University of Washington, Radiation Oncology Physics Residency Program

Medical Physics Site Specific Clinical Rotation

Physics Faculty Mentor:

Start date:
End Date:
Duration:

Meet with mentor(s) every week on ?? to review work including readings, journal entries, project development, and observations/interaction with clinical faculty and medical residents. Additional and alternate meetings scheduled as needed.

Description

Medical physics residents will complete site-specific clinical rotation under the supervision of clinical and physics faculty in the department of Radiation Oncology. Medical physicists in radiation oncology are expected to work closely with physicians to assure the best possible treatments for patients given the state of technology currently available. They are often consulted for the physical and radiobiological aspects of patients' treatments, design of treatment plans and treatment aids, participation in clinical trials, development of new techniques to improve treatment efficacy, and periodic review of patient charts. Therefore it is crucial for medical physics residents to obtain insights into clinical decision making processes, e.g., design and prescription of individual therapy for each patient depending upon how their disease presents and the use of any adjuvant therapy, target identification and contouring, and the role of imaging and diagnostic tests in this process.

Clinical rotation consists of training in the following 8 different sites that are commonly treated with radiation.

- SS1 Head and Neck
- SS2 Central nervous system (CNS)
- SS3 Prostate
- SS4 Thoracic and Gastrointestinal (GI)
- SS5 Sarcoma
- SS6 Pediatrics and Lymphoma
- SS7 Breast
- SS8 Genitourinary (GU) and Gynecological (GYN)

The physics mentor will make arrangements for residents to shadow attending physicians who have expertise in each site and their medical residents. Physics residents are expected to follow instructions and additional training goals set by attending physicians for each site. At the

completion of training for each site, residents are expected to submit a report to describe what they have learned by Friday of the following week.

Objectives

- Discuss the role of radiotherapy in managing tumors in each site in conjunction with surgery and chemotherapy
- Demonstrate understanding of basic mechanism of prescribing doses and factors that may affect the prescription dose such as disease condition and/or adjuvant therapy
- Demonstrate understanding of radiobiological effects of different fractionation schemes; radiation dose escalation and acceleration
- Discuss limiting factors in treating tumors in each site, possible compromises faced by clinicians and their alternatives
- Discuss the role of secondary imaging modalities such as PET and MRI, and image registration in identifying tumor volume
- Discuss special considerations in treatment plans, e.g., clinical priority of normal tissue doses and re-irradiation for recurrent disease
- Discuss the criteria of evaluating treatment plans
- Discuss common side effects; acute vs. late
- Discuss definitive radiotherapy vs. palliative radiotherapy
- Discuss prognostic factors and the correlation, if any, between local control/survival rates and the dose given to patients
- Discuss clinical trials and their significance in improving treatment efficacy

Competencies

Thoracic and Gastrointestinal (GI)

Thoracic and GI tumors include, but are not limited to, lung, mediastinum, esophagus, heart and great vessels, stomach, pancreas, liver, colon and rectum, and anal cancers

- Demonstrate understanding of how to account for motion in delineating target volume and use of 4DCT in the contouring process; understand the concept of GTV, CTV, ITV, and PTV
- Discuss the accuracy of different dose calculation algorithms, i.e., pencil beam, superposition/convolution, and Monte Carlo, in the presence of tissue heterogeneity, and its effect on clinical decisions
- Demonstrate understanding of special techniques such as stereotactic body radiotherapy and Active Breathing Coordinator

Head and Neck

Head and neck tumors include, but are not limited to, nasopharynx, nasal cavity and paranasal sinuses, salivary glands, oral cavity, intraocular and orbital tumors, oropharynx, hypopharynx, larynx, thyroid, and unusual nonepithelian tumors

- Discuss conventional 3-field treatments (two laterals and supraclavicular field) with electron boost vs. IMRT/3D
- Demonstrate understanding of benefits and fabrication of common treatment aids such as thermoplastic masks, bite blocks, dentures, and eye shields
- Demonstrate understanding of prescribing doses in multiple phases or dose painting
- Discuss additional radiation for persistent disease using brachytherapy after a full course of external beam treatments (or brachytherapy followed by external beam treatments, for example, in thyroid cancer)
- Demonstrate understanding benefits of using neutron therapy in treating salivary glands
- Discuss radiation-induced thyroid cancer and the use of radionuclide in thyroid imaging
- Discuss the management of the neck including unknown primary tumors

Central Nervous System (CNS)

CNS is made up of the brain and the spinal cord

- Demonstrate understanding of principles and special concerns in cranio-spinal irradiation (CSI), whole brain, and partial brain irradiation respectively
- Discuss the use of stereotactic radiosurgery (SRS) and fractionated stereotactic radiotherapy (FSRT) in managing brain tumors; candidates for SRS/FSRT, the advantages and disadvantages of Gamma Knife and linac based radiosurgery respectively, FSRT using Optical Guidance Platform (OGP)
- Discuss the use of heavy charged particles in managing CNS tumors, especially in CSI
- Demonstrate understanding of body stereotactic radiotherapy (SBRT) for spine treatments
- Demonstrate understanding of using MRI or myelogram to identify spinal cord
- Demonstrate understanding of image registration for cord definition

Prostate

- Discuss treatment options for low-risk, and intermediate- and high- risk prostate cancers, respectively

