

Is Sparing the Deep Lobes of Parotid Gland Necessary on Intensity Modulated Radiation Therapy of Head and Neck Cancers?

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ABSTRACT

RT to the lymphatics of the neck is an essential component in squamous cell cancers of the head and neck (SCCHN). Radiation induced mouth dryness, thickening of saliva and taste alteration affects nutrition and performance status of the patients. Protection of parotid glands from radiation is an important task during RT planning. Contemporary methods such as intensity modulated radiation therapy (IMRT) ease the protection of parotid glands. Most of the recurrences are seen close to the spared deep lobe of parotid glands. Exclusion of the deep lobes for sparing with dosimetric analysis has not been studied in the literature. In this study, we evaluated treatment plannings of 13 patients with SCCHN. As a dosimetric analysis, we compared the applied IMRT and the virtual IMRT without delineation of deep lobe of parotid glands. The dose for lymphatic region was prescribed as 50-54 Gy. Superficial and/or deep lobe of parotid gland was constrained as 26 Gy.

Without definition of deep lobe, the radiation for dose lymphatic region planning target volume (PTV) was achieved without any dose change in the primary or high risk regions. With definition of deep lobe, the mean dose of lymphatic region PTV (not less than 95%) decreased by 5.8% (2.9-3.1 Gy). In conclusion, exclusion of sparing of deep lobe of parotid gland prevents decrease of radiation dose in the lymphatic region. It would be a treatment rationale to avoid the dose drop in the metastatic side of the neck region or the site of high risk for recurrence next to the parotid gland.

Keywords: Radiation therapy, Parotid, Intensity modulated radiation therapy

ÖZET

Baş-Boyun Kanserli Hastalarının YART Tedavisinde Parotis Bezinin ve Derin Loblarının Korunması Gerekli mi?

Baş boyun kanser tanıları hastaların çoğunda, boyun lenfatik bölgesine radyoterapi uygulanır. Radyasyona bağlı ağız kuruluğu, tükürük kıvamında artış ve tat almada değişme hastaların beslenmelerini ve hatta performanslarını etkilemektedir. Radyoterapi planlamasında radyoduyarlı organ olan parotis bezlerinin korunması önemlidir ve son yıllarda yoğunluk ayarlı radyoterapi (YART) bu işi kolaylaştırmıştır. Radyoterapi sonrası boyun bölgesi rekürrenslerinin önemli bir kısmı parotis bezine yakın bölgede görülmektedir. Lenfatik bölgeye yakın olan derin lobun tanımlanmadan YART doz analizi ve dokümantasyonu yapılmamıştır. Bu çalışmada, baş boyun kanserli 13 hastanın derin lob tanımlı ve tanımsız YART tedavi planlarını dozimetrik analiz olarak değerlendirdik. Lenfatik bölge doz tanımı 50-54 Gy ve parotis bezi doz tanımı (yüzeyel ve/veya derin loblar) 26 Gy olarak planlandı. Derin lob tanımlanmadığında, primer bölge ve yüksek riskli bölgelerde doz değişimi olmaksızın lenfatik bölge radyasyon dozu oluşturulmuştur. Derin lob tanımlandığında ise, lenfatik bölgenin özellikle parotis derin lob yakınında olan bölgede %5.8 (2.9-3.1 Gy) doz düşmesi bulundu. Sonuç olarak, parotis bezi derin lobunu tanımlamadan yapılan tedavi planında, boyun lenfatik bölge radyoterapi dozunun düşmesinin engellenebilir. Boyun lenfatik bölge metastazlı taraf veya parotis bezine yakın yüksek riskli bölgede doz düşmelerini engellemede tedavi rasyoneli olarak değerlendirilebilir.

Anahtar Kelimeler: Radyoterapi, Parotis, YART

INTRODUCTION

Radiotherapy (RT) to the neck lymphatics is frequently applied in squamous cell cancers of the head and neck (SCCHN). The major salivary glands of the mouth are parotid glands which produce 65% of total oral salivary output.¹ They are radiosensitive organs at risk for radiation of upper neck or pharyngeal cancers. Protecting parotid gland during RT is important to avoid hyposalivation and xerostomia for optimum quality of life and nutrition.^{2,3} Xerostomia may occur at doses above 26 Gy for parotid glands.⁴ Sparing the parotid glands could be achieved by using intensity modulated RT (IMRT). Furthermore, the deep lobe of parotid gland which is very close to the target lymphatic region to be irradiated causes a series of clinical problems. After definitive IMRT for SCCHN patients, the recurrences are seen in the region of spared parotid gland.^{5,6} Dose escalation is recommended for high risk lymphatic regions at which the majority of local recurrences occur.^{7,8} Nevertheless, the exclusion or inclusion of the deep lobe for IMRT planning is not well documented in terms of its effects on radiation dose of the neighboring lymphatic regions.

In this study, we evaluated treatment plannings of 13 patients of SCCHN. As a dosimetric analysis, we compared the applied IMRT and the virtual IMRT without definition of deep lobe of parotid glands.

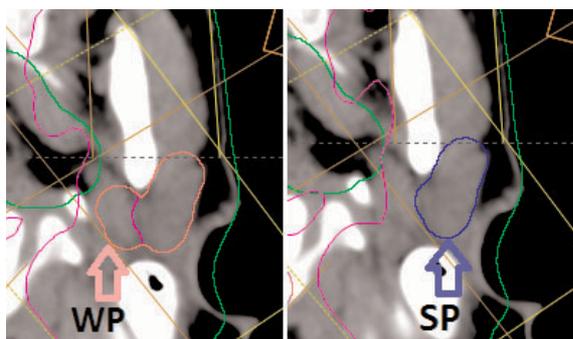


Figure 1. Whole parotid gland and superficial lobe delineation

WP: Whole parotid gland delineation (pink line)
SP: Superficial lobe delineation (blue line)

MATERIALS AND METHODS

Patients

From May 2009 to September 2009, 13 patients with SCCHN were treated with IMRT (Eclipse version 8.1.20) and concomitant weekly chemotherapy. Location of primary cancers were tongue, hypopharynx or nasopharynx. Patient characteristics are summarized in Table 1.

