



# **Coping with RADIATION**



**CANCER PATIENT'S AID ASSOCIATION**  
**Total Management of Cancer**  
[www.cancer.org.in](http://www.cancer.org.in)

About CPAA..... 02

1. Radiation Treatment..... 03

2. Radiation Treatment Planning..... 03

    i. Treatment Accessory Preparation Immobilization Device

    ii. Patient Imaging for Treatment Planning

    iii. Treatment Planning in TPS

3. Different Types of Radiation..... 05

    i. External-Beam Radiation Therapy

        a. 3 Dimensional Conformal Radiation Therapy (3D-CRT)

        b. Intensity Modulated Radiation Therapy (IMRT)

        c. Image-Guided Radiation Therapy (IGRT)

    ii. Tomotherapy

    iii. Stereotactic Radio Surgery / Radiation Therapy (SRS/SRT)  
        (Intra-Cranial /Extra-Cranial)

    iv. Stereotactic Radio Surgery

    v. Stereotactic Body Radiation Therapy

        a. Proton Therapy

        b. Other Charged Particle Beams

    vi. Internal Radiation Therapy

        a. Interstitial Brachytherapy

        b. Intracavitary Brachytherapy

        c. Episcleral Brachytherapy

4. Some Important Facts..... 08

5. Answers To Some Typical Questions ..... 09

6. Managing And Coping with Side effects..... 10

    i. Watch for fever and infection

    ii. Skin irritation

    iii. Hair loss

    iv. Tiredness or fatigue

    v. Dealing with Diarrhea

    vi. Dealing with Constipation

7. Side effects due to Radiation to specific sites..... 12

8. After Treatment Care..... 13

9. Diet, Appetite and You..... 13

Cancer Patients Aid Association (CPAA), a registered charitable non-governmental organisation (NGO), was started in 1969 mainly to provide financial assistance to needy cancer patients. Over the last forty three years the organisation has expanded its mission to address the root cause of the exponential increase in cancer cases in India, namely that of lack of knowledge and information. CPAA complements the work being done by medical practitioners and hospitals, concentrating on education and awareness, early detection, insurance, support to treatment, guidance and counseling and rehabilitation or 'Total Management of Cancer'. It has grown from a tiny Mumbai based organisation surviving on small donations to one with branches in Delhi and Pune. CPAA draws its entire annual budget from corporate and individual donations.

CPAA's main aim is to:

- Spread awareness on the dangers inherent in accepted social practices such as chewing of tobacco, early marriage and multiple pregnancies, which are responsible for approximately 70% of cancers in India.
- Initiate steps for the early detection of cancer since treatment at this stage leads to a cure in a majority of cases.
- Provide complete assistance to cancer patients beyond that given by the medical profession, taking a holistic approach.

Our activities which encompass every area related to cancer are: Awareness, Advocacy, Early detection, Insurance, Patient Care, Rehabilitation Centre, Tobacco Cessation Centre and a Volunteers Training Programme.

## **1. RADIATION TREATMENT**

Radiation therapy is an extremely important treatment option in the management of cancer. In the last two decades spectacular progress in technology has led to better radiotherapy with fewer side effects. Radiation therapy uses high-energy radiation to shrink tumors and destroy cancer cells by damaging their DNA. X-rays, gamma rays and charged particles are types of radiation used for cancer treatment.

Radiation may be delivered by a machine outside the body (External-Beam Radiation Therapy), or it may come from radioactive material placed in the body near cancer cells (Internal Radiation Therapy, also called Brachytherapy). Systemic radiation therapy uses radioactive substances, such as radioactive iodine, that travel in the blood to kill cancer cells.

A patient may receive radiation therapy before, during, or after surgery. Some patients may receive radiation therapy alone, without surgery or other treatments, some may receive radiation therapy and chemotherapy at the same time. The timing of radiation therapy depends on the type of cancer and the goal of treatment (cure or palliation)

***Patients and their families are always pleasantly surprised at how easy radiation therapy actually is !***

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## **2. RADIATION TREATMENT PLANNING**

During radiotherapy the patient generally stays at home and reports to the hospital for treatment. Conventionally the treatment is given once a day for five days a week, over a period of time. One dose (a single fraction) of the total planned dose of radiation is given each day. The total duration i.e. the frequency of radiation and time are decided by a Radiation Oncologist.

