

AbstractID: 3321 Title: Determination of Midplane Fetal Doses arising from Distant Sites treated via typical Helical Tomotherapy IMRT

Purpose: To determine the fetal dose arising from a typical helical tomotherapy IMRT treatment delivered at anatomical sites distant from the embryo/fetus.

Method and Materials: An anthropomorphic phantom (Rando™ slices 1-25) with the pelvis section replaced by a plastic water™ phantom was used to develop a treatment sinogram with the Hi-Art™ device using typical parameters: 6 MV photons, 2.5 cm field width, pitch of 0.3, and modulation factor of 2. Target dimensions were 8 cm (W) x 7 cm (H) x 11 cm (L) and was centrally located in the abdominal region of Rando™, which was planned and treated to a dose of 5 Gy. Fetal dose measurements were made at a midplane depth of 10 cm in the plastic water using TLD and a calibrated diode. Four sites in Rando™ were treated using the same sinogram allowing the fetal dose to be determined as a function of distance from the treatment site center, which varied from 23 cm to 75 cm. To express results as a percent of the delivered dose for the same sinogram, an approximate correction was made to account for differences in tissue thicknesses at the various treatment sites.

Results: For the same sinogram delivery (of approximately 5 Gy), fetal dose varied from 3.53 cGy for a lower abdominal treatment at a distance of 23 cm to 0.23 cGy for a brain/head treatment at a distance of 75 cm. A power law fit indicates fetal dose is proportional to the distance to the -2.3 power.

Conclusion: Typical helical tomotherapy treatments at distant sites may yield fetal doses approaching 1 percent of delivered dose; and fetal dose is reduced by more than the square of the distance to the treatment site.

Conflict of Interest: A collaborative research relationship is currently being developed with TOMOTHERAPY, Inc.