

UNIVERSITY OF COLORADO
RADIATION ONCOLOGY ELECTIVE
Medical Student Handbook

Radiation Oncology Course 8005 -- A Primer for Medical Students

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Welcome to Radiation Oncology at The University of Colorado Anschutz School of Medicine. During this rotation, you will become familiar with the role of radiation therapy in the overall management of patients with cancer. You will learn to perform a focused history and physical on a patient and you will learn about some of the common cancers (lung, breast, prostate, head and neck and cervix).

Objectives of the Course:

1. To understand the role of radiation therapy in the treatment of common cancers (lung, breast, head & neck, brain, GI, GU, GYN, etc).
2. To learn about the general principles of oncology, including
 - a. Basic Science of Oncology
 - b. Diagnostic workup and staging of cancer
 - c. Decision on a cancer treatment plan
 - d. The administration of treatment for cancer
 - e. The supportive medical care of the cancer patient
3. To observe the specialized procedures of radiation therapy for cancer, including
 - a. Treatment planning simulation
 - b. Planning and administration of CT-planned conformal Radiation Therapy.
 - c. Planning and administration of brachytherapy.
4. To complete the assigned reading.
5. To give a 20-minute oral presentation on a pertinent topic of oncology, with 10 minutes of Q &A.

Required Reading:

1. **Essentials of Clinical Radiation Oncology** by Matthew C. Ward, Rahul D. Tendulkar and Gregory M. M. Videtic. The staging manual is important for anyone who is interested in any field of oncology.
Textbook will be loaned to the medical student. They must be returned at the end of your rotation.

2. **Important papers** on any specific cancer suggested by an attending.

You will be assigned to an attending for each day. This is flexible and you should confirm the next day's schedule with the Chief Resident daily. You will be given a schedule of conferences and tumor boards that you are required to attend depending on whose service you are scheduled on for the day. You will also attend morning chart rounds (Mondays - Thursdays at 8am) where patients starting radiation therapy are discussed.

In the last week of your rotation, you will make a formal presentation on a cancer related topic based on a patient you have seen. The patient and topic should be identified in the first two weeks of the rotation. This should be discussed with the patient's attending who will review your presentation. Please make an appointment with your selected attending in the third week of the rotation. Kate can assist you by letting you know which Administrative Assistant handles each attending's schedule.

Medical Student Responsibilities:

Consultations:

For the first consultation, the student will observe as the resident gathers the pertinent information (x-rays/CT/MRI reports, path reports, operative reports, etc.) and does an H&P on the patient. For this first consult, the resident will present the case to the attending while the student observes. For all subsequent consultations, the student will see and examine the patient together with the resident. The student will then present the case to the Attending and Resident.

Follow-Up Visits and On-treatment Visits:

The student will examine the patient with the resident, in a format similar to hospital rounds. The student will assist the resident in obtaining pertinent information (e.g. lab or x-ray results; updating the patient's medication list; scheduling tests or appts with other providers).

Simulations, Dosimetry, and Setups:

The student will observe the attending and resident in the technical aspects of radiation oncology. The student is expected to help in gathering the pertinent information (e.g. CT/MRI) necessary for these procedures. The student may be quizzed about anatomy and oncology during these procedures, but is not expected to perform any of these technical procedures.

Presentation:

The student is required to give a 20-minute PowerPoint presentation on a cancer related topic based on a patient that the student has seen. The PowerPoint slides must be reviewed with the patient's attending at least one week prior to the presentation date.

Grading (Honors, High Pass, Pass, Fail, Incomplete)

At the end of rotation, the student will receive a notification from Oasis to complete an evaluation for the course and for each attending the student worked with. Each attending will report back to the course director with written comments on the student's performance and a tentative grade. The course director will take into consideration of all attendings' evaluation and comments and give a final grade. For the grade of Honors, the student must be excellent in all categories evaluated.

Steps involved in Clinical Radiation Therapy:

1. Consultation, including decision to irradiate
2. Pre-radiation workup, including staging, dental evaluation, nutritional assessment
3. Simulation, including immobilization of the area to be irradiated
4. Dosimetry (Calculation of radiation dose to tumor and normal structures)
5. Setup or final quality assurance planning session
6. Radiation Treatments, including on-treatment visits by the physician(s)
7. Post-radiation follow-up visits

Roles of Radiotherapy: *Role of Radiotherapy Examples*

1. **Definitive Radiotherapy alone** -- for early larynx cancer.
2. **Preoperative Radiotherapy** -- prior to resection of a low-lying rectal cancer.
3. **Postoperative Radiotherapy** -- after mastectomy for locally advanced breast cancer.
4. **Palliative Radiotherapy** -- for a massive incurable lung cancer causing pain/bleeding

The Four "R's" of Radiation Biology: *R Definition Clinical Example(s)*

1. **Repair:** Cells repair DNA damage from radiation in between radiation fractions (doses).
2. **Redistribution:** Cells "redistribute" from radioresistant phases (e.g. S phase) of the cell cycle to more radio-sensitive cell cycle phases (e.g. M phase) in between radiation fractions.
3. **Reoxygenation:** Cells may go from a hypoxic (and thus radioresistant) environment to a well-oxygenated state as a course of treatment proceeds.
4. **Repopulation:** Cells may respond to the death of adjacent cells by "accelerated repopulation".

