Liquid fiducial marker applicability in proton therapy of locally advanced lung cancer

Background and purpose: We investigated the clinical applicability of a novel liquid fiducial marker (LFM) for image-guided pencil beam scanned (PBS) proton therapy (PBSPT) of locally advanced lung cancer (LALC). Materials and methods: The relative proton stopping power (RSP) of the LFM was calculated and measured. Dose perturbations of the LFM and three solid markers, in a phantom, were measured. PBSPT treatment planning on computer tomography scans of five patients with LALC with the LFM implanted was performed with 1-3 fields. Results: The RSP was experimentally determined to be 1.164 for the LFM. Phantom measurements revealed a maximum relative deviation in dose of 4.8% for the LFM in the spread-out Bragg Peak, compared to 12-67% for the solid markers. Using the experimentally determined RSP, the maximum proton range error introduced by the LFM is about 1. mm. If the marker was displaced at PBSPT, the maximum dosimetric error was limited to 2 percentage points for 3-field plans. Conclusion: The dose perturbations introduced by the LFM were considerably smaller than the solid markers investigated. The RSP of the fiducial marker should be corrected in the treatment planning system to avoid errors. The investigated LFM introduced clinically acceptable dose perturbations for image-guided PBSPT of LALC.

General information
Publication status: Published
Organisations: Department of Micro- and Nanotechnology, Colloids and Biological Interfaces, Rigshospitalet, Paul Scherrer Institute, Bispebjerg University Hospital
Number of pages: 7
Pages: 393-399
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Radiotherapy & Oncology
Volume: 122
Issue number: 3
ISSN (Print): 0167-8140
Ratings:
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.56 SJR 2.313 SNIP 1.639
Web of Science (2017): Impact factor 4.942
Web of Science (2017): Indexed yes
Original language: English
Keywords: Beam perturbation, Liquid fiducial marker, Lung cancer, Proton therapy
DOIs:
10.1016/j.radonc.2016.12.027
Source: FindIt
Source-ID: 2351237063
Research output: Contribution to journal › Journal article – Annual report year: 2017 › Research › peer-review