


UNC Lineberger Cancer Network
ADVANCED PRACTICE PROVIDER 

November 9, 2022

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UNC Lineberger Cancer Network's
live webinar*

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Advanced Practice Provider webinars created and coordinated by Tommy Dighelone, MD, MSc, MEd, in partnership with UNC Lineberger Cancer Network

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OUR PRESENTER



Lara Novak, PA-C

Lara Novak has been a PA-C since 2005. She attended Penn State University for undergrad and Drexel University at Hahnemann Hospital for PA School. She has practiced in oncology for 11 years, 7 of those at UNC's Radiation Oncology Department.

She presently works closely with Drs. Shen and Weiner, caring for patients with CNS tumors and Head & Neck Cancers with Team Shen and for patients with thoracic and gynecologic malignancies with Team Weiner.

Lara is also a wife, and mother of 2, and can be found walking through Carolina North listening to a podcast in her free time.

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Text **UNCLCN** to **22333** once to join, then **A** or **B**

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Any side effect from radiation treatment depends on the type and location of cancer, the dose of radiation given, and the administration of concomitant chemotherapy.

True **A**

False **B**

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Any side effect from radiation treatment depends on the type and location of cancer, the dose of radiation given, and the administration of concomitant chemotherapy.

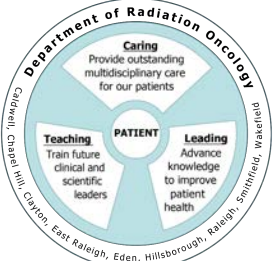
True
False

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Radiation & Its Acute Side Effects

Lara Novak, PA-C
UNC Healthcare
Department of Radiation Oncology




The logo for the Department of Radiation Oncology is a circular emblem. It features a central blue circle with the word "PATIENT" in white. Three blue arrows radiate from the center to the outer edge of the circle. The top arrow is labeled "Caring" and contains the text "Provide outstanding multidisciplinary care for our patients". The bottom-left arrow is labeled "Teaching" and contains "Train future clinical and scientific leaders". The bottom-right arrow is labeled "Leading" and contains "Advance knowledge to improve patient health". The outer ring of the logo contains the text "Department of Radiation Oncology" at the top and lists various locations: "Chapel Hill, Carrington, East Raleigh, Eden, Hillsborough, Raleigh, Smithfield, Wakefield" around the bottom.

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Objectives

- Recognize that, with the exception of fatigue, Radiation Side Effects are local.
- Describe the process by which Radiation Side Effects occur.
- Identify Radiation Side Effects across organ systems.



The logo for the Department of Radiation Oncology is a circular emblem. It features a central blue circle with the word "PATIENT" in white. Three blue arrows radiate from the center to the outer edge of the circle. The top arrow is labeled "Caring" and contains the text "Provide outstanding multidisciplinary care for our patients". The bottom-left arrow is labeled "Teaching" and contains "Train future clinical and scientific leaders". The bottom-right arrow is labeled "Leading" and contains "Advance knowledge to improve patient health". The outer ring of the logo contains the text "Department of Radiation Oncology" at the top and lists various locations: "Chapel Hill, Carrington, East Raleigh, Eden, Hillsborough, Raleigh, Smithfield, Wakefield" around the bottom.

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Tools for Treating Cancer

Local Therapies

- Surgery
- Radiation

Systemic Therapies

- Chemotherapy
- Immunotherapy
- Targeted Therapy



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Radiation is a local therapy

Treatment fields are shaped and sculpted to maximally treat the target tissues and minimally impact normal, healthy tissues.



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How radiation works:

- Radiation therapy kills cancer cells or slows their growth by damaging their DNA.
- Cancer cells whose DNA are damaged beyond repair stop dividing or die.
- Cancer cells continue to die for weeks to months upon completion of radiation therapy.



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Types of Radiation Therapy

External

- Photons
- Protons
- Electrons

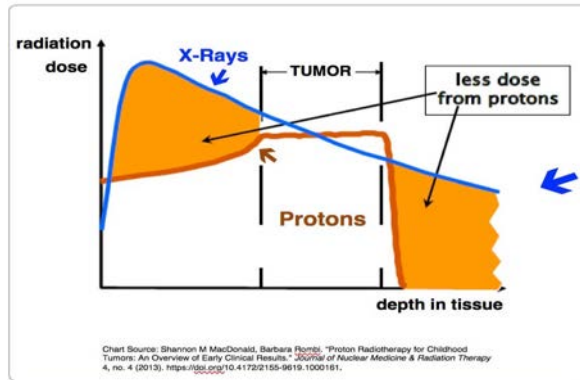
Internal

- Brachytherapy
- Gamma Tiles



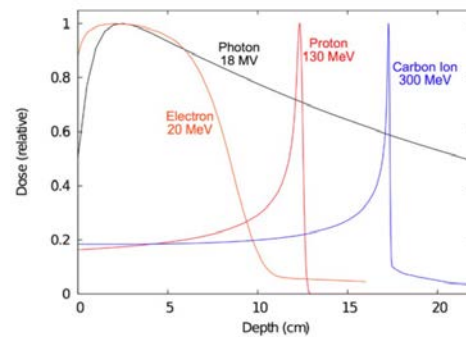
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Radiation via Photons vs Protons