Glossary of Terms Related to Radiation Therapy:

Adjuvant: Generally, refers to postoperative therapy. However, chemotherapy given after "definitive" radiotherapy would also be considered adjuvant.

Blocks: Thick shields made of a lead-like alloy which can be shaped for each patient to "block" portions of their anatomy that would otherwise fall into the radiation field. In the treatment of head and neck cancer, for example, every attempt is made to block as much CNS tissue as possible.

Brachytherapy: radiotherapy given in the form of radioactive sources placed directly into or around a patient's tumor. This may be given interstitially (sources imbedded directly into tissue) or intracavitary (sources laid into a cavity such as the nasopharynx).

cGy (centigray): A modern basic unit of radiotherapy dose; 1 cGy = 1 rad. 1 cGy = 100 ergs per gram of absorbed energy.

Conedown: Shrinking the field size sometime during the course of radiotherapy, to take advantage of the decreasing size of tumor during treatment and to minimize the amount of toxicity of treatment. For example, a patient may begin radiotherapy with a 15 x 15 cm field and then have a conedown midway through treatment to a 10 x 10 cm field.

Conformal Radiotherapy: The use of extremely sophisticated imaging studies and dosimetry to design radiation fields that "conform" precisely to the shape of a patient's tumor. Conformal radiotherapy usually uses smaller "safety margins" around a patient's tumor, a larger number of fields, and less prophylactic radiotherapy of clinically uninvolved lymph node areas.

Consolidative: Refers to radiotherapy given after a maximal or complete response to chemotherapy, as is often done in the treatment of lymphomas.

Course: A series or program of radiation treatments or fractions with a specific goal in mind for a patient, e.g. a seven-week course of daily radiotherapy to the head and neck cancer for attempted cure.

Definitive: Refers to radiotherapy given with the intention of cure without radical surgery. May be given with other non-surgical treatment such as chemotherapy.

Dosimetry: The process of optimizing the radiotherapy fields and dose by calculating the radiation dose to be received by a tumor and/or normal tissues in a radiation field(s). Physicists and "dosimetrists" work with the radiation oncologist in comparing possible radiation treatment plans with the goal of maximizing the radiation dose to the tumor while minimizing dose to normal tissue, often requiring sophisticated computer programs. Dosimetry can be described as the radiotherapy version of pharmacokinetics.

External beam radiotherapy (x-ray therapy): radiotherapy given from a machine (usually a linear accelerator) which produces a high-energy x-ray beam which is then aimed at a patient's tumor and/or suspected tumor areas.

Field: An area at which a radiotherapy beam is directed, usually described as a rectangular shape, in cm (e.g. 10 x 14 cm). "Blocks" are often used to further customize the shape of a field. A single fraction of radiotherapy may include multiple fields, typically two to four.

Fraction: A single radiation therapy session, usually given over one to three minutes. A fraction may consist of one or multiple "fields," and any dose, as prescribed by the radiation oncologist. Most courses of radiotherapy involve one fraction per day, Monday through Friday, over one to seven weeks, although an infinite number of possible fractionation schedules are possible.

Gy (Gray): The SI modern basic unit of radiotherapy dose; 1 Gy = 100 cGy = 100 rad. One Gy = 1 Joule per kilogram of absorbed energy.

Hyperfractionation (see also fraction): The delivery of two or more radiation fractions per day, generally given with a four or more-hour interval between fractions.

Neoadjuvant: Generally, refers to preoperative therapy. However, chemotherapy prior to "definitive" radiotherapy would also be considered neoadjuvant.

Palliative: Refers to therapy given with the goal of relieving distressing symptoms, without any anticipated effect on survival.

Prophylactic: Refers to radiotherapy given to a site at which there is no known tumor but which is considered to be at high risk for harboring occult "microscopic" disease, such as lymph node areas.

Rad: Basic unit of radiotherapy dose; terminology has now changed to the S.I. units (cGy and Gy). 1 rad = 1 cGy (See Gray).

Radiation Therapy Oncology Group (RTOG): A National Cancer Institute-sponsored multicenter clinical trials cooperative group which performs studies related to radiation therapy, including many lung cancer studies.

Radiosensitizers: Drugs or other treatments which increase the cellular response to radiotherapy. Many chemotherapeutic drugs have radiosensitizing properties.

Safety Margin: A margin of "normal-appearing" tissue which is added onto the visible tumor area for the purposes of radiation planning. Typically, 1.5-2 cm in all dimensions is added, to account for microscopic extension of tumor cells and the possibility of slight patient motion during treatment.

Simulation: A detailed planning session for radiation therapy, which "simulates" but does not actually deliver a radiation treatment. Simulation consists of immobilization of the patient in an appropriate position for radiation therapy, marking the patient's skin, localizing the area to be treated under fluoroscopy, taking radiographs of the area to be treated, and taking measurements of the patient's contour for dosimetry purposes.

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