



**Comprehensive Division of  
RADIOTHERAPY**

INTEGRATED ACTIVITY DEPARTMENT ONCOLOGY  
Director: dott. Giorgio Paladini

**Comprehensive Division of RADIOTHERAPY**

**Director: Aulo Beorchia, MD**

Phone: 040 – 399 2402; Fax: 040 – 399 2139  
e-mail: radioterapia@aots.sanita.fvg.it

**Technical Coordinator: Silvia Aichholzer**

Phone: 040 – 399 2389  
e-mail: silvia aichholzer@aots.sanita.fvg.it

Via della Pietà 19 – 34129 Trieste  
[www.aots.sanita.fvg.it](http://www.aots.sanita.fvg.it)

This brochure aims at providing simple but correct information to those who must undergo radiation therapy; medical terminology has been adjusted to everyday language, easily understandable by everyone, in order to allay the obvious concern arising in each patient. Yet, one should not forget that radiotherapy is a complex discipline, where different methods and techniques are used in a wide range of illnesses and conditions, and that each patient has his/her personal clinical history, that makes him/her unique.

Therefore, comparing one's own case, symptoms and therapies with others' often engenders confusion.

We suggest that you read this brochure, to understand how to undertake this therapeutic route together with us, without fear....

## **BEFORE STARTING.....**

The first concern to be REMOVED is the idea of being "radioactive" during and after the whole radiotherapy treatment. You can carry on with your usual life; you can drink, eat, hold your children in your arms because you are not radioactive, therefore you are not dangerous for yourself, your friends or family.

You will be radioactive only when you have to undergo a radiotherapy treatment, whereby permanent radioactive sources are placed in your body (brachytherapy with permanent implants); should this be the case, you shall be properly informed, and all necessary precautions shall be taken.

## **WHAT IS RADIOTHERAPY?**

Radiotherapy is the branch of medicine that deals with the treatment of oncologic disease through ionizing radiations.

This discipline was born following upon the discovery of X rays (1895) and radioactive phenomena (1896), even though nowadays painless higher-energy radiations are used, which are similar to the radiations used in radiology.

There are two types of radiotherapy:

- ✓ **EXTERNAL BEAM RADIOTHERAPY**, where the linear accelerator (Linac), namely the source of radiation, is placed outside the patient and beams of radiation are delivered to a specific area of the patient's body. This method is called **3-Dimensional Conformal Radiotherapy (3DCRT)**. The target or tumor volume (the disease) is modelled and the radiations are directed to this volume. Therefore the dose of radiations hitting the healthy cells of the anatomically adjacent organs, which are not affected by the illness, can be reduced.
- ✓ **SEALED SOURCE RADIOTHERAPY**, by putting radioactive material inside the body: **Brachytherapy**. The irradiation technique is different: the radioactive source is placed in direct contact with the target or tumor volume (the disease). Radioactive material can be different in shape and size (WIRES, CAPSULES, SPHERES)

These radioactive sources can be placed either in the pathological tissues or nearby, and then removed after some time (brachytherapy with temporary implants) or permanently left in place (brachytherapy with permanent implants).

In most cases, brachytherapy requires admission to hospital and some safety measures until removal of the source, whereupon the patient can go back to his/her usual family life. In case of permanent implants, the patient will have to comply with some safety measures, until radioactivity is exhausted; specific instructions shall be provided, according to the type of radioactive material used.

## **RADIOTHERAPY – HOW IT WORKS**

The ionizing radiations used affect the growth of tumor cells which have the innate capacity to multiply and grow in an uncontrolled way. The target of the ionizing radiation is the cellular DNA, namely the "heart" of the cell.

When the DNA is hit or irreversibly damaged the cell dies quickly or later on, or loses its capacity to reproduce. If radiotherapy is carried out when the cell is going to split, the radiation will prevent the growth peculiarity of the pathological cells. For the above-mentioned reasons, the pathological cells are more sensitive to radiations; therefore a larger number of pathological cells is destroyed in comparison with the healthy cells. Even though Linac linear accelerators are ever more advanced and accurate in detecting the target volume, healthy cells are also hit by radiations, which damage normal tissues and bring about **side-effects**. Such effects are unwanted and unavoidable, but can be expected and treated according to the radiotherapist's instructions.

