The Three Roles of Radiation Treatment: Cure, Treat, and Manage

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Disclosure

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- **Employer:**
  - Radiation Oncology, Nebraska Methodist Health System
- **Disclosure:**
  - None

Objectives

- What is the value of radiation therapy in multidisciplinary cancer care?
- Role of radiation therapy in curative setting
- Role of radiation therapy in palliative setting
- Common challenges with radiation treatments and how to manage them

What is the Value of Radiation Therapy in Multidisciplinary Cancer Care?

Understanding Cancer

Characterized by uncontrolled cell growth, local tissue invasion, distant metastases.

How cancer spreads:

Direct invasion → other organs	**Via Lymphatics** → lymph nodes	**Via Bloodstream** → lungs, liver, brain, bones

Surgery, systemic therapy, and radiation therapy complement each other to address these patterns of spread

How Does Radiation Therapy Work?

- Radiation therapy works by damaging the DNA of cells and destroys their ability to reproduce
- Both normal and cancer cells can be affected by radiation, but cancer cells have generally impaired ability to repair this damage, leading to cell death
- All tissues have a tolerance level, or maximum dose, beyond which irreparable damage may occur

Properties of the Treatment Modalities

Surgery | Systemic Therapy | Radiation Therapy

- **Surgery & Radiation are primarily local/regional therapies**
  - Sometimes either can be used for local control of a metastatic site
- **Chemotherapy (and other drugs) are systemic therapies**
  - Though it can enhance local control when used with radiation

Using the Treatment Modalities

For hematologic cancers

Chemo (and other drugs) is the primary curative treatment

Since there is typically nothing localized to cut out or irradiate

For solid tumors

Surgery or radiation is the primary curative treatment

Unless they become metastatic (primarily a systemic issue)

Combinations of therapy are common for many cancers

Why 3 Types of Oncologists?

- Administration of each treatment modality is complex
- Not all knowledge of cancer is shared
- Each offers unique expertise and perspective that benefits the team.

Effective teamwork → higher quality, patient-centered care

(Radiation) Oncology is a Team Sport

- Rad Oncs, Med Oncs, Surg Oncs
- Radiologists, Pathologists, PCPs
- Social workers, nutritionists, dentists, physical therapists, nurses, patient navigators, research coordinators, etc

- Radiation Oncologists
- Medical physicists
- Dosimetrists
- Radiation Therapists
- Radiation Oncology Nurses
- Patient Navigators

Radiation Treatment Process

REFERRAL

CONSULTATION

SIMULATION

TREATMENT PLANNING

QUALITY ASSURANCE

DELIVERY OF RADIATION THERAPY

Referral

REFERRAL | CONSULTATION | SIMULATION | TREATMENT PLANNING | QUALITY ASSURANCE | DELIVERY OF RADIATION THERAPY

- Tissue diagnosis has been established
- Referring physician reviews potential treatment options with patient
- Treatment options may include radiation therapy, surgery, chemotherapy or a combination

It is important for a referring physician to discuss all possible treatment options available to the patient

Consultation

REFERRAL | CONSULTATION | SIMULATION | TREATMENT PLANNING | QUALITY ASSURANCE | DELIVERY OF RADIATION THERAPY

- Radiation oncologist determines whether radiation therapy is appropriate
- A treatment plan is developed
- Care is coordinated with other members of patient's oncology team

The radiation oncologist will discuss with the patient which type of radiation therapy treatment is best for their type of cancer

