Kilovoltage (up to 300 kV tube potential) x-ray beams have been applied in radiation therapy for many years and are still used in many cancer treatment centers. In this talk, a brief introduction will be given of the applications of kilovoltage x-rays in cancer management. The history of dosimetry protocols for kilovoltage x-ray beams will be reviewed together with a summary of the results of a survey recently conducted by the AAPM RTC TG-61 of the use of kilovoltage x-ray beams in radiotherapy. The formalisms recommended by the various dosimetry protocols for low- (40 - 150 kV) and medium-energy (100 – 300 kV) x-rays will be summarized. Two commonly used methods will be examined, the in-air method which requires a backscatter factor in the conversion of the free-in-air ionization chamber measurement to the dose on the surface of a water phantom and the in-phantom method which requires the measurement to be performed at a specified depth (2 or 5 cm) in a water phantom. Recent studies on the consistency of the in-air and in-phantom methods will be reported. Descriptions of beam quality specification and determination, as well as dosimeters and phantoms for reference dosimetry will be given. New dosimetric data for the two methods will be provided for various biological tissues. These include the backscatter factors for water, soft tissue and bone and the ratios of mass energy-absorption coefficients for air, water, skin, muscle, lung, soft tissue and bone. The dosimeters commonly used to perform relative dosimetry measurements will be described and the associated uncertainties will be analyzed.

Educational objectives

After this lecture, the attendees will have been taught the following:

1) clinical application of kilovoltage radiotherapy;
2) historical review of kilovoltage x-ray dosimetry;
3) formalisms for low- and medium-energy x-ray reference dosimetry;
4) dose measurement using the in-air method;
5) dose measurement using the in-phantom method;
6) beam quality specification and determination;
7) dosimeters and phantoms for reference dosimetry;
8) dosimetric data for various biological tissues;
9) dosimeters for relative dosimetry and associated uncertainties