Planning target volume (PTV) of primary nasopharyngeal lesion was treated as Table 1 and PTV of metastatic lymph node site or site of close margins to tumor bed were given 66 Gy (>95%, priority level 80). Elective lymphatic region was treated with 50 Gy for 4 patients and 54 Gy for 9 patients (>95%). Parotid glands (superficial and deep lobes) are delineated and constrained as 20 Gy (<10%) and 26 Gy (<1%, priority level 1.1-1.9).

The virtual IMRT plans were done by delineation of superficial lobe of parotid gland only (Figure 1). Delineation of lymphatic region, dose prescriptions and dose constrains were the same as the original IMRT.

Technique

The dose volume histograms (DVH) of original IMRT and virtual IMRT were assessed for every patient. PTV of lymphatic region is planned for 50 Gy. The lymphatic radiation dose at 95% volume of PTV of lymphatic region (LW50) was noted when the whole parotid gland was constrained. Addi-

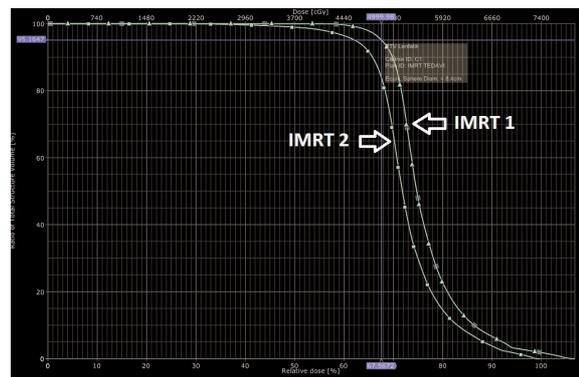


Figure 2. The histograms of IMRT plans and the doses of lymphatic region

IMRT 1: The dose volume graph of lymphatic region in the IMRT with superficial lobe definition

IMRT 2: The dose volume graph of lymphatic region in the IMRT with whole parotid gland definition

Table 1. Patient Characteristics					
Pts	Primary tumor	Sex	Age	Fraction Dose	Fraction No
1	Tongue	M	68	220	30
3	Tongue	F	48	200	33
4	HP	M	61	200	35
5	NP	M	63	200	37
6	NP	F	59	200	37
7	HP	F	66	220	33
8	Tongue	F	53	200	33
9	NP	M	21	200	37
10	NP	M	71	200	37
11	NP	M	65	200	37
12	NP	F	46	200	37
13	NP	M	44	220	33

NP: Nasopharynx, HP: Hypopharynx

onally, the lymphatic radiation dose at 95% volume of PTV of lymphatic region (LS50) was noted when the superficial lobe of parotid gland was constrained. Figure 2 shows the histograms of IMRT plans of a patient and the doses of lymphatic regions. If the patient was treated with 54 Gy for lymphatic region, DVH of IMRT plans were evaluated, and LW54 and LS54 values were noted. The mean values of LW50, LS50, LW54, LS54 were calculated and compared for evaluation.

RESULTS

When the whole parotid gland was delineated for IMRT plan, the mean dose for lymphatic region was 4733 cGy. If the superficial lobe was delineated only, the mean dose for lymphatic region was 5020 cGy. There was no dose change for either PTV for primary lesion nor PTV for metastatic lymph node. The decrease in the dose of lymphatic region was 5.8% (2.9 Gy) and the dose of superficial lobes of parotid glands more than 30 Gy became 2%. For the patients who received 54 Gy to the lymphatic region, the decrease in dose was 5.8% (3.1 Gy) and the dose of superficial lobes of parotid glands more than 30 Gy became 4%.

DISCUSSION

Protecting parotid gland during RT of SCCHN patients is important to avoid hyposalivation and xerostomia. Sparing of the parotid gland could be achieved by using IMRT, comparing with three dimensional conformal RT.⁹ Nevertheless, there are some uncertain points related to volume definition of parotid gland. Firstly, there is no consensus about the cranial border of the RT target volume of the level II neck nodes in the literature. The cranial border of level II is the transverse process of the atlas or at the top of the corpus of the atlas.^{10,11} The dose to the parotid glands depends on the cranial border of the lymph node target volume. Secondly, the parotid gland delineation especially the deep lobe may differ from institution to institution.¹²

The lymphatic region near to deep lobe of parotid gland is affected from this uncertainty. In the literature, recurrent disease of SCCHN patients after IMRT are reported in the region of spared parotid gland.^{5,6} To avoid the recurrences in the neck lymphatic region, the efficient radiation dose should be delivered.¹³ For the high risk lymphatic region, dose escalation is also recommended.^{7,8} By excluding deep lobe of parotid gland delineation, the decrease of radiation dose of lymphatic region was

prevented without any change of dose of primary lesion or lymph node. The mean parotid gland from IMRT plans increases slightly and the superficial lobe which is the major functioning part of parotid gland could be spared. In our dosimetric study, the dose of superficial lobes of parotid gland more than 30 Gy became 2-4% when the deep lobe was excluded. On the other hand lymphatic region next to the parotid gland was given radiation without any decrease of dose.

In conclusion, exclusion of sparing of deep lobe of parotid gland prevents decrease of radiation dose in the lymphatic region. It would be a treatment rationale to avoid the dose drop in the metastatic side of the neck region or the site of high risk for recurrence next to the parotid gland.

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