

Radiation Therapy and Cancer Management: An Overview "Patient's Perspective"

Radiation can be defined as an electromagnetic wave of specified wave length, frequency and energy (same as light, radio waves, mobile phone waves and others) that when it traversing any medium (as human body), will lead to many effects in cells constituting our bodies.

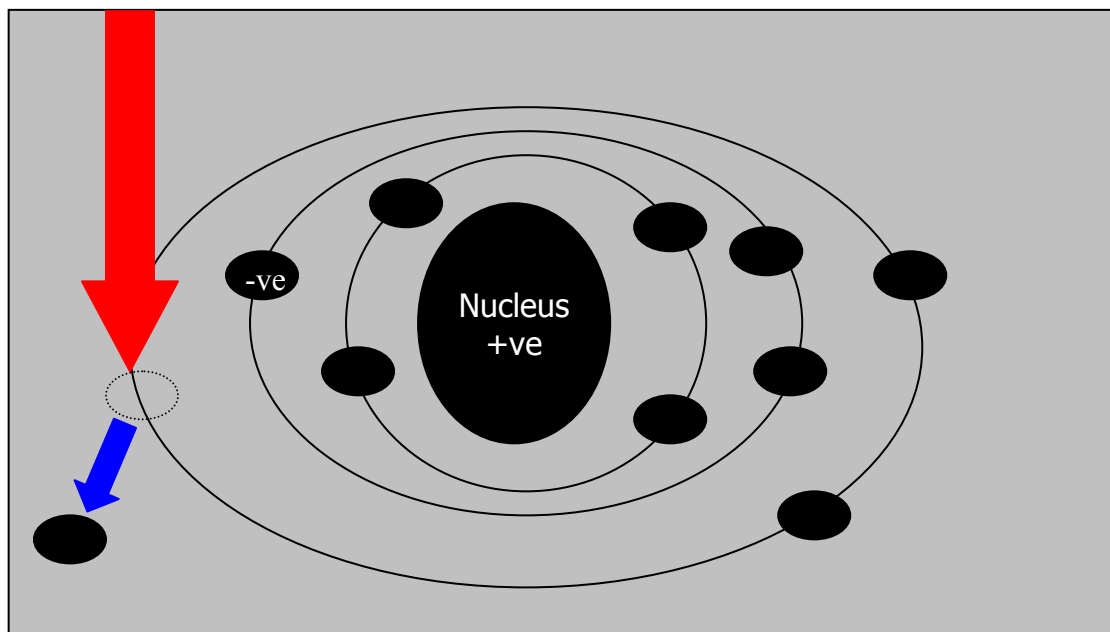
Our bodies are formed of many elements as water, minerals ... etc. These elements consist of atoms which are stable in most of cases due the equal numbers of positive and negative electric charges they have.

How Radiation Can Produce its Effect on Human Body?

Radiation beam can be best understood as a packet of energy. When radiation passes by any human body; this energy will be transferred to atoms that constitute elements which finally form every part of the human body. The transferred energy will lead to loss of some of the negative charges, and hence the atom will be in restless state due to the higher number of positive charges (defined physically as ionization) and hence the term ionizing radiation.

The following diagram illustrates an atom of an element within an organ or tissue in a human body, where the nucleus has positive charge, while the surrounding shells or layers (also known as orbits) contain a fixed number of

negatively charged particles known as electrons. In normal atom, the number of positive charges in the nucleus equals the number of negative charges in the outer shells and hence the atom is described as stable. When a radiation beam (packet of energy and represented by the red arrow) passes near the stable atom, it will hit an electron located in an outer shell, which in turn will gain an extra energy enough to be able to leave its fixed location which will be empty. In other words; the number of negative charges will be less than the positive charges in the nucleus, and hence the atom will lose its electrical stability and now known to be ionized and this is simply the basic interaction and effect of irradiation and any matter.



As a known fact; our bodies are constituted basically of **water** (more than 60% of our bodies). Water molecule has a chemical abbreviation (H_2O). It is actually composed of 2 parts (OH^- and H^+) which are linked together in the stable state. Passage of radiation beam through water inside our cells will lead to such splitting. The negatively charged portion (OH^-); is also known as **free radical**. This free radical has the ability to attack the nucleic acids present

in the nucleus and arranged in specific sequence in chromosomes that determines almost all of our body functions. After such attack with subsequent changes in the nucleic acid sequence; the cell might **die immediately** or survive but with altered shape and function that don't allow for normal cell division i.e. **late death**. This theory is the basic concept upon which the science of radiation therapy treatment of cancer has been developed over decades since Rontgen had discovered ionizing radiation in the last decade of 19th Century aiming at inducing fatal damage of the structure and function of cancer cell. Other normal cells in the body are also susceptible for radiation damage upon exposure. The techniques employed in routine daily practice are aiming at localizing the radiation beam to the part of the body needed to be treated while sparing the other normal parts.

