

HAND BOOK ON MODERN RADIOTHERAPY



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PREFACE

This booklet is aptly timed to cope up with technical know how in radiation treatment. At a time when 80% of the cancer patient require radiotherapy during their lifetime, it is important to bridge the gap amongst radiation oncologist and the general physicians for the better treatment outcome. The aim of radiotherapy treatment is a perceived delivery of the prescribed dose to a defined target volume. While escalating the dose in the target volume for a tumoricidal dose, the surrounding healthy tissue is to be spared as much as possible. Though it is very difficult to compile a booklet in a field, while that field is rapidly changing and being redefined, the awareness is important both for the treating physician and the patient concerned to achieve the therapeutic outcome keeping in mind the quality of life.

Considering the impact of technology on medical care has been greater than from revolution in tumor and molecular biology, it is the responsibility of the radiation oncologist to disseminate the knowledge to his fellow colleagues and patients for better compliance. This booklet will help you become an informed partner though it is only a guide. Remember 'self help' is never a substitute for professional care

INTRODUCTION

Radiation Oncology alias Radiotherapy as a subject in medical science in the last two decades has undergone huge innovation. This prompted me to sit down and write a few lines in order to disseminate the knowledge to my fellow colleagues as well as common man.

Essentially the revolution it has undergone has put this modality as treatment option in cancer management to the highest order, as 80% of cancer patients require radiotherapy treatment, during their life time.

Finally this effort would not have been possible without the unstinted support of my family and well wishers.

To conclude my patients are my biggest source of inspiration which enforced me to compile this book and would like to dedicate the same for them.

Understanding Radiotherapy

1. What is Radiotherapy?

Radiotherapy is the use of high energy radiation, primarily electronically generated x-rays, to kill cancer cells. Doctors have traditionally used x-rays as a tool for painlessly visualizing the inside of the human body. The radiation used to treat cancer is given in doses many times higher than those delivered by x-rays. This application of high energy radiation has had a profound effect on cancer survival.

2. How does Radiotherapy work?

Normal cells divide and replace themselves in an orderly process, keeping the body healthy and repairing structures as needed. Cancer occurs when cells lose the ability to control their own growth. These abnormal cells multiply quickly, forming clumps of tissue called tumors and spreading to nearby tissues and organs (and sometimes to other parts of the body).

Radiotherapy works by damaging the DNA of cancer cells, the genetic information that is vital for cell reproduction. Once the DNA has been damaged the cancer cells are not able to divide and grow thereby causing the tumor to shrink. Cells that are growing and multiplying rapidly are especially sensitive to the effects of radiation.

3. What are the goals of Radiotherapy?

Radiotherapy is an effective treatment for various types of cancers in almost any part of the body. Its two main goals are :

- a. To cure cancer
- b. To relieve symptoms

For many patients, radiation is the only treatment needed. However, radiation treatment may also be given in combination with chemotherapy and/or surgery. Radiation can be used before surgery to shrink the tumor and during or after surgery to kill any cancer cells that may still be present. Doctors sometimes use radiation along with anticancer drugs to destroy the cancer instead of performing surgery. Radiation can be used as palliative therapy, meaning that its

primary intent is not to cure the cancer, but to relieve pressure, bleeding or pain by shrinking the tumors.

4. How is Radiotherapy given?

External Radiation:

Radiation treatment can be given in one of two forms: external or internal. Most cancer patients receive external radiation therapy, which uses a machine to direct the high energy rays or particles at the cancer cells and the normal tissue surrounding it. The radiation is usually produced in a machine called a linear accelerator. Different machines produce different types of energy; some are better for treating cancer near the surface, while others work best on cancers deeper in the body. The radiation oncologist decides which machine is best for each patient. Note that patients are not radioactive at any time during external beam radiation therapy.

Internal Radiation:

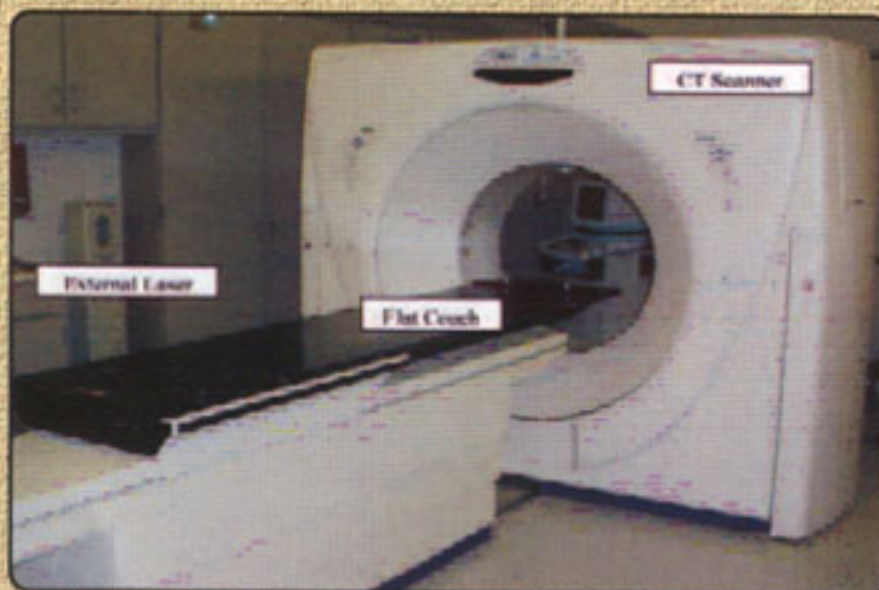
Internal radiation therapy places the source of the high energy rays inside the body as close as possible to the cancer cells, thereby reducing exposure of normal cells to the radiation. Internal radiation therapy allows the doctor to give a higher total dose of radiation in a shorter time than is possible with external treatments. The radioactive substances typically used include radium, cesium, iodine and phosphorus and they may be implanted for only a short time or left in place permanently. Patients with radiation implants sometimes need to be isolated from visitors so as not to expose them to radioactivity.

5. What is simulation?

After the initial consultation, the radiation oncologist may need to do some special planning to pinpoint the treatment area, a process known as "simulation." Alignment is critical during this planning process. The patient will be asked to lie very still on a table while the radiation therapist (a specially trained technologist), under the supervision of the radiation oncologist, will use a special x-ray machine or a CT scan / flat couch to define the patient's treatment area (sometimes called the treatment portal or field). This is the exact place in

the body where the radiation will be aimed. Ink lines are usually drawn on the skin to identify the area to be treated. Tattoos (tiny permanent skin markings the size of a freckle) may be placed at the time of simulation.

Several other treatment planning steps occur after simulation and before treatment, but the patient is not required to be present for these. Simulation x-ray may be used to design customized shielding devices (blocks) to protect healthy tissue from the radiation beam. The information from simulation, other tests and the patient's medical history will be used by the doctor, radiation physicist (who monitors the equipment), and dosimetrist (who calculate the correct dose) to create a customized treatment plan. The doctor then decides how much radiation is needed, how will it be delivered and how many treatments the patient will need. After all treatment planning is completed, the patient returns for verification on the treatment machine.



6. What is Brachytherapy?

Brachytherapy is a specialized cancer treatment technique involving the placement of the radioactive source in or near the cancerous cells. These radioactive sources may be placed for a short time or left in place permanently. There are a variety of brachytherapy treatment techniques and your physician will explain the details of your treatment.

7. High dose rate Brachytherapy?

One common brachytherapy technique involves high dose rate brachytherapy (HDR). This is special device which usually allows outpatient treatment.

8. Low dose rate Brachytherapy?

Low dose rate brachytherapy is often used for gynaecological cancers and involves the placement of radioactive sources over a period of many hours to several days. This procedure requires hospitalization. During hospitalization, the patient will need to stay in a private room and remain at bedrest to avoid dislodgement of the radioactive sources. Visitors will be restricted with regards to how close they may get to the patient and how long they may stay in the room with the patient. Pregnant women and children below the age of 18 are not allowed to visit. Prostate cancer may be treated with permanent implantation of radioactive seeds. This involves a minor brief surgical procedure. If you will be treated with brachytherapy, your physician will provide a more detailed discussion of how your treatment will be given. Brachytherapy is often given in combination with external beam radiation therapy.

Remember ... patients and their families are generally reassured and pleasantly surprised at how “easy” radiation therapy actually is!

What is Modern Radiotherapy

Introduction

The 3 dimensional conformal radiation therapy (3 DCRT) and the intensity modulated radiation therapy (IMRT) are part of the revolution in medical technology thus providing a leading edge so far as modern radiotherapy is concerned. The modern linear accelerators (LA) and treatment planning system (TPS) has the technological innovation to influence major technological saltation in both imaging and computer controlled radiation treatment. The resulting radiation treatment method having greater current application as well as potential implication for evolving treatment paradigm that both tumors assessment or computer controlled treatment would be expected to have individually. The modern radiotherapy will open new horizon for more effective and less toxic treatment but will also bring to us issues and concern not faced before in radiation oncology

Individual approach to simulation, immobilization, target delineation plan optimization and delivery and quality assurance ultimately could transfer into good radiotherapy treatment.

