

AbstractID: 10469 Title: Clinical Application of Image Guidance to radiotherapy of pre-operative rectal cancer : from day-to-day positioning to biological modelling

Introduction and purpose

Pre-operative (chemo)radiotherapy is standard in stage II/III rectal cancer, but associated with significant small bowel toxicity. This study focuses on the ability of helical tomotherapy to spare the small bowel compared to the conventional approach, and to explore the positioning and radiobiological benefit of daily MVCT scanning and positioning for these patients.

Material and methods

A planning protocol was developed allowing minimization of the volume of small bowel irradiated with a dose $>15\text{Gy}$. To define the image-guidance strategy for the treatment of rectal cancer on tomotherapy MVCT-scans of 10 patients were acquired before and after treatment. Using automatic bony registration the setup-error was determined and by delineating the mesorectal area on both MV and kV(planning)-images an estimation was made of the internal margin by assessing the movement of the internal organs. Suitable margins were extracted and applied for future patients. To assess the biological relevance or benefit of the application of daily scans a NTCP model was applied to the 10 patients, comparing NTCP linked to small bowel toxicity for conventional treatments, and tomotherapy treatments with and without image guidance.

Results

Analysis of dose volume histograms show the ability to reduce the 15Gy-volume of the small bowel with helical tomotherapy. Assessment of setup errors and internal movement show a possible margin reduction from 15mm to 8mm (lateral), 16mm to 11mm (anterior) and 14mm to 7mm (posterior) when using daily MVCT positioning. TCP and NTCP calculations show a statistically significant benefit going from classical (39.5%) to rotational IMRT (26.5%), and also between IMRT and IGRT with daily MVCT-positioning (18%).

Conclusion

This study shows that treatment of pre-operative rectal cancer on tomotherapy is feasible and that daily MVCT-positioning can reduce margins and has a significant biological effect on small bowel toxicity.