RADIATION ONCOLOGY 101

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Radiation Oncology

- Radiation Oncology: Clinical and scientific discipline devoted to the management of patients with cancer by ionizing radiation, alone, or in combination with other treatment modalities
- Radiation Therapy: Clinical process that uses radiation for the treatment of cancer.

Radiation Therapy

- A technology intensive discipline of medicine
- Complex and sophisticated equipment
- Combines expertise of Radiation Oncologists, Medical Physicists, Dosimetrists and Radiation Therapists
- Requires support from Radiologists, Nursing, Engineering Technologists, Radiobiologists, Software Engineers and Administrators.

Treatment Goals

Curative

Intent is of long term survival after treatment

Eradicate cells in a tumor capable of cell division

Palliative

Control tumor growth to limit the spread of disease

Improve quality of life by reducing or relieving symptoms

Both are delivered to a target area while minimizing damage to critical structures/normal tissue

SYSTEMIC THERAPY=CHEMOTHERAPY/IMMUNOTHERAPY

LOCALIZED THERAPY=RADIATION THERAPY

When radiation is given is unique to each cancer and individual

- Definitive Therapy
- Neoadjuvant therapy
- Adjuvant Therapy
- Intra-operatively

Terms of Radiation

- Rad- Radiation absorbed dose
- Rad = Gray (Gy) = DOSE
- Measurement of energy absorption of all ionizing radiations by materials
- Fraction = TREATMENT/Radiation Session
- Simulation: Planning session for radiation

Approximately 75% of people treated for cancer will receive radiation treatment alone or in combination with other modalities such as chemotherapy or surgery.

How Does it Work?

- Direct Action- The charged particle "directly" interacts with the target molecule.
- Indirect Action- The charged particle interacts with a water molecule producing free radicals which then interact with the target molecule.

- *To summarize, radiation can directly kill the cancer cell or damage the DNA of the cancer cell so that it stops reproducing*

Methods of Radiation Delivery

- External Beam (EBRT):

  Linear Accelerator – Local Treatment

Photons: Most common form of RT. High energy xray with deep penetration

Electrons: Shallow treatment (spares deeper tissues; depth of penetration varies with energy; high skin doses)

Cyberknife: Highly precise form of radiation delivering hundreds of precise beams to a small target

Protons: a charged particle the dose is deposited over a narrow range of depth, and there is minimal entry, exit, or scattered radiation dose

- Brachytherapy:

  Radioactive Source Therapy – Sealed radioactive sources emits beta particles and gamma rays

CT Simulation

WHY simulate?

- To plan the radiation dose to a specific target and to delineate the surrounding physiologic structures.
- To set up the patient for intended treatment to ensure they are in the same position every day
- Patient comfort.
- Mark the skin surface after identifying the treatment location (tattoo)
- Masks are made at this time if needed.

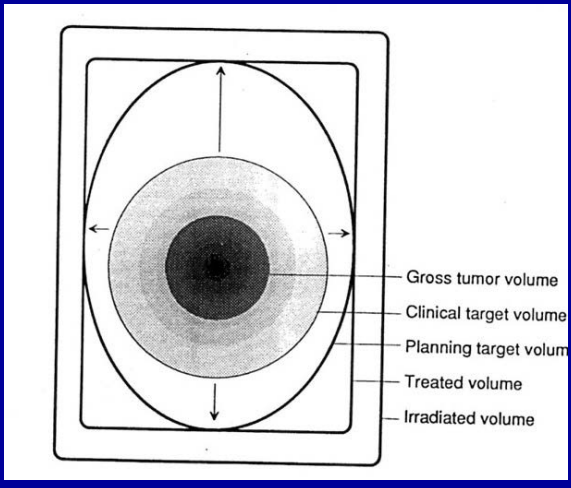
Fabrication of Treatment Aids

- Immobilization:

