Conventional Radiotherapy

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The following is an advanced-level, step-by-step description of conventional fractionated radiotherapy procedures for the head and body performed in a linear accelerator (LINAC). For basic-level information, see Introduction to Radiation Therapy.

Conventional Radiotherapy

Conventional, or fractionated, radiotherapy is a form of external beam radiation that delivers a fraction of the complete radiation dose over many sessions to shrink or destroy tumors. Delivering a fraction of the radiation dose allows normal cells time to repair themselves between treatments and are protected from permanent injury or death. Any tumor, lesion or malformation to be treated with radiation is called a target. During an initial consultation and simulation, a treatment plan is developed. Patients return daily over a period of several weeks to receive the complete radiation dose.

Am I a candidate?

You may be a candidate for conventional radiotherapy if you have a:

- Metastatic (cancer that has spread) tumor
- Prostate tumor
- Lung tumor
- Liver tumor
- Kidney tumor
- Gynecological tumor
- Colon / Rectum tumor
- Benign (non cancerous) or malignant (cancerous) tumor of the body

How well a particular tumor or malformation will respond to radiotherapy depends on its cell type, grade and stage. Radiotherapy may be used alone or in combination with surgery or chemotherapy.

What happens before treatment?

Consultation

Once a diagnosis has been made, your doctor will discuss all treatment options and may recommend a consultation with a radiation oncologist. The radiation oncologist will perform a physical exam and reconfirm your diagnosis based on the results of imaging studies (x-rays, MRIs) and pathology reports. They will discuss with you the best type of radiation treatment for your particular tumor or lesion, explain the treatment process, and describe some possible side effects. Once you've decided to go ahead with treatment, you will sign consent forms.

Simulation

The first step, called a CT simulation, is performed to carefully plan your radiation treatment. It is a planning procedure, without the actual radiation beam, to determine the type of treatment field, energy source, and angles of the radiation beam. You are positioned on the treatment table and x-rays are taken. An immobilization device may be fabricated and used for the simulation to help you hold still. Information about the tumor location, its volume, and closeness to critical structures is gathered and will be transferred into the treatment planning computer system. Marks may be made on your skin to help the radiation therapist position you for treatment; do not wash them off.

Molds and Masks

Immobilization devices such as molds and masks may be used to hold the treated area perfectly still during radiation treatment. They are custom-made to fit your body area exactly and are used during each radiotherapy visit. These immobilization devices are made from several different materials.

Masks are usually used for the face and neck. First, a quick-setting cream is applied to the body area. Next a plastic mesh is dipped into a water bath, making the mesh very flexible. The mesh is placed over the body area and allowed to conform (you can still breathe). The mesh dries quickly. A clear plastic shell is made from the mesh mold (Fig. 1). If you have a beard or mustache, you may be asked to shave.

Molds are usually used for the pelvis, belly and chest. A liquid Styrofoam is poured into a frame placed around the treatment area and allowed to conform and harden.

Determining the treatment plan

High-end computers and special software are used to plan the treatment so that all beams meet – and produce a high, focused dose of radiation – at a central point within the target. The software uses your CT or MRI images to form a 3D view of your anatomy and the target (Fig 2). The team (radiation oncologist and physicist) determines the radiation prescription:

- appropriate radiation dose
- number and angle of treatment arcs
- size and shape of the beams
- number of treatment fractions

It is crucial that the dose is applied only to the target area. By using numerous beams, the radiation dose to normal tissue is minimized. All beams meet at a single point, where the target is located. At the center, the beams add up to a very high dose of radiation.

What happens during treatment?

The treatment takes about 10-30 minutes.

Step 1. Prepare the patient

Check in with the receptionist for your appointment. The nurse or radiation therapist will escort you to a changing room, where you may need to change into a gown, depending on the area being treated. Lockers are available for safekeeping your personal belongings and valuables.

