CT-Imaging Protocol for Heart Delineation in The Radiation Therapy Preparation Workflow

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Since CT-based 3D conformal radiation therapy has been in use in radiation therapy (RT), doses to the heart have been collected and attempts were made to correlate them to cardiac disease. Retrospective studies on large populations of patients treated either for breast cancer or for Hodgkin’s lymphomas [1-4] showed a correlation between cardiac mortality and dose volume histogram (DVH) or normal tissue complication probability (NTCP) values of the heart. These studies maybe biased by the multiple cofactors of risk in cardiac diseases [2,5]. Moreover, RT-induced toxicities depend on the region of the heart that was irradiated and there is a need for improved imaging protocols to identify the heart substructures such as the coronary arteries. A recent dosimetric study [6] showed that evaluating the dose to the left anterior descending artery (LAD) may change the treatment strategy in breast irradiation. However, planning organ at risk volumes (PRV) must be defined with sufficient margins (ICRU 62) to include motions due to cardiac beating and breathing.

The magnitude of these movements can be evaluated by the use of breath hold (at inhale and at exhale breath times). Cardiac gated CT imaging may be useful to eliminate image blurring and identify the contours of small structures like the coronary arteries which diameter is in the order of the mm. Image resolution in-plane and in the cranio-caudal (CC) direction (slice thickness) is one important parameter, as well as collimation width and rotation time. Intra-venous contrast injection should be optimized to obtain a clear visualization of the heart substructures boundaries.

This preliminary study focuses on the establishment of an imaging protocol that could be used in routine for all thorax RT patients, using a large bore CT scanner (Toshiba Aquilion LB, Toshiba Medical, Puteaux, France) installed in the RT department (Table).

**Conclusion**

This protocol could be proposed to young patients with left side breast tumors, as well as mediastinal lymphomas. Future evaluation is needed to compare injected and non-injected CT scan.

**References**


**Table 1:** Parameters used to image the patients’ vessels.

| Toshiba 16 detector Aquilion LB (Toshiba Medical, Puteaux, France) |
|------------------------|------------------------|
| **Region**             | **Direction of acquisition**<br>Breathing status<br>Scout view<br>Patient position |
| **CT acquisition parameters**<br>Acquisition mode<br>Rotation time<br>Rotation angle<br>Collimator width<br>Slice thickness (mm) / Interval<br>Pitch<br>Scan field-of-view (SFOV)<br>kV / mA |
| **CT reconstruction parameters**<br>Acquisition filter<br>Reconstruction filter<br>Reconstructed slice thickness and interval |
| **Contrast concentration**<br>- Quantity (ml)<br>- Rate (ml/sec)<br>- Start |

**Preparation Workflow**

- Rate (ml/sec)<br>- Quantity (ml)<br>Contrast concentration

**CT acquisition parameters**

- With constrast<br>- Without constrast

**CT reconstruction parameters**

- With<br>- Without<br>Séries

**Patient position**

- CR – CA (cranio-caudal direction)<br>Free breathing<br>120 Kv / 10 mA<br>Radiation Treatment position

**Contribution**