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## Left breast radiation therapy - institutional analysis of doses to heart and LAD

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### Background.

Respiratory motions and free breathing during radiation therapy treatment of sites in the proximity of lungs, influence significantly on treatment of tumor volumes (in terms of sizes of PTV margins and also in possible under dosage of tumor volumes). It also influences the dose received by normal tissues surrounding the tumor volumes. This is particularly important in patients undergoing radiation therapy of the left breast, since these patients have long life expectancy in one hand, and on the other hand, the unintended irradiation of the heart and LAD artery, may cause later cardiac failure and other cardiac side effects.

Since one of four cancer patients, in Serbia and its northern province of Vojvodina, in female population is suffering from the breast cancer, and approximately half of them are left breast patients, we have conducted retrospective analysis of treatment plans of patients treated in our center in 2007-2010. These patients will be examined by cardiologists in following 3 years, and their current status evaluated, and if necessary treated cardiologically in order to prevent cardiac failure or other cardiac problems. Another prospective study which follows in future months, will show how current practice in radiation therapy treatment planning is reflecting in the doses to critical organs, and this will be also presented to public. Another step which is planned to be conducted based on the results of the study, is to prepare protocol and implement the deep inspiration breath hold, for the left breast patients whenever possible, in order to exclude the critical structures from the treatment field.

### Methods and materials.

The patients presented in this study were treated during 2009. Treatment was delivered by linear accelerators of Radiotherapy Clinic, Institute of oncology Vojvodina, Sremska Kamenica. The machines were manufactured by Varian Medical Systems, and accelerators are of series 2100C and 600 DBX. The treatment planning system used, was of manufacturer Elekta, XIO v 4.62. The treatment planning system was verified according to the IAEA recommendations, and machines are regularly calibrated, and checked biannually in IAEA TLD audits. There were in total 114 left breast patients in 2009, of which 92 could be successfully de-archived 7 years after treatment, and returned to treatment planning system, without any error during de-archiving procedure.

Since at the time of treatment planning for these patients, in 2009, the LAD artery was not delineated, the radiation oncologists delineated LAD structure on de-archived plans as they could recognize it, or where it should be anatomically (if not visible), and re-delineated heart, according to current practice and protocols at the Institute. Accordingly, the treatment plans were re-calculated and reviewed by medical physicists, to obtain doses to these two new structures, and results noted.

### Results.

The results of evaluation of radiation therapy treatment plans, of left breast patients, whose patient plans were generated during the period January 1st 2009-December 31st 2009 are presented. The patients were prescribed different therapeutic doses, from 50 Gy to 60 Gy, depending on the stage and type of illness. The dose range to the heart was maximum 62.4 Gy and minimum dose was 3.6 Gy, while mean dose to heart as whole organ was 3.9 Gy. The mean volume of the heart was 687 cm<sup>3</sup>. As for the left lung, the maximum dose found was 65.5 Gy, minimum dose 0 Gy, and mean dose 6.9 Gy. Left anterior descending artery (LAD), which was newly delineated, after the de-archiving of the treatment plans, has received a dose range of: maximum dose 62.1 Gy and minimum dose 0.2 Gy, while mean dose was 20.3 Gy. The volume of delineated LAD was 4.8 cm<sup>3</sup>. We did not record distances of the heart to the treatment field edge at this stage, which will be done in the next

weeks.

Discussion.

Breast cancer is the most common cancer throughout the world female population. It is nowadays illness which can be treated successfully, and life expectancy is long after treatment. If a patient is treated in such a way that she is free of cancer after treatment, and another life threatening illness is caused by the treatment of primary disease, then the result of cancer treatment is practically annulled. The dose to the neighbouring tissues depend mainly on anatomical structure of the patient, but there are now techniques which can improve the outcome to heart, LAD and lungs, as the most affected organs. This study will be continued, and these results are preliminary.

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