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Adaptive radiation treatment planning for vulva cancer patients

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When a patient is submitted to radiotherapy a treatment plan is made. This plan accounts for the energies used in the treatment, the angles from which the energy is delivered and the number of times the patient has to receive treatment i.e number of fractions. In conventional oncology the radiation plan will stay unchanged throughout all the fractions, without regard for minor, long or short term changes in the physiology.
In my thesis I have explored a new option for treatment planning, for vulva cancer patientsm namely adaptive planning.
In adaptive planning we do a cone-beam-CT (CBCT) in a combined CT-Linac, every time the patient is receiving a fraction. From that CBCT it is possible to see changes in physiology around the target, the tumor, and then make minor changes to the treatment plan. These changes takes from 15 to 30 minutes to make. This is done primarily by a medical doctor with a speciality in oncology, but the plan needs approval from a medical physicist. The point of these small changes to the original plan is to optimize the coverage of the target and at the same time to make sure that the organs-at-risk (OAR), all non-tumor organs in the area of radiation, is receiving as little a dose as possible. Changes in the physiology is ranging from deformation of organs, changes in tumor size, shifts in tumor or
OAR location, all the way to urine in the bladder and air in the intestines. But since this adaptation takes 15 to 30 minutes there might be other minor changes to the physiology during the adaption process. In order to to be able to check if the adaptation is still valid when the radiation is delivered a second CBCT is taken just before the delivery of the radiation, after the adaption process.
This project is using the second CBCT to simulate an entirely new adaptation, made with the image taken just before the original treatment. This simulated treatment is compared with the clinically used plan to see if the adaption is still valid.
So far results are showing that adaptation used on 10 patients are valid and are still usable after 15 to 30 minutes. The next step is dose accumulation across all fractions not only to check each fraction, but every fraction all together, to make sure the patient is receiving enough radiation in the tumor whilst as low a dose in the OARs as possible.
The scope of the project is to have a direct impact of the treatment methods used at Rigshospitalet in order to minimize side effects and maximize treatment success in vulva cancer patients.

Field of study

Biophysics

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