The advent of sophisticated information technology, software and data processing over years had shared the success of developing of what we call **CONFORMAL RADIATION THERAPY TECHNIQUE**. Simply it allows construction of a 3-D image of the human body where radiation beam delivery can be restricted to certain part while avoiding un-necessary exposure of other normal tissues, so the cancer can be treated effectively with as minimum as possible side effects to normal structures.

Treatment Intention:

1. **Radical Radiation Therapy:** Where radiation therapy is used as a sole treatment of cancer without any associated surgical intervention but coupling with drug therapy may be considered to maximize treatment benefits. Radical radiation therapy usually includes delivery of high radiation dose over many fractions (may be more than 35) over protracted duration that might reach 7 to 8 weeks. Treatment is usually delivered daily for 5-days a week with 2 days off. The most

advanced technology is usually used. This treatment intent should be considered only when **CURE** is the ultimate goal. The best examples include treatment of cancer in the head and neck region (Larynx, Nasopharynx ...etc) and cancer of the prostate.

2. **Adjuvant Radiation Therapy:** Where radiation therapy is used after surgical removal of a tumor aiming at killing the remaining cells at tumor bed that might account for recurring tumor in the future. It is usually a lengthy treatment lasting for 5-6 weeks. Again treatment intention should be **CURE**.
3. **Neo-adjuvant Radiation Therapy:** Where radiation therapy is used before applying surgery aiming at making the tumor size much smaller. This will help surgeons to achieve easier and safer tumor removal, and is associated with higher cure as well as disease control. It can be coupled with drug therapies in most instances to maximize treatment benefits. The best example is treatment of cancer of the rectum.
4. **Palliative Radiation Therapy:** where radiation treatment is used to alleviate specific symptom or complaint as pain in bone, cough associated with bleeding and so on. This strategy is usually reserved for those patients not considered for cure, and we need to control their problem without side effects and within a very short time.

All of the above mentioned data are collectively called **EXTERNAL BEAM RADIATION THERAPY**; where the radiation source is placed away from the body and the radiation beam will travel in air to get inside the human body to a specific part.

Other forms of radiation therapy treatment include:

- ✚ **Brachytherapy:** It is a terminology means radiation therapy delivery from a near by source inserted in the body. Examples include treatment of cancer of the cervix, uterus and tongue.
- ✚ **Radio-isotope therapy:** where the radiation source is in the form of fluid that can be drunk or injected into the blood stream as in iodine therapy for cancer of the thyroid gland and therapy for bony pains.

Common Instructions for Patients Treated with Radiation Therapy Treatment:

Specific instructions depend on the site to be treated, however, **general guidelines include:**

1. Avoid eating food for 1-2 before and after treatment session to avoid radiation induced sickness (nausea & vomiting) in some, not all people.
2. Avoid **tough skin manipulation** in the region covering the area to be treated, as it is known that such skin will be weak enough to be injured easily even with minor trauma or strong jets of water while under shower. The skin handling should be so gentle regarding the dress material in direct contact with the skin, while cleaning and drying. The use of topical emulsion to minimize the skin affection with radiation therapy treatment should be under strict supervision of the treating physician especially in the skin creases and under the belly abdomen.
3. Care should be taken for keeping the **nutritional balance** in the positive state through encouraging the patient to consume highly caloric, highly nutritive, easily digested food stuff with special emphasis upon adequate fluid intake so as to keep patient's vitality.

4. Special attention should be paid to avoid development of **anemia** which will negatively affect treatment outcome and is associated with bad tolerance to treatment.
5. Care should be taken regarding timing and regularity of **medicines** as instructed by the treating physician.