The higher the dose (Energy) of radiotherapy, the greater its effectiveness. Yet, the dose of radiation cannot be delivered in a single session, because a small percentage of healthy cells are hit by radiations and their tolerance to radiation is different from the pathological cells'; therefore, the radiation dose must be delivered in daily fractions.

**PLEASE NOTICE: THE TOTAL DOSE, THE NUMBER OF SESSIONS AND THE DURATION OF THE TREATMENT ARE NOT THE SAME FOR EVERY PATIENT BUT CHANGE ACCORDING TO THE AFFECTED AREA AND THE TYPE OF DISEASE.**

## **RADIOTHERAPY – WHEN?**

Nowadays, the therapeutic route of more than 60% of oncologic patients includes radiotherapy. To ensure best results, radiotherapy can be used in association with other oncologic therapies, such as surgery, chemotherapy or both.

Radiotherapy is very important for recovery, the local control of a disease or the resolution of painful symptoms connected with the disease. Radiotherapy can be classified according to its curative intent:

- ✓ **Elective Radiotherapy**  
A stand-alone therapy, with curative or radical intent, aimed at eradicating the disease.
- ✓ **Pre-operative Radiotherapy**  
Carried out before surgery, in order to reduce the tumor mass and foster its macroscopic removal.
- ✓ **Post-operative or Precautional Radiotherapy**  
Carried out after surgery as a precaution, to reduce the risk of local relapse.
- ✓ **Intra-operative Radiotherapy**  
All or part of the radiation dose is delivered during surgery.
- ✓ **Symptomatic or Palliative Radiotherapy**  
Carried out in order to relieve the symptoms associated with the advanced stage of the disease, such as pain, bleeding and tumor mass compression, this treatment aims only at improving the patient's quality of life.
- ✓ **Radiotherapy Associated with Chemotherapy**  
Carried out with drugs bringing about a "radiosensitizing effect", in order to ensure synergy and increase the effectiveness of radiation.

## **THE RADIOTHERAPY DEPARTMENT**

### **Waiting Room**

You will spend some time, usually a few minutes, in this room, before undergoing radiotherapy. You will probably find other patients waiting for treatment; we recommend that you do not compare your feelings and symptoms.

Please remember that radiotherapy can be different according to the various diseases and clinical conditions, which can be similar but are never the same.

## **Centering and Simulation Room**

The first stage of radiotherapy is the location of the area to be treated, namely the target volume.

During this stage, the target is located by means of some dedicated equipment (universal simulators); diagnostic equipment is also used (CT and, under special circumstances, MR). According to the type of radiotherapy – external or internal – there are two different types of simulation.

### **SIMULATION FOR EXTERNAL RADIOTHERAPY**

During this stage, the technician and the radiotherapist will simulate the patient's position on the bed, and for special diseases they will work out some immobilization devices, that make it possible to faithfully reproduce such position, in every treatment session. It is crucial that the patient lies very still for the whole stage, not to compromise it. It is often necessary to apply dot tattoos (upon your consent) next to the centre and two of the corners of each "field" or entry points of the radiation, that is going to be delivered during treatment; all of which, in order to make localization easier.

### **SIMULATION FOR INTERNAL RADIOTHERAPY**

At this stage, the radiotherapist must establish the position of special applicators or guidewires, which will be "loaded" or filled with radioactive material afterwards.

This operation can be carried out in an outpatient unit or under slight sedation.

After setting the guidewires, X-rays are taken to accurately detect their location.

## **Treatment Bunker Room**

This room contains all treatment equipment or Linear accelerators (Linac) and shall be entered only at the time of treatment.

All equipment is large and can turn around the patient, in order to find the most suitable position. This equipment can often be scary; don't worry, it's quite usual. Try to relax and to lie very still during radiotherapy; during the session nothing is going to happen to you, you are not going to feel pain or other unpleasant sensations.

The equipment is provided with sophisticated safety systems, to control its movement and to deliver the radiation dose; it is handled by skilled staff, which is supervised periodically by a technician and a physicist.

Every room is provided with an intercommunication system and a closed circuit video equipment, so that you are constantly under control; should there be any problem, just raise your hand and the technician will interrupt the session.

