Contribution ID: **31** Type: **Oral**

Dosimetric and image quality comparison of radiation oncology and radiology head scan protocols

Friday, 28 October 2022 11:45 (10 minutes)

Purpose:

Imaging plays a more and more important role in radiation oncology (RO) treatments with technological advances and increased complexity of treatment techniques (hypofractionation, IGRT, SRT etc.). This study aimed to compare our RO head scan protocols with those present in our radiology (RA) department based on their radiation exposure and image quality.

Methods:

The standard RO head CT scan protocol for treatment planning (PCT) and the head CBCT scan protocol for IGRT were compared with our RA native head scan protocol in addition to our preoperative protocols for the paranasal sinuses and the temporal bone. The devices covered in this study included an MSCT scanner Canon Aquilion and an on-board cone beam CT system at a TrueBeam linac (RO), and for RA, an MSCT scanner Siemens Definition Force and the CBCT scanner NewTom 5GXL. For the dosimetry, an Alderson phantom was used. Thermoluminescent dosimeters (TLD MCP-N, RaDPro) measured absorbed dose (mSv) at sensitive locations (eyes, nasal cavity, thyroid, brain). The mean value of a set of three dosimeters for each location was calculated. CatPhan 604-based images were analyzed using Pylinac scripts for the image quality aspect.

Results:

Measured PCT in-field doses were all in the same range of 46±4 mSv except for the thyroid with a significantly higher value of 71 mSv. RO-CBCT doses were more than an order of magnitude lower. In comparison to the RA protocols, differences in dose were equivalent to the changes in protocol doses (˜30% higher and ˜60% lower for CT and CBCT, respectively, when comparing RO and RA protocols). Similar image quality (MTF, noise and low contrast detectability) was obtained by all the different devices with specific differences found.

Conclusion:

RO-CBCT doses are configured in such a way that sufficient image quality is achieved. This ensures an acceptable total patient dose, even with frequent exposures, and allows, with high geometric fidelity, the position of the tumor and surrounding tissues along with organs at risk to be accurately identified.

Disclosures:
N/A

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Session Classification: Session III: Imaging

Track Classification: Radiation Therapy