Purpose: The aim was to develop and test a novel automated intra-patient segmentation method of the cervix-uterus structure in CT-scans of cervical cancer patients to facilitate the online selection of the best plan-of-the-day based on in-room acquired CT-scans. Current automated segmentation methods for pelvic organs, which use statistical shape models and require a large training set, are unsuitable for cervix-uterus due to large inter-patient variability in shape and position.

Methods: An automated segmentation method was implemented that adapts a closely initialized surface of the cervix-uterus to boundaries in the new image. The novel idea was to use patient-specific motion-models derived from only two pretreatment CT-scans to initialize and drive the segmentation process. The cervix-uterus surface was initialized by using a 3D patient-specific cervix-uterus model that predicts the shape and position of cervix-uterus based on bladder volume, a 1D model predicting the bladder volume based on a manually marked bladder top, and implanted markers. The segmentation method was tested on 13 patients that had 9-10 CT-scans acquired at pretreatment and after 40 Gy. For each patient, two pretreatment CT-scans (full and empty bladder) were used for model construction and others were used for testing. The overlap between manually delineated and automatically segmented cervix-uterus structures was quantified by the Dice coefficient.

Results: Marking the bladder top and markers required minimal user intervention (<1 min). The overlap between the manually delineated and the initialized cervix-uterus structures was 82Â±7% for pretreatment and 71Â±11% for after 40 Gy data. The automatic adaptation of the initialized structure to image boundaries increased the overlap to 87Â±3% for pretreatment and 80Â±13% for after 40 Gy. The automatic segmentation method required 2Â±0.5 min.

Conclusions: A fast and robust automated segmentation method was developed that could support plan selection in online adaptive radiotherapy for cervical cancer patients.

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