**Title:**

Coronary delineation and margin definition for breast radiation therapy after contrast enhanced CT scan

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**Purpose/Objective:**

The increased risk of cardiovascular diseases following left breast radiation therapy is well known, these diseases are multifactorial but the radiation dose plays a key role. Since hot spots of tens of Grays can affect the Left Anterior Descending coronary artery (LAD) it should be, if possible, spared. For that purpose the first prerequisite would be to contour it, but it cannot be seen on RT planification CT scans.

This study aims to:

* Study the possibility to visualize the LAD with Contrast-Enhanced CT scans (CE-CT);
* Define LAD contouring margins and thus taking into account the heart movements.

**Material/methods:**

This study received approval from the regional ethic committee and currently 24 female patients have been enrolled. All the patients received the prescribed left breast radiation therapy but underwent an additional CE-CT and a Coronary CT Angiography (CCTA) exam. This technique is chosen because of it positioning as standard in the field.

The CE-CT was performed on a 16-slice GE Optima 580, with Omnipaque 300 as contrast agent. The time between injection and acquisition start was set to 35 seconds.

The CCTA was performed on a 64-slice GE Optima 660, 25 phases of the cardiac cycles were acquired.

Four anatomic landmarks were defined: the ostium, the bifurcations of the LAD with the left circumflex coronary and with the 1st and 2nd diagonal. The landmark’s displacements were measured on the CCTA to assess them in the 3 directions. For each landmark the diameter of the LAD was measured at 70% of the cardiac cycle.

The LAD dimensions at the landmark locations were measured in the 3 directions on the CE-CT images and compared with the displacements.

The margins were calculated summing the displacement and the diameter found with the CCTA and subtracting the dimension found with the CE-CT.

**Results:**

On the CE-CT images the bifurcation between the LAD and 2nd diagonal was identified for 19 patients over 24.

On the CCTA images, 4% of the 288 planned measurements were not possible. Displacement values depended on the landmarks and on the direction, the mean displacement was (5.8 ± 1.7) mm (mean ± std). Disregarding landmark’s positions, the LAD diameter was (3.1± 2) mm.

On the CE-CT images, 18% of the planned measurements were not possible. The dimension depended on the landmarks and on the direction, the mean dimension was (3.6 ± 1.5) mm.

The margins were between 0.4 and 13.4 mm. For the ostium landmark the margin was calculated as (7.1 ± 2.5) mm; for the three other landmarks the margin was (5 ± 2) mm.

**Conclusion:**

CE-CT scan can be used to visualize and to contour the LAD, if the time between injection and image acquisition is properly chosen. But margins, according to the heart movement, must be defined.

The displacement measured on the CCTA differs significantly from the dimensions found on the CE-CT in the 3 directions. Between the ostium and the circumflex bifurcation a margin of 7 mm was found; below this bifurcation a margin of 5 mm was found.