Types

Techniques practiced in radiotherapy treatment :

Conventional

3 DCRT

IMRT

IGRT

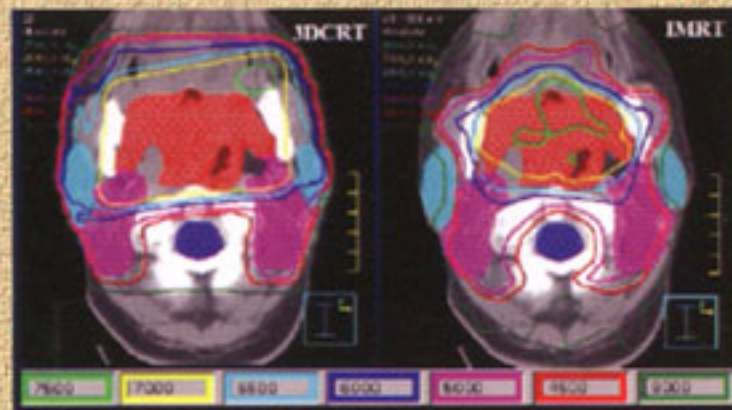


Conventional Radiotherapy is suitable in treating patients in small volume target in a palliative setting. This is a two dimensional method of delineating target volume where optimization is not required.

This is a standard technique in a busy radiotherapy department where quality assurance of each treatment delivery is not very important, but simulation and immobilization are important tools for good radiotherapy treatment.

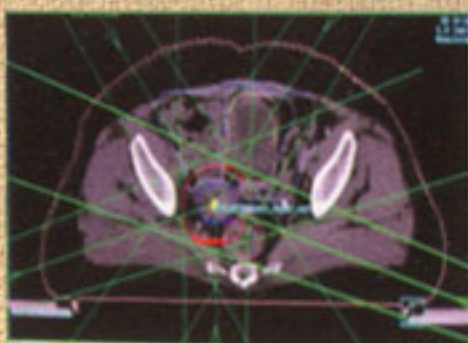
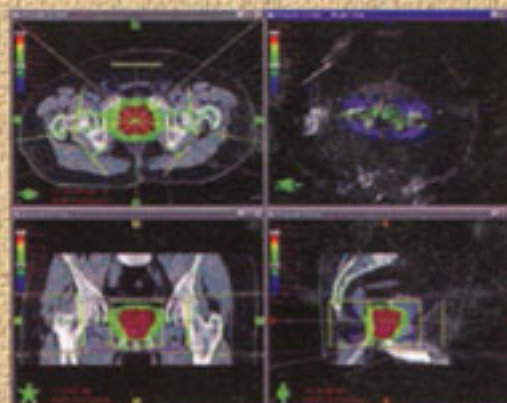
3 DCRT this is relatively a new technique where different target volumes and organs at risk are contoured by different imaging techniques like CT Scan, MRI, SPECT and PET-CT scans and finally treatment is optimized in the treatment planning system.

This is a standard practice for treating most of the cancers in a given setting.



IMRT the intensity modulated radiation therapy emerged in clinical practice as result of the development of 3 DCRT. It is generally agreed on the wide spread implementation and realization of the technique. Physically a common feature of IMRT techniques is that it attempts to enhance control over the 3 dimensional dose distribution through the superimposition of large number of independent segmented fields from either a number of fixed directions or from directions distributed on one or multiple arcs. The MLC (multi leaf collineators) fixed to the gantry head allows the rapid and controllable adjustment of field apertures and is thus ideally suited for dynamic radiation beam modulation

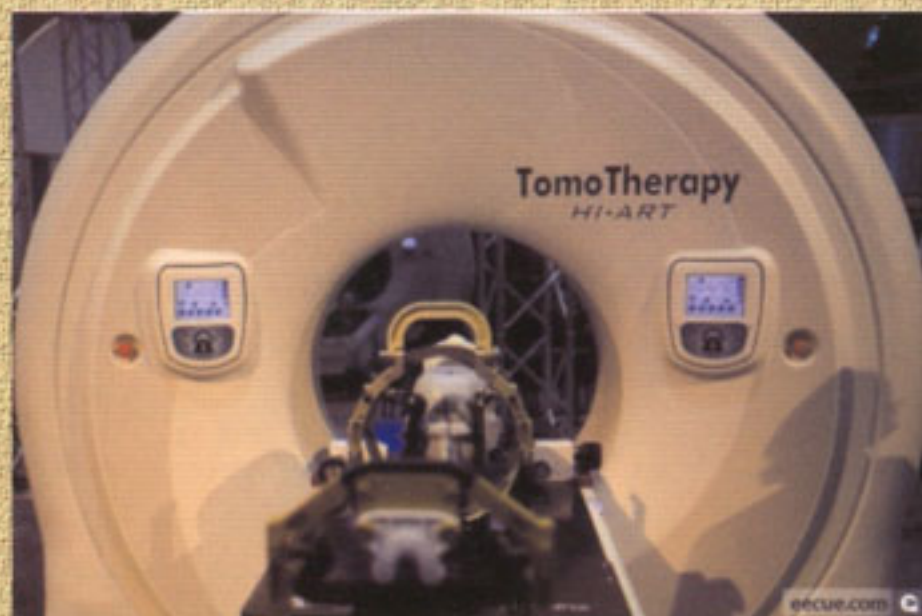
IMRT method of treatment in clinical practice is largely implemented in Head & Neck, prostate and brain tumors, though it can be executed in other sites also.



