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Theme: Physics

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Abstract Title: Carbon Ion Radiotherapy Optimization Techniques for Pancreatic Cancer: Accounting for the Effect of Bowel Gas Variation

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Background / Aims:

- Bowel gas variation can cause significant dosimetric changes in carbon ion radiotherapy (CIRT) for locally advanced pancreatic cancer (LAPC).
- This study quantified **the impact of bowel gas variation** and **compared three mitigation strategies** to improve robustness.

Subjects and Methods:

Dataset:

- Eight LAPC cases treated with SABR at SNUH.
- Planning CT and all-fraction CBCTs were included.
- Air regions were defined by threshold-based segmentation and refined.
- CIRT plans (552. GyE/12 fx) using SFUD were optimized in RayStation (MKM)

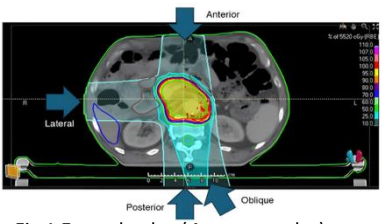


Fig.1 Example plan (4 gantry angles)

Replacement Pattern:

- Pattern 0 : No replacement
- Pattern 1 : Gas to water
- Pattern 2 : bowel to G_{mean}
- Pattern 3 : Gas to G_{mean}

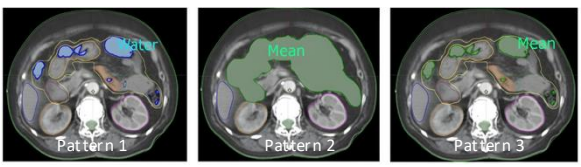
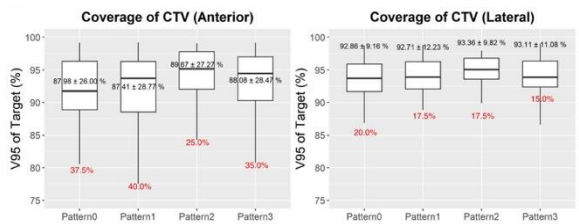


Fig.2 Replacement patterns

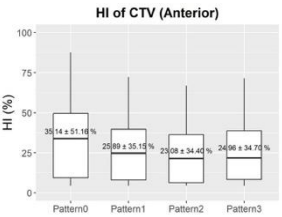
Quantitative Evaluation:

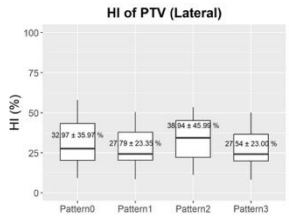
- Dosimetric evaluation : **CTV/PTV $V_{95\%}$, homogeneity index, OAR doses**

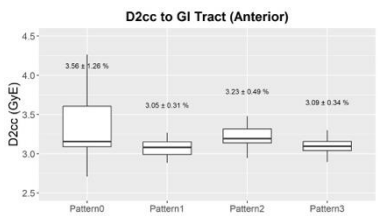
Result:



- Density-override patterns reduced inter-fractional variation in target coverage and OAR dose compared with no-override.
- For the lateral beam, Pattern 3 showed the lowest PTV homogeneity index (HI = 27.54 %)







- **Pattern 2** was found to be **most robust in terms of target coverage**, followed by pattern 3. **Pattern 2** was shown to have poor homogeneity and be unfavorable in terms of the dose to the GI tract.
- Thus, if it becomes desirable to uniformly deliver a high dose to the target volume, or if the target is adjacent to the GI tract, pattern 3 should be considered.