Simulation

REFERRAL | CONSULTATION | SIMULATION | TREATMENT PLANNING | QUALITY ASSURANCE | DELIVERY OF RADIATION THERAPY

Alpha-cradle

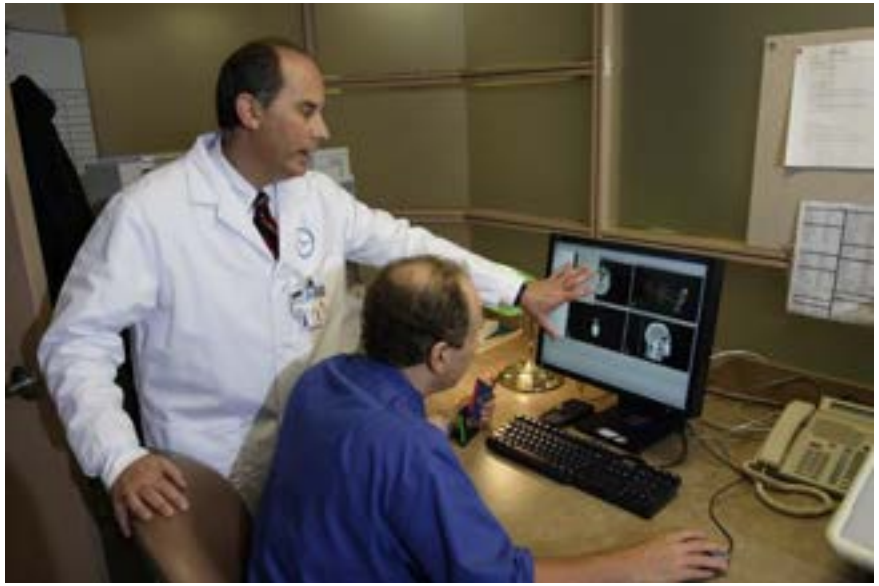
Aqua-plast

- Patient is set up in treatment position on a dedicated CT scanner
  - Immobilization devices may be created to assure patient comfort and daily reproducibility
  - Reference marks or “tattoos” may be placed on patient
- CT simulation images are often fused with PET or MRI scans for treatment planning

Treatment Planning

REFERRAL | CONSULTATION | SIMULATION | TREATMENT PLANNING | QUALITY ASSURANCE | DELIVERY OF RADIATION THERAPY

- Physician outlines the target and organs at risk
  - Sophisticated software is used to carefully derive an appropriate treatment plan
    - Computerized algorithms enable the treatment plan to spare as much healthy tissue as possible
  - Medical physicist checks the chart and dose calculations
  - Radiation oncologist reviews and approves final plan



Radiation oncologists work with medical physicists and dosimetrists to create the optimal treatment plan for each individualized patient

Quality Assurance

- Each radiation therapy treatment plan goes through many safety checks
  - The medical physicist checks the calibration of the linear accelerator on a regular basis to assure the correct dose is being delivered
  - The radiation oncologist, along with the dosimetrist and medical physicist go through a rigorous multi-step QA process to be sure the plan can be safely delivered
  - QA checks are done by the radiation therapist daily to ensure that each patient is receiving the treatment that was prescribed for them

Treatment Delivery

REFERRAL | CONSULTATION | SIMULATION | TREATMENT PLANNING | QUALITY ASSURANCE | DELIVERY OF RADIATION THERAPY

The type of treatment used will depend on the location, size and type of cancer.

- *External beam* radiation therapy typically delivers radiation using a linear accelerator
- Internal radiation therapy, called *brachytherapy*, involves placing radioactive sources into or near the tumor
- The modern unit of radiation is the *Gray (Gy)*, traditionally called the *rad*
  - 1Gy = 100 centigray (cGy)
  - 1cGy = 1 rad

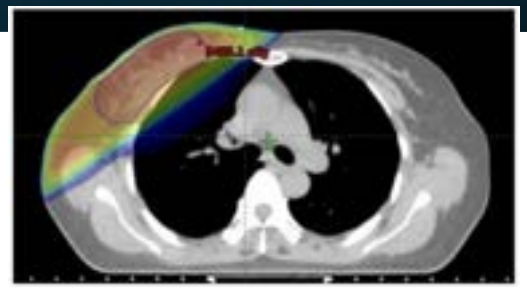
Role of Radiation Therapy in the Curative Setting

