

## THE IMPACT OF DYNAMIC PAROTID VOLUME CHANGES AND BODY WEIGHT LOSS ON DOSE DISTRIBUTIONS FOR PATIENTS WITH NASOPHARYNGEAL CANCER RECEIVING INTENSITY-MODULATED RADIATION THERAPY

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**Background** : Intensity-modulated radiation therapy (IMRT) has become the new promising treatment of nasopharyngeal cancer (NPC) in terms of providing excellent tumor coverage with significant sparing of the parotid glands. In this study, we intend to quantify the importance of the volume shrinkage of parotid gland and its influence on the dose distribution of parotid glands among patients with or without significant body weight loss.

**Material and Methods** : From Feb. 2003 to Oct. 2005, 30 patients with NPC were enrolled into this study. 13 patients suffered from significant body weight loss (> 6% of their origin body weight at the end of the 4th week of the entire RT course). A 2nd plan CT scan images were acquired after every patient had received 41.4 to 46.8 Gy of prescribed dose. A second IMRT plan was generated for the cone-down treatment. However, we also created a 2nd plan (Hybrid 2nd plan) for the 1st CT images to assume if no 2nd plan CT images were available.

**Results** : The reductions of body contours are highly correlated with the body weight loss of the patients. The parotid glands decrease in size no matter the patients had significant body weight loss or not. When comparing the dosimetric effects of Hybrid and New 2nd plan, there were no significant dosimetric differences of target coverage. However, increases in the doses of normal tissue such as brainstem, spinal cord, left and right parotid glands were noted. In the subgroup analysis, there were significant increase of spinal cord, brainstem, R't parotid gland doses and hot spots in PTV<sub>CTV1</sub> for patients with significant body weight loss. For patients without significant body weight loss, there were increases of spinal cord and brainstem doses but the target dose coverage remained satisfactory.

**Conclusions** : We conclude that the volume of parotid glands decreased significantly during the course of IMRT even in patients without significant body weight loss. A 2nd

plan CT and a new 2nd IMRT plan based on the new CT scan are needed for the IMRT treatment of NPC.

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Key words: Nasopharyngeal neoplasm, Intensity-modulated radiotherapy, Parotid gland, Weight loss, Radiotherapy planning

## INTRODUCTION

Nasopharyngeal cancer (NPC) is an endemic disease in Southern East Asia, Southern China and Taiwan. Due to the unique anatomic location and radiosensitive nature of the disease, radiotherapy is the mainstay of NPC treatment. However, for most of the survivors treated with conventional radiotherapy, significant treatment-related toxicities (especially xerostomia) have caused major influences on their quality of life [5].

With the development of intensity-modulated radiation therapy (IMRT), improved tumor controls and preservation of the functions of parotid glands could be achieved in patients with NPC [7, 9-11]. In several studies conducted by Eisbruch et al. [4], a mean radiation dose of 26 Gy was found to be the threshold for preserving stimulated saliva flow, which was by direct measuring of the salivary flow rates before and periodically after RT selectively from each major salivary gland. In another study conducted by Chao et al. [3], the stimulated saliva flow at 6 months after treatment was reduced exponentially, for each gland independently, at a rate of approximately 4% per Gy of mean parotid dose. Whereas, in two recent reports conducted by Kwong et al. [8] and Huising et al. [7], salivary functions still could be reserved even after higher radiation dose to the parotid glands (mean dose 38.8 Gy and 43.9 Gy respectively).

Currently, most IMRT planning was based on the acquisition of a single set of CT

series before the start of treatment. Several variables could theoretically cause deviations in radiation dose delivery from the thoughtful initial treatment plan. These uncertainties include daily setup variation, changes of their external body contours, geometric and volumetric changes of targets or normal tissues occurring throughout the 8-week radiotherapy course. These factors might significantly influence the real dose to the parotid glands.

In a study conducted at M.D. Anderson Cancer Center, significant body contours, parotid gland and gross tumor volumes changes were observed during the fractionated radiotherapy for 14 patients with Head and Neck cancer by performing CT three times per week [2]. In their study, the median skin contours at levels of C2 and base of skull were highly correlated to the body weight changes of the patients. Despite that most of their patients lost weight throughout their courses of RT, some patients didn't have significant body weight loss or even gain weight (median -7.1%, range +5.2% to 13%). In our clinical practice, most of the patients suffered from the treatment-related toxicities and have loss their weights during the RT course. However, the magnitude varies among different patients. In this study, we intend to see if repeat imaging and replanning will have significant dosimetry effects on patients with or without significant body weight loss during the IMRT course for their NPC. The dynamic volume changes and dosimetry effects of parotid glands between replanning and non-replanning were also recorded.