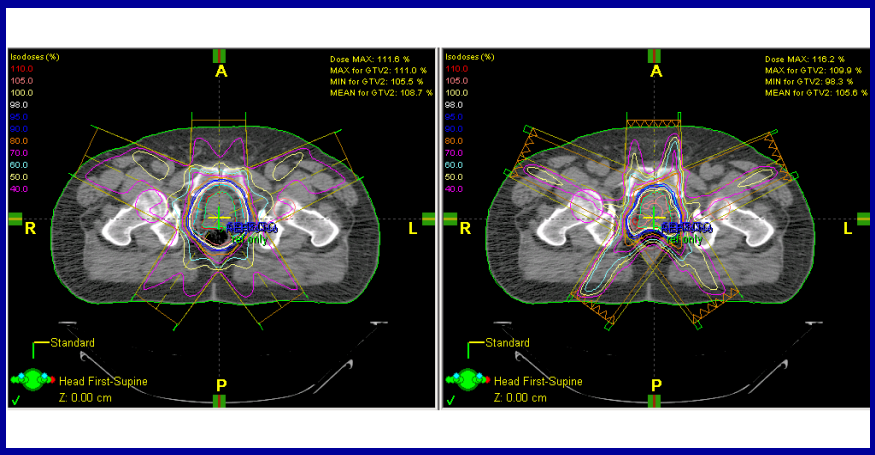
Treatment Planning

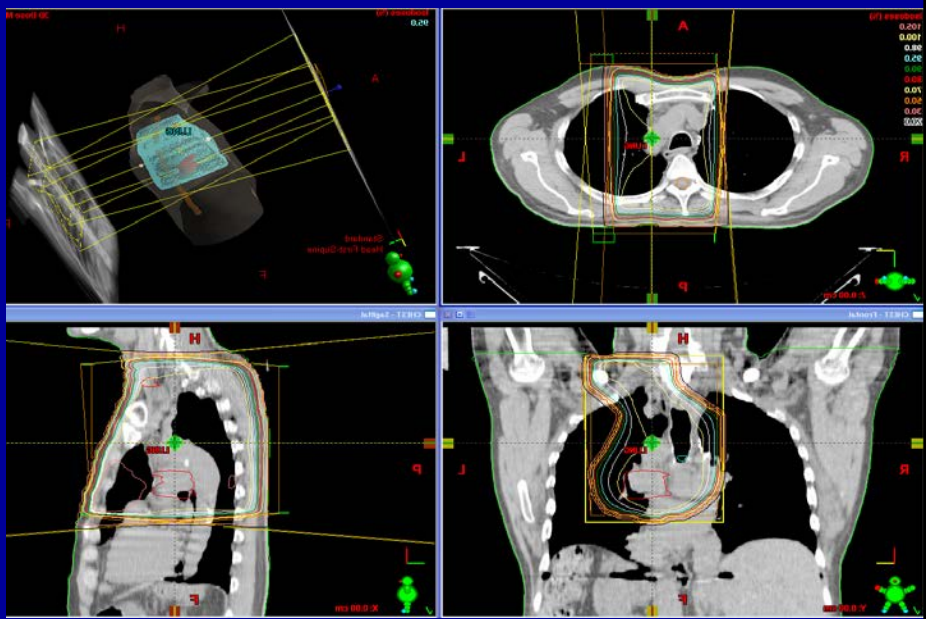
- Taking the simulation information and and develop a plan to treat target area
- Ensures adequate dose is delivered to the tumor while not exceeding the tissue tolerance. It includes the # of treatments, dose per fraction, energy and total dose.
- This process can take 1-2 weeks depending on treatment plan complexities