On the first day the illness is evaluated completely by the Radiation Oncologist and the protocol is decided. The patient is explained the treatment in detail. The radiation treatment will be planned, simulated and the dose calculated before it commences. The

tumor size and volume is identified by the radiation oncologist using clinical, endoscopes, biochemical and imaging data. The critical organs influencing the treatment plan are identified.

A computer is used to generate a method of delivery which will deliver maximum radiation to the target and minimum to normal tissue.

**(i) Treatment Accessory Preparation - Immobilization Device:** Since the radiation treatment delivery system should be of utmost precision, a method of immobilization is usually established taking into account the portion of the body to be treated and its limitation of mobility while delivering radiation. This is custom made to suit the requirement of the individual patient. This can be of various forms – Thermoplastic mould materials, mainly used for the treatment of brain tumors and head and neck region tumors, but can be used for other trunk and extremity region tumors. Vacuum cushion bags (Vac locks) of various shapes and sizes can be practically used for tumors of any body region.

**ii) Patient Imaging for Treatment planning :** The basic pre-requisite for all Radiation Treatment planning procedures are generally (3DCRT, IMRT, IGRT, RS, and SRT) CT scan of the required anatomical site, done for the planning purpose under the guidance of the Radiation Oncologist and a Radiologist of the hospital. In cases additionally MRI, PET scans and other scans may require in the best interest of the patient. These Radiation-planning CT scan images alone or combined with other scans done for the planning purpose are transferred to the Radiation Treatment Planning Work Station through proper network.

**iii) Treatment Planning in TPS :** This is the most critical step in the planning process. This involves importing the RT (Radiation Treatment) planning Imaging data to a dedicated computerized work- station, where based on the RT planning CT scan images and / or fused images obtained, the Radiation Oncologist delineates the tumor area / target region, all critical surrounding normal tissues in each slice of the scan images and ultimately constructs a 3-dimensional form of the anatomy of the treatment site. Next, on another dedicated treatment planning software system, the Medical Physicist and the Radiation Oncologist create radiation beam planning. The planning amongst other details also contains the total dose delivered to the volume of cancerous tissue and the approach of beams (called portals or fields). Every effort is made by the Radiation Oncologist at this stage to ensure that the dose-planning is accurate and best suited for that patient. The Radiation Oncologist also ensures the principle rule of Radiation Oncology that the prescribed and the maximum radiation dose precisely covers the target volume and that the normal healthy tissue surrounding the affected volume is spared from high radiation doses and receives the least radiation dose.

***Fear, not cancer, can obstruct your path to cure.***

### **3. DIFFERENT TYPES OF RADIATION**

Radiation can come from a machine outside the body (External-Beam Radiation Therapy) or from radioactive material placed in the body near cancer cells (Internal Radiation Therapy, more commonly called Brachytherapy). Systemic radiation therapy uses a radioactive substance, given by mouth or injected through a vein and transmitted through the blood to tissues throughout the body.

The type of radiation therapy prescribed by a radiation oncologist depends on many factors including:

- Type of cancer.
- Size of the cancer.
- Location in the body.

- How close the cancer is to normal tissues that are sensitive to radiation.
- How far into the body the radiation needs to be targeted
- Patient's general health and medical history.
- Whether additional cancer treatment to be included
- Other factors, such as the patient's age and other medical conditions.

**(i) EXTERNAL-BEAM RADIATION THERAPY :** External-beam radiation therapy is most often delivered in the form of photon beams (either x-rays or gamma rays). It can be thought of as a bundle of energy. The amount of energy in a photon can vary. Many types of external-beam radiation therapy are delivered using a machine called a linear accelerator (also called a LINAC). Various methods of external beam radiation therapy are currently being used in cancer treatment. These methods include -

**a. 3-Dimensional Conformal Radiation Therapy (3D-CRT) :** This is one of the most common types of external-beam radiation therapy. 3D-CRT uses very sophisticated computer software and advanced treatment machines to deliver radiation to precise target areas.

