UNIVERSITY OF COLORADO
Medical Students
RADIATION ONCOLOGY ELECTIVE

Radiation Oncology Course 8005 -- A Primer for Medical Students

Course Director: Tyler Robin, MD
Course Coordinator: Sandy Korn
Phone # (720) 848-0156
Email address: Sandra.Korn@CUAnschutz.edu

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 and GYN).

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 pertinent topic of oncology, with 10 minutes of Q &A.

Welcome to Radiation Oncology. This is a brief summary of what we hope you will get out of your elective rotation through Radiation Oncology. You may not want to become a radiation oncologist, but we do want you to 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 with cancer. Also, you will learn about some of the common cancers (lung, breast, prostate, head and neck and cervix).

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.
   Text book will be loaned to the medical student. They must be returned at the end of your rotation.

2. **Important papers** on a 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 on a daily basis. 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.

Morning chart rounds (Mondays - Thursdays at 8am) where all new 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. Sandy can assist you in letting you know which Administrative Assistant handles each attending's schedule.

We hope that you will enjoy this rotation and consider it an opportunity to see how radiation oncology fits into the treatment of cancer. There are many things that can be done to help cancer patients and all of us continue to learn. We hope you will be learning with us.

Medical Student Responsibilities:

1. Consultations:
For the first consultation, the student will observe the resident as he/she 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 looks on. 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 the Resident together.

2. Follow-Up Visits and On-treatment Visits:
The student will see and examine the patient together 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 M.D.'s).

3. 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.

4. Presentation:
A requirement of the rotation is 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.

Research opportunities – course RAON8600

The department offers opportunities for clinical and/or basic science research for highly motivated students interested in a career in radiation oncology. In general, the one-month rotation of course RAON8005 is not sufficient time to design and implement even a simple research project. However, an additional 4 week rotation focusing on research projects is available (RAON8600). The prerequisite for RAON8600 is that the student has completed the course RAON8005 and the departmental and associate dean of student affairs approval must be obtained, and all arrangements made one semester in advance. This elective is designed to acquaint the student with current research development, knowledge and techniques in radiation oncology.

Course work away from our department

Course work in an institution other than the University of Colorado hospital is available to students. The prerequisite is that the students complete the course RAO8005, and departmental approval must be obtained one month in advance. Students are required to discuss their course evaluation with their individual instructor and ensure that the written evaluation is mailed to course director.

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.

Revised 7 13 22