- Demonstrate understanding of the benefits and risks of low dose rate (LDR) brachytherapy, high dose rate (HDR) brachytherapy, and external beam radiotherapy (EBRT), respectively; combination of EBRT and brachytherapy
- Demonstrate understanding of using ultrasound in seed implants (LDR)
- Discuss the efforts to reduce dose to organs-at-risk, e.g., rectal balloon and full bladder
- Demonstrate understanding of an intra-fractional tumor tracking system such as Calypso
- Discuss the use of heavy charged particles to treat prostate cancer in combination with photons
- Demonstrate understanding of prostate-only radiotherapy vs. whole pelvic radiotherapy followed by a prostate boost; special concerns in each type of treatment

Breast

- Demonstrate understanding of matching the tangential fields with the supraclavicular field; single isocenter technique vs. two isocenters
- Demonstrate an understanding of the benefits of forward planned multiple segmented breast plans without wedges.
- Demonstrate understanding of using posterior axillary boost for selective cases
- Demonstrate understanding of treating whole breasts and internal mammary lymph nodes (IMN) using photon fields matched with electron field(s)
- Discuss the use of Active Breathing Coordinator to reduce heart dose for left breast treatments
- Discuss the use of Calypso in treating breast tumors
- Discuss accelerated partial breast irradiation using HDR, MammoSite, and EBRT respectively

Sarcoma

Sarcomas are tumors in the connective tissues in any anatomic location of the body

- Discuss the central role of radiotherapy in managing sarcomas
- Discuss the difficulties and various techniques in positioning and immobilizing extremities
- Discuss the use of interstitial brachytherapy in managing sarcomas
- Discuss the use of intraoperative radiotherapy (IORT) in managing osteosarcomas

Pediatrics and Lymphoma

- Discuss tumor sites/types that are prevalent in children

- Demonstrate understanding of long term side effects, for example, endocrine deficits, cardiovascular complications, growth impairment, and radiation-induced secondary cancers; possibly lower tolerance levels for organs-at-risk
- Discuss the role of anesthesia during CT simulations and daily treatments
- Discuss the use of heavy charged particles and its benefit in CSI tumors in children
- Discuss techniques in managing Hodgkin's disease and Non-Hodgkin's lymphoma

Genitourinary (GU) and Gynecological (GYN)

GU and GYN tumors include, but are not limited to, kidney, ureter, bladder, cervix, vagina, endometrium, and anal urethra cancers

- Discuss preoperative irradiation vs. postoperative irradiation
- Demonstrate understanding of preserving ovaries and ovarian function
- Demonstrate understanding of LDR using Cs-137 and HDR using Ir-192 in treating cervical cancers; discuss dose rate/fractionation impact on outcome
- Discuss the use of intracavitary vaginal brachytherapy

Projects

To be determine

Didactic Lectures

Resident will attend didactic lectures, including all grand rounds, as suggested by the mentor.

Log Book/Diary

Resident will document his/her activities daily in a logbook to keep a record of attendance at conferences, seminars, grand rounds, clinical chart rounds, didactic lectures, and summaries of activities directly related to this rotation.

Reading List

- Abdalla E.K., Stuart K.E. *Overview of treatment approaches for hepatocellular carcinoma.* http://www.uptodate.com/contents/overview-of-treatment-approaches-for-hepatocellular-carcinoma
- Ang KK, Garden AS, *Radiotherapy for Head and Neck Cancers: Indication and Techniques*, fourth edition, Lippincott Williams & Wilkins, 2007
- Aoyama H et el., *Stereotactic radiosurgery plus whole brain radiation therapy vs stereotactic radiosurgery alone for treatment of brain metastases: a randomiszed controlled trial*, JAMA 295 (21) 2483-2491, 2006

- Beddar A.S., Briere T.M., Balter P., et al. *4D-CT imaging with synchronized intravenous contrast injection to improve delineation of liver tumors for treatment planning*. Radiother Oncol. 87(3):445-8, 2008
- Brockstein, B., Vokes, E.E. *Concurrent chemoradiotherapy for head and neck cancer. Seminars in Oncology.* 31(6):786-793, 2004
- Coia LR, Moylan DJ, *Introduction to Clinical Radiation Oncology*, third edition, Medical Physics Publishing, 1998
- Cox J, Ang KK, *Radiation Oncology: Rationale, Technique, Results*, ninth edition, Mosby Elsevier 2009
- Edge, S.B., Byrd, D.R., Compton, C.C., Fritz, A.G., Greene, F.L., Trotti, A. *AJCC Cancer Staging Manual*. 7th edition, 2009
- Halperin E, Perez CA, Brady LW, Wazer DE, Freeman C, Prosnitz LR, *Principles and Practice of Radiation Oncology,* fifth edition, Lippincott Williams & Wilkins, 2007
- Murshed H, *Clinical Fundamentals for Radiation Oncology Residents*, Medical Physics Publishing, 2006
- *NCCN Clinical Practice Guidelines in Oncology: Soft Tissue Sarcoma. National Comprehensive Cancer Network*. Version 3 2012
- Parvathaneni, U., Laramore, G.E., and Liao, J.J. *Technical Advances and Pitfalls in Head and Neck Radiotherapy.* Journal of Oncology, 2012. doi: 10.1155/2012/597467
- Sperduto PW et el., *Summary report on the graded prognostic assessment: an accurate and facile diagnosis-specific tool to estimate survival for patients with brain metastases*, Journal of Clinical Oncology, 30(4), 2012