OC-0341: Robustness of swallowing-sparing proton therapy for head and neck cancer
Laan, H.P. van der; Brouwer, C.L.; Korevaar, E.W.; Veld, A.A. van ’t; Sijtsema, N.M.; Langendijk, J.A.
DOI: 10.1016/S0167-8140(15)32647-5

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date: 2013

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

Copyright
Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

Take-down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): http://www.rug.nl/research/portal. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.
Results: Mean (standard deviation) V95 of the PTV of all plans was 98.6 (4.3), and 94.7 (5.8) in the recomputed plans on the localization CT (p = 0.007). V95 for the GTV was 99.6 (4.1) and 99.0 (4.7) on the localization and the planning CT, respectively; this difference was not significant (p = 0.0549). V98 for the GTV was 82.3 (10.9) and 83.5 (13.6) on the localization and the planning CT, respectively; this difference was again not significant (p = 0.1483).

Conclusions: The coverage of the PTV (5 mm margin) was significantly lower in the recomputation on the localization CT, whereas V95 and V98 of the GTV remained unchanged in this group of patients. The clinical relevance of these changes remains to be elucidated. Jet ventilation appears to be a feasible technique for irradiation of small peripheral tumors with proton therapy. The study of new planning strategies and margin concepts is warranted.

OC-0341
Robustness of swallowing-sparing proton therapy for head and neck cancer
H.P. van der Laan1, C.L. Brouwer1, E.W. Korevaar1, A.A. van’t Veld1, N.M. Sijtsma2, J.A. Langendijk1
1University of Groningen / University Medical Center Groningen, Department of Radiation Oncology, Groningen, The Netherlands

Purpose/Objective: Proton therapy is more sensitive (less robust) to geometrical uncertainties than photon therapy. Different methods have been proposed to increase proton plan robustness. These methods include robust CTV-based planning as an alternative to conventional PTV-margin based planning. Thus, different changes will be combined in the intended improvement for proton therapy. The purpose of this study was to test the robustness of scanned-beam intensity-modulated proton therapy (IMPT) to setup errors and geometrical changes compared to IMRT for head and neck cancer if conventional PTV-margin based planning would be used.

Materials and Methods: In 10 patients with laryngeal or pharyngeal cancer, a planning CT (CT0) and a repeat-CT scan (CT1) during the course of radiotherapy were made (median interval 25 days). Five patients had relatively small shape changes and 5 patients had relatively large shape changes. Target volumes were delineated on CT0, including a uniform 5 mm margin from CT0 to PTV. IMPT and IMRT plans were made with optimal sparing of the parotid glands and swallowing organs at risk (SWOARs). Structures were propagated from CT0 and CT1, but increased on CT1 with IMPT more than with IMRT (see table). The mean dose in the SWOARs on CT0 was lowest with IMPT. The influence of the setup correction method on the mean parotid gland and SWOAR dose on CT1 was relatively small. Dose changes in OARs were mainly caused by changes in patient geometry during the interval between CT0 and CT1.

Mean dose values with simulation of one position correction

<table>
<thead>
<tr>
<th>Small shape changes (n=5)</th>
<th>Ipsilateral parotid mean dose (Gy)</th>
<th>Contralateral parotid mean dose (Gy)</th>
<th>Supraglottic larynx mean dose (Gy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMRT</td>
<td>35.4 (19.9)</td>
<td>15.5 (6.9)</td>
<td>59.1 (14.7)</td>
</tr>
<tr>
<td>IMPT</td>
<td>32.2 (20.1)</td>
<td>12.1 (6.3)</td>
<td>50.3 (14.7)</td>
</tr>
<tr>
<td>Large shape changes (n=5)</td>
<td>Ipsilateral parotid mean dose (Gy)</td>
<td>Contralateral parotid mean dose (Gy)</td>
<td>Supraglottic larynx mean dose (Gy)</td>
</tr>
<tr>
<td>IMRT</td>
<td>51.1 (11.8)</td>
<td>23.1 (12.2)</td>
<td>43.3 (25.4)</td>
</tr>
<tr>
<td>IMPT</td>
<td>47.2 (14.5)</td>
<td>14.1 (11.1)</td>
<td>43.1 (25.4)</td>
</tr>
</tbody>
</table>

Conclusions: With conventional PTV-margin based planning, IMPT would be less robust to geometrical changes than IMRT, resulting in reduced gains with regard to the mean dose delivered to OARs on CT1. Adaptive CTV-based treatment strategies are expected to fully exploit the benefits of IMPT, especially for patients with large geometrical changes. This study defines a reference to quantify the benefit of these proton strategies.

OC-0342
Anatomical changes in mesothelioma patients: effect on proton dose distributions and benefits of early replanning
S. Lorentini1, G. Fava2, P. Vitali2, F. Felini2, S. Tonoli3, M. Amichetti2, M. Schwarz1
1ATP Agenzia Provinciale per la Protonterapia, Medical Physics, Trento, Italy
2ATP Agenzia Provinciale per la Protonterapia, Radiation Oncology, Trento, Italy
3Spedali Civili, Radiation Oncology, Brescia, Italy

Purpose/Objective: To evaluate the dosimetric effects of anatomy变化 in patients affected by malignant pleural mesothelioma (MPM) on intensity modulated proton therapy (IMPT) plans and 2) to propose an approach to mitigate this effect.

Materials and Methods: The study was based on the planning CT and either 3 or 4 verification CT scans acquired during the course of the treatment of five patients treated with trimodality approach (surgery + chemo + radiationtherapy). CT scans were registered with automatic rigid registration on bony anatomy. Structures’ contours were copied on the verification CTs and manually adjusted by a radiation oncologist. Changes in the volume of air pockets within the CTV over the treatment course were quantified. For each patient, a 2-fields IMPT plan was generated on the planning CT and then recalculated on the verification CTs. The effect of replanning early in the treatment cycle was evaluated by replanning on the first control CT (taken after about one week of treatment) and then recalculating on the remaining control CTs.

Results: The CT data showed a systematic reduction of the air volume in the CTV over the treatment course: the mean reduction between the planning CT and last control CT was 80±13% (range: 63-100%). The dosimetric impact on the planned dose distributions is summarized in table. A decrease of V98 in the CTV up to 17.2% was observed, along with an absolute +24% in V107. Dramatic discrepancies were not observed for OARs: the typical increase in mean dose for liver and ipsilateral kidney was 2Gy and 3Gy, respectively. However relative differences up to 40% were found in V40 for oesophagus. The IMRT plan provided similar results as IMPT concerning target coverage, while for OARs it is more robust. However even after the last recalculating IMPT is still better. When IMPT treatments were recalculated on the first verification CT and then recalculated on the remaining verification CTs, smaller differences were found (see figure), especially concerning the target coverage (on average V98 decreased only by 4.7%). For both the liver and ipsilateral kidney the mean dose increase was less than 1 Gy. A 4D-CT scan was acquired for one patients to assess intrafraction organ motion. Results showed no impact.