Influence of CT contrast agent on head and neck VMAT dose distributions using Acuros XB® algorithm

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Introduction: Intravenous contrast agent injection during the patient CT simulation facilitates radiotherapy contouring in the case of head and neck cancers. However, the image contrast enhancement may introduce discrepancy between the planned and delivered dose. The aim of this retrospective study is to quantify the variations of Hounsfield unites (HU) and to investigate their effect on Volumetric Modulated Arc Therapy (VMAT) dose distributions.

Material and methods: Ten patients previously treated by VMAT techniques with identical dose levels (70/60/50 Gy) were selected. For each patient, two CT scans were performed, 2 min. (CTinj) and 12 min. (CTdelay) after Iomeron® 350 biphasic intravenous injection (60 mL, 1mL/s followed by 90 mL, 2 mL/s after 30 s). The treatment planning (optimization and calculation) was performed with CTinj using the Eclipse TPS and Acuros XB® algorithm. Two other treatment plans were recalculated with the same parameters and CTdelay. The mean HU and the iodine distribution were compared between the two scan images in the PTV50, the parotids and the thyroid. A dosimetric comparison using dose-volume histograms in target volumes and OAR (thyroid, parotids) was performed. The maximum (D2%), minimum (D98%) and median (D50%) doses were registered.

Results: The maximum HU average difference over all the patients was observed in the thyroid (81.37 ± 36.01 HU) followed by the PTV50 (10.76 ± 15.70 HU) and the parotids (9.39 ±16.01 HU). The differences observed with Acuros® algorithm were below 0.2 % for D2%, D98% et D50% in target volumes and 0.31% in OAR.

Conclusion: This study shows that the use of intravenous contrast during CT simulation does not significantly affect dose calculation in head and neck VMAT plans using Acuros® algorithm.