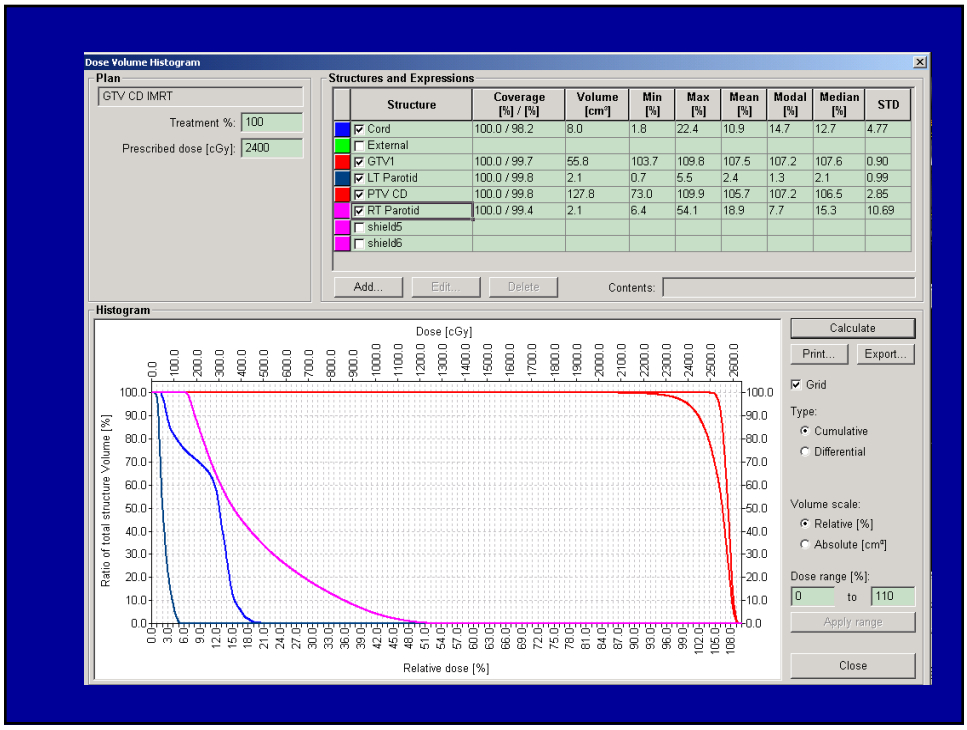
Volumes



Isodose Lines for 3D and IMRT





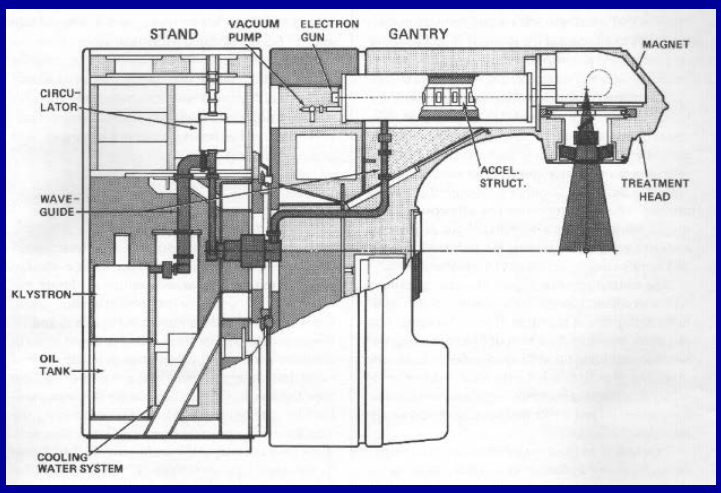


Production of External Beam Radiation

Linear Accelerator:

- Device which uses high frequency electromagnetic waves to accelerate charged particles such as electrons to high energies through a linear tube
- Produces x-ray and electron radiation
- Treatment delivered to patient from outside the body

Treatment



Dual Photon
Energies (6 MV & 15 MV

MultiLeaf Collimator

Port Films

RADIATION TREATMENT SCHEDULE

- Every day, Monday-Friday. Weekend and holidays off
- Treatment schedule varies. Maybe 5 treatments for palliative or 6-7 weeks for curative

Treatment Side Effects

- Inherent to all radiation are three acute side effects that are likely to occur.

