AbstractID: 3619 Title: Fetal Doses Measurements for Helical Tomotherapy

Purpose:
According to AAPM Report 50, there are in excess of 4000 women per year that require radiotherapy. In the past ten years, the technology of radiation therapy has advanced considerably with the advent of IMRT and IGRT. The purpose of this work was to measure fetal doses on a helical tomotherapy delivery system.

Method and Materials:
A water-equivalent phantom was constructed for measuring the dose outside of a helical tomotherapy treatment field. The phantom was 60-cm in total length, and the thickness varied from 15 to 17-cm. The phantom was divided into four sections: (1) Head, (2) Shoulders, (3) Torso, and (4) Pelvis. Absolute measurements were taken inside the pelvis section following the TG-51 protocol with a farmer chamber at depths of 1.5, 5.0, and 10.0-cm. Measurements were taken with distance from the chamber to the bottom edge of the field set to 5, 10, 15, 20, and 25-cm.

Results:
The Tomotherapy fetal doses are substantially larger (4.3% verses 1.4%) at 5-cm from the field edge. However, the fetal doses from APPA and helical tomotherapy treatment delivery are within 1 percent beyond 10-cm from the field edge. This is particularly surprising given that the MUs are over a factor of 10 larger for the tomotherapy delivery. The reason is that the head leakage component in the tomotherapy delivery system is much less than a conventional linear accelerator due to the 20-cm of tungsten shielding in primary jaws, the multi-leaf collimator, and head shielding.

Conclusion:
The dose to the fetus on a helical tomotherapy system is within 1% of the fetal dose from conventional APPA delivery. Depending on the total dose and the distance to the fetus, pregnant patients could receive a highly modulated and conformal treatment delivery without exceeding fetal dose tolerance.