**b. Intensity-Modulated Radiation Therapy (IMRT) :** IMRT uses hundreds of tiny radiation beam-shaping devices, called collimators, to deliver a single dose of radiation. The collimators can be stationary or can move during treatment, allowing the intensity of the radiation beams to change during treatment sessions. This kind of dose modulation allows different areas of a tumor or nearby tissues to receive different doses of radiation. The goal of IMRT is to increase the radiation dose to the specific areas and reduce radiation exposure to sensitive areas of surrounding normal tissue.

**c. Image-Guided Radiation Therapy (IGRT) :** In IGRT, repeated imaging scans (CT, MRI, or PET) are performed during treatment. These imaging scans are processed by computers to identify changes in a tumor size and location due to treatment and to allow the position of the patient or the planned radiation dose to be adjusted during treatment as needed. Repeated imaging can increase the accuracy of radiation treatment and may allow reductions in the planned volume of tissue to be treated, thereby decreasing the total radiation dose to normal tissue.

**(ii) TOMOTHERAPY :** Tomotherapy is a type of image-guided IMRT. A Tomotherapy machine is a hybrid between a CT imaging scanner and an external-beam radiation therapy machine. The part of the Tomotherapy machine that delivers radiation for both imaging and treatment can rotate completely around the patient in the same manner as a normal CT scanner

**(iii) STEREOTACTIC RADIO SURGERY / RADIATION THERAPY(SRS/SRT) (INTRA-CRANIAL / EXTRA-CRANIAL) :** SRS / SRT is a highly specialized non-surgical procedure that uses highly focused X-rays (also called- X-knife) beams to converge on the tumor / abnormality with very high level of precision and accuracy to deliver a high dose of radiation. It can be done with a localization frame fixed to the skull or can be frameless (intra-cranial) or even with a Stereotactic body-frame (SBF) device (extra-cranial). SRS delivers very high radiation dose in a single session, while SRT is delivered in multiple sessions. In SBFRT again a relatively higher dose of radiation is delivered per fraction for a few sessions spaced out in time. Many benign lesions / tumors of brain, cranial metastatic lesions, arteriovenous malformations (AVMs) are treated with SRS / SRT. Metastatic lesions in various organs (like lungs, liver, close to an involving spinal cord ), and even some locally advanced inoperable primary tumors can be treated with SBFRT. Difficult to treat lesions lying very close to critical structures such as spinal cord, brain stem, and optic apparatus can be treated with Intensity- Modulated Radio surgery (IMRS).

**(iv) STEREOTACTIC RADIO SURGERY :** Stereotactic Radiosurgery (SRS) can deliver

one or more high doses of radiation to a small tumor. SRS uses extremely accurate image-guided tumor targeting and patient positioning. Therefore, a high dose of radiation can be given without excess damage to normal tissue. SRS can be used to treat only small tumors with well-defined edges. It is most commonly used in the treatment of brain or spinal tumors and brain metastases from other cancer types. For the treatment of some brain metastases, patients may receive radiation therapy to the entire brain (called Whole-Brain Radiation Therapy) in addition to SRS. SRS requires the use of a head frame or other device to immobilize the patient during treatment to ensure that the high dose of radiation is delivered accurately.

**(v) STEREOTACTIC BODY RADIATION THERAPY :** Stereotactic Body Radiation Therapy (SBRT) delivers radiation therapy in fewer sessions, using smaller radiation fields and higher doses than 3D-CRT in most cases. SBRT can be used to treat only small, isolated tumors, including cancers in the lung and liver. Many doctors refer to SBRT systems by their brand names, such as the CyberKnife®.

**a) Proton therapy :** External-Beam Radiation Therapy can be delivered by proton beams as well as the photon beams. Protons are a type of charged particle.