Instructions Specific to the Site of Treatment:

1. Head and Neck Region:

- ✚ Correction of all chronic health problems as **diabetic state** and try to make them under control.
- ✚ Keeping the mouth cavity and throat as **wet** as possible through excessive drinking of water even in the absence of thirst sensation.
- ✚ Optimum and continuous **oral hygiene** (Fixed schedule and after ingestion of any food material or sugary fluids) is the most important factor to be associated with the least possible complications.
- ✚ Liberal use of **toothpaste** especially the sensitive formulas and mouth **wash** so as to keep the ideal environment of oral cavity.
- ✚ Avoid ingestion of too **cold** and too **hot** fluids and food material.
- ✚ Assessment of **dental health** and correction of any underlying problems has the upfront priority and should be carried out before the start of treatment.
- ✚ Special attention to prevent development of **anemia** being associated with adverse treatment outcome.

2. Chest Region:

- ✚ Avoid **dusty** air as much as you can.
- ✚ **Smoking** is completely prohibited including all of its forms.

- ✚ Avoid ingestion of too cold and too hot fluids and food material.
- ✚ Try to get rid of all retained secretions in the chest through the use of warm fluids, expectorants and chest physiotherapy.
- ✚ Assessment of pre-treatment vital respiratory functions is very important to establish the most suitable medicines to be given. Low dose cortisone is usually prescribed with other medications and should not be feared of or ignored by the patient for fear of its complications. Trust your physician who is caring for you.
- ✚ Correction of all chronic health problems as diabetic state.
- ✚ Special care should be taken for patients with suspected history of tuberculosis especially in the elderly, for fear of activation. Usually chest radiation is to be avoided in them.

3. Abdominal Region:

- ✚ Avoiding immediate eating before and after sessions is the most important instruction. At least 1-2 hours interval should be allowed.
- ✚ Care must be taken to prevent the sensation of nausea, vomiting, heart burn and bad digestion, flatulence, or intolerance to meals through the proper intake of medicines according to physician instruction. Gastro-intestinal upset encountered during radiation therapy treatment is not a constant finding, and has a variable degree of expression among patients ranging from nothing to severe forms that mandates stopping of treatment.
- ✚ Food quality is very important. It is quite important to avoid fatty and spicy food and encourage instead low fibre diet with high carbohydrate content.
- ✚ It is quite recommended to have frequent small meals rather than big infrequent ones.

- ✚ Encourage **drinking** all through the day.

4. Pelvic Region:

- ✚ **Intestinal anti-septic** and drugs aiming at slowing motions are frequently prescribed.
- ✚ **Constipating** food items are preferred.
- ✚ Fresh full cream **milk** products are not favoured.
- ✚ Special attention should be considered regarding **fluid consumption** to allow for big volume of diluted urine rather than small concentrated volume which dramatically increase the sensation of burning maturation.
- ✚ Correction of urinary tract **infection** by proper anti-microbial therapy should be considered before starting radiation treatment.
- ✚ The use of medicines that keep **urinary pH** on alkaline side may be recommended.
- ✚ Try to have a **full bladder** during your radiation therapy session so as to remove the loops of small intestine upward in the abdominal cavity outside the radiation port. This is reported to be associated with much lower complication rate.

5. Bone & Skeletal Regions:

- ✚ Limitation of mobility should be considered to avoid **unexpected fractures** which might occur frequently and even without or with minor insignificant trauma.
- ✚ Avoid un-necessary use of **pain killers**.
- ✚ The use of **bone building medicines** should be considered.
- ✚ **Low dose cortisone** is usually indicated at the start of treatment and may be continued for several days. It has a special benefit of preventing spinal cord compression especially with advanced vertebral disease.

- ✚ Consider blood count assessment once or twice weekly if a big volume of bone is under radiation therapy treatment.

6. Brain Irradiation:

- ✚ Care must be taken to avoid **convulsions** as well as manifestations of **increased pressure inside brain** (nausea, vomiting, headache, blurring of vision). Be strictly adherent to your physician's prescription which usually include cortisone, anti-convulsion, diuretic (to loose water from the body), and sedatives.
- ✚ Avoid excessive **salty diet** as it might increase the pressure of brain.
- ✚ Avoid **sudden and vigorous nervous stimulation** as sudden light, hearing sudden high sound, and horror scene on TV and so on, as these events are associated with unpredictable response of the brain and might precipitate convulsions.

Finally, Radiation therapy is another cornerstone in cancer management in addition to surgery and drug therapies. Results are improved and complications are minimized over years after the advent of 3-Dimensional technology. All patients under radiation therapy treatment are to follow their physician's instructions regarding modification of their life style and daily habits as well as medications, so as to have a smooth treatment period without significant complications.