IGRT the recent advances in radiation therapy have been revolutionary, the improvement in computing power, the integration of 3D imaging into linacs and precise and targeted dose delivery are all leading to real time adaptive treatment. The technology of IGRT, rapid arc therapy will enable a highly personalized accurate and fast radiation treatment delivery. As imaging information only temporal changes of patient anatomy during the radiation process will be considered although Adaptive Radiotherapy (ART) strategies could in principle above applied to new information based on functional or biological images.

The need for time management in imaging for treatment planning is now being recognized and to an increasing extent more advanced respiratory correlation is used in both CT and Pet scanning to obtain four dimensional images.

IGRT provides lot of anatomical information of the patient just prior to treatment and therefore the possibility to align even more accurate tumor and soft tissue. Apart from set up, the imaging systems (KV and MV) can be used for real time tracking of moving targets the Tomotherapy. The commercially available machines designed to provide volumetric anatomic information of the patient in treatment position directly before and during each radiation fraction with adequate quality assurance is certainly a feather in the cap for radiation therapeutic technological revolution



Infrastructure

The typical radiotherapy department comprising of at least two dual energy Linear Accelerators with facility for +/- G-IMRT therapy is warranted in each centre, because of the known downtime for each of this sophisticated toy. Patient can be transferred to the second LA in case one machine is on service without interruption of the therapy.

A typical radiotherapy department is electronically connected by Dicom software between the dedicated flat couch CT scanner, the treatment planning system (TPS) and the therapy machines the Linear Accelerators. Facility for MRI and PET images to be reconstructed for treatment planning for further information is a boost for a good radiotherapy centre.

Nonetheless the manpower comprising of a radiologist, physicist, dosimetrist and breed of good therapy technologist along with Radiation Oncologist make a perfect team A good Radiotherapy Centre.



Common Queries

1. Does radiation treatment hurts?

No. They are similar to diagnostic x-rays. You do not feel them

2. Will radiation treatment burn my skin?

The skin usually becomes pink like in a sunburn. The degree of redness will vary from individual to individual and depend on the total dose of radiation being delivered as well as the skin's sensitivity. Peeling is less common. Some patients develop a rash. Your physician and nurse will keep a close watch on you during your treatments and will provide you with special creams and lotions should you need them. You should avoid sun exposure over the part of the body receiving treatment, as this is likely to worsen the skin reaction.

3. Will I feel Nauseous?

You may experience mild nausea, usually very well controlled with medication, depending on the part of your body being treated. Your physician will provide

4. Will I be radioactive after treatment?

No. External beam radiation treatments are like diagnostic x-rays in that the radiation is present in the treatment room only during the few minutes that the beam is on. You do not become radioactive and there is no danger to others.

5. Should I be on special diet?

You may require a special diet depending on the part of the body receiving radiation. For example, patients receiving treatment to the pelvis are counseled about foods that may increase their risk of experiencing diarrhea. Your physician will determine whether you need dietary counseling in which case a nutritionist will be available for you. Whatever your diet, you should try to maintain your weight and proper nutrition during your course of treatment.

6. Can I continue taking vitamin?

A single, daily multivitamin tablet is OK to take during treatment. We advise against the use of additional vitamins A, C or E during your course of radiation, you may resume them once your course is complete. Theoretically, these may interfere with your treatment.

7. Should I continue taking my medication?

Yes. Your regularly prescribed medications will not interfere with your radiation treatment. You should, however, let your radiation oncologist know of all the medications that you are taking.

8. What happens when my treatment course is finished?

Your radiation oncologist will continue to do a follow up for many years along with your other physicians. Follow up visits are usually 3- 4 months during the first two years, depending on your condition. Your physician will determine the frequency of visits, and diagnostic tests to be performed.

9. How long does each treatment last?

Each treatment lasts only a couple of minutes. Time spent in the treatment room is approximately 10 minutes, and you are likely to spend approximately 20-30 minutes total in the department. You will come in at the same time everyday once your treatments are underway. Your physician will check you at least once a week; On these days you may be in the department slightly longer than 30 minutes.

10. Will I be able to drive?

This will depend on your general condition. Most patients are able to drive without difficulty.

11. Should I limit my activities during the time I receive radiation treatment?

You should be attentive to your body's requirements and do what feels comfortable.

In other words, you should neither over exert yourself nor feel that should you spend extra time in bed. Sometimes

specific exercises will be prescribed to you.

12. What happens if I miss a treatment?

In general, missing one day does not change the overall effectiveness of the prescribed treatments. Your physician may, in fact, advise a short break if you are experiencing side effects. However, it is important that treatments are completed during the time course prescribed by your physician. If they are not, they may become less effective.

