Online MR-guided adaptive radiotherapy - new role for RTTs

Radiation therapy has become increasingly complex over the past few years owing to advances in software and hardware. Despite technological advances, much of the radiation therapy workflow still requires time-consuming, manual input by medical dosimetrists and radiation therapists (RTTs).

Online, adaptive magnetic resonance-guided radiation therapy (MRgRT) offers several major advantages over conventional radiotherapy, which include superior soft-tissue imaging, intrafractional functionality, and online real-time, target-tracking radiation for imaging. However, these advantages come at the cost of lengthened periods of treatment in the room.
Recently , we published our preliminary experience with MRgRT, which included a time analysis of the steps involved in this new workflow. (1,2) We observed that 83.2% of adaptive fractions were completed in less than 60 minutes in this study, while the median total treatment time was 46 minutes.

Total number of fractions:
- *2321 fractions in 396 Patients*
- *1709 fractions adapted (74%)*

Adaptive fractions:
- *81% SBRT*
- *19% IMRT*

*Average number of fractions per day : 7*
Maximum numbers of fractions per day: 13

A total of 396 patients were treated at Acibadem Maslak Hospital, Istanbul, Turkey, through use of our ViewRay MRIdian (ViewRay Inc, Oakwood, California, USA) linear accelerator (linac) system between September 2018 and February 2021. The MRIdian linac was utilised for simulation and treatment delivery. It consists of a split, superconductor low-field (0.35 Tesla) magnetic resonance imaging (MRI) system with a 70-cm bore and a 50-cm field-of-view. The radiotherapy delivery system includes a ring gantry-mounted 6MV linear accelerator and double-focused multi-leaf collimator.

MRI linac

MRI provides better soft-tissue contrast than computed tomography imaging and does not expose patients to additional imaging dose. Integration of an MRI scanner into a radiation therapy delivery system enhances the delineation of tumour and of organs at risk, and it improves the accuracy of patient setup and adaptation of the treatment to interfractional anatomy changes. MRgRT also enables the monitoring of intrafractional motion and real-time adaptation of the treatment delivery. Furthermore, utilisation of video feedback to patients during the delivery of gated MRgRT enables them to play an active role in their treatment.
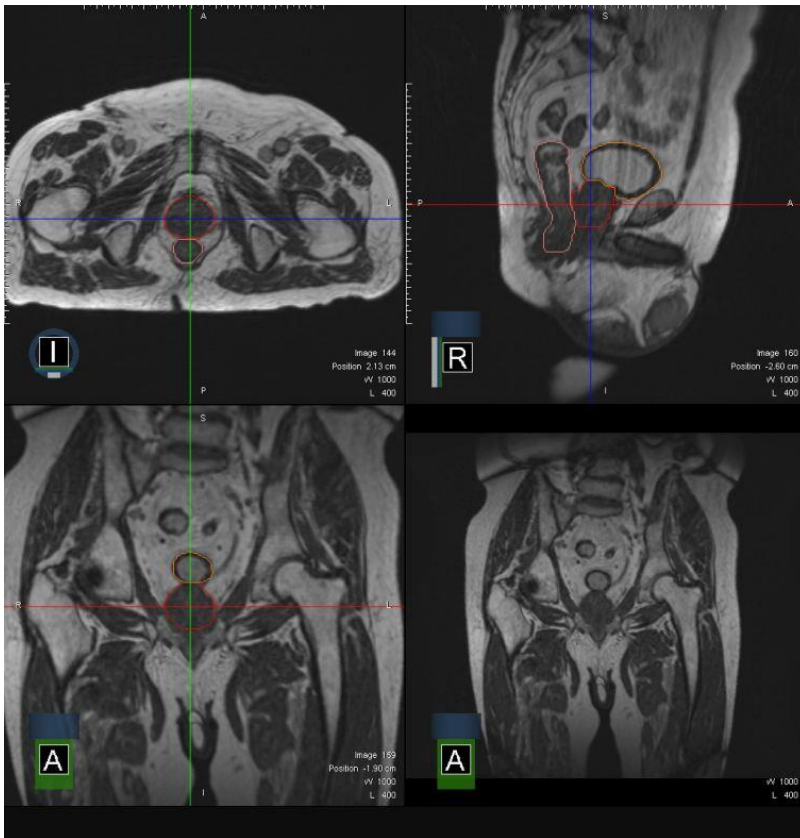
Imaging

The role of radiation therapists is significantly increased in MRgRT compared with their job in conventional radiotherapy. Radiotherapists have important roles in simulation, contouring, set-up, recontouring during adaptive radiotherapy, treatment delivery and audiovisual coaching phases of MRgRT.

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References:

1. Sahin B, Zoto Mustafayev T, Gungor G, Aydin G, Yapici B, Atalar B, et al. First 500 fractions delivered with a magnetic resonance-guided radiotherapy system: initial experience. *Cureus* 2019; **11**: e6457. doi: https://doi.org/10.7759/cureus.6457
2. Güngör G, Serbez İlkay, Temur B, Gür G, Kayalılar N, Mustafayev TZ, et al. Time analysis of online adaptive magnetic resonance-guided radiation therapy workflow according to anatomical sites. *Pract Radiat Oncol* 2020;30 Jul 2020. doi: https:// doi.org/10.1016/j.prro.2020.07.003