Thanks to the modern linear accelerators, different types of radiotherapy can be performed.

The 3-Dimensional Conformal Radiotherapy (3DCRT) provides a good selectivity of the area to be radiated, by using multiple fields, that are shaped to match exactly the shape and size of tumor lesions.

Intensity-Modulated Radiation Therapy (IMRT) is an advanced mode of conformal radiotherapy, ensuring greater protection to the healthy organs surrounding the tumor.

Image Guided Radiation Therapy (IGRT) is carried out by means of **Tomotherapy**, a highly-sophisticated equipment made up of a linear accelerator and a CT; during the treatment session, both the volume and the location of the lesion are shaped in real time and adjusted to the daily morphological changes of tumor.

## **RADIOTHERAPY STAFF**

### **Oncologist-Radiotherapist**

The medical radiotherapist is an oncologist, specialized in the use of radiations to treat several types of tumors. He/She has a double skill: a clinical one, as a physician specialized in the treatment of tumors, and a technical one, as an expert in the use of radiotherapy equipment. His/Her activity is carried out on three different levels.

The first one concerns his/her cooperation and contacts with several specialists, to define treatment and plan the therapeutic programme.

The second one concerns the exact location of disease, its volume and extension.

The third one concerns the patient's management for the whole radiotherapy cycle.

He/She follows the patient with periodic visits and check-ups, that are scheduled after the end of radiotherapy, to assess the therapeutic results and any side effects both during and after treatment.

### **Health Physicist**

He/She has a university degree in physics, and a special training on the use of radiations; he/she checks the regular functioning of all the equipment in the department and cooperates with the radiotherapist in drawing up the treatment plan.

### **Radiotherapy Technician**

This is the member of the staff the patient is most in contact with, for he/she is responsible for the daily treatment. His/her role is very important, in particular when special customized devices have to be found to optimize treatment (lead shielding, immobilization devices).

### **Registered Nurse**

He/She assists the physician and the technician in the preparation for treatment, and thanks to his/her qualified training, he/she will provide major help during treatment. This nurse takes care of dressing (if any) and administers supporting therapies.

### **Nutritionist**

During treatment, this healthcare operator could be necessary to help you maintaining or adjusting your diet.

## **Psychologist**

Radiotherapy could sometimes be psychologically hard to take, especially if it comes at the end of a therapeutic route, started with surgery. You will be able to rely on the help of this specialist if you require it.

## **Administrative staff**

This staff performs several functions, such as handling patients' admission and appointments.

## **THE FIRST VISIT IN THE WARD**

The first visit is also called "radiotherapy consultation", which takes place in the radiotherapy ward, where the patient is referred to either by his/her own general practitioner or a specialist.

During this visit, the radiotherapist establishes the nature and the extension of disease, to decide about the opportunity of treatment and its usefulness, whilst informing the patient on the various types of treatment. To this end, the radiotherapist gathers any information about the patient's current and past medical conditions, and performs a general and an *ad hoc* check-up; moreover, he/she analyzes all patient medical reports provided by the patient and, should it be necessary, he/she may require other tests to have all necessary information for treatment. Afterwards, he/she shall prescribe, if suitable, the RADIATION TREATMENT.

**AFTER COLLECTING ALL USEFUL AND RELEVANT  
INFORMATION  
WE SHALL START TOGETHER  
THE RADIOTHERAPY TREATMENT**

## **SIDE EFFECTS**

Radiotherapy, like any curative treatment and most medical therapies, produces side effects.

The significance of side effects depends on several factors:

- ✓ Type of patient
- ✓ Number of fractions and overall dose of radiation
- ✓ Type of lesion to be treated, location and extension of the irradiated area of the body
- ✓ The patient response to the treatment performed
- ✓ Side effects are usually temporary, and only under certain circumstances they can last for some time after treatment.

They can be classified into two categories: GENERAL SIDE EFFECTS and SIDE EFFECTS TO SPECIFIC AREAS OF THE BODY.

## **GENERAL SIDE EFFECTS**

### **Tiredness**

During radiotherapy some people complain of tiredness or fatigue, because their organisms use up a lot of energy; this is true especially for those patients who undergo this treatment at the end of a therapeutic route, started with surgery or systemic chemotherapy long time before. Therefore, try to rest as much as you can and reduce your working hours.