Do's and Don't

Oral sores

Possible cause : Total body irradiation (TBI), chemotherapy, methotraxate, oral infections, graft versus host disease.

Do's :

Eat lukewarm or cold food, rather than hot.

Cook food until tender and soft.

Drink through a straw to bypass mouth sores.

Eat high protein, high calorie food to speed healing of the sores.

Try a liquid or blenderized diet, or a complete nutrition supplement.

Eat soft food such as cream soups, cheese, mashed potatoes, yoghurt, eggs, custard, puddings, cooked cereals, ice cream and milk shakes.

Eat cold food such as milk shakes, cottage cheese, yoghurt, watermelon, canned fruit (blenderized, if necessary).

Eat soft, non irritating frozen food such as popsicles, ice cream, frozen yoghurt and slushes.

Drink fruit nectars and fruit flavoured beverages instead of acidic juices.

Maintain good mouth care.

Request pain medications if discomfort is severe.

Don't :

Do not eat or drink tart or acidic foods and beverages such as citrus fruits and juices, and pineapple juices.

Do not eat or drink salty food and drinks, including broth.

Do not use strong spices such as pepper, chilli powder, nutmeg and cloves.

Do not eat rough or coarse food such as raw fruits and vegetables, dry toast, grainy cereals and breads and crunchy snacks.

Do not drink alcoholic beverages.

Do not eat or drink extremely hot food and beverages.

Dry mouth

Possible cause : TBI, anti nausea medication, antihistamines, chronic oral GVHD

Do's :

Add sauces, gravies, broth and dressings to food.

Suck ice chips, popsicles, gum or sugarless hard candies to keep the mouth moist.

Try including citric acid in your diet to stimulate saliva production. Citric acid is present in oranges, orange juices, lemon, lemonade and sugarless lemon drops. You can also add lemon to tea, water and soda.

Drink liquids with your meals.

Practice good mouth care.

Ask your dietitian or doctor about commercial saliva substitutes.

Don't :

Do not eat plain meats, bread products, crackers, or dry cake.

Do not eat or drink very hot food or beverages.

Do not drink alcohol.

Change in taste

Possible cause : TBI, chemotherapy, some pain medications, some antibiotics.

Do's:

Eat and drink food and beverages cold or at room temperatures.

Eat strongly flavored food such as chocolate, lasagna, spaghetti or barbequed foods, unless you have mouth or throat sores.

Eat tart or spicy foods, unless you have mouth or throat sores.

Select food that smell appetizing.

Drink fluid with your meal to rinse away any bad taste.

Eat protein food without strong odors, such as poultry, eggs, and dairy products rather than those with strong odors such as beef and fish.

Use plastic utensils, if food seem to have a metallic taste.

Add sauces to food.

Try eating meat with something sweet, such as cranberry sauce, jelly or applesauce.

Don't:

Some patients have trouble eating bland food such as casseroles, custards, puddings, unsalted chips and crackers, overcooked vegetables, plain meats and plain fish. Red meat, chocolate, coffee and tea may also be difficult to tolerate.

Thick saliva

Possible cause: TBI, dehydration.

Do's:

Drink club soda or hot tea with lemon.

Try sucking sugarless, sour lemon drops.

Eat a lighter breakfast if you have mucuous build up in the morning and bigger meals in the afternoon and evening.

Rinse frequently with a saline solution (1 quarter water to $\frac{3}{4}$ tsp. salt and 1 teaspoon to 1 table spoon baking soda).

Drink lots of fluid.

Eat soft, tender food such as cooked fish and chicken, eggs, noodles, thinned cereals, blenderized fruits and vegetables diluted to a very thin consistency.

Eat small, frequent meals.

Drink diluted juices, broth based soups and fruit flavored beverages.

Switch to a liquid diet if problem is severe.

Don't:

Do not eat meats that require chewing, bread products, gelatin desserts, oily food, and hot cereals.

Do not drink thick cream soups or nectars.

Nausea and vomiting

Possible cause: Chemotherapy, TBI, drugs to control GVHD such as cyclosporine, methotrexate, drugs to control infections such as trimethoprim sulfamethoxazole (Bactrim or Septra), pain control medications (narcotics), interferon, interleukin-2, gastrointestinal GVHD, infection, mucous drainage from mouth and sinuses.

Do's:

Eat small frequent meals.

Eat dry crackers or toast.

Eat cold food rather than warm food because they tend to have less food odor.

Eat low fat food such as cooked vegetables, canned fruit, baked skinless chicken, sherbet, fruit ice, toast, crackers, vanilla wafers and angel food cake.

Drink clear cool beverages such as carbonated beverages, flavored gelatin, popsicles and ice cubes made of a favorite liquid.