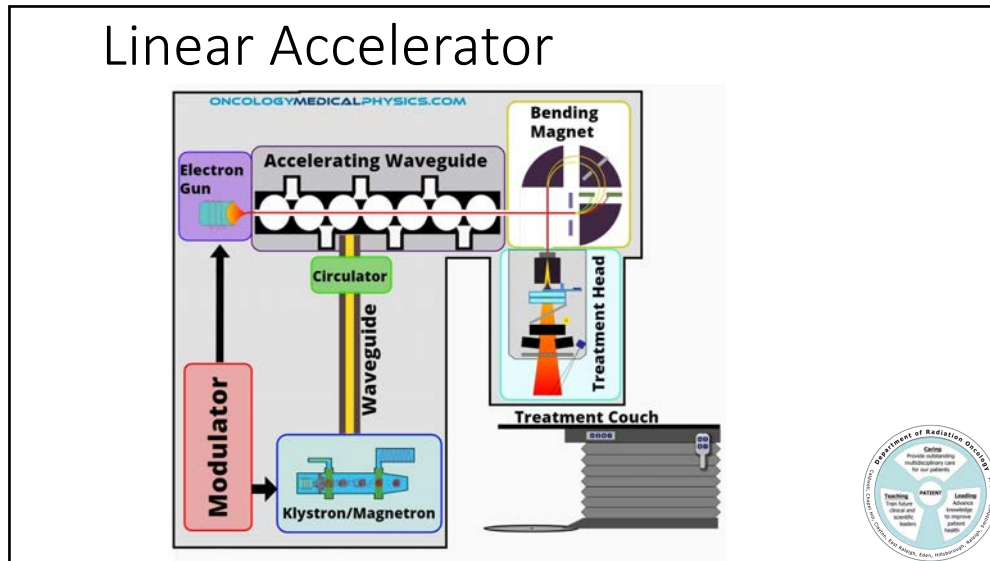


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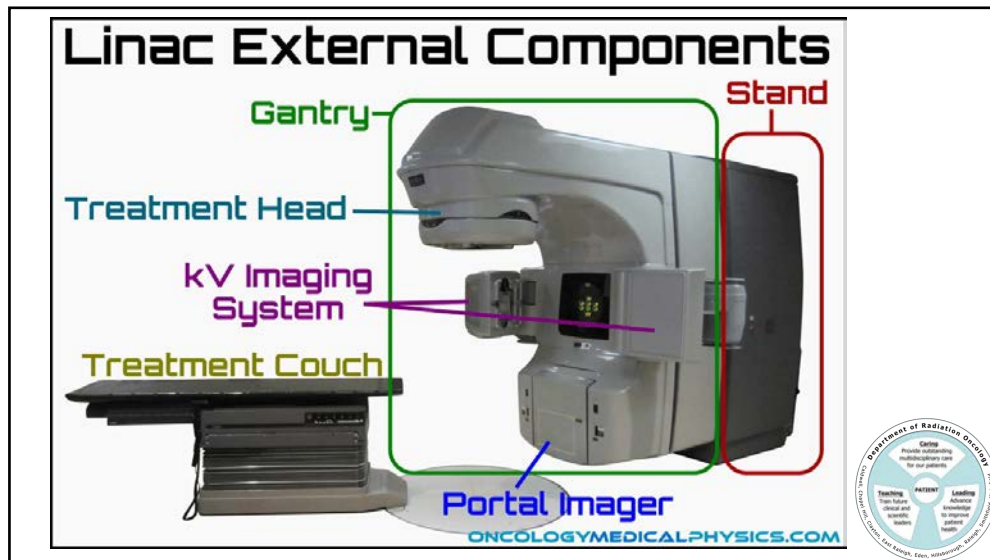
Radiation via Electrons



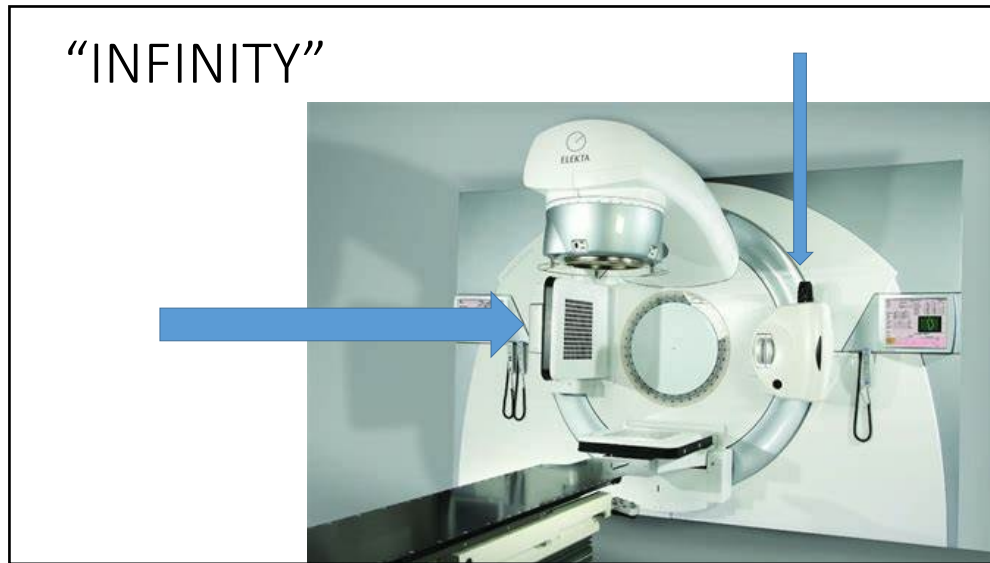
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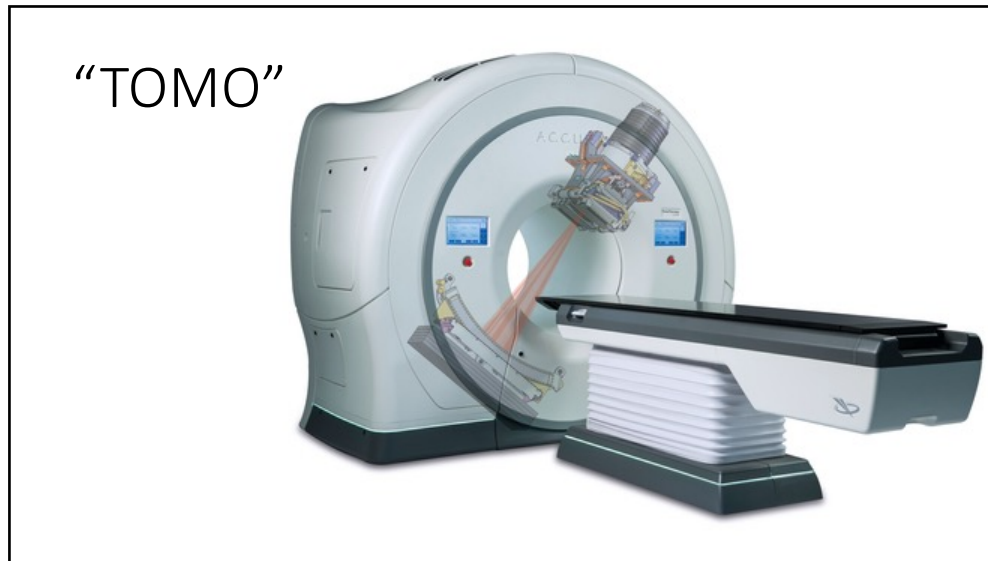
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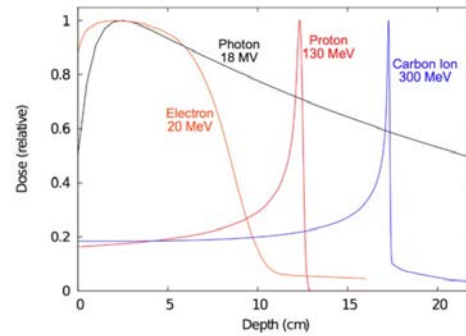


