This is key to avoiding serious problems.

You should have been given telephone numbers to call at any time (day or night), including weekends. Many chemotherapy units give out cards with details about the drugs you are taking to show your GP or district nurse if you need to. These cards should give advice on what to do if you become feverish or unwell when your neutrophil count is low. If you have not been given this information, ask for it.

If you spot signs of an infection, contact your medical team straightaway. If they advise you to go to the hospital, go at once. Infection can be severe and take hold quickly if you are neutropenic.

It is always best to be checked over and have treatment early if it is needed. A delay can be life-threatening.

**How is neutropenia treated?**

If your neutrophil count is low because of chemotherapy, you might not need any treatment. This is because your bone marrow may have only stopped working correctly for a short while before your neutrophils return to a safe level.

**Prophylactic (preventive) antibodies**

Sometimes doctors recommend a regular, small dose of antibiotics to lower the risk of infection. You might have them for just a short time while your neutrophil count is expected to be at its lowest.
With certain chemotherapy drugs, your risk of infection is higher. This is because of the effects of the drugs on the immune system as a whole rather than on your level of neutrophils. If you are taking one of these drugs, your doctor will prescribe a low dose of antibiotics. You may need to carry on taking them for some time after your chemotherapy has finished to give your immune system time to recover.

Antibiotics can lower your risk of infection but they cannot prevent all infections. You must still contact your hospital immediately if you suspect an infection while you are taking them. If you develop an infection, you will need treatment with higher doses of other antibiotics, usually given intravenously (into a vein).

**Growth factors (G-CSF)**

If you are neutropenic and your doctor thinks you have a higher risk of infection, you might be given a growth factor. ‘Growth factors’ are hormones (chemical messengers) that occur naturally in our bodies. They do not attack cancer cells but they can help boost your white blood cells when you are having chemotherapy.

The growth factor most commonly used is called granulocyte-colony stimulating factor (G-CSF). This is a type of protein that triggers the bone marrow to make a type of white blood cell. G-CSF helps your neutrophil levels return to normal more quickly after chemotherapy, which lowers your risk of infections.

You will be given G-CSF by subcutaneous injection (an injection into the fatty tissue just under your skin). These injections use a tiny needle. They are usually given into your stomach, the top of your leg or the top of your arm. Most people are trained to inject themselves at home. Friends or relatives could also be taught to give them to you. The injections are usually painless although they can sting, particularly if the G-CSF is cold. If you have a type of G-CSF that must be stored in the fridge, it can help to take it out of the fridge 20 minutes before you use it.

G-CSF can cause side-effects such as flu-like symptoms, back pain and headaches. Ask your medical team for advice on managing these symptoms. If you have any unusual symptoms or feel unwell during your growth factor treatment, contact your hospital immediately.

**How can I prevent infection if I am neutropenic?**

You cannot prevent yourself from becoming neutropenic but eating well can help your bone marrow recover and make new neutrophils as quickly as possible. Remember that your neutrophil levels can stay low for a number of days after each dose of chemotherapy, sometimes right up until the next dose. There are simple ways (listed below) that can help manage your risk of infection.

**Minimise contact with germs**
• Stay away from people with infections such as a cold, flu, diarrhoea, vomiting or chickenpox.
• Avoid places where the risk of infection is higher like cinemas, busy shops, public transport during rush-hour, swimming pools and jacuzzis.
• Take care when handling pets. Always wash your hands after touching them and try to avoid bites and scratches. Wear protective clothing when cleaning up after pets, or ask someone else to do it for you.

Keep good personal hygiene

• Wash your hands before meals and after using the toilet.
• Clean your bottom gently but thoroughly after each bowel movement, wiping from front to back.
• Take a warm bath or shower every day.
• Keep good dental hygiene. Use antiseptic/antibacterial mouthwashes but avoid any that contain alcohol as they can irritate your mouth.

Protect your skin

• Use lotion or oil to moisturise your skin if it becomes dry or cracked.
• Use an electric shaver instead of a razor.
• Take care in the kitchen to avoid nicks and cuts when using knives or scissors.
• Wear protective gloves when gardening.
• Try to prevent cuts and tears of the cuticles of your nails.
• If you do cut or graze yourself, use warm water, soap and an antiseptic to clean the wound.
• Always wear shoes outdoors.
• Don’t squeeze spots or scratch scabs.

How do I ensure food safety if I have neutropenia?

Having neutropenia means you are more at risk of developing food-borne infections. These infections are illnesses caused by eating food that is contaminated by certain types of bacteria and fungi (microbes). Following basic food safety guidelines can help to lower this risk. You might have heard of a ‘neutropenic diet’ (also sometimes called ‘clean’, ‘low-bacterial’ or ‘low-microbial’ diet). The aim of this type of diet is to cut out the foods that are more likely to contain infection-causing microbes. However, it seems that following the general principles of good food safety and hygiene is the most helpful approach.

