

This is an electronic reprint of the original article.

This reprint *may differ* from the original in pagination and typographic detail.

Author(s): Fenoglio, Federica; Ruo Redda, Maria Grazia; Kela, Katri; Jussila, Aino-Liisa

Title: Volumetric radiation therapy and IGRT with kV-CBCT and Calypso in prostate cancer : experiences of technical-practical training in comparison

Year: 2020

Version: As published

Please cite the original version:

Fenoglio, F., Ruo Redda, M. G., Kela, K. & Jussila, A.-L. (2020). Volumetric radiation therapy and IGRT with kV-CBCT and Calypso in prostate cancer: experiences of technical-practical training in comparison. *Journal of Clinical Radiography and Radiotherapy*, 18 (1), 17 - 18.

Retrieved April 23, 2020, from

https://www.sorf.fi/doc/KI_radiografialehdet/Kliininen_1_2020_VALMIS2.pdf

Volumetric radiation therapy and IGRT with kV-CBCT and Calypso in prostate cancer: experiences of technical-practical training in comparison

Federica Fenoglio

Student of Bachelor's Degree Course in Medical Radiology Imaging and Radiotherapy Techniques, Department of Oncology, University of Turin

Maria Grazia Ruo Redda

Professor, University of Turin

Aino-Liisa Jussila

Senior Lecturer, PhD, Oulu University of Applied Sciences

Katri Kela

Radiographer (BSc), Oulu University Hospital

Purpose and nature of the study: The study analyses and compares two IGRT technologies used in prostate treatment: kV-CBCT and the Calypso tracking system. A training period was carried out both at the Department of Radiotherapy of the University Hospital of Oulu (OYS) in Finland and at the SCDU Radiotherapy of the Mauriziano Umberto I Hospital of Turin in Italy. This allowed to compare the use of the two technologies in the two services and, in particular, allowed the in-depth analysis of the Calypso system (present only at the OYS). In addition, the opportunity was taken to observe the differences between the two professional realities as regards the role of the radiographer and the global organization of the Service.

Thanks to the Erasmus+ Traineeship experience of internship abroad, it was possible to attend the Department of Radiotherapy of OYS. On this occasion, it was possible to study and analyze (with observation, interviews to the healthcare staff and clinical practice) the functioning of the Calypso tracking and tracing system and its methods of use in clinical practice with regard to radiotherapy treatment of the prostate.

Once back in Italy, the internship was carried out at the SCDU Radiotherapy of the Mauriziano Umberto I Hospital in Turin, where only the kV-CBCT is used to carry out the checks undergoing treatment for the prostate.

Methods: The two IGRT technologies were compared for what concerns the patient's clinical path, the impact they have in the total duration of the treatment, the accuracy and precision of the localization of the target, the radioprotection and the costs. Their advantages and disadvantages were evaluated by comparing the summary tables and the data from observation and practice. Concluding notes were drawn regarding possible future developments regarding the use of the Calypso system as a valid alternative to kV-CBCT in the prostate treatment.

Furthermore the role of the radiographer was assessed in the two experimented realities. In particular, the analysis was focused on the tasks of the radiographer and the numerical availability of technical staff.

Key results: The Calypso tracking and tracing system uses the electromagnetic signal transmitted by three transponders implanted inside the prostate to identify the spatial coordinates of the target to be irradiated. The analysis of this IGRT technology revealed the obvious dosimetric advantages of the latter, as non-ionizing radiation is used. This saves the patient the daily dose contribution (7 mSv) related to the acquisition of kV-CBCT during treatment checks.

Thanks to its high precision, the

Calypso system also allows the reduction of PTV margins of $\frac{1}{2}$ mm in all the directions. This allows to contain the dose administered to the organs at risk, especially to the rectum, and thus reducing the toxic effects of the therapy.

The daily alignment of the lesion isocenter with the accelerator one can be corrected and improved and changes in glandular volume during therapy can be evaluated by daily monitoring of transponders. This permit the creation of an adaptive treatment, whose plan can change from one session to the next in case of variation of the volume or position of the target.

The Calypso system allows a rapid set up of the patient (around 15 minutes for the total treatment session) and provides, even though indirectly, information on the rectal and bladder preparation necessary for the proper delivery of the radiation therapy treatment.

Finally, the analysis of the organizational and practical dynamics of the Department of Radiotherapy of the Hospital of Oulu allowed to identify the different role that the radiographer has in Finland compared to Italy. In the Radiotherapy Service of the Hospital of Oulu, the radiographer takes care (independently or together with the doctor) of the reception of the patient, of the consulting and ongoing treatment examinations, as well as the complete management of the treatment path of each patient. All

this is allowed by a different University education compared to the Italian one. The course of study includes a basic nursing training that is then develops and specializes in the radiological and radiotherapy area. Once acquired all the competencies that each radiographer must have, the student has the opportunity to choose whether or not to deepen his or her own knowledge in the field of radiotherapy.

A path of this kind could also be undertaken in the Italian reality. Without the need to change the university education, it would be sufficient to introduce optional training courses after graduation.

However, it is necessary to consider that, at present, the situation of technical staff, and not only, available in the Radiotherapy Services of Italian peninsula could rarely allow such a training and professional scenario due to the often small number of structured personnel within the Hospital Organizations.

Relevance of results to radiation therapy:

The use of the Calypso system certainly offers an advantage from a dosimetric point of view. As it does not require the use of ionising radiation, it saves the patient a dose contribution of 7 mSv per day for the execution of a kV-CBCT. Although in Oulu Hospital the system is still used in association with CBCT, the aim is for Calypso to replace CBCT in treatment testing procedures. Thanks to the high positioning accuracy provided by this IGRT technology, it is also possible to reduce treatment margins.

A further advantage of localization using electromagnetic transponders is the possibility of daily correction of the treatment isocenter positioning. This results in a dose reduction in the rectum, which leads to a reduction of side effects and enhances the outcome of therapy.

The presence of implanted markers inside the prostate also makes it possible to determine the variation in glandular volume during treatment. These size

changes can lead to geometric and dosimetric inaccuracy due to geographical missing of the target.

The calypso system also reduces positioning time for each patient and provides indirect information about the patient's rectal and bladder preparation.

The main limitation of this IGRT technology is the high cost of the equipment, wiring necessary for data transmission and transponders. Transponders in particular, once implanted inside the prostate, can no longer be removed. The cost for the treatment of each patient is therefore very high, with prices around 1000 euros.

In conclusion, it is clear that the role and tasks of the radiographer are different in the two working realities analysed. The staff of radiographers in the Finnish Service is much higher and this allows the TSRM to perform operations normally performed by doctors and nurses are delegated to the radiographer. All this is allowed by a different and more sectorial university training: the adaptation of the didactic training to the tumultuous technological evolution requires the development of specific competences preparatory to the performance of part of the tasks usually proper to the medical and nursing staff.