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Radiation via Electrons



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Intraoperative Radiotherapy



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Types of Radiation Therapy

External

- Photons
- Protons
- Electrons

Internal

- Brachytherapy
- Gamma Tiles



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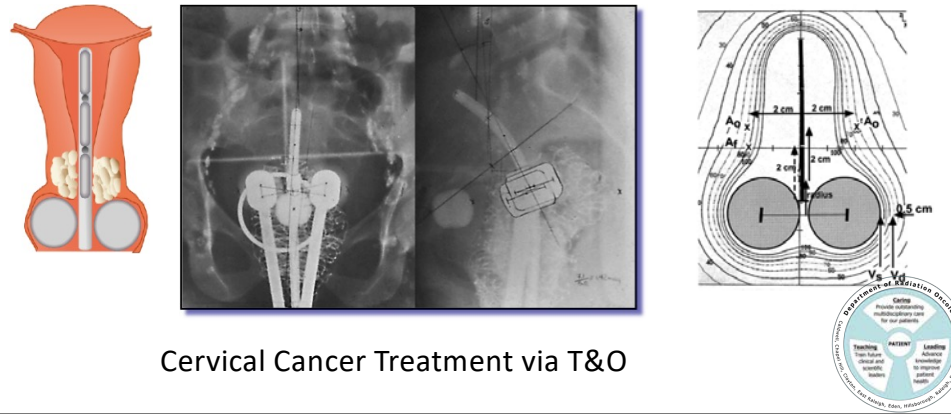


Marie Curie (right) and her daughter Irène, 1925.



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Brachytherapy - HDR

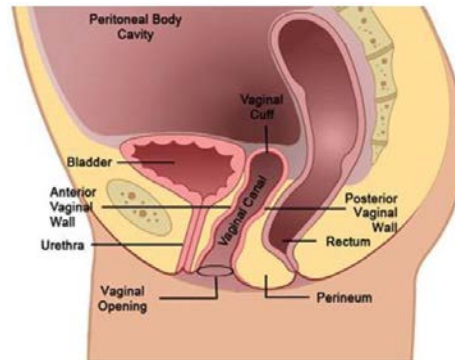


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Brachytherapy



Syed Implant



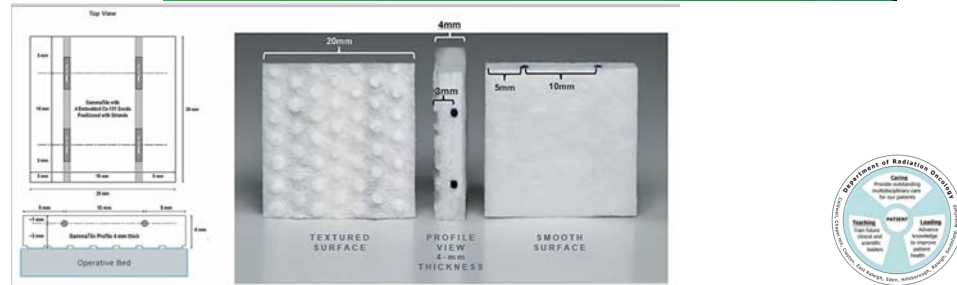
Vaginal Cylinder

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GammaTiles - HDR

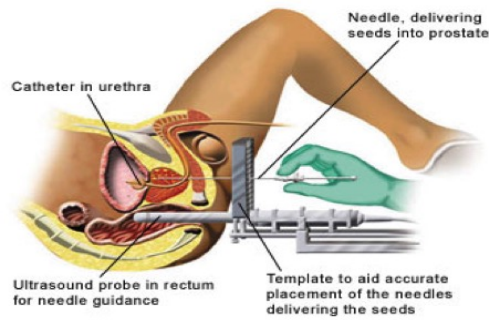
**Surgically Targeted Radiation Therapy
for Patients with Brain Tumors (STaRT)**

**Indication for use: GammaTile is intended to deliver radiation
therapy in patients with newly-diagnosed malignant intracranial
neoplasms and recurrent intracranial neoplasms**

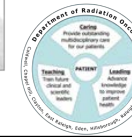
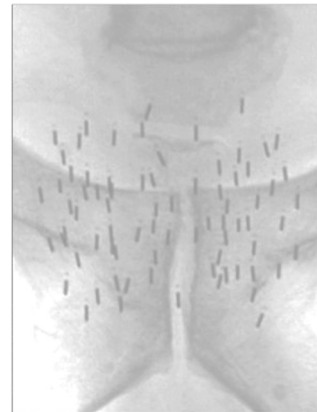


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Brachytherapy- LDR



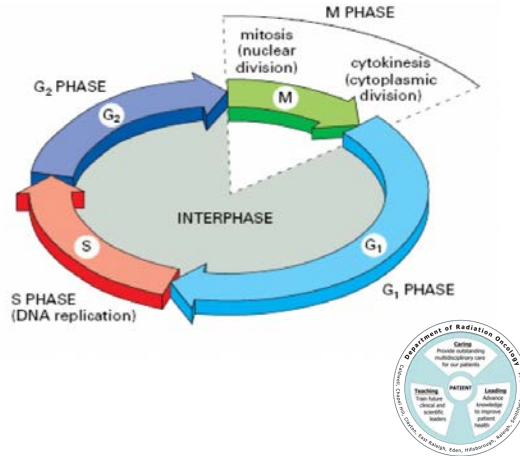
Prostate Cancer Treatment via
Radioactive Seeds



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Radiation and Cellular Reproduction

- Cancer cells replicate more frequently than regular cells
- More frequently in a vulnerable phase
- As a result, they are more readily damaged by RT.



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Radiation Delivery

Definitive H&N Cancer Rx: $200\text{cGy} \times 35 = 7000\text{cGy}$ or 70Gy

Definitive Lung Cancer Rx: $200\text{cGy} \times 30 = 6000\text{cGy}$ or 60Gy

Palliative Rx's:

$300\text{cGy} \times 10 = 3000\text{cGy}$ or 30Gy

$400\text{cGy} \times 5 = 2000\text{cGy}$ or 20Gy

$800\text{cGy} \times 1 = 800\text{cGy}$ or 8Gy



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How does radiation work?