The guidance below is based on the advice of the government’s Food Standards Agency. On their website (www.foodstandards.gov.scot/food-safety-standards/food-safety-hygiene), you can read more about general food safety and hygiene. The Association of UK Dietitians also offers advice and information that you may find helpful (www.bda.uk.com).
Shopping

- Check ‘use by’ dates.
- Don't buy food that is in damaged packaging.
- Avoid buying unwrapped goods (eg ‘pick and mix’ sweets, loose bread rolls from bakeries, and salad from salad bars).
- Choose pre-packed meats and cheeses over unpackaged ones from deli counters.
- Don’t buy food that is stored in an overloaded fridge or freezer. Overloading can lower the overall temperature of the food.
- Pick up any chilled or frozen food last. Use cooler bags or ice packs to keep these items cool if you have a long journey ahead.
- Keep raw meat in separate shopping bags.
- Wash your hands after you have been shopping and after putting your food away.

Storing chilled and frozen food

- Keep your fridge and freezer set to the correct temperature. The manufacturer’s manual will tell you what it is. You can use a thermometer to check the temperature inside the fridge. As a general guide, fridge temperature should be between 0°C and 5°C. Freezer temperature should be -18°C.
- Prevent overloading your fridge and freezer because this can increase the overall temperature.
- Clean the inside and outside of your fridge regularly, following the manufacturer’s guidance.
- Label food with the date if you’re batch-cooking and storing it in the freezer.
- Prevent raw food from contaminating other foods by storing items on the correct shelves in your fridge, as pictured below:
Hygiene and food preparation

Hand washing

- Wash your hands thoroughly in warm, soapy water before and after handling food. Pay special attention to the areas between your fingers and around your fingernails as this is where germs can gather. You should also remove any items of jewellery (eg rings, watches and bracelets) before washing your hands as bacteria can sit under these.
- Dry your hands with a separate towel or kitchen paper rather than a tea towel.
- Make sure your hands are completely dry before handling food. Germs spread more easily when your hands are wet.
- Cover any cuts or wounds before preparing food.

Work tops and utensils

Adapted with the permission of the Food Standards Agency
• Disinfect worktops before use with an antibacterial cleaner or boiling water.
• Wash and change utensils and chopping boards between preparing raw and cooked foods. This helps to prevent cross-contamination. If possible, have three chopping boards
  ○ one for raw meat and poultry
  ○ one for cooked meat and poultry
  ○ one for other foods.
• Replace kitchen cloths and sponges regularly, or wash them and let them dry before you use them again.
• If you are washing by hand, let cutlery and utensils drip-dry. This way is more hygienic than drying with a tea towel.
• Wash and scrub root vegetables well (e.g., potatoes and carrots) to remove traces of soil.

Meat and poultry

• Keep frozen meat separate from other food while it is defrosting.
• Take special care when preparing chicken
• Store raw chicken away from other food, chilled on the bottom shelf of the fridge.
• Do not wash raw chicken because the splash spreads germs.
• Wash anything that touches raw chicken in hot water and with an antibacterial cleaner. This includes utensils, chopping boards and your hands.
• Before eating, cut through the thickest part of the chicken to check that it’s cooked throughout; the juices should run clear. All meats should be steaming hot with no pink or red colour inside.

Leftovers

• Cool any leftovers at room temperature and then store them in the fridge. It is safest to transfer them to the fridge within 1–2 hours.
• Eat leftovers within 24 hours.
• Don’t re-heat food more than once. Don’t re-heat rice at all.
Eating out

- Check the food hygiene standard of the café, restaurant or pub where you want to eat. You can check food hygiene rating scores on the Food Standards Agency’s website. If you are in England or Northern Ireland, you might also see a sticker in the window that states their rating.
- Check that food is cooked all the way through. It should be steaming hot. Don’t eat food that has been kept warm under heat lamps.
- Avoid buying ice cream from parlours and vans. Instead, buy wrapped ice creams or ice lollies from a shop.
- Takeaways are not recommended if you are neutropenic.

BBQs and picnics

If you are severely neutropenic, it is best to avoid barbecues. Check with your medical team if you are unsure.

- Keep all food in the fridge until you need to use it.
- Be sure that the barbecue coals are hot enough to cook food properly. They should be glowing red.
- Fully defrost meat before cooking it.
- Cut the meat to check it is cooked through. If it’s pink inside, then cook it for longer.
- Move food around the barbecue and turn it often to help cook it evenly.
- Keep raw and cooked foods on separate plates and handle them with different utensils.
- Keep food outside covered to stop insects getting to it.
- Wash your hands thoroughly after touching raw meat.
- Wash salads, fruit and vegetables properly before you eat them.

What can and can’t I eat if I have neutropenia?

Your hospital is likely to give you advice on food and drinks to avoid, especially if you are severely neutropenic. Below is a summary of the guidance most hospitals give but always check with your medical team as they will know your individual medical situation. Follow medical advice from your hospital team on what to eat and what to avoid if you are severely neutropenic.

