Cancer - A General Overview

This leaflet gives a general overview of cancer. Other leaflets in this series provide details of different types of cancer, treatments, and other related topics.

What is cancer?

Cancer is a disease of the cells in the body. There are many different types of cell in the body, and many different types of cancer which arise from different types of cell. What all types of cancer have in common is that the cancer cells are abnormal and multiply out of control. Some cancers are more serious than others, some are more easily treated than others (particularly if diagnosed at an early stage), some have a better outlook (prognosis) than others.

So, cancer is not just one condition. In each case it is important to know exactly what type of cancer has developed, how large it has become, whether it has spread, and how well it usually responds to treatment.

What are cells?

Normal body cells

The body is made up from millions of tiny cells. Different parts of the body such as organs, bones, muscles, skin, and blood are made up from different specialised cells. All cells have a centre called a nucleus. The nucleus in each cell contains thousands of genes which are made up from a chemical called DNA. The genes are like codes which control the functions of the cell. For example, different genes control how the cell makes proteins, or hormones, or other chemicals. Certain genes control when the cell should multiply, and certain genes even control when the cell should die.

Most types of cell in the body divide and multiply from time to time. As old cells wear out or become damaged, new cells are formed to replace them. Some cells normally multiply quickly. For example, you make millions of red blood cells each day as old ones become worn out and are broken down. Some cells do not multiply at all once they are mature - for example, brain cells. Normally, your body only makes the right number of cells that are needed.

Abnormal cells

Sometimes a cell becomes abnormal. This occurs because one (or more) gene in the cell becomes damaged or altered. The abnormal cell may then divide into two, then four, then eight, and so on. Lots of abnormal cells may then develop from the original abnormal cell. These cells do not know when to stop multiplying. A group of abnormal cells may then form. If this group of cells gets bigger, it becomes a large clump of abnormal cells called a tumour.

What are tumours?

A tumour is a lump or growth of tissue made up from abnormal cells. Tumours are divided into two types: benign and malignant.

Benign tumours

These may form in various parts of the body. Benign tumours grow slowly, and do not spread or invade other tissues. They are not cancerous and are not usually life-threatening. They often do no harm if they are left alone. However, some benign tumours can cause problems. For example, some grow quite large and may cause local pressure symptoms, or look unsightly. Also, some benign tumours that arise from cells in hormone glands can make too much hormone, which can cause unwanted effects.

Malignant tumours (cancers)

Malignant tumours tend to grow quite quickly, and invade into nearby tissues and organs, which can cause damage. Tumours normally develop in one original site - the primary tumour. Malignant tumours may also spread to other parts of the body to form secondary tumours (metastases). This happens if some cells break off from the primary tumour and are carried in the bloodstream or lymph channels to other parts of the body. These secondary tumours may then grow, invade and damage nearby tissues, and spread again.

Note: not all cancers form solid tumours. For example, in cancer of the blood cells (leukaemia) many abnormal blood cells are made in the bone marrow and circulate in the bloodstream.

What causes cancer?

Each cancer is thought to first start from one abnormal cell. What seems to happen is that certain vital genes which control how cells divide and multiply are damaged or altered. This makes the cell abnormal. If the abnormal cell survives it may multiply out of control into a malignant tumour.

We all have a risk of developing cancer. Many cancers seem to develop for no apparent reason. However, certain risk factors are known to increase the chance that one or more of your cells will become abnormal and lead to cancer. Risk factors include the following:

Chemical carcinogens

A carcinogen is something (chemical, radiation, etc) that can damage a cell and make it more likely to turn into a cancerous cell. As a general rule, the more the exposure to a carcinogen, the greater the risk. A list of known and suspected chemical carcinogens can be found at http://msds.chem.ox.ac.uk/carcinogens.html and well known examples include:

- **Tobacco smoke**. Smokers are more likely to develop cancer of the lung, mouth, throat, oesophagus, bladder and pancreas. Smoking is thought to cause about a quarter of all cancers. About 1 in 10 smokers dies from lung cancer. The heavier you smoke, the greater the risk. If you stop smoking, your risk goes down considerably.
- **Workplace chemicals** such as asbestos, benzene, formaldehyde, etc. If you have worked with these without protection you have an increased risk of developing certain cancers. For example, a cancer called mesothelioma is linked to past exposure to asbestos.