Sip liquid slowly through a straw.

Sip or drink small amount of liquid frequently throughout the day.

Request that food trays be brought to you without covers on the plates to avoid being over whelmed by the smell.

Request medications to control nausea if it is severe.

Don'ts:

Do not go near cooking areas where smell might be offensive.

Do not eat spicy food.

Do not eat overly sweet food.

Do not eat foods with strong odor.

Do not eat high fat, greasy food.

Do not drink a lot of liquids with meals.

Do not drink hot liquids.

Do not lie flat on your back after eating. If you need rest, sit or recline with your head elevated.

Lack of appetite / weight loss

Possible cause: TBI, chemotherapy, infection, psychological problems such as depression, fatigue.

Do's:

Eat small, frequent, high calorie meals.

Drink high nutrients liquids such as juice or milk, instead of low calorie drinks like coffee, tea or diet soda. Eat dense, high calorie food such as cheese, whole milk, cream, whipped cream, sour cream, cottage cheese, ice cream, extra butter or powdered milk, eggs, oil, mayonnaise, peanut butter, wheat germ, nuts, instant breakfast beverages

and fruits.

Use carbohydrates supplements, protein powders or complete nutrition supplements provided they have been approved by your dietitian.

Alternatively, nonfat dry milk powder can be added to casseroles, cooked cereals and mixed dishes.

Create a pleasant, mealtime atmosphere, eg. Colorful place settings, varied food colors and textures, soft music, enhancing food aromas.

Engage in light exercise to stimulate your appetite.

It's important you keep trying to eat, even if you don't have much of an appetite.

Address the psychological problem, if one exists, with the help of a psychologist or social worker.

Diarrhoea

Possible cause: TBI, chemotherapy, some antibiotics, gastrointestinal GVHD, intestinal infections, oral medications such as magnesium salts, metoclopramide (Reglan), lactose intolerance.

Do's:

Eat smaller amounts of food at each meal.

Increase your intake of fluids to prevent dehydration.

Drink fluid between meals, rather than with meals.

Eat and drink food and beverages high in potassium and low in fiber such as ripe bananas, potatoes without the skin, tomato juice, orange juice, peach and pear nectar, baked fish and chicken, ground beef, eggs, well cooked vegetables (excluding beans, broccoli, cauliflower and cabbage), canned fruit, rice and white bread. Use low lactose milk and dairy products.

Don't:

Do not eat high fiber food such as bran, whole grain cereals and bread, vegetables, fruits, popcorn, nuts and seeds.

Do not eat or drink dairy products such as milk, cheese and yogurt, unless they are treated with "Lactaid"

Do not eat food that can cause gas or cramps such as carbonated beverages, beans, broccoli, cauliflower, cabbage, chewing gum and highly spiced food.

Do not eat rich gravies and sauces.

Do not eat or drink food and beverages containing caffeine such tea, coffee, chocolate and colas and caffeinated soft drinks.

Constipation

Possible cause: Narcotics, chemotherapy

Do's:

Increase fluid intake.

Drink warm beverages.

Eat high fiber foods such as raw fruits and vegetables, whole wheat bread and cereals, dried fruit, dried peas and beans.

Engage in light exercise.

Ask your doctor about stool softeners or laxatives if the problem persists.

Don't:

Do not Skimp on fluid when increasing your fiber intake.

Weight gain

Possible cause: Steroids, such as prednisone that cause fluid retention.

Don't eat/or reduce the intake of: Salt.

Don't eat salt foods and avoid food that are high in salt such as the following:

Meats: bacon, bologna, cold cuts, chipped beef, corned beef, hot dogs, ham, salt pork, sausage, canned and salted meats.

Prepared Food: bouillon, canned or frozen soups, frozen dinners, olives, pickles, pizza.

Salted snacks: Potato chips, corn chips, pop corn, etc.

Seasonings: Salt, celery salt, onion salt, chile sauce, monosodium glutamate (MSG), mustard, soy sauce, steak sauces, any seasoning mixed with salt.

Vegetables: Sauerkraut, beans cooked with salt pork.

Conquering the side effects

Coping with side effects of Radiation and Chemotherapy

If you have cancer and are undergoing cancer treatment, you may not feel well. Both the disease and treatment (including surgery, radiation, and chemotherapy) can cause a variety of symptoms including nausea, vomiting, fever, infection and fatigue.

Unfortunately, while some of these side effects are simply unpleasant, others can pose significant risks to your health and healing process.

For this reason, if you or a loved one is experiencing any of the symptoms listed below, there are some general guidelines you should keep in mind. The best course of action for anyone with cancer is to learn about potential side effects before they occur, so that you know what to do when and if they happen.

Watch for fever and infection

Radiation and chemotherapy are very powerful forms of cancer treatment and can produce strong side effects. One of the most dangerous side effects is infection.

