informedhealthonline.org
INDEPENDENT, OBJECTIVE AND EVIDENCE-BASED

Fact sheet: External radiotherapy

IQWiG

People who have a carcinoma (cancerous tumour) generally have three treatment options: surgery, chemotherapy and radiotherapy. Radiotherapy, also called radiation therapy, aims to destroy the cancerous cells in a tumour by exposing them to high-energy rays. The source of radiation can be located outside the body (external radiotherapy) as well as inside the body or very close to the tumour (internal radiotherapy or brachytherapy). This fact sheet focuses on external radiotherapy. You can read about internal radiation therapy in our brachytherapy fact sheet (URL: http://www.informedhealthonline.org/index.303.en.html) .

What is external radiotherapy?

External radiotherapy is the most common form of radiation therapy. It is called "external" because the radiation is beamed from a source outside of the body through the skin (percutaneously) and other layers, right through to the tumour. The kind of radiation used in external radiotherapy is called high-energy (ionising) radiation. It has the ability to change the structure of cells. The aim is to damage the cancer cells and destroy them. Non-ionising forms of radiation, such as normal light rays or microwaves, do not have this effect.

When is external radiotherapy used?

Whether or not external radiotherapy is used to treat a cancerous tumour depends on a number of factors:

- Where (in which organ) is the tumour?
- How big is it?
- Has it spread to other parts of the body? If so, to what extent?
- What kind of tumour is it?

When treating a malignant tumour, external radiotherapy can generally be used alone or together with surgery and/or chemotherapy. If radiotherapy is given at the same time as another therapy, it is called "concomitant" radiotherapy (additional therapy to fight known remaining cancer cells). So-called "adjuvant" radiotherapy is normally used after the complete surgical removal of a tumour, to prevent it from returning. And if it is given before surgery or chemotherapy, it is known as "neo-adjuvant" radiotherapy. Radiotherapy can either be used to try to cure the cancer ("curative") or to slow it down and relieve pain and other symptoms ("palliative").

What different kinds of external radiotherapy are there?

There are basically two kinds of radiation which can be used in radiotherapy: electromagnetic radiation (for example, X-rays) and particle radiation (for example, beams of electrons or protons). Nowadays most radiation treatment is carried out using machines called particle accelerators (for example, linear accelerators). These machines produce and deliver radiation using electric fields rather than radioactive material.

One special kind of radiotherapy is called "proton therapy". In Germany, only a limited number of radiotherapy centres currently offer proton therapy because it is very complex and expensive. So far, for most potential areas of use there has not been much research on whether it has benefits compared to radiotherapy with a linear accelerator.

A further kind of radiation therapy, so-called "stereotactic radiosurgery", is only used in specific types of tumours. Despite its name, it is a non-surgical procedure which involves precisely targeting well-defined areas of tissue with narrow beams of radiation from an external source. These special kinds of radiotherapy will not be discussed in further detail here.

What has to be done in preparation of treatment?

No matter what kind of radiation is used, the aim is to precisely target the tumour cells and minimise the damage to surrounding healthy cells. The dose of radiation that reaches the tumour also needs to be high enough. This involves a lot of planning.

First of all, the exact location of the tumour is determined with the help of ultrasound pictures, X-rays, computer tomography and magnetic resonance imaging scans. Based on what they find, doctors then have to decide which exact area they are going to irradiate. A treatment plan is made, laying out details such as what kind of radiation and what doses will be used. Patients very rarely receive the full radiation dose in one go. It is usually spread out across a number of sessions – an approach known as "fractionated radiotherapy" (dose fractionation). This is done because healthy cells and tumour cells react differently to radiation. Healthy cells regenerate more quickly than tumour cells do after exposure to radiation. Fractionated radiotherapy therefore gives the healthy tissue a chance to recover somewhat in between sessions.

Created at: 12/21/2007 | Last update: 12/23/2010

Fractionated radiotherapy is typically spread out over a time period of several weeks (usually between five and eight weeks). During this time, the patient usually has one session a day on five days a week (Monday to Friday). Sometimes people might have up to three sessions a day ("hyperfractionation") or only one to three times a week ("hypofractionation").

Sometimes the tumour is irradiated from a number of different angles at different radiation intensities. To make it easier to precisely target the same area in each session, "tattoo" marks are made on the skin using a special kind of semi-permanent ink. Making moulds or casts of body parts can also help to ensure that the patient's body is always in the same position during radiotherapy sessions.

What happens during the treatment?

Radiotherapy is nearly always an outpatient procedure. In other words, you can go home after each session. One session usually lasts about 15 to 45 minutes. Most of this time is spent setting up the equipment and positioning it precisely. The actual exposure to radiation only takes a few minutes. During this time you are left alone in the treatment room but can see the medical staff and can attract their attention by pressing a button. You can normally leave your underwear on during the procedure, but it is advisable to wear outer layers of clothing that are easy to take off.

Similarly to when you have an X-ray done, you do not feel anything during the radiotherapy itself. The equipment might make buzzing, humming or loud clicking noises. Sometimes the source of radiation might move to a different position during the treatment, making a noticeable motor-like sound.

You are not allowed to move during treatment. Staying in the same position may become uncomfortable after a while. But the actual radiation itself does not hurt.

What are the possible adverse effects?

Whether or not you experience adverse effects during or after radiotherapy depends on many factors. These include the strength of the radiation dose, the part of the body being treated and what organs are within the irradiated area. What's more, radiation affects different people in different ways.