### **Loss of appetite**

Loss of appetite can be due to several factors; it is important for patients to keep a healthy diet in order to maintain a constant and suitable weight.

For this reason we recommend that the patients:

- ✓ Eat every time they are hungry, even between meals
- ✓ Try eating smaller but frequent nourishing and highly energetic meals
- ✓ Vary their diet (avoid eating always the same things)

- ✓ Use tasty sauces on meat and fish
- ✓ Avoid unpleasant smells

Write down your weight every week; should you notice significant differences, inform your physician, who may decide to prescribe a suitable therapy.

### **Skin reactions**

Irradiated skin reacts like after sunburn, because it is extremely sensitive.

Wear comfortable clothes; skin needs protecting from the sun for at least 4-6 weeks after treatment, unless your radiotherapist prescribes otherwise.

When you wash, use warm water and mild soap; avoid lotions, creams, deodorants or perfumed soap. Skin may become darker, a reaction which gradually settles down.

Use an electric razor rather than wet-shaving; avoid depilatory cream, wax and shavers. If there is hair in the irradiated area, it may fall out or become weaker during treatment; it will usually grow back a few months after treatment.

**EVERY PATIENT HAS HIS/HER OWN PSYCHOPHYSICAL REACTION; IF YOU FOLLOW CAREFULLY THESE TIPS, YOU WILL HANDLE TREATMENT AND ANY SIDE EFFECT MUCH MORE EASILY.**

### **SIDE EFFECTS TO SPECIFIC AREAS OF THE BODY AND RECOMMENDATIONS**

#### **Brain irradiation**

Radiotherapy in this area of the body requires a preliminary stage, during which a thermoplastic mask or “means of contention” will be prepared; after heating in warm water, the mask will take the shape of the patient's head. The patient cannot move but can breathe

regularly and will wear the mask every day during radiotherapy sessions.

Possible symptoms (their intensity depends on several factors):

Nausea, headache, sleepiness and asthenia (fatigue).

These symptoms are connected to the accumulation of liquid in the brain area following upon its irradiation; an antiedema therapy may be prescribed. Should this be the case, it will be carried out even on Saturdays and Sundays, and for some time afterwards even at the end of radiotherapy. It will be up to the radiotherapist to decide when to interrupt.

Side effects, such as weight increase and water retention, due to the assumption of steroids (prescribed as antiedema therapy) could appear; they will gradually disappear after the end of therapy.

Around the end of treatment, hair loss could be observed in the irradiated areas. Hair will grow back after a few months, but it will be weaker and thinner, and its colour may change; in some cases, this effect could be permanent.

The irradiated area could be sore and dry, but these effects will disappear at the end of radiotherapy.

Wash your hair with warm water and mild soap, both during radiotherapy and for some months afterwards.

## RECOMMENDATIONS

- ✓ If you go out in the sunshine, cover your head to protect it, during radiotherapy and for several months afterwards.

### **Irradiation of the oral cavity and neck**

- ✓ MUCOSITIS AND STOMATITIS, with pain and difficulties in chewing.

This is due to the fact that the mucous membrane in the digestive tract is highly sensitive to radiations.

- ✓ DRY ORAL CAVITY AND DIFFICULT SWALLOWING. This may happen because sometimes salivary glands are included in the treatment field, and consequently a smaller quantity of saliva is

produced, whereas its viscosity increases, so that the mouth is more easily attacked by bacteria and fungi.

- ✓ **TASTE CHANGES.** Damage to the microvilli of the taste cells can lead to taste changes or loss of taste. There are often changes in the taste sensations of acid and bitter; the taste sensations of sweet and salty are the most involved. You are likely to recover fully from this within 2-4 months from the end of therapy, but some people report dulled taste even for a longer period (up to one year).