Common signs of infection are swelling, redness, pain or fever (especially sustained fever). High fever can itself be dangerous, so it is very important to deal with fever as soon as it occurs and monitor it so that it does not get too high.

It is important to remember that the risk of infection and fever does not go away as soon as treatment ends. The amount of time a patient is at risk for infection varies greatly. Depending on each person's diagnosis and treatment options, it can be as long as two months. It is important for you to ask your doctor or health care team about this.

Why does fever occur?

Due to their powerful activity, both radiation and chemotherapy can greatly reduce the number of white blood cells in your body. These white blood cells are the body's natural defense against infection. Having a low white blood cell count as a result of treatment can leave a person at high risk for infection.

A fever can be a sign that your body has an infection. In addition, fevers cause harm to your body. They can be exhausting, cause chills, headaches and other problems. Hence, it is important to reduce fever (and the infection causing it) as soon as possible in order to monitor progress. It is also important to provide reports on your condition to your physician or health care team.

The most common course of action will be to treat the fever and the cause of the infection at the same time, with anti fever drugs, antibiotics, and medicine to help replenish your body's white blood cells. As with any serious side effect, the key to dealing with fever and infection is to watch for warning signs, communicate with your doctor and take quick action.

Myths about fever

1. "Fever come and go it's best just to let them run their course."

False. Fever are always an indication that something is wrong and should be reported and treated if fevers get too high, they can lead to dehydration and cause seizures. When you are undergoing radiation or chemotherapy, fevers often indicate infection, which is serious and requires medical attention.

2. "Fevers help burn up whatever is wrong".

False. High fever do not destroy the bacteria that cause infection. This is why your doctor or health care team will treat both the fever and the possible infection. If your white blood cell count is low, your body will not be able to fight off the infection on its own.

Remember: Watch for warning signs of infection, especially fever. If a fever develops, don't wait to see what happens. Tell your doctor or health care team, and follow their advice.

Skin irritation

One of the most common side effects of radiation therapy is skin irritation in the area of the body that is being treated. The skin reaction can range from very mild redness and dryness (similar to a sunburn) to severe desquamation (peeling) of the

skin in some rare cases. With modern radiation techniques, many patients can be spared significant symptoms related to the skin. There are, however, some instances where full treatment to the skin is required.

Always let your nurse or doctor know if your skin is becoming irritated. Most patients start with some redness and dryness to the skin 2-3 weeks into treatment. This can progress to peeling and ultimately moist desquamation with oozing of fluid in the area. There are effective topical medications available for radiation induced skin irritation. Typically the nurses in the radiation oncology department are the most experienced in dealing with skin reactions. There are some rare instances where radiation therapy must be placed on hold to allow for some skin healing, but this is a decision that must be made by the treating oncologist.

Skin reactions can be magnified in those patients who are receiving chemotherapy along with radiation therapy. There is also a reaction known as the "radiation recall phenomenon" that can occur with specific chemotherapy agents, particularly Adriamycin. In this phenomenon, skin may completely heal after the radiation treatment only to have the same skin occur some time later with the start of Adriamycin therapy.

There are some precautions that patients can take to minimize skin irritation during radiation treatments:

- Wash the skin in the treatment area with mild soaps such as Dove/Lux/Cinthol etc.
- Use a mild shampoo, such as baby shampoo, if the head is being treated.
- When using a towel, pat the area dry instead of rubbing.
- If you must shave in the treated area, use an electric razor to prevent cuts.
- Avoid using shaving lotions or scented creams.
- Do not use perfumes, deodorants or make up in the treated area.
- Always check with your nurse or doctor before using creams or lotions on the skin. Samples of safe topical

medications are usually available in the radiation clinic.

- Avoid using heating pads and ice packs on the skin in the treated area.
- Use only paper tape with dressings applied to the treated area.
- Wear loose fitting clothing that does not rub on the skin in the radiated area.
- Avoid sun exposure of the treated area (i.e. use of hats, thick clothing, umbrellas, etc.).

Feeling of fatigue

Tiredness or fatigue is a feeling of weariness, weakness or exhaustion or a lack of energy to carry on. There are a number of factors that can cause fatigue, including anemia, accumulation of waste products, not enough intake of protein, calories, vitamins, and minerals, disruption of sleep and rest, lack of activity, stress, anxiety, and depression. Many patients may feel fatigue while undergoing radiation therapy.

Fatigue is often the greatest 2 to 4 hours after treatment. Here are some hints to try to feel less tired:

- Try to eat even when you are tired. Sometimes a little food will give you extra energy.
- Try to get more rest. Rest when you are tired. Get more sleep at night. Take a nap during the day.
- Limit your activities if you can. Don't feel you have to keep up with your normal activities.
- Plan to get some exercise each day.
- Prepare meals ahead of time and freeze them.
- Use convenience foods and those foods that are ready to eat.
- Accept the offers of friends and relatives to help.
- Drink three quarts of fluid each day to avoid the build up of cellular waste products.