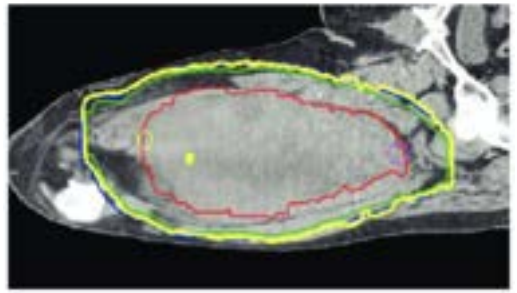
Curative Approaches Involving Surgery

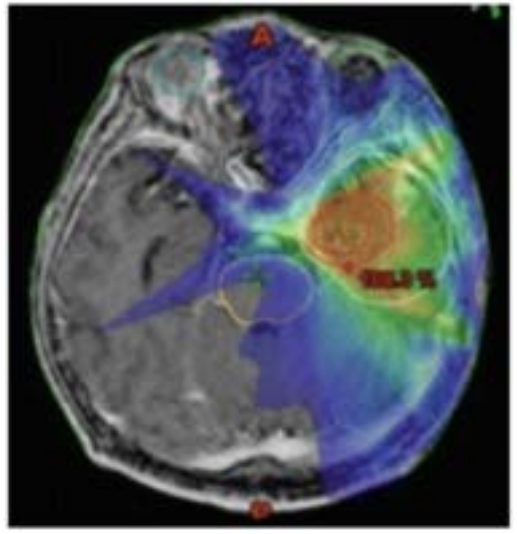
- **Sometimes surgery is the primary curative modality**

- **Pre-op or post-op radiation therapy** is used to:
  - Eradicate microscopic tumor cells in the area
  - Enable a less extensive or morbid surgery

- **Examples:**
  - Breast cancer, soft tissue sarcomas, malignant gliomas





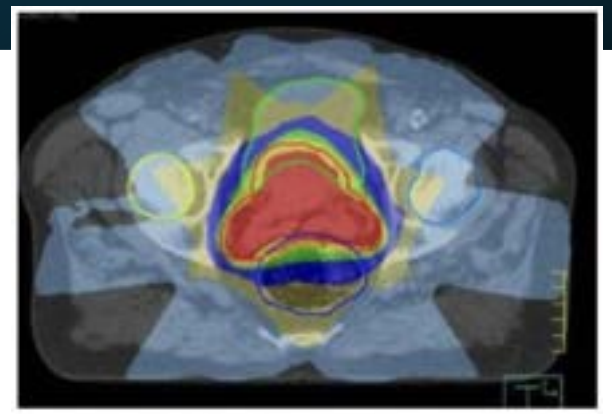


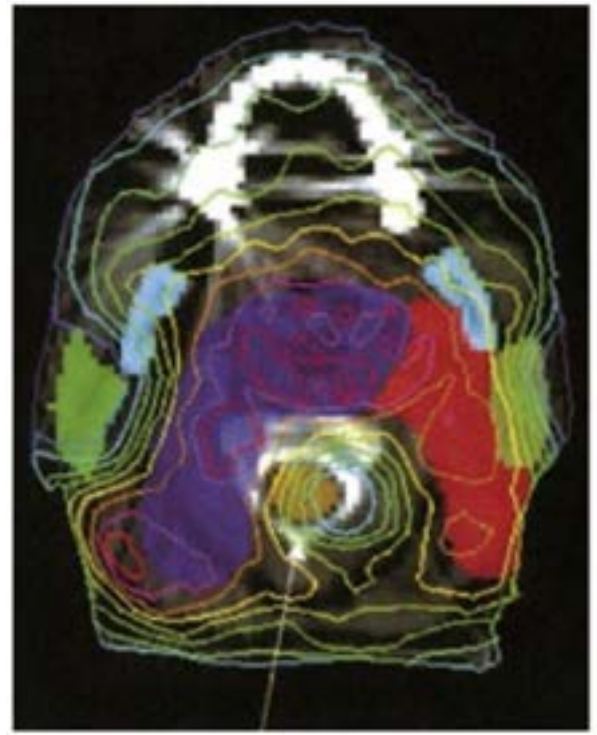
Curative Approaches ***NOT*** Involving Surgery

- **Sometimes definitive radiation therapy is used instead of surgery with comparable probability of cure**

- **Potential reasons include:**
  - Not all tumors are surgically resectable
  - Not all patients are medically operable
  - Sometimes cancer surgeries are very morbid & organ preservation is desirable