**b) Other charged particle beams :** Electron beams are used to irradiate superficial tumors, such as skin cancer or tumors near the surface of the body, but they cannot travel very far through tissue. Therefore, they cannot treat tumors deep within the body.

**vi) INTERNAL RADIATION THERAPY :** Internal Radiation Therapy (Brachytherapy) is radiation delivered from radiation sources (radioactive materials) placed inside or on the body. Several Brachytherapy techniques are used in cancer treatment. Brachytherapy can be given as a low-dose-rate or a high-dose-rate treatment. In low-dose-rate treatment, cancer cells receive continuous low-dose radiation from the source over a period of several days. In high-dose-rate treatment, a robotic machine attached to delivery tubes placed inside the body guides one or more radioactive sources into or near a tumor, and then removes the sources at the end of each treatment session. High-dose-rate treatment can be given in one or more treatment sessions. For permanent Brachytherapy, the sources are surgically sealed within the body and left there, even after all of the radiation has been given off. The remaining material (in which the radioactive isotopes were sealed) does not cause any discomfort or harm to the patient. Permanent Brachytherapy is a type of low-dose-rate Brachytherapy.

For temporary Brachytherapy, tubes (catheters) or other carriers are used to deliver the radiation sources, and both the carriers and the radiation sources are removed after treatment. Temporary Brachytherapy can be either low-dose-rate or high-dose-rate treatment.

Brachytherapy is administered in the following ways:

**(a) Interstitial Brachytherapy** uses a radiation source placed within tumor tissue, such as within a prostate tumor.

**(b) Intracavitary Brachytherapy** uses a source placed within a body cavity, such as in the uterus and vaginal cavity, as in cancer of cervix.

**(c) Episcleral brachytherapy**, which is used to treat melanoma inside the eye, uses a source that is attached to the eye. In Brachytherapy, radioactive isotopes are sealed in tiny pellets or 'seeds'. These seeds are placed in patients using delivery devices, such as needles, catheters, etc. As the isotopes decay naturally, they give off radiation those damages nearby cancer cells.

***Radiation treatment is similar to diagnostic***

*X-rays and does not hurt. You do not even feel them.*

#### **4. SOME IMPORTANT FACTS**

Compared to other treatment options for cancer, the side effects due to radiation are generally mild, the nature depending on site and dose. Your Radiation Oncologist will explain the risk of complications due to therapy prior to treatment. It is important that you should not be so concerned about the minimal radiation complications to refuse recommended radiation treatment which is important for your health. Please make it a point to discuss the nature of treatment, side-effects and any other doubts you may have at this time.

First day of radiation

This is the day many approach with fear. But armed with knowledge of events to come and a fierce determination to conquer, you will feel confident.

Clarification of the following questions will help you to gain confidence

- Why do I need radiation even after operation?
- What are the treatment options?
- What are the benefits of treatment?
- What are the risks and side effects of treatment?
- Will I need to change my normal activities?
- For how long?
- Can I keep working during the treatment?
- What is the prognosis of my disease?
- How often will I need to have checkups?
- What are the other choices and their advantages and disadvantages?
- What is the cost of the treatment?
- Will I need hospitalization?

*To regain one's former identity, the most important thing is determination, confidence and a positive attitude.*

#### **5. ANSWERS TO SOME TYPICAL QUESTIONS**

**i) Will I feel nauseous?**

You may experience mild nausea, depending on the part of your body being treated, which can usually be controlled with medication. Ask your physician to provide you with the appropriate medication if this occurs.

**ii) Will I be radioactive after my 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.

**iii) Should I continue taking my medications?**

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

**iv) 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 about 20-30 minutes in the department. You will come in at the same time everyday once your treatment is underway. Your physician will check you at least twice a week. On these days you may be in the department slightly longer.

**v) 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 you should spend extra time in bed.

**vi) 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 might advise a short break if you are experiencing side effects. However, it is important that treatment should be completed during the time prescribed by your physician. If not, the treatment is less effective.