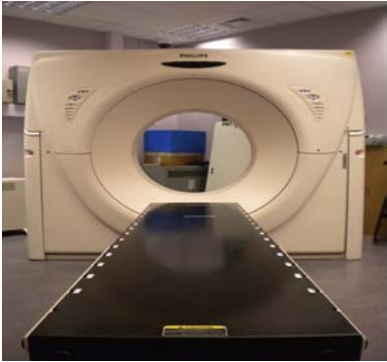
Lasers damage the tissues.
Linear Accelerators are cool and break stuff.
High power x-rays damage cellular DNA.
You will have to ask the radiation team about that.

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Radiation Planning = CT "SIM"



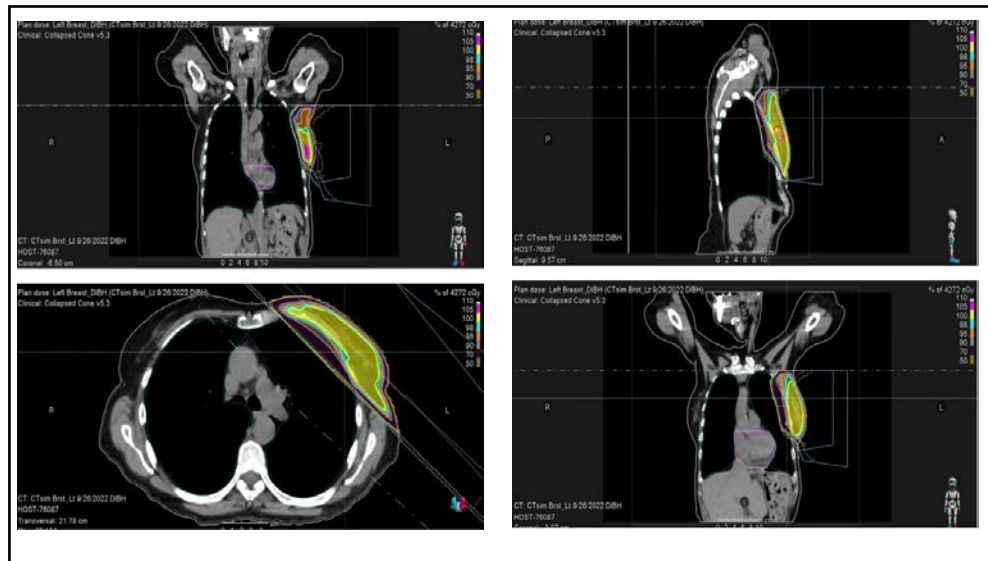
36

[xkcd: Tattoo](#)

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"The Mask"

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Departmental Sim Review

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Acute Radiation Side Effects

- Typically begin after receiving several fractions of radiation
- Are limited to the tissues in the treatment field, with the exception of fatigue
- Majority will resolve within several weeks after the completion of radiotherapy
- CTCEA and RTOG have scorecards for all toxicities



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Radiation Dermatitis

- Erythema presents in weeks 2-3 of RT
- Dry desquamation begins after a dose of 30 Gy
- Moist desquamation occurs at 45-60Gy
- Peak 1-2 weeks after completion of treatment.

Table 1. RTOG Grading Tool (reproduced with permission from Trucman and the Princess Royal Radiotherapy Physics Team, 2014).


Stage	Skin reaction	Assessment/observation	Effects of radiotherapy on skin cells
RTOG 0		No visible change to the skin.	
RTOG 1		Faint or dull erythema. Mild tightness of skin and itching may occur.	
RTOG 2a		Bright erythema/dry desquamation. Sore, itchy and tight skin.	
RTOG 2b		Patchy moist desquamation. Yellow/pale green exudate. Soreness and oedema.	
RTOG 3		Confluent moist desquamation. Yellow/pale green exudate. Soreness with oedema.	
RTOG 4		Ulceration, bleeding, necrosis (rarely seen).	

■ Epithelial cells in basal membrane damaged by radiation. ■ Damaged cells from basal membrane migrating upwards. ■ New epithelial cells generated in basal membrane.


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CTCAE (Common Terminology for Adverse Events)


(a) Grade I




(b) Grade II




(c) Grade III



(d) Grade IV



Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Faint erythema or dry desquamation	Moderate to brisk erythema; patchy moist desquamation, mostly confined to skin folds and creases; moderate edema	Moist desquamation in areas other than skin folds and creases; bleeding induced by minor trauma or abrasion	Skin necrosis or ulceration of full thickness dermis; spontaneous bleeding from involved site	Death



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Factors impacting radiation dermatitis

Treatment Related Factors

- Higher total dose
- Higher dose/fraction
- Higher volume and surface area
- Use of tissue expander and bolus material
- Concurrent systemic therapy (sensitizing drugs-paclitaxel, docetaxel, anthracyclines, mtx, 5-FU, cetuximab)

Patient Related Factors

- Demographic and behavioral factors (smoking, advanced age)
- Comorbid conditions (connective tissue disorders)
- Inherited disorders (xeroderma)
- **SITE OF RADIATION THERAPY**



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Radiation Dermatitis

Radiation dose is shaped to limit skin toxicity without compromising treatment goals

SKIN CARE

- Wash irradiated area daily with water and mild soap, use a water based moisturizer
- Wear loose fitting clothes
- Avoid skin irritants (perfumes, alcohol based lotions)
- Avoid extreme temperatures and sun exposure



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We love emollients



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When a patient asks, "Will radiation make me lose my hair?" the correct answer is:

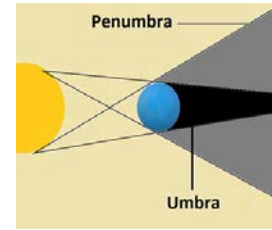
- YES, all of it.
- NO, none whatsoever.
- YES, however, only the hair located in the treatment field.
- You will have to ask the radiation team about that.