- **Examples:**
  - Prostate, larynx, pharynx, bladder, anus, cervix, lung

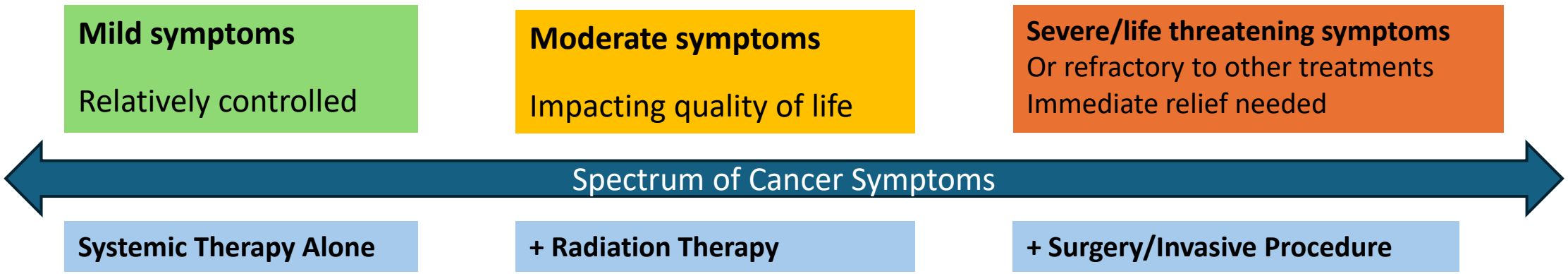




Role of Radiation Therapy in Palliative Setting

Palliative Treatment of Metastatic Cancer

- When a cancer has spread to distant sites it is typically no longer curable, and quality-of-life is the primary goal.
- Systemic therapy is the main treatment to control tumor growth and potentially prolong life. However…
  - Response rates are often low, and take weeks-months to occur
- Radiation and/or surgery are often indicated when a patient needs more rapid symptom relief



Palliation of Symptoms with Radiation

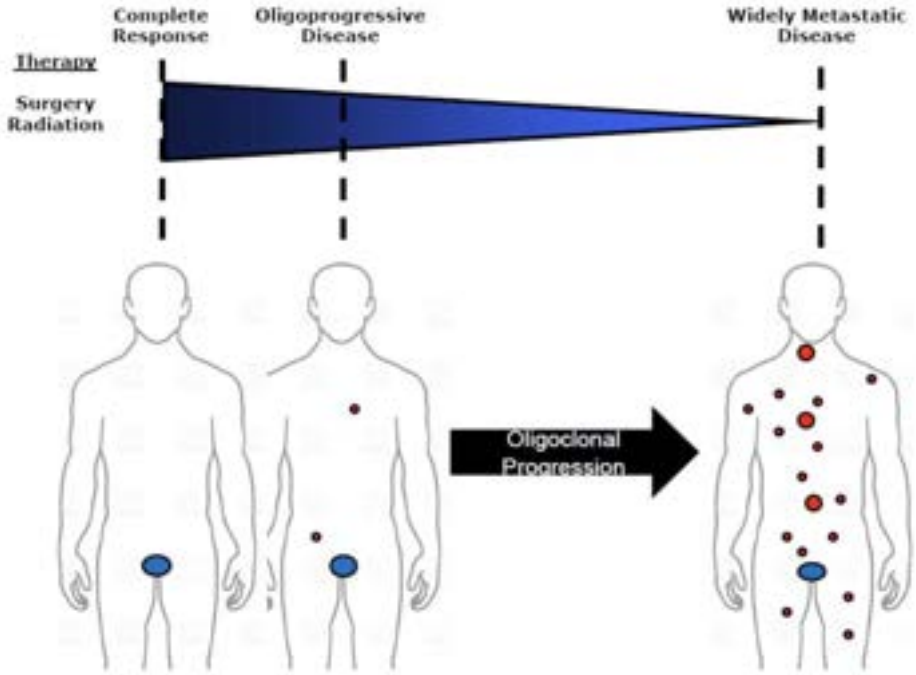
	Examples	Time to Response
Bleeding	Bladder, Gyn, Lung, etc.	Days
Obstruction	SVC, airway, esophagus, ureter, bile ducts	Days – weeks
Pain	Bone mets, neuropathic pain	Days – weeks
Neurologic symptoms	Cord compression, brain mets	Days – weeks

- A general rule of thumb is that ~75% of patients who live long enough to response to palliative RT will have improvement in their symptoms (though in practice, a number of factors can affect this rate).

Consolidative RT for Metastatic Cancer

- Patients with a limited number of metastases (i.e. **oligometastatic**) often have a better prognosis than patients with diffuse metastases.
  - Consolidative RT to all tumor sites can help prolong duration of response to systemic therapy.

- Patients on systemic therapy sometimes have mixed response or progression in a limited number of sites (i.e. **oligoprogression**).
  - Consolidative RT to resistant tumor sites can enable patients to stay on a systemic regimen that they are tolerating otherwise.



