To approximate and evaluate the effect of interfractional gastrointestinal motion of organs at risk (OARs), for cases of liver stereotactic body radiation therapy (SBRT), on dose to OARs using multiple CT scans.

**RESULTS**

The current planning risk volume (PRV) expansion model used during planning to account for setup uncertainties and internal organ motion is based on target setup uncertainty defined by a minimum of .3 cm by RTOG-1112 (5). For these cases, PRVs were created during planning using .5 cm isotropic expansions of OARs. The PRV for an organ contour within a scan indicates the expected range of motion over the course of treatment.

Within the treatment process, the Day 2 scan is considered the primary scan because it is used for planning. The Day 1 scan is considered the secondary scan because it is not used for planning. PRVs are created using the primary scan only.

**Relevant Constraint Metrics**

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Constraint</th>
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<tbody>
<tr>
<td>Liver + .5 cm</td>
<td>22 Gy maximum</td>
</tr>
<tr>
<td>Bowel + .5 cm</td>
<td>V9 &lt; 30 Gy</td>
</tr>
<tr>
<td>Stomach + .5 cm</td>
<td>V9 &lt; 30 Gy</td>
</tr>
<tr>
<td>Duodenum + .5 cm</td>
<td>30 Gy maximum</td>
</tr>
</tbody>
</table>

Organ at risk constraints used for this project were defined by RTOG-1112 and MGH standards. The gastrointestinal organs considered in this study were the large and small bowel, the stomach, and the duodenum.

**METHODS**

The population studied was 7 patients who had been treated with Liver SBRT at MGH and had two days of CTs available without coversheet immobilization devices. Day 1 and Day 2 scans were contoured to determine locations of the stomach, duodenum, small bowel, and hepatic flexure of the large bowel within proximity to the target. The scans were fused via nondeformable image registration according to the fiducials.

For this project, when the Day 1 scan was considered the primary scan, the Day 2 scan was also considered the secondary scan, and when the Day 2 scan was considered the primary, the Day 1 scan was considered the secondary. \( V_{outside} \), defined by the difference in expected organ volume and location (defined by the .5 cm isotropic PRV) from the actual organ volume and location (defined by the secondary scan), was collected for the case of Day 1 = primary and Day 2 = primary.

**CONCLUSION**

For the stomach and hepatic flexure, the secondary constraint value was 11% and 22% less than the primary constraint value. In contrast, for the small bowel and duodenum, the secondary constraint value was 11% and 130% greater than the primary constraint value. For the duodenum and small bowel, an isotropic .5 cm PRV may not be an adequate planning tool, but for the large bowel and stomach, the plans created with .5 cm PRVs that met constraints were adequate to meet constraints on a representation of another day of treatment. Future research could be done to determine an optimal PRV or to determine another planning tool to compensate for digestive motion.

**REFERENCES**