**vii) What happens when my treatment course is finished?**

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

## **6. MANAGING AND COPING WITH SIDE EFFECTS**

Most patients are quite pleased to find they have no side effects or that they are much milder than what they had anticipated. Radiation therapy will not cause side effects in areas other than the area being treated. Blood tests may be requested at regular intervals to ensure no blood count abnormalities develop a rare occurrence.

However, there are significant individual differences in the side effects that may result. You will be evaluated regularly by your radiation oncologist while under treatment. This will give you an opportunity to ask questions and discuss side effects, if any. Write down your questions before hand and ensure that you report all difficulties and symptoms.

Both Chemotherapy and Radiation, treatment options of cancer can cause a variety of side effects including nausea, vomiting, fever, infection and fatigue. While these side effects are often simply unpleasant, others can pose significant risks to your health and healing process. However it is important to remember that the side effects go away once the treatment is over.

It is always better to be aware about potential side effects, which will be discussed in the following pages to be prepared to handle them.

**i) WATCH FOR FEVER AND INFECTION :** One of the most common side effects of radiation is infection. Common signs of infection are swelling, redness, pain or sustained fever. High fever can itself be indicative of infection, so it is important to deal, monitor and treat with it. 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 from infection varies greatly. It is important for you to ask your doctor or health care team about this.

**ii) SKIN IRRITATION :** One of the most common side effects of radiation therapy is skin irritation at the sight of treatment the skin reaction can range from mild redness and dryness (similar to sunburn) to severe peeling of the skin in rare cases. With modern radiation techniques, many patients are spared significant symptoms related to the skin. There are, however, some instances where a full treatment to the skin is required. Always let your nurse or doctor know if there is a problem. There are effective topical medications available for radiation induced skin irritation. It is important to maintain good hygiene at the irradiated site by washing with a mild soap. Dab with a soft towel, and do not rub the area.

**iii) HAIR LOSS :** Hair loss may occur in the treatment field. Loss of scalp hair occurs only if radiation is directed to the head. The hair generally grows back following completion of the treatment; however, this is dependent on the dose.



**iv) TIREDNESS or FATIGUE :** Tiredness or fatigue is a feeling of weariness, weakness or exhaustion or a lack of energy. 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 maximum, 2 to 4 hours after treatment. The following measures can help you to cope with the fatigues:

- 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 or 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 convenient health foods, and are ready to eat healthy food.
- Accept the offers of friends and relatives to help
- Drink three liters of fluids each day to avoid the build-up of cellular waste products.
- The feeling of tiredness should wear off a few weeks after your radiation therapy ends.

**v) DEALING WITH DIARRHEA :** Radiation therapy causes diarrhea when the area treated includes the abdomen and pelvis. Fortunately this is a temporary side effect and can be effectively managed by following these recommendations:

- 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, spicy or fried foods
- Drink plenty of water since your body is losing fluids.
- Start with clear fluids and semi solid diet.
- Gradually add solid food back into your diet as tolerated.
- Try rice and bananas.
- Add more heavy foods starting with pasta, potatoes as diarrhea improves
- If diarrhea lasts more than 24 hours, consult your doctor.

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.

**vi) DEALING WITH CONSTIPATION**

- Increase fluid intake.
- Drink warm beverages.
- Eat high fiber foods such as raw fruits, vegetables, whole wheat bread and cereals, dried peas and beans.
- Engage in light exercise.
- Ask your doctor for laxatives if the problem persists.

## **7. SIDE EFFECTS DUE TO RADIATION TO SPECIFIC SITES**

**Mouth and Throat:** Radiation effects in the mouth and throat often begin after 2-3 weeks of treatment. These effects include mouth discomfort, variably altered taste of food (often with decreased taste sensation) and discomfort in swallowing. Keep a good oral hygiene during treatment by gargling regularly with non alcoholic mouth wash. Use a

soft brush for brushing the teeth twice daily. It is also advisable to eat softer foods and avoid acidic, irritating, fried, greasy or hot foods when one has a sore mouth during treatment. It also helps to drink plenty of liquids and have nutritious diet in small amounts frequently. Smoking and betel nut chewing not only reduces the effectiveness of your treatment but also predispose you to a second cancer risk. One must make every effort to give up these habits. Hoarseness may occur if the vocal cords are in the treatment area. Several months after treatment, a permanent dry mouth may result. A dry mouth increases the risk of dental problems, developing after radiation therapy is complete. If a dry mouth is likely to result, your Radiation Oncologist may ask you to 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 to the breast usually include a mild degree of skin redness that is mild and does not cause severe symptoms. Reactions will resolve in a few weeks and long term adverse cosmetic results attributable to radiation therapy are unusual.

