Use of AI advances adaptive radiotherapy for cancer care

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Kill the cancerous tissue with radiation therapy and leave the healthy tissue untouched. Save the patient while sparing them as much as possible from treatment side effects. These are simple oncologic goals but executing them can be made difficult because the patient's picture—the literal position of their anatomy—can change daily.

That is where technology guided by augmented intelligence (AI) and supervised by physicians and other clinicians at Henry Ford Health can help ease the burdens on patients and give them some precious time back to lead their lives.

Radiation oncology is often at the forefront of adopting leading-edge technologies to improve patient experiences and clinical operations. The radiation oncology team at Henry Ford West Bloomfield Hospital in suburban Detroit is doing just that with its adaptive radiotherapy program.

The radiation oncology program recently implemented the Varian Ethos system equipped with HyperSight—an innovative platform that leverages advanced imaging with AI.

Henry Ford Health is a member of the AMA Health System Program, which provides enterprise solutions to equip leadership, physicians and care teams with resources to help drive the future of medicine.

Use of the Ethos system has helped enhance the precision and efficacy of adaptive radiation treatments at Henry Ford West Bloomfield, while also improving the patient experience for people who have certain cancers.

Here is how Henry Ford Health uses AI to improve adaptive radiotherapy for patients with cancer.

Address challenges in care

Henry Ford Health brought the Ethos system online to address one of the biggest challenges in radiation oncology: how to adjust a radiation plan to accommodate the natural, everyday changes that occur in a patient's anatomy.

For example, natural bodily functions such as bladder filling or digestion can shift a patient's organs and tissue.

"When patients come in, their anatomy may be different today than it was yesterday or the day they first saw the radiation oncologist," said Kundan Thind, PhD, division head of physics and vice chair of academics and radiation oncology at Henry Ford Health.

Since radiation is such a targeted treatment, even the slightest changes in a patient's anatomy can affect the previously planned clinical protocol metrics. These protocols dictate how much radiation the cancer tissue will get and how much dose-sparing is needed to reduce the risk to nearby healthy tissue and organs.

Any changes in the anatomy could shift the location of the cancerous tissue. This can result in the cancer getting less radiation dose than initially planned or healthy tissue and organs getting more radiation exposure.

The new Ethos system has helped the radiation oncology team successfully address this issue by fine-tuning the program's adaptive radiotherapy processes. The updated process combines the technology's imaging capabilities and AI-generated segmentation with clinician-led, supervision and decision-making.

"The system allows us to provide radiation therapy to patients that we can adapt on a daily basis," said Thind.

More precision, more personalization

When a patient comes in for treatment, the Ethos system quickly creates high-quality cone beam computed tomography images that visualize the patient's anatomy that day. Using these real-time images, the AI solution identifies and segments the organs, healthy tissue and cancer tissue. It then computes a new dose plan calculation that is tailored to each patient.

“This is not just a step, but a giant leap forward in cancer treatment,” Ben Movsas, MD, a radiation oncologist and chair of the department of radiation oncology and medical director at Henry Ford Cancer, said in a news release. “Utilizing this new system, treatments can be adjusted and tailored in real-time based on an individual patient’s needs and anatomy, as well as the specific changes observed during their therapy.”

Equipped with the data, the clinical team can seamlessly recalibrate the radiation dose and adapt the treatment plan to conform to the initial protocol. This provides a customized treatment approach for each patient while ensuring the treatment is efficient and efficacious in targeting the cancer and sparing healthy surrounding tissue and organs.

It’s still a team approach

While the technology plays a crucial role in the adaptive radiotherapy process, physicians and other medical specialists do the heavy lifting.

At Henry Ford West Bloomfield Hospital, adaptive radiation oncology is a team effort. The team includes radiation oncologists who lead the process, radiation therapists who ensure the processes run smoothly and that the patient is comfortable, and medical physicists who oversee the technical aspects.

“Together, we come to a decision to go ahead with adaptive radiotherapy and how much to adapt or not,” said Thind. “The entire team has to be there at the console and able to work together to make adaptive radiotherapy successful.”

With this all-hands-on-deck approach, successfully implementing an adaptive radiotherapy approach requires additional resources, refined workflows, clinical training and, of course, the technology itself.

Improved experience

The combination of advanced imaging and efficient and accurate AI-driven data analysis has helped streamline workflows and improve treatment quality and efficiency.

AI capabilities have been particularly helpful in managing some of the complexities of the treatment by quickly doing the tasks needed to ensure a successful treatment. This includes identifying and segmenting the organs and making sure the 3D-dose variation is computed appropriately. While physicians review and supervise the AI-driven outputs, this technology has helped significantly speed up these processes.

Most importantly, though, the system has played an important role in improving the patient experience for radiation oncology patients at Henry Ford West Bloomfield.

The improved efficiency has lowered treatment time for patients—and has sometimes even resulted in fewer radiation treatments. For patients who come in for treatment five days a week for a set number of weeks, even one or two fewer appointments can make a difference.

Additionally, clinical teams now have more patient-facing time and can focus more heavily on treatment quality. With an overall adaptive treatment time of around 45 minutes, it has resulted in higher patient satisfaction overall.

The AMA has developed advocacy principles that build on its AI policy. These principles (PDF) address the development, deployment and use of health care AI, with particular emphasis on:

- Health care AI oversight.
- When and what to disclose to advance AI transparency.
- Generative AI policies and governance.
- Physician liability for use of AI-enabled technologies.
- AI data privacy and cybersecurity.
- Payer use of AI and automated decision-making systems.

The future of AI in radiotherapy

While evidence is quite supportive of the benefits of AI-supported adaptive radiotherapy, it is still an emerging field. Specifically, researchers are studying which cancers would most benefit from adaptive radiotherapy compared with traditional radiotherapy—and how often treatments should be adapted.

“It’s quite clear that adaptive radiotherapy helps because you are able to precisely sculpt the dose to patients’ changing anatomy,” said Thind. “However, there are still other questions that we are figuring out, such as how often to do it, what dose to choose and so on. We’re discussing those questions in the field at large.”

For now, radiation oncologists at Henry Ford Health are using the system to treat cancers that most benefit from adaptive radiotherapy according to current evidence. These include prostate cancer, gastrointestinal cancers and lung cancers.

The improved precision is particularly helpful for treating prostate cancer.

“It is quite important to be able to adapt the radiation plan to make sure we’re not only targeting the prostate, but also the high-risk cancer zones within the prostate,” said Thind. “The system is able to

help us make sure that those zones are being targeted accurately and appropriately."

Researchers at Henry Ford Health are also currently studying how AI-driven adaptive radiotherapy could benefit patients with other cancers as well.

"We hope to ultimately treat all kinds of cancer where there's evidence of the benefits of adaptive radiotherapy over traditional radiotherapy," said Thind. "We'll expand to other disease sites as more evidence emerges and as we gather our own evidence with this technology."

Learn more with the AMA about the emerging landscape of augmented intelligence in health care (PDF).