

Active pharyngeal sparing for photon head & neck treatment plans: a feasibility plan study

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Purpose/Objective:

Pharyngeal sparing is increasingly recognized as a crucial approach for reducing treatment-related toxicity in patients with head and neck cancers undergoing radiotherapy (RT) [1]. RT for tumors in the oropharyngeal region often exposes the pharyngeal musculature to high radiation dose, which can lead to long-term complications such as dysphagia, aspiration and fibrosis, significantly impairing quality of life. In this study, we aim to investigate the feasibility to spare the pharyngeal structures in the radiation plan due to proposed constraints of ASTRO [2] and Paetkau [1] without compromising the surrounding organs at risk.

Material/Methods:

We are retrospectively investigating a cohort of ten oro- and nasopharynx cancer patients who were irradiated in our department between June 2023 and May 2024. All treatment plans were generated with Pinnacle (Philips, version 16.2.1) using VMAT technique with two full rotations and 6 MV photons. Prescription dose was $28 \times 1.8\text{Gy} = 50.4\text{Gy}$ to the elective lymphatic drainage and $35 \times 2\text{Gy} = 70\text{Gy}$ for the primary tumor. The contours are auto-segmented by ART-Plan (TheraPanacea, version 2.1.0). The pharyngeal constrictor muscles (PCM) were subdivided into superior, middle and inferior. Besides adequate target volume coverage, attention was paid to $D_{0.03\text{cc}}$ of PRV spinal cord, D_{mean} of the parotid glands and D_{mean} of the oral cavity. In addition, active pharyngeal sparing was based on the following constraints [1, 2]: PCM (superior & middle, sm) D_{mean} : 35–50Gy (if uninvolved), D_{mean} : 45–60Gy (if involved), PCM (inferior) D_{mean} : 20–35Gy (if involved); PCM $D_{63\%} < 55\text{Gy}$; smPCM: $V_{31\text{Gy}} < 100\%$.

Results:

Due to pharyngeal sparing, the average dose values for the individual sections of the pharynx were considerably reduced for the patient group (fig.1). The mean dose reductions for the superior and superior-middle pharyngeal sections were -7.9% and -7.2%, respectively. Improved pharyngeal sparing was achieved without relevant dose increases to the surrounding organs at risk (OAR) (figure 2). Furthermore, as a result of the pharyngeal protection, only minor variations of less than $\pm 1.2\%$ were observed in the dose parameters $D_{2\%}$ and $D_{98\%}$ (dose to 2% respective 98% of the volume) for the PTVs.

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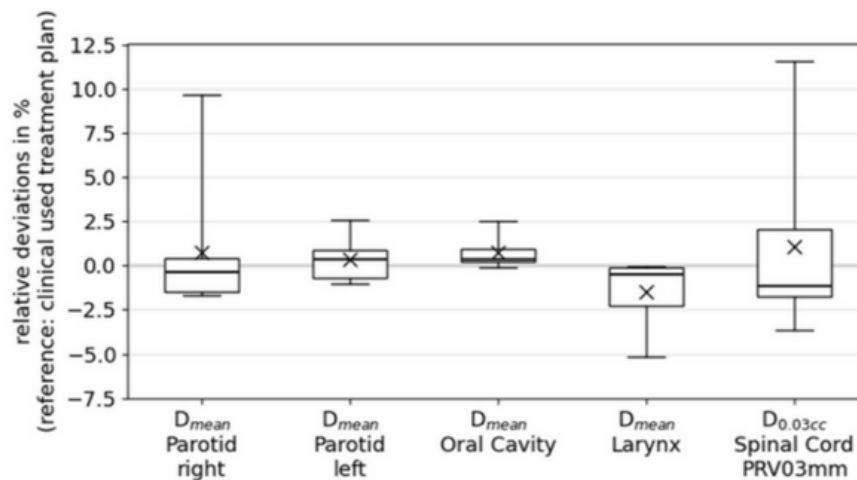


Figure 2: Relative dosimetric deviations for various OARs resulting of pharyngeal sparing RT. "x": mean value. Line: median. The minimum and maximum values are represented by the whiskers. The box displays the interquartile range, which represents the middle 50% of the data.

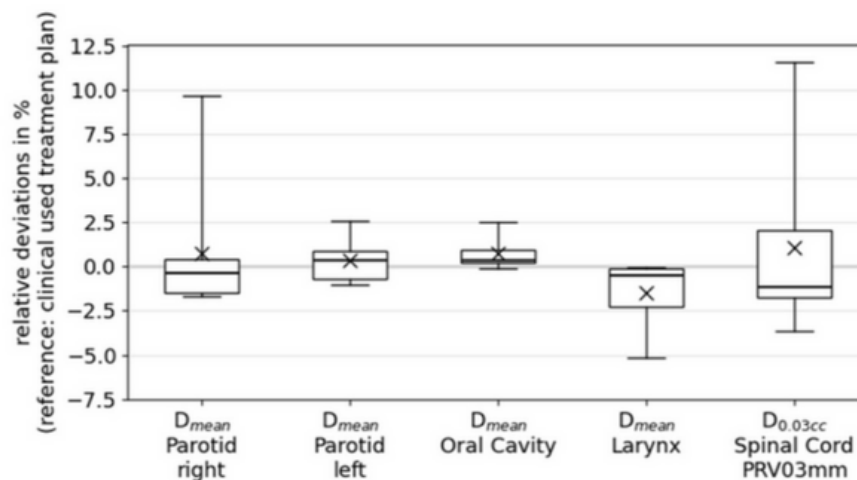


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Conclusion:

Our results show that a potential reduction of the pharyngeal dose in the treatment of head and neck cancers is possible without negative dosimetric effects to the surrounding OARs without compromising the target coverage. We plan to initiate a clinical trial to test the clinical relevant and measurable benefit of this advanced treatment planning technique.

Keywords: head and neck, pharyngeal sparing