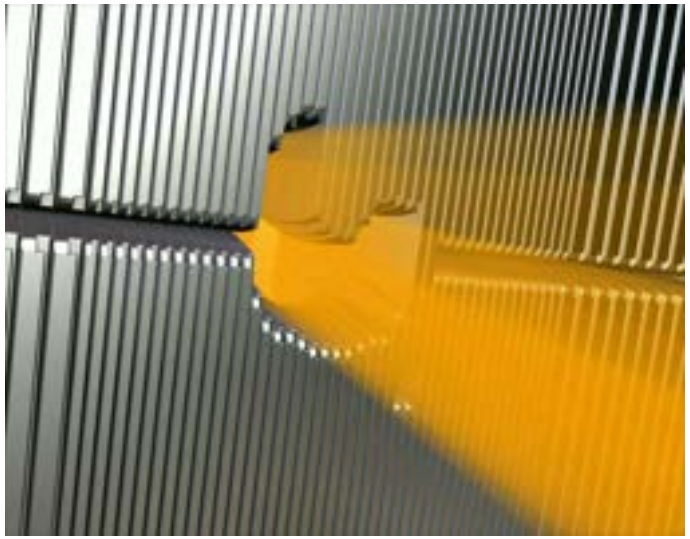
Common Challenges with Radiation Treatments and How to Manage Them

