

Treating Oligometastatic Cancer with MRIdian

Tell us about your MRIdian program. Has anything changed since you began treating patients?

Our MRIdian program began in September 2018 with our decision to focus our efforts on stereotactic radiotherapy. The system is uniquely suited for this because you can perform on-table adaptive treatments, reduce treatment volumes, and deliver higher doses of radiation. Our initial focus was adaptive radiotherapy for stereotactic patients, but we quickly realized that even conventionally fractionated patients benefit from MRIdian. In the last five months, we've expanded our capabilities to treat more patients with conventional fractionation on MRIdian. It's very easy and we are much more streamlined now. The MRIdian is gaining recognition locally and everyone knows about this unique technology. We attract approximately 30 percent of our patients from outside our region.

You have reported treating a number of oligometastatic cancer patients on MRIdian. Where do you see the greatest benefit?

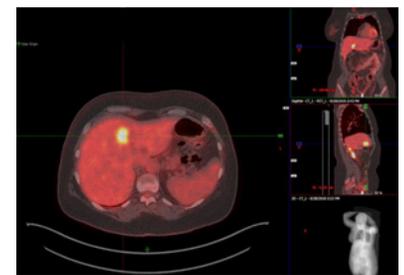
It's a new concept all over the world. With several compelling phase II trials that have shown improved overall survival, we feel more confident treating oligometastatic cancer patients with stereotactic body radiation therapy (SBRT). These trials are reporting better results with SBRT than with other targeted therapies or chemotherapy trials, so why not radiotherapy for oligometastasis? We believe the world is heading in this direction and the survival advantage is very high.

These patients have metastasis everywhere, all over the body. Previously, before we had MRIdian, we were not treating them unless the tumors showed up in the peripheral lung because it was easier to treat on a conventional linac. Now with MRIdian, we can treat more oligometastatic patients with tumors throughout their bodies. This has expanded our indications—we can treat patients and tumors we could not treat before. MRIdian allows us to see the small lymph nodes in the abdomen and treat liver metastasis without having to implant fiducial markers. We are able to treat many more oligometastatic patients now that we are using MRIdian.

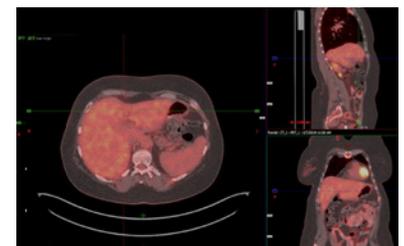


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Patients with abdominal metastases, or cancer in areas where we can directly visualize the detailed anatomy and lower doses to critical organs, really benefit from MRIdian. For example, patients with tumors in areas neighboring the esophagus, the central mediastinal area, or the stomach or the bowel. With MRIdian, we are able to do much more than just see the anatomy directly, we can adapt the plan daily. We have the advantage of lowering the dose to critical organs, for each fraction, while maintaining a high dose to the tumor and we are very safe about it. Also, we can see what's happening in real-time during the treatment, even the movement of the bowels. With MR-based soft tissue tracking, the system sees and adapts to any and all of these changes in real-time. Automated beam gating ensures the tumor is in the correct position before radiation is delivered. If the tumor moves out of the prescribed radiation boundary, the beam delivery is halted. When the tumor moves back into the boundary, the radiation is resumed. That's why we have the confidence to treat these types of tumors. We just couldn't do this with the cone beam computed tomography (CBCT) on other linear accelerators.



Pre-SBRT PET CT



Post-SBRT PET CT: 3-Month Follow-Up

MRIdian physician spotlight

Banu Atalar, MD

For more information about MRIdian, visit [ViewRay.com](https://www.viewray.com)

You mentioned not needing fiducial markers. Can you expand on this?

The MRIdian allows us to see and track the tumor directly in real-time. This eliminates the need for fiducial markers. Without the additional procedure required to implant fiducials, we can start patient treatments sooner and treat patients faster. Even more important, our patients didn't want this invasive procedure and incurred additional costs as the procedure was done by an interventional radiologist in another department. Most patients didn't like it and we didn't like it either, as we were forced to delay treatment by at least a week while we waited for the fiducials to stop migrating. We also had to watch the patient for infection due to the implant procedure. While infections were rare with prostate cancer patients, we saw lots of pneumothorax in our lung cancer patients. It was very hard to tell a patient with oligometastatic disease who has one tumor in the lung and another in the abdomen, "I am not able to treat the abdomen metastasis, but I'm going to treat the lung one. First, I have to implant a fiducial which has the risk of pneumothorax." It was so hard. With MRIdian, we can treat both and track the tumor directly without fiducial markers, making it much easier, safer, and more cost effective for patients.

What criteria do you look at when you're selecting patients for MRIdian?

The most important thing for us to assess are the organs at risk, and whether the tumor is moving or not. Because the system was designed to very easily track a tumor directly, we can create plans with tighter margins and smaller treatment volumes. It is also very beneficial to do daily on-table adaptive radiotherapy to minimize dose to the organs at risk. Those are my two main criteria for choosing the MRIdian. Other than that, the fully integrated planning and delivery system is nice in terms of making plans with tighter conformality.

Now that you are able to get more conformal plans, are you able to increase the dose to higher, more ablative doses?

Yes, we can treat with increased doses, especially in the subdiaphragmatic region. We can escalate dose and use much higher, ablative doses because we can perform on-table adaptive treatments during the therapy. This is a huge advantage of the MRIdian system.

Can you give me an example for what type of cases you would give a higher dose?

Before MRIdian, on a conventional linac, I was treating 5 fractions of 6 Gy for most of the areas in the abdomen treated with SBRT. But now with MRIdian I'm choosing 5 fractions of 7 Gy or 5 fractions of 8 Gy, even for tumors in high-risk areas. For the very radioresistant tumors like a sarcoma mass or renal cancer metastasis, I escalate dose even higher. I was choosing 3 fractions of 9 Gy for them, but now I feel comfortable increasing to 3 fractions of 10 Gy or 3 fractions of 11 Gy. With MRIdian I am able to escalate the dose while sparing the healthy tissue.

How would that compare to outcomes treated on a traditional linac? What would you expect to see?

With a conventional linac, we were afraid treatment would cause bleeding, obstruction, or perforation with the gastrointestinal system. Because of these risks, we did not often treat those patients. I can't say that I have any experience treating with ablative doses on a conventional linac. We chose lower doses for those areas—doses that were not curative.

What do you see as future clinical opportunities for MRIdian?

With the upcoming SmartVISION™ and High-Speed MLC upgrades, MRIdian will become faster and faster, which will make it very useful for more conventional cases. We have many stage III lung cancer patients being treated in the mediastinum and large lung tumors that can benefit from MRIdian. We know that most of these tumors are shrinking halfway during the treatment and we are currently not adjusting our plans to compensate for these changes. I could see, in the future, transferring more and more of these patients we treat from a conventional linac to MRIdian, especially for lung cancer cases because we can adapt on-table, see the tumor directly, and gate the beam automatically. Of course, there are more studies showing benefits of diffusion-weighted imaging (DWI) and other of MR images where we can do dose painting in the brain or some other areas. I think the MRIdian system will eventually allow us to use these images and help us treat tumors metabolically, personalizing treatments even more. I believe the MRIdian system will continue to evolve and give us a whole world of opportunities for treating patients.