Figure 1. Plastic mesh is molded to the contours of your face. The front and back pieces of mesh are secured to a U-shaped frame, which attaches to the treatment table to hold the head still.

Step 2. Position the patient

You will lie on the treatment table and be placed in the exact position as the simulation, using the same mask or mold. Alignment lasers help the radiation therapist position you correctly. Approximately once a week an x-ray, called a port film, may be taken of you in your treatment position. The radiation oncologist compares the port film taken during treatment to the x-rays taken during simulation to check the treatment accuracy.

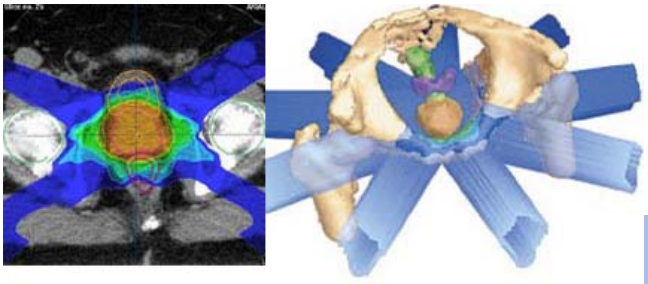

Figure 2. Treatment planning software helps the radiation oncologist determine the radiation dose and number and angle of the beams.

Step 3. Treatment

Once positioning is confirmed, the therapist leaves the room and operates the machine from the control room. The therapist can watch you through video monitors and speak to you over an intercom. The gantry and treatment table may rotate to deliver radiation beams from one or more directions.

The LINAC machine is large and makes noises as it moves around your body. Its size and motion may be intimidating at first; it may pass close to your body but will not touch you (Fig. 3).

Figure 3. The patient lies on the treatment table while the linear accelerator rotates, aiming radiation beams at the tumor. Alignment lasers and a repositionable mask or mold ensure that the patient is perfectly positioned during each daily session.

Step 4. Weekly check-up

The radiation oncologist will meet with you once a week for a treatment management visit. He will examine you, discuss any side effects you may be experiencing, determine how well you are responding to the treatment and answer any questions.

What happens after treatment?

After your treatment the radiation therapist will remove any body molds or masks and allow you to go back to the changing room. Once you've gathered your belongings, you may leave.

What are the results?

Several months after treatment, CT, MRI or angiography scans will be taken to look for signs of response. Several months may pass before the effects of treatment are visible. Doctors will look for signs of tumor shrinkage or slowing of further tumor

growth. Results of radiotherapy vary depending on the size, location and type of tumor. Talk to your doctor about your specific prognosis.

What are the risks?

Side effects vary depending on the tumor type, total radiation dose, size of the fractions, duration of therapy, and amount of healthy tissue in the target area. Some side effects are temporary and some are permanent. Generally, patients may experience fatigue, skin irritation around the target area, and hair loss (see Introduction to Radiation Therapy).

Sources & links

If you have more questions, please contact Precision Radiotherapy at 513-475-7777. Additional information is available on the web at www.PrecisionRadiotherapy.com.

Links

National Cancer Institute
www.cancer.gov
International Radiosurgery Association
www.irsa.org
American Brain Tumor Association
www.abta.org

www.radiologyinfo.org

www.oncologychannel.com

Glossary

benign: not cancerous.
chemotherapy: treatment with toxic chemicals (e.g., anticancer drugs).
fractionated: delivering the radiation dose over multiple sessions.
lesion: a general term that refers to any change in tissue, such as tumor, blood, malformation, infection or scar tissue.
linear accelerator: a machine that creates a high-energy radiation beam, using electricity to form a stream of fast-moving subatomic particles; also called a LINAC.
malignant: cancerous.
metastatic: cancerous tumor that has spread from its original source.
port films: x-rays taken to verify the radiation treatment area.
stereotactic: a precise method for locating structures within the body by the use of 3-dimensional coordinates.
target: area where the radiation beams are aimed; usually a tumor, malformation or other abnormality of the body.