- Fatigue
- Hair Loss
- Skin Changes

Fatigue

Fatigue

- ONS PEP cards- Recommended for practice: EXERCISE
- Evidence at the highest level supports the benefit of exercise in the management of fatigue during and follow cancer treatment in patients with breast cancer, solid tumors and those undergoing hematopoietic stem cell transplant. Several times/week rec.

Likely to be effective

- Screen for potential etiologic factors and management as appropriate
- Energy conservation and activity management
- Education/Information Provision
- Optimize sleep quality
- Relaxation- muscle relaxation, breathing, yoga
- Massage and healing touch

Hair Loss

Where

- Hair loss will only occur in the treatment area.
- Usually grows back but depends on the dose of radiation- may take 3-6 months.
- 55 Gy may lead to permanent hair loss- primary brain tumors. May return different color or consistency.

Skin reactions

- 90-100% XRT patients experience
- For 85-90% its just mild erythema
- For others – breast in particular – it can progress to brisk erythema, then to
- Dry desquamation (scaling, peeling) and
- Moist desquamation (peeling, oozing) usually in small islands within field

Skin Changes

Dry Desquamation

Wet Desquamtion

Skin Care

- Avoid irritating treated skin.
- When you wash, use only lukewarm water and mild soap; pat dry.
- Do not wear tight clothing over the area.
- Do not rub, scrub, or scratch the skin in the treatment area.
- Avoid putting anything that is hot or cold, such as heating pads or ice packs, on your treated skin.
- Ask your doctor or nurse to recommend skin care products that will not cause skin irritation. Do not use any powders, creams, perfumes, deodorants, body oils, ointments, lotions, or home remedies in the treatment area while you're being treated and for several weeks afterward unless approved by your doctor or nurse.
- Do not apply any skin lotions within 2 hours of a treatment.
- Avoid exposing the radiated area to the sun during treatment. If you expect to be in the sun for more than a few minutes you will need to be very careful. Wear protective clothing (such as a hat with a broad brim and a shirt with long sleeves) and use a sunscreen. Ask your doctor or nurse about using sunblocking lotions. After your treatment is over, ask your doctor or nurse how long you should continue to take extra precautions in the sun.

Skin Creams

- Aquaphor, Eucerin
- Dove soap daily- may be the most important
- Green tea bags
- Aloe vera
- Calendula
- Proctocort for rectal area
- Silvadene

Mucositis

- Saline/soda/water rinses
- OTC non alcohol products (Biotene, ACT mouthrinse)
- Magic Mouthwash
- Viscous lidocaine
- Analgesic
- Sitz baths

Non-Oncological Indications for Radiation

- Prevention of Heterotopic Ossifications
- Glomus tumors
- Keloids
- Trigeminal Neuralgia
- Chordomas
- Endocrine Orbitopathy

Things to Consider Before Starting Radiotherapy

- Pacemaker/DEFIB
- Autoimmune disorders
- Prior H/O radiation
- Claustrophobia
- Mobility Issues
- Social Situation

- Malignant Spinal Cord Compression
- Superior Vena Cava Syndrome
- Excessive Bleeding
- Symptomatic Brain Metastases
- Intramedullary Spinal Cord Metastasis

What Should You Know About the Hospitalized Patient and Radiation

- Are they under active treatment? If so, are they stable or unstable?
- What time is radiation? Is it daily or BID?
- If not under active treatment, how recently did they complete radiation?
- Who is their radiation oncologist?
- What is their treatment site? Expected side effects?
- Are they/did they get chemotherapy with radiation? What type of chemotherapy?

Treatment is complete

- Once treatment is finished, the patient will continue to experience the acute side effects for approximately two weeks. After that time, things should slowly return to normal, however in some cases hair loss may persist, this is dependent on the delivered dose to the area.

Thanks for viewing.