Age

The older you become, the more likely you will develop a cancer. This is probably due to an accumulation of damage to cells in the body over time. Also, the body's defences against abnormal cells may become less good as you become older. For example, the ability to repair damaged cells, and the immune system which may destroy abnormal cells, may become less efficient with age. So, eventually one damaged cell may manage to survive and multiply out of control into a cancer. Most cancers develop in older people.

Lifestyle factors

Diet and other lifestyle factors can alter the risk of developing cancer. For example:

- If you eat a lot of fruit and vegetables you have a reduced risk of developing certain cancers. The exact way in which they protect against cancer is not fully understood. These foods are rich in vitamins and minerals, and also contain chemicals called antioxidants. They may protect against damaging chemicals that get into the body. We should all eat *at least* five portions of fruit and vegetables per day (some experts recommend even more).
- Eating too much fatty food possibly increases the risk of developing certain cancers.
- The risk of developing certain cancers is increased by: obesity, lack of regular exercise (physical activity), and drinking a lot of alcohol.

For example, one large research study (cited below) followed up over 55,000 people for 10 years. It looked at lifestyle factors and rates of cancer. The study concluded that by following recommendations on keeping physically active, keeping weight in check, not smoking, drinking alcohol in moderation and having a healthy diet, the risk of developing bowel cancer could be reduced by as much as 23%. But, the study found that even improvement in some of these lifestyle factors had some reduction in risk.

Radiation

Radiation is a carcinogen. For example, exposure to radioactive materials and nuclear fallout can increase the risk of developing leukaemia and other cancers. Too much sun exposure and sunburn (radiation from UVA and UVB) increase the risk of developing skin cancer. The larger the dose of radiation, the greater the risk of developing cancer. But note: the risk from small doses such as from a single X-ray test, is very small.

Infection

Some viruses are linked to certain cancers. For example, people with persistent infection with the hepatitis B virus or the hepatitis C virus have an increased risk of developing cancer of the liver. Another example is the link between the human papillomavirus (HPV) and cervical cancer. Most (possibly all) women who develop cervical cancer have been infected with a strain (subtype) of HPV at some point in their life. However, most viruses and viral infections are not linked to cancer.

Immune system

People with a poor immune system have an increased risk of developing certain cancers. For example, people with AIDS, or people on immunosuppressive therapy.

Your genetic make-up

Some cancers have a strong genetic link. For example, in certain childhood cancers the abnormal gene or genes that may trigger a cell to become abnormal and cancerous are inherited. Other types of cancer may have some genetic factor which is less clear-cut. It may be that in some people their genetic make-up means that they are less resistant to the effect of carcinogens or other factors such as diet.

Most cancers are probably due to a combination of factors

Not everybody who comes into contact with a carcinogen or has an unhealthy lifestyle will develop cancer. For example, not all smokers develop cancer of the lung. In fact, we are all probably exposed to low doses of carcinogens a lot of the time.

The body has certain mechanisms that may protect us from developing cancer. For example, it is thought that many cells that are damaged by carcinogens can repair themselves. Also, the body's immune system may be able to destroy some types of abnormal cells before they multiply into a tumour. Perhaps one carcinogen may only damage one gene, and two or more genes may need to be damaged or altered to trigger the cells to multiply out of control.

In many cases it is likely that a combination of factors such as genetic make-up, exposure to a carcinogen, age, diet, the state of your immune system, etc, plays a part to trigger a cell to become abnormal, and allow it to multiply out of control into a cancer.

How is cancer diagnosed?

If a cancer is suspected from your symptoms

Your doctor will examine you to look for abnormalities such as a lump under the skin, or an enlarged liver. You may be referred for tests such as X-rays, scans, blood tests, endoscopy, bronchoscopy, etc, depending on where the suspected cancer is situated. These tests can often find the site of a suspected cancer. However, a biopsy is often needed to be certain that the abnormality is a cancer and not something else (such as a benign tumour).

Biopsy

A biopsy is when a small sample of tissue is removed from a part of the body. The sample is then examined under the microscope or tested in other ways to detect abnormal cells. Sometimes it is easy to obtain a biopsy. For example, from a lump on the skin which may be a skin cancer. However, it can be difficult to obtain a biopsy from deeper tissues and it may require specialised procedures.

What are the treatment options for cancer?