**Chest:** Lung and esophagus cancers are the most common cancers involving radiation therapy to the chest. After 2-3 weeks, radiation effects in the esophagus may result in discomfort in swallowing. If this happens, special dietary instructions may be given or medication may be recommended

**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 prescription medication 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.

**Pelvic Region:** Side effects of radiation in the pelvis may include diarrhea due to radiation to the small bowel which may begin 2-3 weeks into treatment similar to that described above. Radiation to the rectum may result in discomfort with bowel movements. There may be bleeding, If the reaction in the rectum progresses, but this is usually minimal. 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 during urination. Medications are available for these reactions, but bladder reactions may be more difficult to control than other pelvis radiation effects.

## **8. 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 seem unexpectedly severe or worsen. After radiation therapy treatment is complete, you will probably be given an appointment for a follow up visit. Follow up visits are coordinated with other physicians involved in your care.

## **9. DIET, APPETITE AND YOU**

Food contributes a lot to the quality of our lives and is more than just a physical need. Many cancer patients experience eating problems. Many times cancer patients find that they cannot eat as much as usual and sometimes lose weight. This may be caused by the effects of the illness itself or its treatment. Individual who do not eat enough, and are losing weight, need more energy and protein. We all need a certain number of calories each day to provide the energy for all our activities. The key to a good diet is variety and

balance. This includes Protein (meat, fish, eggs, cheese, milk, beans, lentils, nuts), Carbohydrates (bread, rotis, rice, breakfast cereals, cakes, biscuits, potatoes, sugar sweets), Vitamins (fresh fruits, fresh vegetables, milk products), Fats (butter, oil, cream, eggs, cheese), Fiber (wholegrain bread, brown rice, fruits and vegetables).

Eating well means getting enough calories to prevent weight loss and rebuild normal tissues. You may find eating several small meals and snacks during the day, works better than trying to have three large meals. Some eating problems are related to the disease itself and some are treatment related such as chemotherapy, infection, psychological problems such as depression and fatigue.

### **Suggestions**

- Eat small, frequent, high-calorie meals.
- Drink high-nutrient 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, ice cream, extra butter or powdered milk, eggs, oil, mayonnaise, peanut butter, wheat germ, nuts and fruits.
- Use carbohydrate supplements, protein powders or complete nutrition supplements provided they have been approved by your dietitian.
- Dry milk powder can be added to increase the nutrition level.
- Create a pleasant, mealtime atmosphere, 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 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.

### **Weight gain**

Weight gain could be due to steroids, such as prednisone, that cause fluid retention. In case of weight gain, avoid foods that are high in salt such as pickles, potato chips, popcorn.

***We wish you an eventless experience during your radiation treatment.***

***If you have other ideas that have worked for you, let us know so that we can share your ideas with other patients.***

### **Acknowledgement:**

**Dr. Sandeep Dey MD**

Consultant & Head Dept. of Radiation Oncology,

Holy Spirit Cancer Centre



**Supported by**



**Cancer Patients Aid Association**

**Total Management of Cancer**

**[www.cancer.org.in](http://www.cancer.org.in)**

Anand Niketan, King George V. Memorial, Dr. E. Moses Road,  
Mahalakshmi, Mumbai, MH, India - 400 011

Tel : +91 22 2492 4000 / Fax : +91 22 2497 3599

e-mail : [webmaster@cancer.org.in](mailto:webmaster@cancer.org.in) • website : [www.cancer.org.in](http://www.cancer.org.in)