Chapter 17 – Cancer

Objectives

Given the synopsis in this chapter, competence in each objective will be demonstrated by responding to multiple choices or matching questions, completing fill-in questions, or writing short answers, at the level of 75% or greater proficiency for each student.

A. To explain what is cancer.
B. To explain how cancer spreads.
C. To explain what causes cancer.

What is Cancer?

From American Cancer Society (http://www.cancer.org)

Cancer is the general name for a group of more than 100 diseases. Although there are many kinds of cancer, all cancers start because abnormal cells grow out of control. Untreated cancers can cause serious illness and death.

Normal cells in the body

The body is made up of trillions of living cells. Normal body cells grow, divide to make new cells, and die in an orderly way. During the early years of a person's life, normal cells divide faster to allow the person to grow. After the person becomes an adult, most cells divide only to replace worn-out or dying cells or to repair injuries.

How cancer starts

Cancer starts when cells in a part of the body start to grow out of control. Cancer cell growth is different from normal cell growth. Instead of dying, cancer cells continue to grow and form new, abnormal cells. Cancer cells can also invade (grow into) other tissues, something that normal cells can't do. Growing out of control and invading other tissues are what makes a cell a cancer cell.

Cells become cancer cells because of DNA (deoxyribonucleic acid) damage. DNA is in every cell and it directs all its actions. In a normal cell, when DNA is damaged the cell either repairs the damage or dies. In cancer cells, the damaged DNA is not repaired, but the cell doesn't die like it should. Instead, the cell goes on making new cells that the body doesn't need. These new cells all have the same damaged DNA as the first abnormal cell does.

People can inherit abnormal DNA (it's passed on from their parents), but most often DNA damage is caused by mistakes that happen while the normal cell is reproducing or by something in the environment. Sometimes the cause of the DNA damage may be something obvious like cigarette smoking or sun exposure. But it's rare to know exactly what caused any one person's cancer.

In most cases, the cancer cells form a tumor. Over time, the tumors can replace normal tissue, crowd it, or push it aside. Some cancers, like leukemia, rarely form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues where they grow.

How cancer spreads

Cancer cells often travel to other parts of the body where they can grow and form new tumors. This happens when the cancer cells get into the body's bloodstream or lymph vessels. The process of cancer spreading is called *metastasis*.

No matter where a cancer may spread, it's always named based on the place where it started. For example, colon cancer that has spread to the liver is called metastatic colon cancer, not liver cancer. In this case, cancer cells taken from the liver would be the same as those in the colon. They would be treated in the same ways too.

How cancers differ

Different types of cancer can behave very differently. For instance, lung cancer and skin cancer are very different diseases. They grow at different rates and respond to different treatments. This is why people with cancer need treatment that's aimed at their kind of cancer.

Tumors that are not cancer

A tumor is an abnormal lump or collection of cells, but not all tumors are cancer. Tumors that aren't cancer are called *benign*. Benign tumors can cause problems – they can grow very large and press on healthy organs and tissues. But they can't grow into (invade) other tissues. Because they can't invade, they also can't spread to other parts of the body (metastasize). These tumors are seldom life threatening.

To learn more

More information from your American Cancer Society
Here's more information you might find helpful. You can order free copies from our toll-free number, 1-800-227-2345, or read them on our website, www.cancer.org.

Questions People Ask About Cancer (also in Spanish)
Signs and Symptoms of Cancer (also in Spanish)
American Cancer Society Guidelines for the Early Detection of Cancer (also in Spanish)
American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention (also in Spanish)

We also have information about **many different types of cancer** and how they are treated.

If you're looking for other information about cancer, contact us.
No matter who you are, we can help. Contact us anytime, day or night, for information and support. Call us at 1-800-227-2345 or visit www.cancer.org.

What causes cancer?

From Cancer Research UK (http://www.cancerresearchuk.org)

The many causes of cancer

There are about 200 different types of cancer. It can start in any type of body tissue. What affects one body tissue may not affect another. For example, tobacco smoke that you breathe in may help to cause lung cancer. Overexposing your skin to the sun could cause a melanoma on your leg. But the sun won't give you lung cancer and smoking won't give you melanoma.

Apart from infectious diseases, most illnesses (including cancer) are multifactorial. This means that there are many factors involved. In other words, there is no single cause for any one type of cancer.

Cancer causing substances (carcinogens)

A carcinogen is something that can help to cause cancer. Tobacco smoke is a powerful carcinogen. But not everyone who smokes gets lung cancer. So there must be other factors at work as well.

Age

Most types of cancer become more common as we get older. This is because the changes that make a cell become cancerous in the first place take a long time to develop. There have to be a number of changes to the genes within a cell before it turns into a cancer cell. These changes can happen by accident when the cell is dividing. Or they can happen because the cell has been damaged by carcinogens and the damage is then passed on to future cells when that cell divides. The longer we live, the more time there is for genetic mistakes to happen in our cells.

