Purpose/Objective:

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head and neck cases

Figure 2. Gamma index analysis results for (a) pelvis and (b) head-and-neck cases

(a)

(b)

Conclusions: The presence of intravenous contrast agent does not significantly affect the dose calculation in CT-based 3D-CRT planning of pelvis and head-and-neck.

EP-1200

Evaluation of inter-operator variability in Tomotherapy planning for head and neck cases

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Purpose/Objective: The dosimetric aspects of radiotherapy treatment plan quality are evaluated with isodoses and dose volume histogram (DVH) values. Usually, the reporting consists in some particular values of the DVH endpoints. The study focused on Tomotherapy planning for head and neck cases.

Materials and Methods: Ten patients with bilateral lymphatic node irradiation were selected from our database. Prescribed doses for planning target volumes PTV(tumor) and lymphatic nodes PTV(nodes) were 70Gy and 56Gy in 35 fractions respectively. For each patient, seven physicists of our department produced their own plan based on the same set of contours and the same treatment goals. For plan validation, DVH endpoints were related to the following organs: GTV (D98%), PTV(tumor) (D98%, D2%), PTV(nodes) D(98%), spinal cord (D(2%), parotid glands (Dmean, V45Gy, V30Gy), larynx (V50Gy), oral cavity(V50Gy). The inter-operator variability was studied by comparing the DVH values. Three groups of values were evaluated (i) PTV(tumor), (ii) principal OARs for which the respect of endpoints is mandatory and (iii) secondary OARs for which the respect of endpoints improves the patient quality of life.

Results: Physicists had an experience with Tomotherapy planning software ranging from 1 to 5 years. 70 plans were generated and were evaluated by a single physician. For all patients, all plans were clinically acceptable despite some discrepancies. For group (i), the main difference concerned D98% for PTV(tumor) and PTV(nodes) that were lower for two planners. For group (ii), the D2% to the spinal cord never exceeded 38Gy. Large differences were observed but they were considered minor by the physician. For group (iii), experience and tradeoffs of the planners yielded different dosimetric results, especially in the larynx and in the ipsilateral parotid gland. This organ sparing can lead to an slight undercoverage of the PTV(tumor). Whatever the group, differences were particularly observed for the first patients studied, but were reduced during the study.

Conclusions: This work showed inter-operator variability in Tomotherapy planning for head and neck cases. However, all plans were acceptable by the physician. This comparison allowed to better define the priority of the endpoints to evaluate the quality of a plan and to narrow the variability over the study.
Purpose/Objective: The extended volume irradiation, in pelvis or para-aortic volumes, presents some technique and dosimetric difficulties when performed with 3D-CRT due to the junction and the presence of critical upper abdominal structures. Compared with 3D-CRT, Helical Tomotherapy (HT) delivers an highly conformal dose distribution with the possibility to treat extended fields (EF) without junctions. The aim of this work is to evaluate the EF technical feasibility and safety in Tomotherapy, to optimize the treatment planning parameters minimizing dose constraints. Dosimetric data and early toxicities were evaluated.

Materials and Methods: 31 patients, suitable to EF-IMRT for local disease and/or nodal disease on pelvic or lumbar-aortic area, were treated and analyzed. The prescription dose was 50.4 Gy (1.7-1.8 Gy/die) for prophylactic lymph nodes (N-) and 60-66 Gy (2-2.2 Gy/die) for clinically evident gross disease in the pelvic or para-aortic chain (N+). The better parameters, in terms of modulation factor (MF), pitch and field width (FW) have been considered to optimize dose distribution and treatment time duration. DVH values were analysed in terms of D95, average dose for the PTVs and mean and maximum dose for OARs. The length of the treatment field, the N+ and N- volumes and the time of irradiation were also evaluated. The V5, V10, V15 of body was also calculated in order to evaluate the impact of low doses. To correlate the dose values to the safety of treatment, hematological, hepatic, renal and pancreatic functions were evaluated before, during and after treatment. Acute upper gastrointestinal (u-GI) and hematological toxicity were evaluated by RTOG scale. Hepatic, renal and pancreatic functions were evaluated by changes in serological parameters.

