Purpose: To describe the commissioning process for the first installed commercial MRI-guided IMRT system (ViewRay, Village of Oakwood, OH) and outline quality assurance methods for this novel treatment modality.

Methods: The ViewRay® System (510(k) pending) consists of a 0.35-T double-doughnut MRI coupled with a gantry that houses three Co-60 sources, each with an activity up to 15,000 Ci (120° apart). IMRT delivery is enabled by doubly-focused MLCs that serve as the only beam-shaping collimators for each head, allowing a maximum field size of 27.3 cm² at the 105-cm isocenter. MRI imaging is used prior to and during delivery for setup evaluation, adaptive radiotherapy, and gating. The challenges in commissioning as well as periodic and patient-specific QA arise due to the presence of the magnetic field, unique geometry of this device which is not compatible with many of conventional RT QA devices and techniques, and the penumbra of a 2-cm wide Co-60 source. The following devices were used for commissioning and quality assurance tests: radiochromic and radiographic film, ionization chambers (Exradin A12 & A16), Sun Nuclearâ€™s IC Profiler (Melbourne, FL), and a water tank. Tests were conducted to evaluate the beam profiles, penumbra, and PDDs. Also, tests to check MLC accuracy and reproducibility were evaluated.

Results: Tests were developed to validate geometric performance of the device including a comprehensive set of MLC tests. Due to the low strength of the magnetic field, the mean free path of electrons in the ionization chamber volume is too long to have a noticeable curvature; therefore the magnetic field is not expected to have a noticeable effect on dose measurement.

Conclusions: While the presence of the magnetic field limited the choice of QA devices, it was found that satisfactory methods for MRI-IMRT machine QA exist and can be successfully employed.

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Drs. Green, Goddu, and Mutic served as scientific consultants for ViewRay, Inc. Dr. Mutic is on the clinical focus group for ViewRay, Inc., and his spouse holds shares in ViewRay, Inc.