The feeling of tiredness should wear off several weeks after your radiation therapy ends. If you have other ideas that have worked for you, let us know so that we can share your ideas

with other patients.

Dealing with diarrhoea

Diarrhoea is a common side effect of chemotherapy and radiation therapy. Chemotherapy drugs affect the lining of intestinal tract. Radiation therapy causes diarrhea when the area treated includes that abdomen and pelvis. Radiation seed implants for prostate cancer can also cause diarrhea. Fortunately this is a temporary side effect in the vast majority of patients.

Diarrhea can be effectively managed in most patients who follow these recommendations:

- Start with clear fluids, semisolid diet and toast.
- Slowly add solid food back into your diet as tolerated.
- Rice and bananas are usually well tolerated.
- Eat small, frequent meals.
- Eat food at room temperature.
- Avoid milk products, including cheese and ice cream.
- Avoid fresh fruits.
- Cook all vegetables well. Raw vegetables are difficult to digest.
- Avoid greasy, fatty, spicy or fried foods.
- Drink plenty of water (at least 8 glasses a day) because there is a risk of losing body fluids.
- As the diarrhoea improves, add more heavy foods such as pasta, potatoes and meat to your diet.
- If the diarrhea lasts more than 24 hours, notify your physician.

You should consult your physician before taking any over the counter anti diarrhea medications. These can be very effective, but may not be appropriate in your case.

Hair loss

Hair loss does not result unless the hair is in the direct treatment field. Radiation effects in the hair usually include complete loss of hair in the area being treated. After approximately two weeks of treatment, the hair falls out, often rapidly over a short period of time. Hair regrowth

following radiation therapy is dependent on the dose of radiation given and your Radiation Oncologist will discuss this with you. For most patients, Hair regrowth is expected. Hair regrowth usually begins several weeks after the radiation therapy treatments are complete and takes many weeks to months to complete. Plan ahead for expected hair loss by obtaining a wig, hat or other hair covering device. Sometimes a steroid medicine may be used for brain irradiation.

Mouth and throat

Radiation effects in the mouth and throat often begin 2-3 weeks into treatment. These effects include mouth discomfort, variably altered taste of food (often with decreased taste sensation) and discomfort in swallowing. Hoarseness may occur if the vocal cords are in the treated area. Several months after treatment, a permanent dry mouth may result if most of the salivary glands are treated to a high enough radiation dose. A dry mouth increases the risk of dental problems developing months to years after radiation therapy is complete. If a dry mouth is likely to result, your Radiation Oncologist may have you see a dentist or oral surgeon prior to radiation therapy for any necessary dental surgery and to recommend a course of special fluoride treatment to reduce the risk of future dental complications.

Breast

Radiation effects from radiation therapy to the breast usually include some degree of skin redness that is usually mild and does not cause symptoms. Usually there are no other significant side effects of radiation therapy to this site. The skin reactions usually resolve in a few weeks and long term adverse cosmetic results attributable to radiation therapy are unusual.

Chest

Lung and esophagus (the tube through which food is swallowed) cancers are the most common cancers involving radiation therapy to the chest. After 2-3 weeks, radiation effects in the esophagus may result in a lumpy feeling during swallowing. This reaction may progress to discomfort in

swallowing. If this happens, special dietary instructions may be given. There are several helpful medications available if discomfort in swallowing occurs.

Abdomen

Radiation effects in the abdomen may include diarrhea (from radiation effects on the intestine) which may begin 2-3 weeks into treatment. Diarrhea is usually easily controlled with the medications like Lomotil (available by prescription) and dietary adjustments. If a significant portion of the stomach is treated, nausea and possibly vomiting may result. There are very effective medications to help control nausea.

Pelvis

Radiation effects in the pelvis may include diarrhea (from radiation effects on the small bowel, as discussed in the section on abdomen above) which may begin 2-3 weeks into treatment. Diarrhea is usually easily controlled with the medications like Lomotil (available by prescription) and dietary adjustments. Radiation effects on the rectum may result in discomfort with bowel movements. If the reaction in the rectum progresses, there may be bleeding which is usually minimal in amount. Most patients with rectum reactions can be greatly helped with prescription medications. Radiation effects in the bladder may result in more frequent urination or discomfort urination. Medications are available for these reactions, but bladder reactions may be more difficult to control than other pelvis radiation effects.

After treatment care

Any side effects of treatment that may have occurred usually go away in a few days to several weeks. You should call your physician if you have concerns regarding side effects after treatment or if any side effects after treatment or if any side effects seem unexpectedly severe or worsen. After radiation therapy treatments are complete, you will probably be given an appointment for a follow up visit. Follow up visits are often coordinated with other physicians involved in your care.

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