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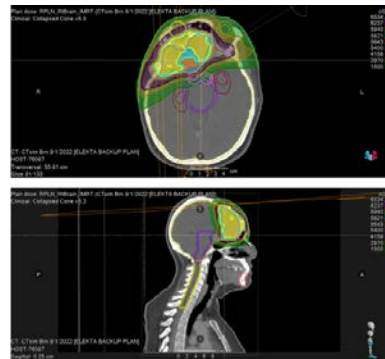
Alopecia

- Begins at 1-3 weeks into treatment
- Can be permanent
- Regrowth of hair within 2-3 months after treatment, can take much longer
- May occur adjacent to treatment site as a result of beam penumbra



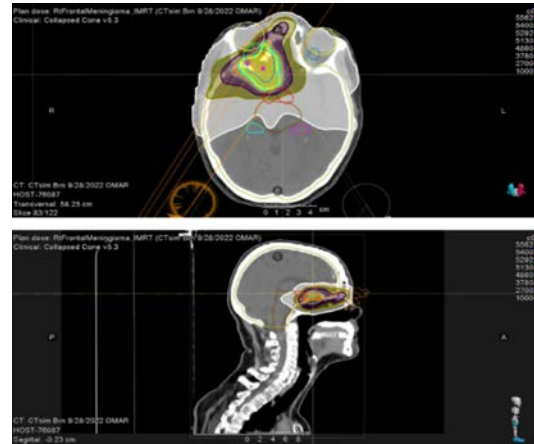
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Alopecia



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Orbital Toxicity



- Blepharitis
- Eyelid Dermatitis
- Eyelash Loss
- Conjunctivitis
- Xerophthalmia
- Corneal Toxicity



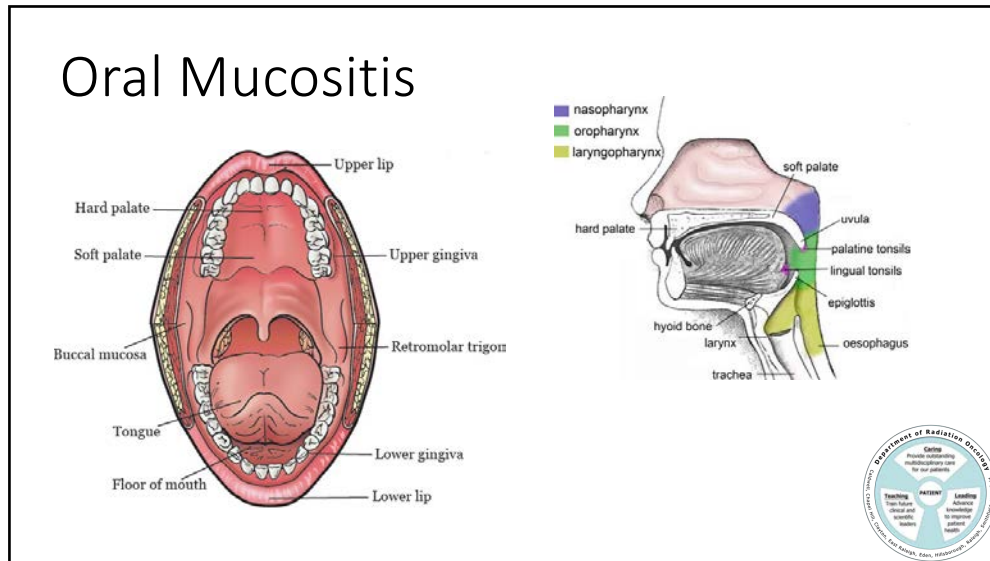
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Otic Toxicity

- External otitis
 - Can be alleviated with OTC analgesics and topical drops
 - betamethasone or dexamethasone otic, decrease inflammation and reduce pain
 - Acetic acid drops-change pH of EAC and has antibacterial and antifungal properties
- Internal otitis
 - Treat with analgesics/antipyretics



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Oral Mucositis

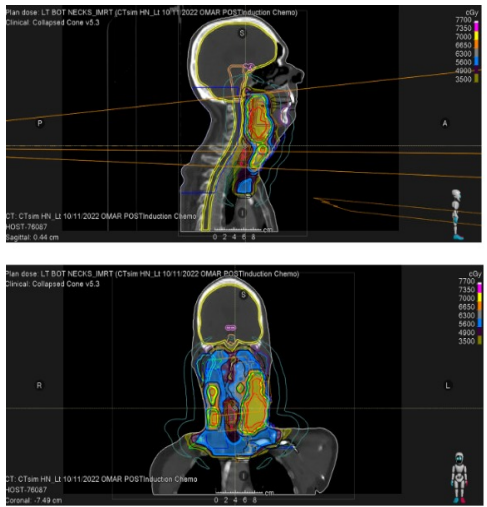
- Unavoidable in patients with head and neck cancer
- PAINFUL
- Dysgeusia
- Odynophagia
 - can result in
 - Dehydration
 - Malnutrition
 - Decreased quality of life


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Mucositis Grading Scales				
	Grade 1	Grade 2	Grade 3	Grade 4
WHO	Soreness with erythema	Erythema, ulcers, can eat solids	Ulcers, liquid diet only	Alimentation not possible
RTOG	Erythema of mucosa	Patchy reaction <1.5 cm, non-contiguous	Confluent reaction >1.5 cm, contiguous	Necrosis or deep ulceration, bleeding
CTCAE (NCI)	Painless ulcers, erythema, mild	Painful erythema, edema, or ulcers but can eat/swallow	Painful erythema, edema, or ulcers requiring IV hydration	Severe ulcers; req PEG/TPN; ppx intubation
				



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Oral Mucositis

SALT AND SODA RINSES

- 1 tsp baking soda
- 1 tsp salt
- 4 cups of water

MAGIC MOUTHWASH

- Lidocaine
- Hydrocortisone
- Maalox
- Benadryl
- Nystatin



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Other Oral Side Effects....

- Changes in taste or smell
- Dry mouth
- Sensitivity to hot or cold foods
- Trouble with swallowing



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Cancer Care

STANDARD REFERRALS FOR HEAD & NECK PATIENTS

- SLP
- Nutritionist
- VIR



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Cancer Care

- COMPREHENSIVE CANCER SUPPORT PROGRAM
- PALLIATIVE CARE
- PSYCHIATRY
- PHARMACY



60

Xerostomia

- If patient is receiving 2Gy/day, by week 2 a 50-60-% decrease in salivary flow occurs.
- After 7 weeks of RT, salivary flow is at 20% and continues to drop for more than 6 months after completing treatment.
- Good news, if dose is less than 60 Gy, changes in salivary glands are reversible



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Taste Changes

- Hypogeusia—reduction in taste sensitivity
- Ageusia—absence of sensation
- Dysgeusia—distortion of normal taste
- Taste changes can occur after as few as 2 fractions of radiation and are maximally impacted at a dose of 30Gy—3 weeks of treatment
- Good news, within 1 year of completing radiation, most folks have return to near normal taste. Unfortunately, a permanent loss of taste can occur at 60 Gy.



