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AI-assisted 3D printing transvaginal template guidance for interstitial brachytherapy in patients with gynecologic malignancy

Abstract:

Background: The three-dimensional (3D) interstitial Brachytherapy (BT) can enhance the efficacy of bulky cervical cancer treatment. BT technology guided by 3D printing templates can assist radiation oncologists in accurately inserting needles and ensuring optimal dose coverage. Artificial intelligence (AI) can enhance the accuracy, precision, efficiency, and overall quality of RT in patients with cancer objective: This is a retrospective study to show the safety and efficacy of using AI-assisted transvaginal 3D printed templates for guiding interstitial BT as a component of RT in patients with gynecologic malignancy.

Methods: Between October 2021 and December 2023,The localization data of 50 patients from computed tomography scanning were collected and imported into the software. Automated configuration of individualized 3D printing templates using AI-assisted technology according to the specific anatomical morphology and volume of the target. The accuracy of the needle insertion paths and needle depth were assessed. The target dose coverage between AI-assisted 3D printing template guidance insertion and free-hand insertion techniques was assessed and compared.

Results: The repetition of the planned needle paths was compared with that of the actual needle insertion, a mean deviation of 1.55±0.45 mm was observed. Compared with freehand BT, significant differences were observed in the DVH parameters CTV V100 ($p = 0.015$), HR-CTV D98 ($p = 0.041$), bladder D2cc ($p = 0.010$), and rectum D2cc ($p = 0.02$) of AI-assisted 3D printing.

Conclusions: This novel technique of AI-assisted 3D printing transvaginal template guidance offers high reproducibility, efficiency, and safety for the insertion BT method in patients with gynecologic malignancy.

Biography

Huiling Li is the deputy director of gynecological oncology radiotherapy department Fujian Medical University, Fujian Cancer Hospital. She has published more than 20 papers and engaged in precise radiotherapy and chemotherapy, targeted therapy, and immunotherapy for gynecological tumors.