**Appendix 1 Planning dose constraints, optimization objectives and weights for reference and selective avoidance planning optimization.**

**Table A1 Planning dose constraints that should be achieved for a clinically acceptable plan.**

|  |  |  |
| --- | --- | --- |
| **Structure** |  | **Expected dose** |
| **PTV** | D95 (%) | > 90% of prescribed dose |
|  | Dmax | < 115% of prescribed dose |
| **Lungs minus GTV** | MLD | < 21 Gy |
| **Heart** | MHD | ALARA, < 46 Gy |
|  | Dmax | < 74 Gy |
| **Spinal cord + 3 mm expansion** | Dmax | < 50 Gy |
| **Esophagus + 5 mm expansion** | Dmax | <74 Gy |

*Abbreviations*: PTV, planning target volume; GTV, gross tumor volume; CT, computed tomography; Dmax, maximal dose; MHD, mean heart dose; MLD, mean lung dose; ALARA, as low as reasonably achievable

**Table A2 Starting optimization objectives and weights applied during reference plan optimization (REF) and lung avoidance plan optimization (AV). In case the objective is used in both planning techniques, it is labelled as ALL.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Structure** | **Planning (REF, AV or ALL** | **Objective type** | **Objective dose (Gy)** | **Objective volume (%)** | **Weight** |
| **PTV** | ALL | upper | 66 | 50 | 150 |
|  | ALL | lower | 66 | 50 | 150 |
|  | ALL | lower | 65 | 100 | 150 |
|  | ALL | upper | 67 | 0 | 150 |
| **Heart** | ALL | mean | 5 |  | 50 |
|  | ALL | upper | 60 | 0 | 120 |
| **Spinal cord + 3 mm expansion** | ALL | upper | 45 | 0 | 150 |
| **Esophagus + 5 mm expansion** | ALL | upper | 35 | 45 | 50 |
|  | ALL | upper | 65.8 | 0 | 150 |
| **Lungs minus GTV** | REF | mean | 15 |  | 120 |
|  | REF | upper | 15 | 20 | 85 |
|  | REF | upper | 5 | 35 | 85 |
|  | ALL | upper | 65.9 | 0 | 150 |
| **Level 1 (<-900 HU)** | AV | No constraints or objectives | | | |
| **Level 2 (-900 to -801 HU)** | AV | mean | 15 |  | 120 |
|  | AV | upper | 15 | 20 | 85 |
|  | AV | upper | 5 | 35 | 85 |
| **Level 3 (-800 to -701 HU)** | AV | mean | 12 |  | 120 |
|  | AV | upper | 15 | 15 | 85 |
|  | AV | upper | 5 | 30 | 85 |
| **Level 4 (-700to -601 HU)** | AV | mean | 9 |  | 120 |
|  | AV | upper | 15 | 10 | 85 |
|  | AV | upper | 5 | 25 | 85 |
| **Level 5 (≥-600 HU)** | AV | mean | 6 |  | 120 |
|  | AV | upper | 15 | 5 | 85 |
|  | AV | upper | 5 | 20 | 85 |

*Abbreviations*: PTV, planning target volume; GTV, gross tumor volume; HU, Hounsfield Unit

**Appendix 2 Individual patient characteristics and resulting total lung doses for both planning strategies**

**Table A3 Patient characteristics for the 12 individual patients in the dataset.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Patient number | PTV (cc) | ‘Lungs minus GTV’ volume (cc) | Institution | Lobe location | Lung | Stage | Prescription dose (Gy) |
|  |  |  |  |  |  |  |  |
| 1 | 823 | 2267 | 1 | upper | right | III | 60 |
| 2 | 399 | 1975 | 1 | upper | right | III | 66 |
| 3 | 457 | 3585 | 1 | upper | left | III | 66 |
| 4 | 637 | 2726 | 1 | lower | right | III | 62 |
| 5 | 1322 | 2691 | 1 | lower | right | III | 62 |
| 6 | 473 | 4187 | 1 | lower | right | III | 66 |
| 7 | 327 | 6500 | 2 | upper | right | IV | 66 |
| 8 | 684 | 7101 | 2 | lower | left | III | 66 |
| 9 | 262 | 2816 | 2 | lower | right | III | 66 |
| 10 | 310 | 6364 | 2 | upper | right | III | 66 |
| 11 | 73 | 3319 | 2 | lower | right | I | 66 |
| 12 | 538 | 4486 | 2 | combined | left | III | 66 |

*Abbreviations*: PTV, planning target volume; GTV, gross tumor volume.