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Radiation Pneumonitis

- Typically occurs within 6 mos after course of radiation with peak onset @ 1-3 months post treatment
- Highly dependent on lung dose and volume receiving RT
- Twice daily RT reduces risk of radiation pneumonitis compared with same total daily dose as a single fraction
- Higher risk for patients receiving concurrent chemoRT or chemo prior to RT



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Radiation Pneumonitis

Symptoms

- Dyspnea (particularly DOE), 90%
- Non productive cough, 50-60%
- Hypoxemia



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Radiation Pneumonitis, continued

Work Up

- CBC
- Chest X-Ray
- Chest CT

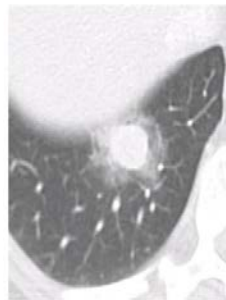
Management

Steroids: 1mg/kg/day x 2-4 weeks then slower taper for additional 6-12 weeks



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Radiation Pneumonitis



Halo Sign

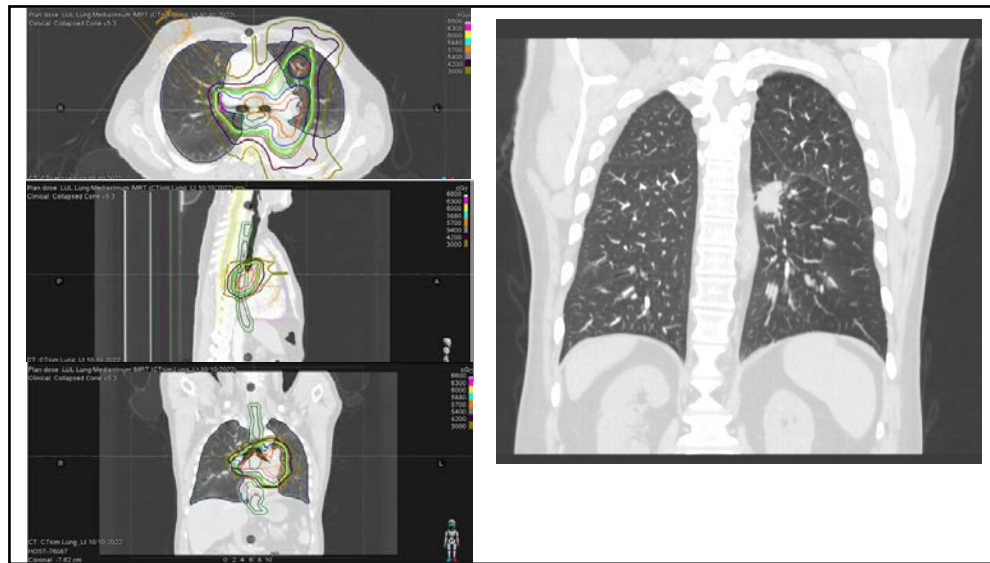


Reversed Halo Sign



Tree-in-bud Sign

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Radiation Esophagitis

- Typically begins on the 2nd or 3rd week of treatment and recovers within 4-6 weeks after treatment
- Concurrent chemoRT, 12 fold greater risk of severe esophagitis



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Radiation Esophagitis

- Frequent small meals with small pieces throughout the day
- Soft foods at warm temp
- Plenty of liquids
- Avoid hot or spicy foods, acidic, hard or crunchy foods
- Avoid alcohol and tobacco
- Pain mgmt. via topical anesthetics, opioids; if reflux sx antacids, H2 blockers, PPI



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For a patient receiving radiation to a breast cancer, which of the following are potential radiation side effects?

- A Fatigue, radiation dermatitis
- B Fatigue, mucositis, xerostomia
- C Fatigue, headache, nausea
- D Fatigue, esophagitis


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Fatigue, Mucositis, Xerostomia — Patients with disease in what location are likely to endure these side effects?

- Cervix
- Femur
- Oral Cavity
- Breast

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Fatigue, Headache, Nausea — Patients with disease in what location are likely to endure these side effects?

- Breast
- Lung
- Brain
- Pelvis

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 UNC Lineberger Cancer Network

Fatigue, Esophagitis – Patients with disease in what location are likely to endure these side effects?

Central lung A
 Esophagus B
 Oral cavity C
 Both A and B D

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Radiation Gastritis

- Occurs in up to half of patients whose stomach is in the treatment field—lymphoma, neoplasm in lower esophagus, stomach, biliary tract, etc)
- Changes to mucosa lead to swelling of tissue and sensation of nausea, anorexia, vomiting and pain
- Ulcers can develop
- In severe cases, gastric perforation
- Management with antacids, antiemetics



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Radiation-Induced Liver Disease

- Dependent upon dose to the liver and volume of liver exposed to > 30-35 Gy
- Typically occurs 4-8 weeks after completion of treatment
- Symptoms can include rapid weight gain, increase in abdominal girth, RUQ discomfort, ascites and jaundice
- Primarily elevated Alk Phos
- Management is supportive, diuresis, analgesia, paracentesis, correction of coagulopathy and steroids.



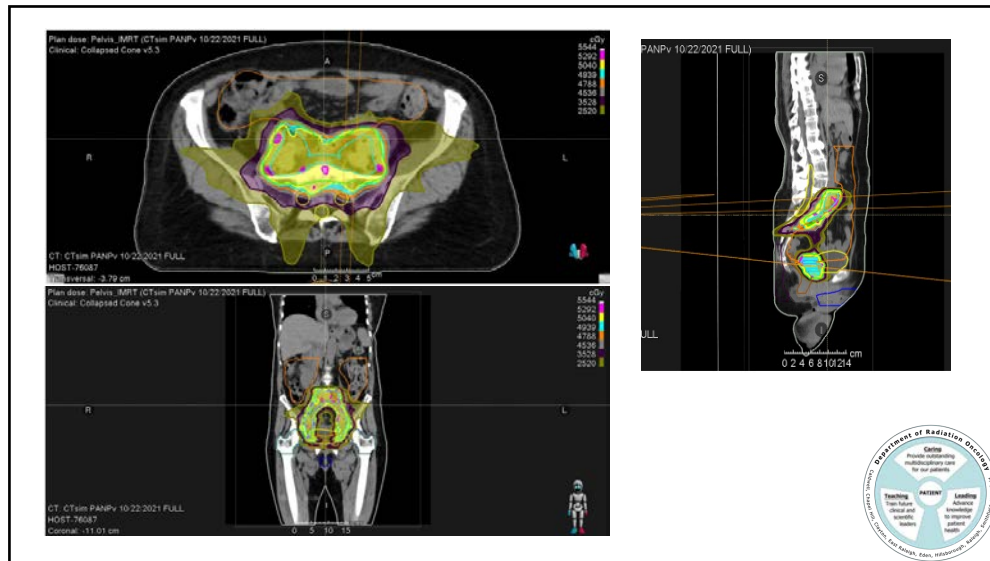
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Radiation Enteritis