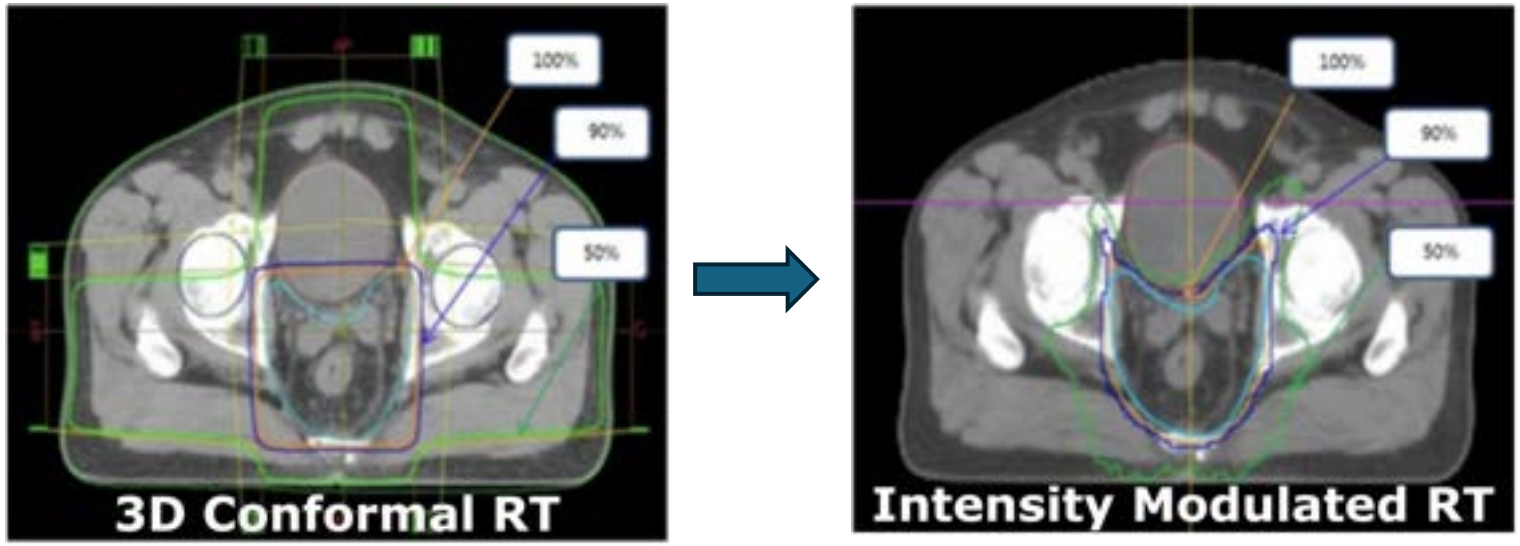
Long Treatment Courses

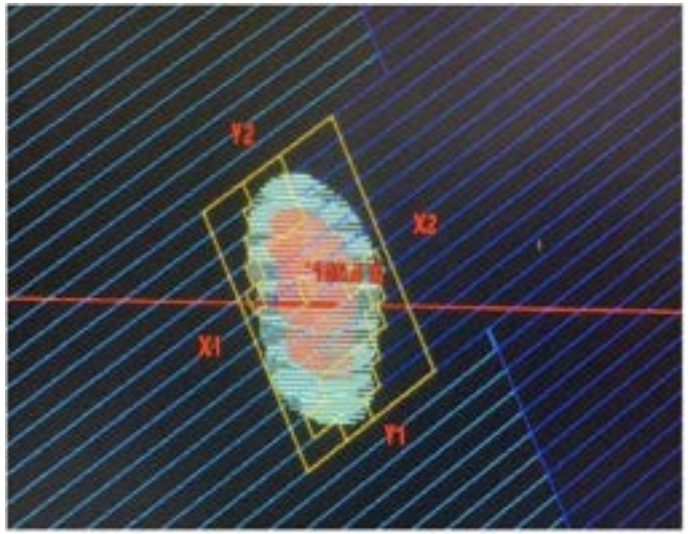
- Range from 1 – 40 treatments
  - Each treatment ~10 min
- Three sites: Omaha NE, Fremont NE, Council Bluffs IA
- Hope Lodge Program

Improved Technologies Reduce Side Effects

- Use of dynamic MLCs to adjust the dose intensity around curved targets (i.e. IMRT or VMAT)
- Real time image guidance to account for daily shifts
- Enable dose escalation AND reduction in toxicity







What to Expect with Side Effects

Side effects, like skin redness, are generally limited to the area receiving radiation.

Cure vs palliation

Side effects are delayed **2-3 weeks**

May last for **several weeks** after the final treatment.

Some sites (head and neck) will have significantly longer delays in healing.

Side effects vary based on a patient's medical profile or diagnosis

Common Radiation Side Effects

Unlike the systemic side effects from chemotherapy, radiation therapy usually only impacts the area that received radiation

Side effects during the treatment vary depending on site of the treatment and affect the tissues in radiation field:

- Breast – swelling, skin redness
- Abdomen – nausea, vomiting, diarrhea
- Chest – cough, shortness of breath, esophogeal irritation
- Head and neck – taste alterations, dry mouth, mucositis, skin redness
- Brain – hair loss, scalp redness
- Pelvis – diarrhea, cramping, urinary frequency, vaginal irritation
- Prostate – impotence, urinary symptoms, diarrhea
- Fatigue is often seen when large areas are irradiated

Modern radiation therapy techniques have decreased these side effects significantly

SKIN (breast, head and neck, skin cancers)

Acute	Chronic
Redness Desquamation Itching Discomfort/pain	Tanning/discoloration Telangiectasias Joint mobility issues Lymphedema

Remedies:
Aquaphor→Silvadene
Barrier gauze
Aloe
Compression sleeves

CHEST (lung, esophagus cancers)

Acute	Chronic
Esophagitis (painful swallowing) Pericarditis (not common with modern radiation techniques)	Pneumonitis/pulmonary fibrosis Esophageal stricture Chest wall pain Spinal cord Late heart damage

Remedies:
Magic mouthwash (combo of numbing agent, antacid, antihistamine, steroid, etc.)
Pain medications
Steroids

PELVIS (gyn, prostate, rectal cancers)

Acute	Chronic
Diarrhea Abdominal cramping (rare) Urinary changes (burning, urgency, nocturia) Hematuria (rare) Vaginal dryness/discomfort	Diarrhea Bloody urine/stool Infertility Strictures Bowel obstruction Vaginal stenosis Sexual function change Erectile dysfunction

Remedies:
Dietary
Imodium/Lomotil
Azo (phenazopyridine)
Enemas/suppositories
Oxybutynin

The Cancer Care Team

It is important for the Cancer Care Team to have an open dialogue throughout the treatment process.

- Doctors meet with patients during consultation to discuss expectations with treatment, and then weekly to address ongoing concerns.
- Always ask questions if you have them - there are no dumb questions.
- Always share your concerns – whether you are the patient or the caregiver, discuss your concerns with the medical team during the treatment consultations.
- Follow-up appointments are a good way to monitor long term side effects, e.g. lymphedema

Radiation = Quality-of-Life

- Radiation oncology is a team sport.
- When used for cure, RT can preserve normal function.
- When used for palliation, the risk:benefit ratio is often favorable.
- Improvement in technologies have led to more targeted treatments, sparing healthy tissue and reducing side effects.
- Being informed helps set expectations and ease anxieties.

Thank you!