Completely automated dose-planning: first clinical experience

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Résumé

Introduction: As the number of cancer patients grows, the need for shorter and more efficient workflows to save resources gets greater as well. Resource- and time-consuming processes like the dose-planning process could greatly benefit from an automatized workflow, especially for less complex plans/diagnosis where most of the time is spent on repetitive tasks that present no challenges for the dose-planner. The purpose of this work was to investigate if automatically generated radiotherapy treatment plans for prostate cancer treatments are clinically acceptable, time saving, and equivalent to manually created treatment plans.
Material and Methods: Using the scripting capabilities in the TPS Eclipse (ESAPI), a program automatizing the entire dose-planning process, starting directly after OAR/target delineation, up to a complete calculated plan, was created. The program requires no human input and creates the plan outside of working hours.

Using this program, a prospective study including 100 patients with prostate cancer was performed. Each of the 100 patients received two plans: one "autoplan" automatically generated by the program, and one manual plan created by a dose-planner. Each plan that the program created was reviewed by an independent dose-planner and reoptimized if the original plan was deemed unsatisfactory according to our clinical standards. The time it took for the independent dose-planner to evaluate the autoplan with or without reoptimization was recorded and compared to the time it takes to make a plan manually (recorded outside of the study on 21 patients).

Finally, for each patient, both autogenerated and manual plans were reviewed by oncologists and medical physicists in a blind chart round and the best plan was selected for treatment. Dose-volume metrics for targets and OARs were also compared.

Results: The average time to evaluate an autoplan without reoptimizing was 6 min ± 1.5 (n=30) and 19 min ± 7.5 (n=70) when reoptimization was needed. This was a substantial time gain compared to the 55 min ± 44 (n=21) it took to make a plan completely manually. The most common reason for reoptimization was that the RapidPlan model used for the optimization in the program had a tendency to press too much on the dose to the OARs

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resulting in a limited loss of target coverage. This was quickly fixed in the RapidPlan model, but in the interest of gathering relevant statistics, it was decided not to use the updated RapidPlan model until the study was completed.

The autogenerated plans were blindly chosen for treatment during the chart round in 63% (n=63) of the cases, but 89% (n=89) were deemed clinically acceptable vs 75% (n=75) for the manual plans. This means that 89% of the autoplans would have been accepted during the chart round if only these plans had been shown and no manual plans. For 7 patients (7%) none of the plans were deemed clinically acceptable. Of the 63% autoplans chosen for treatment, 65% (n=41) presented a higher PTV D98% and 78% (n=49) had a lower V90% in Rectum compared to the plans made manually.

Conclusions: Time can be greatly saved using scripting and an automated workflow for dose-planning. Automatically generated plans were shown to be equal or superior to manually created plans in a moajority of cases and can be created outside of working hours, saving time and resources so that dose-planners can focus on more complex tasks or projects. More diagnosis are under evaluation (palliative plans, rectal cancer, gynecological cancer, breast cancer) and results will be presented at a later stage.

Mots-Clés: automatisation, scripting, plannification de traitement automatisée