Genetic make up

There need to be a number of genetic mutations within a cell before it becomes cancerous. Sometimes a person is born with one of these mutations already. This doesn't mean they will definitely get cancer. But with one mutation from the start, it makes it more likely statistically that they will develop cancer during their lifetime. Doctors call this genetic predisposition.

The BRCA1 and BRCA2 breast cancer genes are examples of genetic predisposition. Women who carry one of these faulty genes have a higher chance of developing breast cancer than women who do not.

The BRCA genes are good examples for another reason. Most women with breast cancer do not have a mutated BRCA1 or BRCA2 gene. Less than 3 out of 100 breast cancers (3%) are due to these genes. So although women with one of these genes are individually more likely to get breast cancer, most breast cancer is not caused by a high risk inherited gene fault.

This is true of other common cancers where some people have a genetic predisposition – for example, colon (large bowel) cancer.

Researchers are looking at the genes of people with cancer in a study called SEARCH. They also hope to find out more about how other factors might interact with genes to increase the risk of cancer.

The immune system

People who have problems with their immune systems are more likely to get some types of cancer. This group includes people who

- Have had organ transplants and take drugs to suppress their immune systems to stop organ rejection
- Have HIV or AIDS
- Are born with rare medical syndromes which affect their immunity

The types of cancers that affect these groups of people fall into 2 overlapping groups

- Cancers that are caused by viruses, such as cervical cancer and other cancers of the genital or anal area, some lymphomas, liver cancer and stomach cancer
- Lymphomas

Chronic infections or transplanted organs can continually stimulate cells to divide. This continual cell division means that immune cells are more likely to develop genetic faults and develop into lymphomas.

Smoking, bodyweight, diet and physical activity

Many cancer cases in the UK are linked to lifestyle factors such as smoking, alcohol, diet, or being overweight. In the western world, many of us eat too much red and processed meat and not enough fresh fruit and vegetables. This type of diet is known to increase the risk of cancer. Drinking alcohol can also increase the risk of developing some types of cancer. There is more information about this on the page about diet causing cancer. Sometimes foods or food additives are blamed for directly causing cancer and described as carcinogenic. This is often not really true. Sometimes a food is found to contain a substance that can cause cancer but in such small amounts that we could never eat enough of it to do any harm. And some additives may actually protect us. There is more about food additives in the page about diet causing cancer.

Day to day environment

By environmental causes we mean what is around you each day that may help to cause cancer. This could include

- Tobacco smoke
- The sun
- Natural and man made radiation
- Work place hazards
- Asbestos

Some of these are avoidable and some aren't. Most are only contributing factors to causing cancers – part of the jigsaw puzzle that scientists are still trying to put together. There is more about this in the page about causes of cancer in the environment.

Viruses

Viruses can help to cause some cancers. But this does not mean that these cancers can be caught like an infection. What happens is that the virus can cause genetic changes in cells that make them more likely to become cancerous.
These cancers and viruses are linked

- Cervical cancer, and other cancers of the genital and anal area, and the human papilloma virus (HPV)
- Primary liver cancer and the Hepatitis B and C viruses
- Lymphomas and the Epstein-Barr Virus
- T cell leukaemia in adults and the Human T cell leukaemia virus
- HPV may also lead to oropharyngeal cancer and non melanoma skin cancers in some people

There will be people with primary liver cancer and with T cell leukaemia who haven't had the related virus. But infection increases their risk of getting that particular cancer.
With cervical cancer, scientists now believe that every woman with an invasive cervical cancer has had an HPV infection beforehand.
Many people can be infected with a cancer causing virus, and never get cancer. The virus only causes cancer in certain situations. Many women get a high risk HPV infection, but never develop cervical cancer.
Another example is Epstein-Barr virus (EBV). These are some facts about EBV

- It is very common – most people are infected with EBV
- People who catch it late in life get glandular fever and have an increased risk of lymphoma
- In sub Saharan Africa, EBV infection and repeated attacks of malaria together cause a cancer called Burkitt's lymphoma in children
- In China, EBV infection (together with other unknown factors) causes nasopharyngeal cancer
- In people with AIDs and transplant patients EBV can cause lymphoma
- About 4 out of 10 cases of Hodgkin's lymphoma (40%) and a quarter of cases (25%) of Burkitt's lymphoma (a rare type of non Hodgkin's lymphoma) seem to be related to EBV infection

Bacterial infection

Bacterial infections have not been thought of as cancer causing agents in the past. But studies have shown that people who have helicobacter pylori (H pylori) infection of their stomach develop inflammation of the stomach lining, which increases the risk of stomach cancer. Helicobacter pylori infection can be treated with a combination of antibiotics.
Research is also looking at whether substances produced by particular types of bacteria in the digestive system can increase the risk of bowel cancer or stomach lymphomas. Some researchers think that particular bacteria may produce cancer causing substances in some people. But research into this issue is at an early stage.
If bacteria do play a part in causing cancer this could be important in cancer prevention. Bacterial infections can often be cured with antibiotics, so getting rid of the infection could be a way to reduce the risk of these types of cancer.