

ESTRO MOBILITY GRANT (TTG) REPORT

Title of the report: Organ motion management 4DCT

HOST INSTITUTE:
MAASTRO, Maastricht, Netherlands

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MAASTRO Clinic, in Maastricht, the Netherlands, is one of the European leaders' centre in biological and translational research and the clinical radiotherapy practice has an important role due to the almost 4000 patients treated per year. In this context organ motion management is very important and it has been strongly studied and developed.

Therefore it was quite natural for us to choose MAASTRO Clinic for a technology transfer grant in order to implement motion management techniques in thorax and upper abdomen using the new dual energy 4DCT that our centre is going to install.

After a warm welcome, Dr. A. Dekker, director of Research & Education, explained us the clinical MAASTRO workflow for patients, and how each professional is involved in the different steps of complete RT treatments.

In the succeeding days we had the opportunity to have a deep look inside the motion management approach of MAASTRO from different point views.

From a physicist point of view Lars Murrer told us that they use 4DCT for the upper abdomen and thorax treatments planning. Most of the treatments are delivered in free breathing except for left breast and other peculiar cases where deep breath-hold inspiration technique is used. For free breathing treatment he explained us the history and methods they used to get a "PTV margin recipe" based on the Van Herk formula, in particular for lung cancer.

From a RTT point of view Jorgen van de Bogaard, Esther van Enckevort and Djoya Hutta shared with us the details of their day-to-day practice about:

- Image acquisition: CT, PET/CT and immobilization systems;
- Delineation: OARs and PTV;
- Planning: hybrid techniques (VMAT+static fields) and inverse (VMAT);
- Treatment: traffic light protocols for RT delivery.

From a physician's point of view Stephanie Peters explained us her experience with breath-hold technique and the different target volume delineation used for NSCLC:

- ITV approach with GTVs delineation in each respiratory phase for SBRT in stage I-II and generation of PTV using fixed margins
- Quasi Mid-position approach with GTV delineation in 50% exhale 4DCT phase for conventional RT in stage III and generation of PTV with "personalized" margins. Margins are obtained evaluating the target motion amplitude between 100% inhale and 100% exhale phases.

Besides motion management we had the opportunity to gain insights into other topics like DGRT and Big Data analysis for predictive models.

Dr. Richard Canters and Dr. Bas Nijsten introduced us to Dose-Guided Radiation Therapy. It is an EPID-based process of measuring the dose distribution during patient treatment delivery for verification purposes or adaptive radiotherapy implemented via a home-made software.

Dr. Leonard Wee and his group introduced us to their Big Data studies. We were astonished in learning how they manage big data records and use them to produce more and more accurate predictive models which aim to help radiation oncologists in taking the best decisions for patients in terms of effectiveness and costs. Among their most valuable results there are some predictive models which are currently accessible in an open access website (predictcancer.org). We also talked about a possible collaboration on MR-imaging.

As a corollary we could also visit the new Protontherapy site that is under construction and the first proton patient is scheduled for June 2018.

In conclusion we would like to stress that all colleagues were very professional and kind providing us the opportunity to get the best from our visit.

We are very thankful to ESTRO committee for accepting our grant project.