Adverse effects may appear a few days after treatment and last for a few weeks. In most cases they go away again. Tiredness is the most common general adverse effect of radiotherapy. It may already become noticeable after a few treatment sessions. It is not clear why people feel tired. One explanation is that breaking down the tumour cells requires a lot of energy and puts a strain on the body. Some evidence suggests that doing sports makes women who have breast cancer feel less tired during radiotherapy. This might also be true for other types of cancer.

Skin irritations are among the possible unpleasant consequences of exposure to radiation. As with sunburn, the skin may become sensitive and red. After three to four weeks it often then becomes dry and starts peeling, sometimes accompanied by itchiness. The skin may eventually become darker because the treatment causes the skin to make more pigment.

If part of the digestive tract is directly exposed to radiation, radiotherapy may cause nausea, vomiting or diarrhoea. Generally speaking, local adverse effects are likely to happen in the area that is irradiated. However, many of these can be treated with drugs, non-drug interventions or other types of medical treatment.

Whenever possible, doctors will try to protect the reproductive organs (testicles and ovaries) from radiation to minimise the risk of infertility. If you have radiotherapy done in the pelvic area your doctor will talk to you about the possible damaging effects and how to limit them.

How can I take care of myself during radiotherapy?

Let your doctors know if you notice any changes to your body during your treatment. You can talk to them about what you can do to prevent or treat adverse events. For example, if you receive radiotherapy in the head and neck area it may be advisable to pay special attention to your teeth in order to prevent tooth decay. It is important that you find out what general precautions you can take during radiotherapy, for example in terms of what you eat and how you can take care of your skin and affected mucous membranes.

You can expect to feel tired and take more rests than usual throughout your treatment. During and after external radiotherapy your body does not release any radioactive energy so you do not need to take any safety precautions to protect the people around you.

Created at: 12/21/2007 | Last update: 12/23/2010

How does radiotherapy fit into my overall cancer treatment?

The aim of radiotherapy is to destroy or shrink the tumour and reduce the associated symptoms. It can either be used alone or in combination with surgery or chemotherapy. Check-ups are done once the radiotherapy is finished to determine what effect it has had on the tumour. Whether you need any further treatment and, if so, what kind depends on the outcome of these tests. It can take weeks or even months before you find out how successful the treatment was.

The various treatment options can be used alone or together, depending on the type of cancer being treated. Research is being done into the most effective methods and the best ways to use radiotherapy, chemotherapy and surgery in different types of cancer. We will keep you up-to-date with any important developments in cancer therapy on InformedHealthOnline.org.

Author: German Institute for Quality and Efficiency in Health Care (IQWiG)

Created at: 12/21/2007 | Last update: 12/23/2010

Glossary

evidence

Evidence is what we call scientific proof from well-conducted, good-quality scientific trials that have been carefully designed to answer specific questions. Depending on the types of questions, different scientific research methods (types of study) are most appropriate to find reliable answers to these questions. Randomized controlled trials (RCTs), for example, are the best way to get reliable evidence on the effectiveness of medical treatments (interventions). This type of study, however, is not the best form of evidence for all possible questions, and does not provide the best answers to all kinds of questions, either. Epidemiological studies, for example, are very suitable for establishing well-founded proof for the spreading of a disease in the population.

Created at: 12/21/2007 | Last update: 12/23/2010

Sources

Galvao DA, Newton RU. Review of exercise intervention studies in cancer patients. *J Clin Oncol* 2005; 23: 899-909.

McNeely M, Campbell KL, Rowe BH, Klassen TP et al. Effects of exercise on breast cancer patients and survivors: a systematic review and meta-analysis. *CMAJ* 2006; 175: 34-41. [Full text (URL: http://www.cmaj.ca/cgi/content/full/175/1/34?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&fulltext=klassen&andorexactfullt]

Swedish Council on Technology Assessment in Health Care (SBU). *Radiotherapy for cancer: a systematic literature review*. Stockholm: SBU. May 2003. [Summary (URL: http://www.sbu.se/upload/Publikationer/Content1/1/radiotherapyslut.html)]

Symonds RP. Recent advances: Radiotherapy. *BMJ* 2001; 323: 1107-1110. [Full text (URL: http://www.bmj.com/cgi/content/full/323/7321/1107)]

Created at: 12/21/2007 | Last update: 12/23/2010

The German Institute for Quality and Efficiency in Health Care (IQWiG)

The German Institute for Quality and Efficiency in Health Care (IQWiG) was established by legislation to provide evaluations of the effectiveness, quality and efficiency of healthcare services. This includes the assessment of medicines as well as the publication of health information for consumers and patients.

Evidence basis of our health information

Our information is based primarily on systematic reviews of the effects of health care. Systematic reviews are necessary to gain an objective picture of health care. In order to do this, a clear question is formulated. Researchers then find all the relevant studies that could answer this question. They then evaluate those studies.

You can find a list of the evidence and other scientific literature on which this information is based at **www.informedhealthonline.org**

Disclaimer

This information was prepared and published by the German Institute for Quality and Efficiency in Health Care (IQWiG). It is based on the evidence and other scientific literature available at the time of publication. The information is intended for the use of patients in Germany. It is not intended to for use to diagnose illnesses and the information is not intended to substitute for medical advice.

Created at: 12/21/2007 | Last update: 12/23/2010