Dairy

Avoid:

- unpasteurised milk (the label should tell you whether it has been pasteurised)
- unpasteurised cream
- yoghurts that are labelled ‘probiotic’ or ‘bio’
- soft unpasteurised cheeses (eg Brie, goat’s cheese, paneer and Camembert) and blue-veined cheeses (eg Stilton and Roquefort).
Alternatives:

- pasteurised milk, soya milk, ultra-high temperature-treated milk (UHT milk)
- yoghurts that are not labelled as ‘pro-biotic’ or ‘bio’
- pasteurised or UHT cream
- tubs of ice cream or frozen yoghurt, wrapped bars or lollies
- hard cheeses (eg Cheddar), processed cheeses (eg Dairylea, Philadelphia), cottage cheese, halloumi and mozzarella.

Eggs

Avoid:

- raw or lightly cooked eggs, eg soft-boiled eggs
- dishes that contain raw or slightly cooked eggs, eg homemade mayonnaise and hollandaise sauce, and homemade ice cream and mousses
- eggnog
- soufflés
- soft meringue.

Alternatives:

- well-cooked eggs, eg scrambled or hard-boiled eggs
- shop-bought mayonnaise
- shop-bought ice cream.

Meat and poultry

Avoid:

- raw or undercooked meat and poultry, eg meat that is still pink, including steak
- ready-cooked hot chicken from supermarkets
- smoked meats, eg Parma ham, salami
- pâté.

Alternatives:

- well-cooked meat (with no pink or red colour inside)
- tinned meat
- vacuum-packed cold meats, eg ham, beef and turkey
- tinned meat pâté or pasteurised meat pâté in a jar.
Fish

Avoid:

- raw or undercooked fish, eg sushi
- raw or lightly cooked shellfish, eg prawns, clams, crab, mussels, oysters, scallops
- caviar.

Alternatives:

- freshly cooked fish, fish fingers or fish cakes
- tinned fish, eg tuna or salmon
- vacuum-packed smoked fish
- frozen fish (except shellfish)
- well-cooked prawns, eg in a curry.

If you are severely neutropenic, check with your medical team whether it is OK for you to eat fish.

Fruit and vegetables

Avoid:

- unwashed fruit and unwashed vegetables
- any fruit or vegetable with damaged skin or mould.

Alternatives:

- good-quality fresh fruit and vegetables, including mushrooms, if they are well washed and freshly prepared (except if you are severely neutropenic.)
- tinned fruit or dried fruit
- cooked berries
- frozen or tinned vegetables.

Salads

Avoid:

- unwashed lettuce, spinach leaves, pre-packed salads, eg bags of leaves
- salad from salad bars in supermarkets or restaurants.

Alternatives:

- salad leaves that have been washed thoroughly (except if you are severely neutropenic)
- pre-packed, shop-bought coleslaw from a well-known brand, not from the deli counter or a salad bar
- homemade coleslaw using shop-bought mayonnaise.
If you are severely neutropenic, ie your neutrophil count is below 0.5, you may be given extra advice about what is and isn’t safe to eat. This is often the time when you are an inpatient in hospital. Always check with your medical team but some of what they might advise follows.

**Food**

**Avoid:**

- soft whip ice cream from vans or machines
- self-serve dispensers of, for example, tomato sauce or mustard
- raw ‘farm-fresh’ honey or honeycomb
- adding spices, herbs and pepper to food after cooking
- uncooked dried fruit and nuts, eg in muesli, Bombay mix
- raw or unpeeled fruit and vegetables (including salad items)
- cold smoked salmon.

**Alternatives:**

- shop-bought tomato ketchup, brown sauce and salad cream
- pasteurised honey, shop-bought jam and marmalade
- black pepper and spices added while cooking and cooked thoroughly
- cooked dried fruit and nuts, eg in a fruit loaf.

**Drinks**

**Avoid:**

- bottled mineral water, water from coolers or fountains (these all contain more bacteria than tap water)
- unpasteurised or freshly squeezed fruit or vegetable juice and homemade smoothies.

**Alternatives:**

- tap water
- pasteurised fruit and vegetable drinks.

**Remember:**

Neutropenia is common in people affected by lymphoma and it can lead to infections. Take care to minimise your risk and always check with your medical team if you have any questions or concerns. Call your medical team immediately if you notice signs of infection or if you feel unwell.
Sources used

These are a few of the sources we used to prepare this information. The full list of sources is available on request. Please contact us by email (publications@lymphomas.org.uk) or by ringing 01296 619409 if you would like a copy.


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We continually strive to improve our resources for people affected by lymphoma and we would be interested in any feedback you might have about this information. Please visit www.lymphomas.org.uk/feedback or email publications@lymphomas.org.uk if you have any comments. Alternatively please phone our helpline on 0808 808 5555.

If you have found this information useful and would like to help make it available to other people coping with lymphoma, then please consider making a donation to support our work at www.lymphomas.org.uk/donate. We rely totally on voluntary donations. Thank you.

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