**Table A4 Dosimetric results (reference and lung damage avoidance plans) for the 12 individual patients in the dataset.**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Reference plan, lung anatomy-based | | | | | | Lung damage avoidance plan, CT density-based | | | | | |
| MLD (Gy) | V20 (%) | V5 (%) | MHD (Gy) | Dmax Esophagus + 5 mm (Gy) | Dmax Spinal cord + 3 mm (Gy) | MLD (Gy) | V20  (%) | V5  (%) | MHD (Gy) | Dmax Esophagus + 5 mm (Gy) | Dmax Spinal cord + 3 mm (Gy) |
| 18.2 | 39.9 | 66.7 | 5.9 | 62.8 | 47.1 | 17.4 | 35.5 | 67.5 | 5.9 | 62.0 | 48.1 |
| 19.1 | 40.6 | 73.8 | 23.1 | 71.2 | 48.2 | 17.8 | 34.8 | 72.6 | 24.2 | 72.7 | 50.0 |
| 19.1 | 40.6 | 70.3 | 15.7 | 71.0 | 46.7 | 19.0 | 37.7 | 70.8 | 15.7 | 71.1 | 47.4 |
| 21.5 | 41.3 | 95.6 | 19.6 | 64.5 | 50.0 | 20.3 | 36.0 | 95.6 | 21.7 | 66.1 | 50.0 |
| 20.9 | 38.7 | 98.8 | 34.6 | 64.9 | 49.2 | 20.6 | 37.8 | 97.4 | 35.2 | 65.7 | 49.8 |
| 17.5 | 29.3 | 72.8 | 14.7 | 67.4 | 49.3 | 17.4 | 30.4 | 73.4 | 13.5 | 71.0 | 49.9 |
| 14.5 | 25.9 | 71.4 | 6.5 | 56.6 | 36.0 | 14.1 | 23.4 | 70.3 | 6.5 | 56.7 | 36.9 |
| 12.8 | 22.3 | 48.5 | 0.7 | 67.4 | 42.5 | 11.7 | 20.4 | 48.2 | 0.7 | 67.3 | 40.1 |
| 13.5 | 23.5 | 60.6 | 13.2 | 70.0 | 41.3 | 12.8 | 22.3 | 58.1 | 13.4 | 70.0 | 41.9 |
| 9.7 | 14.9 | 39.3 | 1.2 | 66.8 | 29.7 | 8.9 | 13.2 | 37.2 | 1.1 | 66.0 | 28.6 |
| 6.7 | 5.5 | 39.7 | 15.0 | 60.1 | 16.7 | 6.3 | 5.2 | 38.5 | 16.4 | 58.1 | 17.0 |
| 16.4 | 28.7 | 64.6 | 6.0 | 67.9 | 39.9 | 16.1 | 29.1 | 64.6 | 5.8 | 68.3 | 40.2 |
| **Avg. 15.8** | **Avg. 29.3** | **Avg. 66.8** | **Avg. 13.0** | **Avg.**  **41.4** | **Avg.**  **65.9** | **Avg.**  **15.2** | **Avg.**  **27.1** | **Avg. 66.3** | **Avg. 13.3** | **Avg.**  **41.7** | **Avg.**  **66.3** |

*Abbreviations*: MLD, mean lung dose; V20, relative lung volume receiving 20 Gy; V5, relative lung volume receiving 5 Gy; MHD, mean heart dose; Dmax, maximal dose; Avg., Average.