



Glottic Cancer: Is it Time to Change to More Sparing RT-Techniques?

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Short Communication

For decades, the standard of care for radiation treatment of early larynx cancers has been conventional treatment using opposed lateral fields encompassing the larynx and overlying neck structures, including the adjacent carotid arteries. The relative simplicity of the 3D technique and the excellent outcomes were shown in several series [1-4]. The ultimate local control is even higher if we take into account the availability of surgical salvage using hemilaryngectomy or total laryngectomy.

Evidently, early-stage (T1–2N0M0) glottic Squamous Cell Carcinoma (SCC) is a highly curable disease when treated with simple parallel opposed small-field radiotherapy (usually 4 cm x 4 cm or 5 cm x 5 cm). Nevertheless, little effort has been directed to evaluate the late effects and complications that may affect the quality of life of these patients. Major complications described in classic series are very low (<2%) and include chondronecrosis, and chronic laryngeal edema requiring tracheostomy. In this sense, for decades we have known that neck-irradiation increases the risk of cerebrovascular incidents in HNC patients [5-9].

Radiotherapy has emerged as an independent risk factor for accelerating carotid atherogenesis [10-13] and increased rates of cerebrovascular incidents in HNC patients.

The vascular effects can manifest more than 10 years after therapy. The carotid arteries are located eccentrically in the path of lateral beams so may receive higher radiation doses than those prescribed to the Clinical Treatment Volume (CTV). The major consequence of carotid irradiation is direct potential injury, which may also limit future RT options in the case of a metachronous second primary Head-and-Neck Cancer (HNC).

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To determine the prevalence of carotid artery stenosis in patients who have received ipsilateral head-and-neck radiotherapy and have no symptoms of cerebrovascular disease, Martin JD et al. [14] studied forty patients treated at his Institution with ipsilateral neck-RT. All underwent ultrasound and computed tomography angiography of their carotid arteries. The vessels on the irradiated side were compared with those on the unirradiated side. He concluded that Radiation causes carotid artery stenosis but this increased risk principally appears when maximal RT-carotid dose is >50 Gy. (Mean dose 35 Gy). Rosenthal et al. [15] are published in IJROBP their initial experience at MDACC with Intensity Modulated Radiation Therapy (IMRT) in early glottic cancer and showed that IMRT significantly reduced unnecessary radiation dose to the carotid arteries compared with conventional lateral fields while maintaining clinical target volume coverage.

Mechanism of radiation-injured carotid injury has been studied but still is not entirely clear. It is felt to be related to radiation damage to all three layers of the vessel wall, the tunica intima, tunica media and tunica adventitia [16]. The most prevalent non-invasive technique for evaluation of the carotid artery utilizes ultrasound. Ultrasound allows measurement of each individual component of vessel wall thickness and can also reveal the presence and thickness of atherosclerotic plaques.

Carotid Intima-Medial Thickness (CIMT) is defined as the distance between interfaces delineating the luminal aspect of the intimal layer and the outer aspect of the medial layer as seen on carotid ultrasound images. Specifically, the distance is measured between these two white lines seen in the vessel wall when the ultrasound beam is perpendicular to the wall. CIMT is a validated surrogate for cerebrovascular disease [17].

Regarding this topic, Samuels et al. [18] have also recently published an excellent and in-depth revision. They agree more carotid-sparing RT-techniques should be adopted as the standard of care for the treatment of glottic cancer.

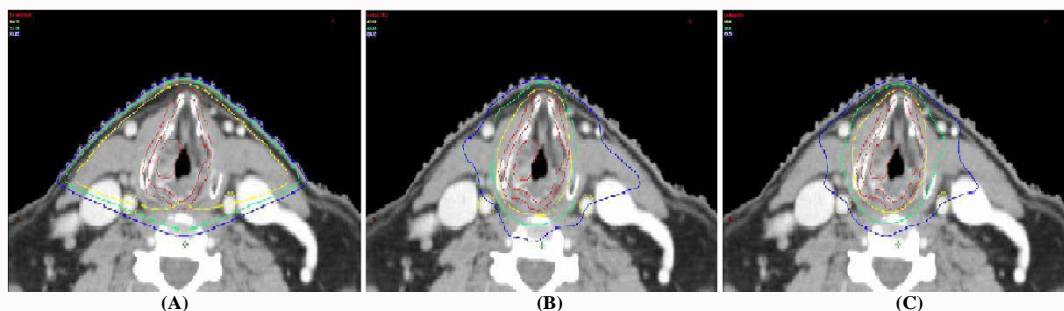


Figure 1: Differences between CTVs doses and carotid doses when comparing three different treatment protocols in the same patient, conventional 3D (Figure 1A), optimized 3D (Figure 1B) and IMRT (Figure 1C).

Apart from IMRT or Volumetric Modulated Arc Therapy (VMAT), there is also the option of sparing- carotid procedure using advanced 3D-planning. In the Figure 1 we can see the differences between CTVs doses and carotid doses when comparing three different treatment protocols in the same patient, conventional 3D (Figure 1A), optimized 3D (Figure 1B) and IMRT (Figure 1C).

Both, optimized 3D and IMRT plans are able to cover the CTV well while sparing the carotid vessels to lower doses in order to decrease the risk of late cardiovascular effects.

In conclusion, based on the literature reviewed, there is clear evidence that high-dose carotid irradiation is associated with an increased risk of several aspects of carotid arterial toxicity (stenosis, increase in intima media thickness, increased arterial wall stiffness and accelerated progression of atherosclerotic plaque, including the most unstable and dangerous plaque subtypes). The more recent implementation of IMRT, VMAT or optimized-3D makes it possible to create radiation treatment plans with sharp dose gradients between the glottic CTV and the carotid arteries. We conclude that high-quality IMRT, VMAT or optimized-3D should be adopted as a new standard of care for the treatment of early glottic cancers.

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