Treatment options vary, depending on the type of cancer and how far it has grown and spread. See the separate leaflets on the specific cancers for more details. There is also another leaflet called *Cancer - Staging and Grading Cancer'* which discuses how a cancer is classified depending on its type (grading) and how far it has spread in the body (staging). Briefly, the three most common treatments are:

- **Surgery**. It may be possible to cut out a malignant tumour.
- **Chemotherapy**. This is a treatment that uses anticancer drugs to kill cancer cells, or to stop them from multiplying. There are various different types of drugs used for chemotherapy. The drug or combination of drugs selected depends on the type of cancer being treated.
- **Radiotherapy**. This is a treatment that uses high-energy beams of radiation which are focused on cancerous tissue. This kills cancer cells, or stops cancer cells from multiplying.

More recently, other treatments have been introduced which include:

- **Bone marrow transplant**. High-dose chemotherapy may damage bone marrow cells and lead to blood problems. However, if you receive healthy bone marrow after the chemotherapy then this helps to overcome this problem.
- **Hormone therapy**. This is where drugs are used to block the effects of hormones. This treatment may be used for cancers that are hormone-sensitive such as some cancers of the breast, prostate and uterus (womb).
- **Immunotherapy**. Some treatments can boost the immune system to help to fight cancer. More specific immunotherapy involves injections of antibodies which aim to attack and destroy certain types of cancer cells. Research is underway to try to find vaccines that would stimulate your own immune system to make antibodies against cancer cells.
- **Gene therapy**. This is a new area of possible treatments. Research is underway to find ways of blocking, repairing or replacing abnormal genes in cancer cells.
- **Special techniques**. These can sometimes be used to cut off the blood supply to tumours. The tumour then dies.

For some cancers, a combination of two or more treatments may be used. A range of other treatments may also be used to ease cancer-related symptoms such as pain.

What are the aims of treatment?

The aims of treatment can vary, depending on the cancer type, size, spread, etc. For example:

- Treatment aims to cure the cancer in many cases. With modern drugs and therapies, many cancers can be cured, particularly if they are treated in the early stages of the disease. (Doctors tend to use the word remission rather than the word cured. Remission means there is no evidence of cancer following treatment. If you are in remission, you may be cured. However, in some cases a cancer returns months or years later. This is why doctors are sometimes reluctant to use the word cured.)
- Treatment may aim to control the cancer. If a cure is not realistic, with treatment it is often possible to limit the growth or spread of the cancer so that it progresses less rapidly. This may keep you free of symptoms for some time.
- Treatment may aim to ease symptoms in some cases. Even if a cure is not possible, a course of radiotherapy, an operation, or other techniques may be used to reduce the size of a cancer,which may ease symptoms such as pain. If a cancer is advanced then you may require treatments such as nutritional supplements, painkillers, or other techniques to help keep you free of pain or other symptoms.

What is the outlook for people with cancer?

- Some cancers are more aggressive and grow more quickly than others.
- Some cancers are more likely to spread to other parts of the body.
- Some cancers respond to treatment better than others.

Therefore, it is not possible give an overall outlook (prognosis). See the information about the individual types of cancer for further details. As a general rule, the outlook is usually better the earlier a cancer is detected and treated.

Some questions you may want to go through with your doctor

If you have been diagnosed with cancer you will have many questions. The organisations listed at the bottom of the leaflet are good sources of further and detailed information. The following are also some suggested questions that you may wish to go over with your doctor:

- What type of cancer have I got?
- How large is it and has it spread to other parts of my body?
- What are the treatment options for this type of cancer?
- What are the risks and possible side-effects of the treatment options?
- How successful is the treatment for my type and stage of cancer? Is the aim of treatment to cure or to control the cancer?

Further help and information

Macmillan

Tel: 0808 808 0000 Web: www.macmillan.org.uk
Provides information and support to anyone affected by cancer.

CancerHelp UK

Web: http://cancerhelp.cancerresearchuk.org
Provides facts about cancer, including treatment choices.

Other support groups

Many cancer support groups are listed on the website of www.patient.co.uk

Further reading & references

- Cancer Medicine 5th Edition 2000. Edited by Robert C. Bast et al
- Kirkegaard H, Johnsen NF, Christensen J, et al; Association of adherence to lifestyle recommendations and risk of colorectal BMJ. 2010 Oct 26;341:c5504. doi: 10.1136/bmj.c5504.

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