## RECOMMENDATIONS

- ✓ Always keep the oral cavity and teeth in optimal cleaning conditions
- ✓ Frequent mouth wash (3-6 times a day, especially after each meal)
- ✓ Avoid alcohol, cigarettes, spicy food and very hot food and liquid
- ✓ Eat highly nourishing food, that does not irritate mucosa, and can be chewed and swallowed easily
- ✓ Remove dental prosthesis
- ✓ During and after radiotherapy ensure good oral hygiene
- ✓ Use small head soft toothbrush and fluoride toothpaste
- ✓ Use dental floss
- ✓ Avoid candies
- ✓ Do not **EXTRACT** teeth in the irradiation field, and **ALWAYS CONSULT THE RADIOTHERAPIST BEFORE CARRYING OUT ANY TOOTH SURGERY.**
- ✓ This kind of surgery could cause serious damage (bone necrosis) to the mandibular and maxillary bones, even some years after the end of radiotherapy.

## Chest irradiation

**SWALLOWING DIFFICULTY:** it is quite frequent in treatments involving the central area of the chest and the oesophagus.

## RECOMMENDATIONS

- ✓ Eat soft, easy to swallow food and integrate your diet with caloric beverages.

- ✓ NAUSEA AND VOMITING. This is a frequent problem if the irradiated area is near the stomach; such symptoms can be easily controlled with a suitable antiemetic therapy and disappear at the end of treatment.
- ✓ DIFFICULT BREATHING. Report any problem connected with breathing (dyspnoea, dry or productive cough); if necessary, a support therapy shall be carried out.

### **Breast irradiation**

- ✓ SKIN REACTIONS  
Cutaneous erythema, i.e. redness of the skin in the irradiated area; the skin is red and painful, like after sunburn and it may itch. It usually appears after the third week of the radiotherapy cycle; the areas which are most sensitive to this phenomenon are the breast areola (the area around the nipple), the submammary sulcus and the axillary fold.  
At the end of treatment, hyperpigmentation will affect the irradiated area (that will darken).
- ✓ BREAST TENSION  
The breast will be swollen because of the accumulation of liquid under and in the skin; this is the consequence of radiations and surgery, that modify the collateral lymphatic circulation.

### **RECOMMENDATIONS**

- ✓ Avoid sun exposure and sun lamps for at least six months after the cycle of radiotherapy.
- ✓ Avoid aggressive detergents, alcohol perfume and tight-fitting clothes; use hydrating emulsions.
- ✓ PLEASE REMEMBER: ALL THESE SIDE EFFECTS OCCUR MORE FREQUENTLY IN PATIENTS WHO HAVE UNDERGONE CHEMOTHERAPY.

### **Irradiation of the abdominal and pelvic areas**

- ✓ NAUSEA AND VOMITING

Upper abdominal irradiations often induce nausea and vomiting, even though these side effects are frequently due to anxiety and stress, and not just to radiotherapy. Therefore, we recommend that you relax as much as possible.

In case of major nausea and vomiting, undergo radiotherapy on an empty stomach or follow a light diet; if necessary, antiemetic drugs can be resorted to.

#### ✓ DIARRHEA AND METEORISM

Lower abdominal and pelvic irradiations can often induce diarrhea and meteorism. They appear around the third or fourth week of treatment, and their duration varies. Radiotherapy on the intestinal mucosa induces enteritis, which can be managed by following the below-mentioned dietary rules and tends to disappear at the end of therapy. In a small percentage of cases it may present months to years after the completion of therapy, with the following symptoms: bowel obstruction, chronic diarrhea or rectal bleeding. RECTAL AND VESICAL TENESMUS AND PAINFUL MICTURITION

These symptoms may appear when the treatment involves the pelvic area, in case of urogenital disease.

They are due to the inflammation of rectal and vesical mucosa. It consists of the early filling of organs (rectal ampulla or bladder) with involuntary contraction of sphincters. All of which implies a frequent need to pass stool and to urinate; despite straining, little stool, mucus or gas is passed. Frequent micturition.

Painful micturition is rare.

#### RECOMMENDATIONS

- ✓ Drink lot of fluid and, if necessary, resort to suitable local therapies (suppositories or enemas)

#### DIETARY SUGGESTIONS

In general **avoid fried food, fatty or spicy sauces, strong spices and herbs, red pepper, pepper and cocoa**

## DURING THERAPY, EAT ONE YOGURT A DAY OR USE LACTIC FERMENTS

Patients will be informed about the type of food recommended or to be avoided during radiotherapy; these simple **dietary suggestions** may be adjusted by patients, introducing some of the prohibited food, if they find that their diet is too strict.



