Purpose:

Magnetic resonance image-guided radiotherapy (MRigRT) has emerged as a promising new technology to reduce tumor position uncertainty during photon radiotherapy. The use of MRI during beam delivery complicates treatment planning since the magnetic field will perturb the radiation dose distribution especially in fields prescribed in heterogeneous regions of the body. The purpose of this study was to investigate the magnetic field effect on dose distributions in patient geometry using Monte Carlo methods.

Methods:

The Monte Carlo code Geant4 was used for all simulations performed in this study. We investigated dose distributions from a 6-MV photon beam energy spectra in patient geometries subjected to homogeneous transverse magnetic fields with varying field strengths. For this study perturbations in the dose distribution from a single rectangular field were simulated in a prostate patient scan.

Results:

Preliminary results show perturbations in the overall dose profile due to the magnetic field can be seen when a transverse magnetic field was applied to the patient geometry. Regions of under- and over-dosing occur throughout the beam path near the penumbra of the photon beam.

Conclusions:

This study demonstrated that patient-specific dose calculations for MRigRT treatments are feasible using Geant4. Work is currently ongoing to include treatment specific field parameters and 4D time-resolved geometries.