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[Keynote] Implementation of Quality Control Procedures in Radiotherapy CT Simulator

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Abstract : Purpose/Objective: Radiotherapy treatment planning requires use of CT simulator, in order to acquire CT images. The overall performance of CT simulator determines the quality of radiotherapy treatment plan, and at the end, the outcome of treatment for every single patient. Therefore, it is strongly advised by international recommendations, to set up a quality control procedures for every machine involved in radiotherapy treatment planning process, including the CT scanner/ simulator. The overall process requires number of tests, which are used on daily, weekly, monthly or yearly basis, depending on the feature tested. Materials/Methods: Two phantoms were used: a dedicated phantom CIRS 062QA, and a QA phantom obtained with the CT simulator. The examined CT simulator was Siemens Somatom Definition as Open, dedicated for radiation therapy treatment planning. The CT simulator has a built in software, which enables fast and simple evaluation of CT QA parameters, using the phantom provided with the CT simulator. On the other hand, recommendations contain additional test, which were done with the CIRS phantom. Also, legislation on ionizing radiation protection requires CT testing in defined periods of time. Taking into account the requirements of law, built in tests of a CT simulator, and international recommendations, the intitutional QC programme for CT imulator is defined, and implemented. Results: The CT simulator parameters evaluated through the study were following: CT number accuracy, field uniformity, complete CT to ED conversion curve, spatial and contrast resolution, image noise, slice thickness, and patient table stability.The following limits are established and implemented: CT number accuracy limits are +/- 5 HU of the value at the comissioning. Field uniformity: +/- 10 HU in selected ROIs. Complete CT to ED curve for each tube voltage must comply with the curve obtained at comissioning, with deviations of not more than 5%. Spatial and contrast resultion tests must comply with the tests obtained at comissioning, otherwise machine requires service. Result of image noise test must fall within the limit of 20% difference of the base value. Slice thickness must meet manufacturer specifications, and patient stability with longitudinal transfer of loaded table must not differ of more than 2mm vertical deviation. Conclusion: The implemented QA tests gave overall basic understanding of CT simulator functionality and its clinical effectiveness in radiation treatment planning. The legal requirement to the clinic is to set up it’s own QA programme, with minimum testing, but it remains user’s decision whether additional testing, as recommended by international organizations, will be implemented, so to improve the overall quality of radiation treatment planning procedure, as the CT image quality used for radiation treatment planning, influences the delineation of a tumor and calculation accuracy of treatment planning system, and finally delivery of radiation treatment to a patient.

Keywords : CT simulator, radiotherapy, quality control, QA programme
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