- Small intestine is more sensitive to RT than colon and rectum
- 80% of patients receiving pelvic RT
- Radiation damage results in impaired absorption
- Motility pattern changes as well
- Symptoms begin about 1-2 weeks into course of RT, peak in 4th-5th week and gradually improve within 2-6 weeks after completing RT



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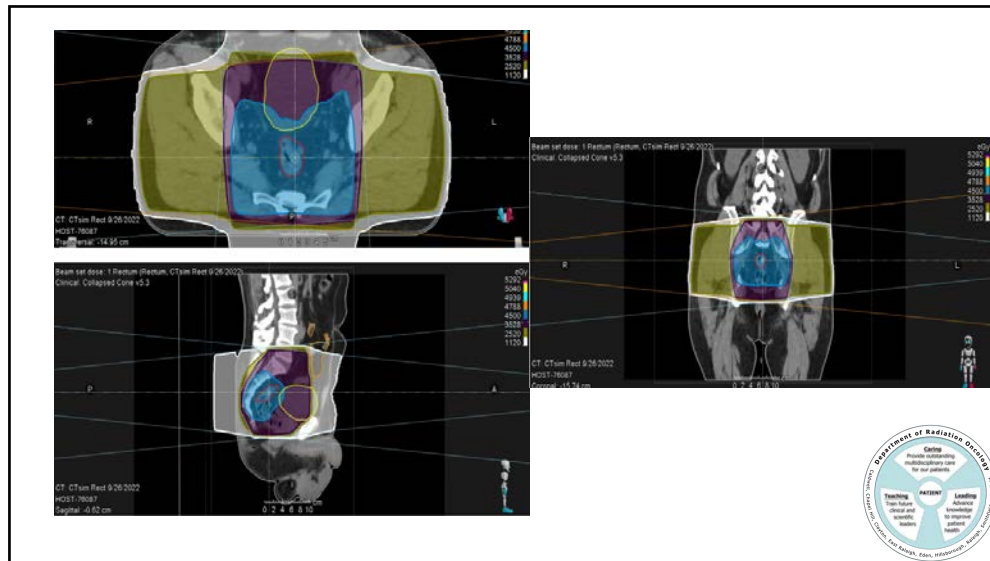
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Radiation Enteritis

- Anorexia
- Nausea
- Vomiting
- Bloating
- Diarrhea
- Dietary modifications
 - Avoid foods with skins and seeds, caffeine, chocolate, alcohol, beans, insoluble fiber, multigrain
 - Consume small volume, high protein foods
 - Avoid dairy
- Antidiarrheal medication
 - Loperamide, Loperamide and more Loperamide; maybe cholestyramine
- Antispasmodic medication
 - Anticholinergic



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Radiation Proctitis

- Affects 75% of patient receiving pelvic
- Risk factors include young age (<60), presence of hemorrhoids, diabetes, inflammatory bowel disease
- Sx: increased frequency/urgency of defecation, rectal pain, tenesmus, mucous discharge; less commonly bleeding and fecal incontinence
- Management: dietary modifications as per enteritis, loperamide, butyrate enema, Sitz baths



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Radiation Cystitis

- Urgency, Frequency, Incontinence, Nocturia, Hematuria
- Need to rule out UTI
- Hydration is critical—dilution of urine can help prevent UTI
- Medical Management = anticholinergics (oxybutynin), alpha-1 blocker (tamsulosin), analgesics (phenazopyrdine)



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Fatigue

“Cancer-related fatigue is defined as a persistent, subjective sense of physical, emotional and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and that significantly interferes with usual functioning.”--NCCN



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Fatigue

- Multi factorial
- Independent of treatment field

- Encourage daily physical activity, good sleep hygiene, comprehensive cancer support program referral, good nutrition/hydration



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Hematologic Side Effects

- If large volume of bone marrow in treatment field, then may have leukopenia
- Field size is most important determining factor for adverse hematologic effects on severity and timing
- Chemotherapy is a big contributor to hematologic side effects



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Do all patients undergoing radiation
experience side effects?

NO!

