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LETTER TO EDITOR

Redefining the role of radiation oncologists in the AI era

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Dear Editor,

Recent years have seen significant acceleration in the integration of artificial intelligence (AI) into radiation oncology practice. From automated contouring to treatment planning optimization and big data analytics, AI offers remarkable advantages in terms of efficiency and accuracy. However, this rapid transformation has also begun to redefine the role of radiation oncologists in clinical decision-making. In this letter, I aim to highlight the potential risk of physicians becoming distanced from critical decisions – and even professionally isolated – as AI assumes a larger role, while also emphasizing the importance of preserving core values such as ethics, autonomy, and empathy throughout this transition.

While AI-driven systems have demonstrated superior performance in several aspects of radiation oncology – such as patient assessment, clinical decision-making, segmentation, dose prediction, and outcome modeling – it is essential to recognize that these tools are only as reliable as the data they are trained on. Radiation oncologists must continue to utilize their expertise in clinical guidelines, patient data, and multidisciplinary assessments to make the best treatment decisions. Each individual's situation is unique, and the decision-making process requires both big data analysis and clinical experience due to disease-specific factors. AI-powered systems can accelerate and support doctors' decisions by providing recommendations based on clinical guidelines. The advantages of clinical decision support systems are that they reduce the margin of error by assisting doctors, analyzing complex patient data more effectively, and recommending the best treatment options for each patient, all while accelerating decision-making in multidisciplinary workflows. However, clinical decisions should not be left entirely to AI. Human oversight is essential to ensure the best outcomes and further validation is needed for clinical acceptance.[1,2]

One of the most time-consuming steps in treatment planning is organ and target volume segmentation. AI-based methods, such as U-Net/TransU-Net convolutional neural network models, have been utilized to reduce segmentation time, making it much faster than manual processes, which can take hours.[3-6] Despite these advancements, full automation is still not possible. Clinical validation is required, and manual corrections may still be necessary in certain cases, such as low-contrast tumors. In addition, clinical integration of these systems requires time, training, and standardization of evaluation criteria.[7]

Synthetic computed tomography (CT) images, generated from magnetic resonance imaging data using AI-based algorithms, are becoming increasingly utilized in radiotherapy planning. Synthetic CT provides an alternative to conventional CT by offering accurate electron density information, which reduces radiation exposure and improves workflow efficiency. However, challenges such as inter-vendor variability and

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anatomical accuracy still remain key areas for further research and standardization. The generative adversarial networks algorithm has shown promise in generating clearer, more detailed synthetic images, offering an advantage in image clarity compared to traditional methods.[8,9]

AI-assisted adaptive radiotherapy offers significant advantages for patients with frequent anatomical changes, such as those with head and neck, lung, or gynecological cancers. Daily cone beam CT imaging allows real-time evaluation, while AI-based auto-contouring enables rapid delineation of tumors and organs at risk. Treatment plans can be updated instantly based on anatomical shifts. However, limitations such as suboptimal image quality and the need for expert validation of AI-generated contours highlight the continued importance of human oversight in clinical decision-making.[10]

Prognostic estimations in radiation oncology have traditionally relied on clinical and anatomical data. However, AI-based models now enable more precise predictions by integrating biological, clinical, dosimetric, treatment, and imaging data.[11,12] Toxicity prediction is equally crucial for developing personalized treatment plans, minimizing both acute and late side effects, and ultimately improving patient quality of life.[13,14] Predictive models, especially those using hybrid approaches, combine radiomic/dosiomic features with clinical and dosimetric parameters to improve both prognosis and toxicity prediction. Challenges include ensuring clinically acceptable model accuracy, ensuring data diversity, and navigating regulatory requirements, such as Food and Drug Administration approval.

As AI continues to reshape the landscape of radiation oncology, it is clear that the role of the radiation oncologist will evolve.[15] With AI automating routine tasks, clinicians are expected to focus more on patient monitoring and complex decision-making. This shift necessitates new competencies, including understanding AI algorithms, interpreting data, and considering ethical implications. Radiation oncologists will need to collaborate with multidisciplinary teams and develop skills in data literacy and clinical validation of AI tools.

As AI becomes increasingly integrated into radiation oncology, several ethical challenges must be addressed. These include ensuring patient privacy through data anonymization and cybersecurity, defining accountability in AI-assisted clinical decisions, and mitigating bias arising from non-representative training datasets. Equitable access to AI tools is a concern, as is the potential erosion of physicians' decision-making autonomy. It is crucial to maintain a strong patient–physician relationship, ensure informed consent for AI use, and respect patients' rights to refuse AI-based interventions. In addition, the environmental impact of AI systems, including energy consumption and e-waste, must be considered.[16,17]

In conclusion, AI is expected to play a central role in shaping the future of radiation oncology. Personalized treatment protocols, biomarker-driven dose adaptation, and even fully autonomous treatment planning may become the norm. However, strong ethical oversight, legal frameworks, and sustainable implementation models will be essential for this integration. Radiation oncologists will need not only medical expertise but also a solid understanding of AI technologies. As the field evolves, the focus will shift from technical tasks to clinical decision-making and patient-centered care, making it essential for radiation oncologists to redefine their roles and actively integrate into multidisciplinary care teams to remain indispensable in an increasingly automated landscape.

Conflict of interest

The author declares that she has no conflict of interest.

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