Results: The mean FW, pitch, effective MF and gantry period were 2.5 cm, 128.7, 1.8 and 13.5 s respectively. The average length of treatment was 31.7 cm. Mean irradiation was 10.8 minutes. Average values of D95 for PTVs was 96.5%, ranging between 94 and 98%. D95 of PTV N+ ranged between 55.1 and 67 Gy. Doses to OARs are reported in the table. The treatment was well tolerated, without schedule interruption. Ten patients (pts) experienced G1 GI toxicity and 3 pts G2 toxicity. Hematological toxicity was G1 in 6 pts, G2 in 4 pts (2 received concomitant chemotherapy), G3 in 3 pts (all received concomitant chemotherapy). In 3 pts we observed a modest increase of pancreatic function and in 4 of liver function. There were no changes in renal function parameters.

Conclusions: With our treatment design and dose schedule, we found that EF-IMRT by Tomotherapy could be safely with a good dose distribution and effectively delivered with minimal toxicity in the upper abdomen area.

EP-1203
A protocol for prostate IMRT plan with step and shoot technique and inverse planning process
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Purpose/Objective: Prostate (P) is one of the treatment sites that is well suited for IMRT. However, radiation induced complications such as urinary incontinence and rectal bleeding are some of the side effects. The purpose of this study is to illustrate a protocol for P and P with seminal vesicles (PBSV) IMRT plan with step and shoot technique and Inverse Planning process (Pinnacle3 TPS) to conform the higher doses to target and to spare the more sensitive structures in the close proximity of the target.

Materials and Methods: The PTBV is the P CTV with the addition of 1cm in all directions except 0.5 cm posteriorly. The PTBV is the SV with the addition of the same margin and PTBV removed from it. Rectum, femoral head, Bladder, anal canal are typical OARs. To force the dose distribution to better conform to the target, a shell ROI (1 cm thick) is created around targets. To reduce high dose regions outside the target volume the RVR ROI is created, which consists of external target contour, 0.5 cm contracted, avoiding targets, shell and OARs. The isocenter is placed in the center of targets. Five 15 MV beams are used (gantry 180°, 255°, 325°, 35°, 105° and collimator 0°, 10°, 10°, 10°, 10°). The couch rotation is set at 0°. Using an odd number of beams makes it easier to avoid creating opposing beams.

The dose prescription for PTBV is 74.25 Gy in 33 fr. (2.25 Gy single fr.), and for PTBV is 62.04 Gy in 33 fr. (1.88 Gy). A SIB IMRT technique is used in PBSV plan. As a starting point the dose volume objectives, as used in the table. The objectives and objectivates weights (relative importance) can be modified to obtain more satisfactory dose distributions. Each beam is optimized using DMPO (Direct Machine Parameter Optimization). The max number of iterations is 40, the maximum number of segments is 25 (P) or 35 (PBSV), the minimum segment area is 10 cm² (P) or 8 cm² (PBSV). The final calculation of dose is performed with the Adaptive Convolve dose engine and 2x2x2 cm³ grid.

Table:

<table>
<thead>
<tr>
<th>Organ at risk</th>
<th>D95% (Gy)</th>
<th>D2% (Gy)</th>
<th>D50% (Gy)</th>
<th>D98% (Gy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancreas</td>
<td>76.8 ± 0.9</td>
<td>71.2 ± 0.6</td>
<td>68.9 ± 2.0</td>
<td>76.8 ± 0.9</td>
</tr>
<tr>
<td>Spleen</td>
<td>76.8 ± 0.9</td>
<td>71.2 ± 0.6</td>
<td>68.9 ± 2.0</td>
<td>76.8 ± 0.9</td>
</tr>
<tr>
<td>Stomach</td>
<td>76.8 ± 0.9</td>
<td>71.2 ± 0.6</td>
<td>68.9 ± 2.0</td>
<td>76.8 ± 0.9</td>
</tr>
<tr>
<td>Liver</td>
<td>76.8 ± 0.9</td>
<td>71.2 ± 0.6</td>
<td>68.9 ± 2.0</td>
<td>76.8 ± 0.9</td>
</tr>
<tr>
<td>Right kidney</td>
<td>76.8 ± 0.9</td>
<td>71.2 ± 0.6</td>
<td>68.9 ± 2.0</td>
<td>76.8 ± 0.9</td>
</tr>
<tr>
<td>Left kidney</td>
<td>76.8 ± 0.9</td>
<td>71.2 ± 0.6</td>
<td>68.9 ± 2.0</td>
<td>76.8 ± 0.9</td>
</tr>
</tbody>
</table>

Conclusions: With our treatment design and dose schedule, we found that EF-IMRT by Tomotherapy could be safely with a good dose distribution and effectively delivered with minimal toxicity in the upper abdomen area.