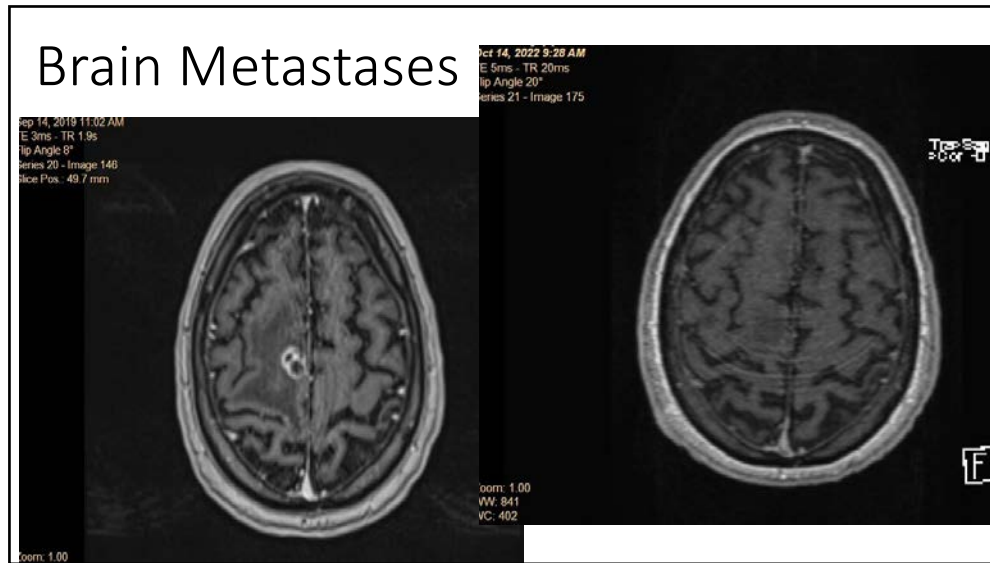


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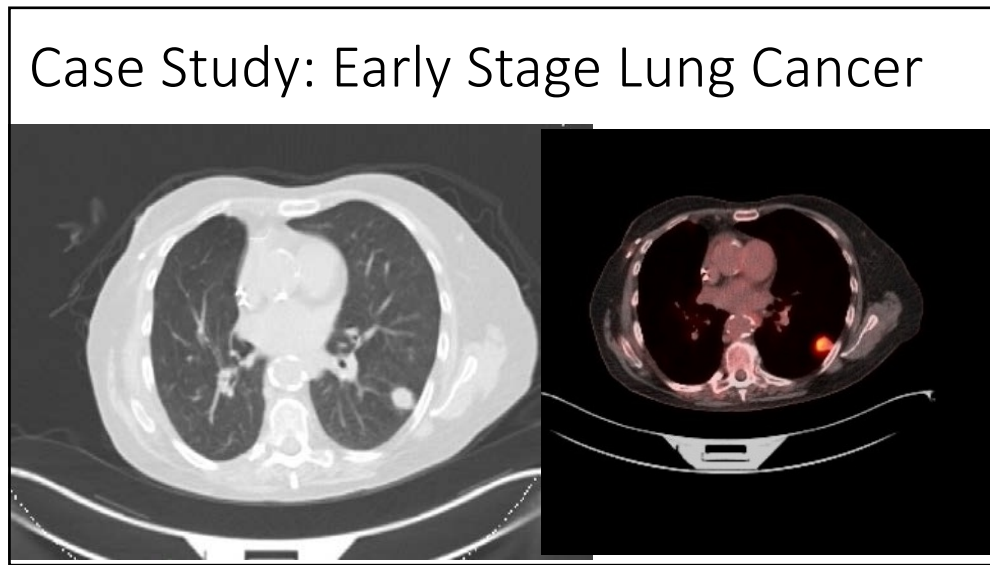
Brain Metastases



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Case Study

SBRT for early stage Lung Cancer

Plan dose: LLL Lung iCAT_SBRT (CTSim Lung_L1 10/22/2021 SBRT OMAR)
Clinical: Collapsed Cone v5.3
HOST: 76087
Coronal: -14.83 cm

Plan dose: LLL Lung iCAT_SBRT (CTSim Lung_L1 10/22/2021 SBRT OMAR)
Clinical: Collapsed Cone v5.3
HOST: 76087
Transverse: 23.38 cm
Slice 50/152

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Center for Personalized Medicine
Providing personalized medicine solutions for our patients

Teaching: Train future leaders in radiation oncology
PATIENT: Providing the best care possible
Advancing: Research to improve patient health

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Case Study-

SBRT for early stage Lung Cancer

Plan dose: LLL Lung iCAT_SBRT (CTSim Lung_L1 10/22/2021 SBRT OMAR)
Clinical: Collapsed Cone v5.3
HOST: 76087
Sagittal: 7.97 cm

Plan dose: LLL Lung iCAT_SBRT (CTSim Lung_L1 10/22/2021 SBRT OMAR)
Clinical: Collapsed Cone v5.3
HOST: 76087
Coronal: -14.83 cm

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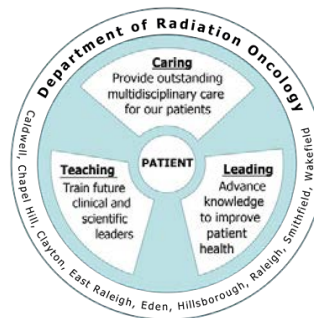
Case Study

SBRT for Early Stage Lung Ca



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THANK YOU



lara.novak@unchealth.unc.edu

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The Telehealth Team

Tim Poe, Director

Veneranda Obure, Technology Support Specialist	Andrew Dodgson, DPT, Continuing Education Specialist
Jon Powell, PhD, Continuing Education Specialist	Nadja Brown, Interim Administrative Support Specialist
Oliver Marth, Technology Support Technician	Patrick Muscarella, Technology Support Technician

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UPCOMING LIVE WEBINARS

<p>RESEARCH TO PRACTICE <small>Free Webinar</small></p> <p>Acute Myeloid Leukemia with Myelodysplasia-Related Changes (AML-MRC): An Evolving Poor-risk Subgroup of High Unmet Need Joshua F. Zeidner, MD</p>	<p>November 23 12:00 PM</p>	<p>SOUTHEASTERN AMERICAN INDIAN CANCER HEALTH EQUITY PARTNERSHIP <small>Free Webinar</small></p> <p>Promoting Equity in American Indian Cancer Control Donald Warne, MD, MPH</p>	<p>November 30 12:00 PM</p>
<p>PATIENT CENTERED CARE <small>Free Webinar</small></p> <p>Occupational Therapy for Cancer Survivors Farrell Wiggins, OTR/L Alexis Petteway, OT</p>	<p>December 7 12:00 PM</p>	<p>ADVANCED PRACTICE PROVIDER <small>Free Webinar</small></p> <p>GVHD: An Overview of Graft vs Host Disease Post Hematopoietic Stem Cell Transplant Megan McElfresh, PA-C</p>	<p>December 14 4:00 PM</p>

Complete details on upcoming LIVE webinars:
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SELF-PACED, ONLINE COURSES

<p>ADVANCED PRACTICE PROVIDER <small>Self-Paced, Online Course</small></p>	<p>What Can VIR Do for You? Katie Riffle, MSN, FNP-BC</p>
<p>PATIENT CENTERED CARE <small>Self-Paced, Online Course</small></p>	<p>Psycho-Social Complications of Receiving a Cancer Diagnosis and Treatment During the Pandemic Justin Yopp, PhD</p>
<p>ADVANCED PRACTICE PROVIDER <small>Self-Paced, Online Course</small></p>	<p>Ostomies, Tubes, and Drains Julienne S. Harris, MSN, FNP-C</p>

Today's webinar will be available in **December 2022** as a **FREE**, Self-Paced, Online Course

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THANK YOU FOR PARTICIPATING!

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Email: unclcn@unc.edu
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