ESTRO MOBILITY GRANT (TTG) REPORT

Title of the report: SPATIAL DESCRIPTION OF URINARY TOXICITY VIA DOSE-SURFACE MAPS (DSM)

HOST INSTITUTE:
Fondazione IRCCS Istituto Nazionale dei Tumori

DATE OF VISIT:
9-23 September 2018

Eugenia Mylona
PhD Candidate
LTSI (Laboratoire Traitement du Signal et de l'Image)
Rennes, France
Email: mylona.eugenia@gmail.com

In my home institute (LTSI), we have developed voxel-based methods (DVMs) allowing to investigate the local relationship between planning dose and side-effects after prostate cancer, while preserving the spatial information of 3D dose distribution. In the case of urinary toxicity, we have identified subregions of the bladder /urethra potentially associated with specific urinary symptoms. Thus, the main objective of the visit was to employ a different methodology based on dose surface maps (DSMs), to investigate local-dose differences and their correlation with post-treatment urinary symptoms.

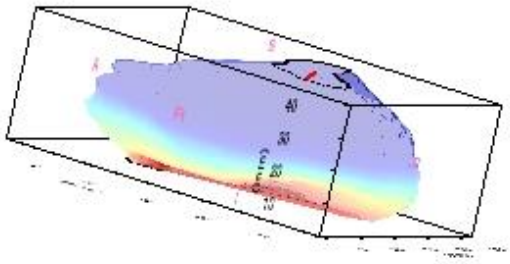
Having already met Dr. Tiziana Rancati and the PhD student Alessandro Ciccheti at the 37th ESTRO conference, a possible collaborative work had been discussed but it was the ESTRO and the Technology Transfer Grand (TTG) that brought this idea to fruition.

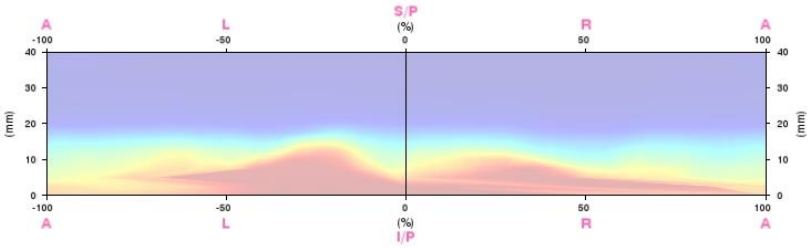
Right from the start, I was well-integrated in the team “Programma Prostata” consisted of physicians, physicists, biologists and phychologists. Thus, I profited from the stimulating environment and was engaged in intriguing conversations across a broad spectrum of topics. Not only was I offered a tour at the institute and the treatment units, but I was also privileged to visit the micro-linac facility accompanied by the medical physicist in charge; who explicitly explained the workflow of treatment planning and delivery. Thanks to the experts of the department and their kindness, I was able to advance my knowledge on treatment planning and adopt new perspectives.

The first days of my visit I was introduced to VODCA, a dedicated software which allows to digitally unfold the 3D surface dose of an organ into a 2D plane. I was offered a detailed presentation and extensive training of the software clearly explaining all the different steps of the process until the DSM extraction. I was then able to use the software and produce DSMs for 250 patients from French studies (already analyzed with DVMs). Two different pre-processing approaches were used prior to the final statistical analysis. First, we sought to reduce all maps to a common reference frame by normalizing them in the left-right and/or cranio-caudal direction. Also, given the high bladder volume variability and relative position of the bladder with respect to the prostate, we attempted to preserve the spatial information by introducing a different point of reference for the alignment of the DSMs across the population. For all the methods employed, different sets of DSMs were produced, and pixel-based statistical analyses were performed to identify regions of the bladder surface that were correlated with urinary morbidity. The results were finally compared with those of the 3D DVM analysis.

I would like to thank all the staff of Istituto Nazionale dei Tumori for their kindness and hospitality. I truly appreciated the exchange of methodological and practical skills with A. Ciccheti and our excellent collaboration on this project. Special thanks to Prof. R. Valdagni, head of the laboratory and veteran in predictive modeling, for his willingness to share his knowledge and offer his advice. Moreover, I would like to express my deepest appreciation and gratitude to Dr. T. Rancati for welcoming me, supporting this research collaboration, for her effortless time investment and her invaluable advices. I strongly believe that we have established the basis for effective collaborative research in the future, in this stimulating field of mutual interest.

To conclude, having the opportunity to work with highly qualified researchers and leading people in the field of radiotherapy, dose-effect predictive modelling has allowed for both professional and personal enrichment that can only strengthen my career goal. Sincere thanks to the ESTRO for giving me this opportunity. It has truly been a great experience.




A
L
S/P
(%)
R
A
-100
-50
0
50
100
40
30
20
10
0
(mm)
A
L
(%)
I/P
R
A