### **Cereals to be avoided**

All bran cereals (bread, pasta, rice, rusks, biscuits or crackers)



### **Allowed cereals**

WHITE BREAD WITHOUT ITS SOFT PART, ORDINARY BREADSTICKS, OAT FLAKES, RICE SOUP, TOAST, WHITE RUSKS.



### **Vegetables to be avoided**

Salad, broad beans, peas, legumes, artichokes, beans, chick-peas, lentils, turnip-tops.



### **Allowed vegetables**

CELERY, COOKED NON LEAFY VEGETABLES, SPINACH, ENDIVE, SMALL QUANTITY OF TOMATOES, VEGETABLE PURÉE, BOILED, ROASTED OR MASHED POTATES, ZUCCHINI, FRENCH BEANS, CARROTS.



### **Fruit to be avoided**

Dried fruit, blueberries, raspberries, plums, figs, red currant, quinces, walnuts, fresh coconut, avocado, pine-seeds.



### **Allowed fruit**

PEACHES, CITRUS FRUIT JUICE, PINEAPPLE, SCRAPED APPLES, BANANAS, LEMONS, TANGERINES



**Eggs to be avoided**  
Fried eggs, omelettes



**Allowed eggs**  
SOFT-BOILED and POACHED eggs



**Cheese to be avoided**  
Ripe, spicy and fatty cheese



**Allowed cheese**  
LIGHT AND FRESH CHEESE



**Meat to be avoided**  
Smoked meat, tripe, pork meat, sausages, prepared meat, entrails, game



**Allowed meat**  
WHITE OR RED LEAN MEAT, CURED OR BOILED DEFATTED HAM, DRIED SALT BEEF



**Fish to be avoided**  
Sea food and dried fish, eel and fatty fish



**Allowed fish**  
BOILED OR WITH LIGHT DRESSING



**Beverages to be avoided**  
Sparkly and cold beverages, coffee, cocoa, milk, alcoholic beverages



**Allowed beverages**  
BARLEY COFFEE, YOGURT, LEMON JUICE, WATER, CAMOMILE TEA, TEA, FRUIT JUICE

**Sweets to be avoided**

Cream, whipped cream, cocoa, ice-cream, dry fruit cakes

**Allowed sweets**

TARTS, NON WHOLE-MEAL AND/OR STUFFED BISCUITS, SIMPLE LOW-FAT CAKES, FRUIT ICE-CREAM

**To be avoided**

Spices, olives, lard, mustard

**Allowed food**

SUGAR AND SALT

**SOME LAST PERPLEXITIES...****Travelling**

Unless your physician advises you against it, you can drive if you feel like it, for there is no danger. Do not drive if you are taking antiseizure or anxiolytic drugs, or if you feel tired.

**Medicines**

During treatment, the dosage regimen of some of your usual drugs may be modified. Write down the list of all the drugs you usually take and show it to your physician before or during radiotherapy

**Personal hygiene**

Wash as usual; do not use any of the above-mentioned prohibited detergents whilst washing the irradiated area.

**Sexual behaviour**

No changes in your sexual behaviour will be required because of treatment. As far as having children is concerned, during

radiotherapy and for some time afterwards some precautions should be taken.

Fertile age women should take a pregnancy test before starting treatment.

Men are also recommended to take precautions during this period, in order not to have children.

### **Clothes**

Always wear loose-fitting light colour or flax clothes; avoid synthetic fibre clothes.

## **CONCLUSIONS**

This brochure aims at providing proper and clear information about the potential consequences of radiotherapy; yet, remember that **NO BROCHURE CAN REPLACE A CONVERSATION**. Do not hesitate to consult the radiotherapy team, at any time and to clear up any doubt.

Drawn up by the Communication Office, based on texts by Michela Madia MD, member of the Comprehensive Division of Radiotherapy

**Communication Office**

Phone: 040 – 399 6301, 040 – 399 6300; fax 040 399 6298

e-mail: [comunicazione@aots.sanita.fvg.it](mailto:comunicazione@aots.sanita.fvg.it)

[www.aots.sanita.fvg.it](http://www.aots.sanita.fvg.it)

Strada di Fiume 447 – I 34149 Trieste

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