AbstractID: 9805 Title: Out-of-field dosimetry for secondary cancer studies: past experience and future needs

Patients treated with ionizing radiation carry a risk of developing second cancers in their life times. Factors contributing to the recently renewed concern about this risk include improved cancer survival rates, younger patient pool, as well as emerging treatment modalities such as IMRT and proton therapy that can potentially prolong secondary exposures to healthy tissues or expose patients to neutrons. In the past 20 years, external beam treatment technologies have evolved significantly, and there is an overwhelming amount of data on both dosimetry and epidemiological studies. This lecture reviews historical studies related to the assessment of scatter and leakage radiation from classical radiation therapy, 3D-Conformal x-ray therapy, intensity-modulated x-ray therapy (IMRT and tomotherapy), and proton therapy. The concept of high-, intermediate- and low-dose regions outside the primary treatment field is introduced. Terms such as “secondary cancers,” “organ-average equivalent dose,” “out-of-field,” and “peripheral dose” are reviewed. Comparison of secondary doses from different treatment modalities, make/energy of accelerator and for adult and pediatric treatments is also made. Concomitant dose from IGRT localization and verification procedures involving cone-beam CT is briefly discussed. This is followed by a detailed review on methods of performing measurements in physical phantoms using different types of radiation detectors, as well as Monte Carlo simulations using gender- and age-specific “virtual patient” computational models. Finally future needs on dosimetry and epidemiological studies are discussed.

Educational Objectives of this CE course:

1. Understand the importance of secondary cancer risk in radiation treatment
2. Understand basic concepts in radiation dosimetry associated with secondary cancer studies
3. Understand practical methods of measurement and Monte Carlo simulation for the assessment of organ-average equivalent doses for various treatment modalities