

Medical science technology



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Question: Modern medical science has made possible many procedures that are life saving and life enhancing discuss a range of technologies that fit this description, describing the technology and its impact on patients

Cancer kills over 7.6 million people throughout the world each year, there would be a lot more lives destroyed if we did not have the technology that we have today. Modern medical science is evolving everyday and there are many procedures that are carried out that save lives that could not have been saved in the past. New technologies allow doctors to diagnose cancer a lot quicker with more accurate results, which allows them to give the patients the best possible advice on treatments. Treatments for cancer have also evolved and save more lives now than ever. In this essay I am going to describe the technologies that are used in the diagnosis and treatment stages of cancer.

What Is Cancer?

Cancer refers to any one of a large number of diseases which are caused by the rapid development of abnormal cells that divide uncontrollably and have the ability to infiltrate and destroy normal body tissue.

Normal cells in your body grow and divide slowly and uniformly to make sure that the number of cells in each tissue stays the same

Cancer begins when a deformed cell starts growing and dividing rapidly and out of control. This one 'bad' cell divides to give two cells, then 4 cells then 8, and so on until they form a growing mass of cancer cells, this is called a tumour.

In some tumours, the 'bad' cells stay in the same place and are unable to spread or grow larger, simply because they have no space to do so. These are less dangerous tumours and are often called 'Benign tumours'. We all have benign tumours in our body, take moles and warts for example, they are a collection of bad cells that have multiplied but cannot grow any further which means they are totally harmless to us.

However in other tumours the deformed cells are able to invade all surrounding tissue and any other tissue that comes into contact with it. This includes spreading into nearby organs where they can cause serious and sometimes fatal damage. These spreading tumours are called 'Malignant' tumours.

Malignant tumours are harmful enough if they stay in the same place and keep spreading, but they can become much worse if they spread and come across blood vessels. The deformed cells can actually spread into the blood vessels and get carried around the body, the cells will eventually get stuck in a vessel somewhere else in the body. Here they again divide and grow forming a new tumour in a new place. This process of spreading cancer throughout the whole body is called 'Metastasis'.

Diagnosis of Cancer

The diagnosis of cancer is an attempt to accurately determine the origin of the tumour or tumours, and the type of cells involved. The body part in which the cancer first developed is known as the primary site. Locating the primary site will determine how the tumour will behave. Most cancers are recognised because signs or symptoms have appeared or through regular

screening. If cancer is suspected then there is an investigation using medical tests which are explained below.

X-Ray

An x-ray machine takes the basic idea of a camera. However instead of visible light, it uses x-rays to expose the film. These rays are produced from the x-ray tube inside the machine. This works when the electron gun inside the tube shoots high energy electrons at a tungsten target. X-rays come out because of the atomic process induced by the energetic electrons shot at the target which is made up of heavy atoms.

Like light, x-rays are electromagnetic waves. X-rays are a lot more energetic than visible light which allows them to penetrate many materials. When x-rays hit the film they expose just as light does. Since bones, fat, muscle etc all absorb x-rays at different levels, the image on the film lets you see different distinct structures inside the body because of the different levels of exposure to the film. On the film it is clear to see fractured bones, different muscular damage, and also tumours.

CAT scan

‘ Computer Axial Tomography’ takes the idea of conventional x-ray imaging to a new level. X-rays give a clear picture of bones and organs, a CAT scan machine forms a full three-dimensional computer model of a patients insides. Using this technology doctors can examine the patient one narrow slice of body at a time.

For the CAT scan to be taken, the patient lies down on a platform which slowly moves through the large hole in the machine. The x-ray tube is mounted on a revolving ring around the edges of the hole. The ring also supports an array of x-ray detectors which is directly opposite the x-ray tube. In order for the x-ray tube and detectors to revolve around the body, a motor is used to turn the ring. Each complete revolution of the ring scans a narrow, horizontal image of the body. The patient is moved further into the machine so that the next 'slice' can be taken. The machine records x-ray slices across the whole body in a spiral motion. In order to scan each type of tissue with the optimum power, the computer has to vary the intensity of the x-rays. This helps give a much clearer picture of the patient's body. Once the scan is complete, the computer combines all of the information to form a detailed image of the body. CAT scans are much more detailed than a conventional x-ray and give doctors a lot more information on the patient's tumour, this will help make any decisions on treatment.

MRI scan

'Magnetic Resonance Imaging' is used in medical imaging to visualise the structure and function of the body. It provides detailed images of the body in any plane which helps the doctor give a more accurate diagnosis of a tumour which would ultimately help when treating cancer. MRI works a lot like a CAT scan but has a much greater soft tissue contrast, which again gives the doctor more details.

MRI works in the same way as the CAT scan, the patient lies on a platform which is moved slowly into the machine to take sections of images which are

put together. MRI scanners also have a revolving ring which holds all the major features. The scanner creates a powerful magnetic field, which is over ten thousand times more powerful than the earth's natural gravitational field. This magnetic field aligns the magnetization of hydrogen atoms throughout the body in a certain way. Radio waves are then sent towards the lined up hydrogen atoms. The waves bounce back and a computer records the signals. Different types of tissue send back different signals which help make up the clear picture of the body. For example, healthy tissue sends back a slightly different signal than cancerous tissue which helps the doctor highlight tumours easily. Like the CAT scan, the MRI scans can take full body scans or can be focused on certain parts of the body. This can be done because the MRI machine takes 'slices' of images as the ring rotates, the same way as the CAT scan does.

Treatment of cancer

Once the doctors have used one of the previous technologies to give a proper diagnostic they now have the information to best treat the disease, this information is either displayed two dimensionally on an x-ray film or three dimensionally on a computer giving the doctor all the information needed to give the best advice on treating the tumour/tumours. The following treatments use many different technologies to save the lives of cancer victims.

Surgery

Small, localised tumours which possess no metastasis potential, can be removed by a surgeon in the operating theatre. The process is carried out

using regular operating tools with the patient under a general anaesthetic. The process involves the surgeon cutting into the patient's body and totally removing the tumour. To ensure all diseased cells have been removed, a pathologist will examine the specimen to determine if a margin of healthy tissue is present. This decreases the chance that microscopic cancer cells are left in the patient. This process is probably the oldest method of removing tumours from a body, although we use the same procedure that has been used for years, it has never been safer. With new operating theatres and new operating tools for each patient, we can minimise the threat of infection which could not have been done years ago.

Chemotherapy

Chemotherapy is the use of drugs to kill off cancerous cells. These drugs can be given orally or by injection. Chemotherapy is considered to be a systemic treatment because the drugs are carried through the blood stream to the entire body, therefore it can kill off tumours no matter where in the body they are, it also means that many tumours can be killed at the same time. Chemotherapy is mainly used to 'cure' the cancer in a patient's body, to keep the cancer from spreading to other parts of the body, or for the cases which cannot be cured, it is used simply to ease the symptoms.

Chemotherapy can remove these bad cells because the drugs are designed to target cells that keep forming and expanding uncontrollably, like tumours. The drug targets these cells and kills them off. Unfortunately the drug can also harm healthy cells which causes the patient to feel side effects such as nausea and hairloss. Some patients need to endure many 'cycles' of

chemotherapy which can cause fatigue, nerve pain and sometimes infections. There are over 50 different types of chemotherapy drugs available. Once diagnosis is complete, the doctor can decide which chemotherapy drug, or mixture of drugs are going to work best at killing the cancer