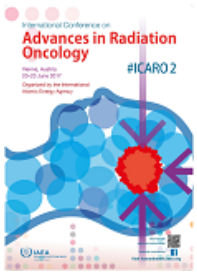

Contribution ID: **37** Type: **Poster**

Dosimetric measurements for small circular cones of a Stereotactic linear accelerator

Thursday, June 22, 2017 3:40 PM (5 minutes)

Introduction:

Stereotactic radiosurgery (SRS) is a technique for non-invasive destruction of intracranial tissues or lesion that may be inaccessible or unsuitable for open surgery using ionizing radiation. Initially stereotactic radiosurgery was started with gamma knife unit with Cobalt-60 sources and had circular apertures of 4, 8, 14 and 18 mm[. Subsequently linear accelerator (Linac) based radiosurgery was introduced, in which circular collimator inserts of size 12.5mm to 30mm were used. Though most Linac based SRS programs use MLCs with miniature leafs of sizes 2.5mm and 3mm at the isocenter, use of circular collimators are still applicable for small lesions. The Cyber Knife, a robotic radiosurgery unit uses circular collimators of size 5, 7.5, 10, 12.5, 15, 20, 25, 30, 35, 40, 50 and 60 mm diameter (FWHM) at 80cm source to axis distance (SAD). The recent model of the Gamma Knife, the Perfexion (GK PFN) has circular collimators of size 4, 8 and 14mm in diameter at the focal point. In addition to the mini and micro MLCs, both BrainLab and Varian provide circular cones of sizes 4mm to 30mm for Linac based SRS.

The dosimetry of such small photon fields is a difficult and challenging task due to issues such as lack of lateral electronic equilibrium, steep dose gradients, volume averaging effect and source occlusion. The objective of this work is to perform measurements for the small circular beams required for commissioning of 'cone planning' module of Eclipse planning system, with different detectors. Though a number of publications have been made available for small circular beams, this is an early measurement on the new EDGE stereotactic linear accelerator for commissioning eclipse 'cone planning' module.

Methodology:

The linac used was the Edge™ Truebeam STX Linac (Varian Medical Systems, Palo Alto, CA) designed mainly for Stereotactic Radiosurgery with 6MV, 6FFF and 10FFF beams, 120 leaf HD MLC and provision for fixing small circular cones. The dosimetric data required for commissioning 'cone planning' were, the Tissue Maximum Ratio (TMR), output factors and off-axis factors at 5 cm depth for three different SADs. The data were measured for circular collimators of 4mm, 5mm, 7.5 mm, 10 mm, 12.5mm, 15 mm and 17.5mm diameters for 6MV, 6FFF and 10 FFF beams. TMRs for these collimators were measured using EDGE diode in water equivalent solid phantom and with EDGE diode and pin point chamber in Sun Nuclear 3D SCANNER water phantom (Figure 1). The beam profiles were measured with the 3D SCANNER using EDGE diode and pinpoint ion-chamber. The output factors were measured with EDGE diode, pinpoint chamber and for specific collimators with radio-chromic films.

Results:

TMR data measured with EDGE detector using water equivalent slab phantom matched well with the TMR data obtained with the 'TPR measurement option' of the 3D Scanner water phantom except in the pre build-up regions. The maximum deviation was 2% for 4mm collimator and was less than 1% for 10mm and 15mm cones for all the three beam energies beyond the depth of dose maximum. This showed that the TPR measurement option of the 3D Scanner provides accurate measurement of TMR data. The TMR values measured with EDGE diode detector and the pinpoint chamber agreed well but for a slight higher estimation at greater depth with EDGE diode for 4mm and 10 mm cones. This increased response of the EDGE diode was within 1-2% for all the beam energies. Beam profiles measured with pinpoint chamber showed larger penumbra compared to the profiles obtained with EDGE diode and this is in expected lines due to the higher detector volume of the ion chamber compared to the EDGE diode and use of pinpoint chamber for profile measurement would provide

inaccurate data. The output factors measured with EDGE diode matched within 1-1.5% with the published data. The output factors obtained with the pinpoint detector for cones of less than 10mm deviated by more than 10-20% and hence the pinpoint detector may be used only for cones of sizes larger than 10mm. The output factor measured with radio-chromic films were close to that of EDGE diode except for the pixel heterogeneity observed and one would need to do more sampling to get accurate results.

Conclusion:

The TMR values measured with 3D SCANNER and the solid phantoms agreed well. The output factor measurements performed with EDGE diode were closer to published values and were suitable for commissioning the 'cone planning' module of the Eclipse planning system.

Country

India

Institution

Christian Medical College

Primary author: BABU RAO, Paul Ravindran (Christian Medical College)

Co-author: WOON, WuiAnn (The Brunei Cancer Center)

Presenter: BABU RAO, Paul Ravindran (Christian Medical College)

Session Classification: Thursday afternoon - Poster Presentations - Screen1

Track Classification: Dosimetry