



Appraisal of Target Definition for Salvage Stereotactic Irradiation of Patients with Hypopharyngeal Cancer After Initial Surgery Alone



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Abstract

Objective: Hypopharyngeal cancers may recur after initial therapy. Some patients refuse to undergo multimodality management and prefer surgery as initial treatment. Even after multimodality treatment, local recurrence may develop during the follow-up period. Stereotactic irradiation offers a highly precise radiotherapeutic modality with improved stereotactic localization of well-defined targets under image guidance. In this study, we evaluated target definition for salvage stereotactic irradiation of patients with hypopharyngeal cancer after initial surgery alone.

Materials and methods: We performed a comparative analysis of target definition by Computed Tomography (CT) simulation images for stereotactic RT planning and with Magnetic Resonance Imaging (MRI).

Results: Stereotactic RT planning has aimed at achieving optimal target coverage without violation of normal tissue dose constraints. IGRT techniques including kilovoltage cone beam CT was used, and salvage stereotactic irradiation was performed by Synergy (Elekta, UK) LINAC. As the primary outcome of the study, we found that CT and MRI defined target definition resulted in differences. Taking this into account, we used fused CT and MRI for ground truth target volume definition for salvage stereotactic irradiation of hypopharyngeal cancer after initial surgery alone.

Conclusion: From the standpoint of radiation oncology, results may have implications for increased adoption of multimodality imaging-based target definition for salvage stereotactic irradiation of hypopharyngeal cancer after initial surgery alone, however, there is still need for future studies to shed light on this critical issue.

Keywords: Hypopharyngeal cancer; Salvage stereotactic irradiation; Target definition; Computed Tomography (CT); Magnetic Resonance Imaging (MRI)

Abbreviations: CT: Computed Tomography; MRI: Magnetic Resonance Imaging; RT: Radiation Therapy; IGRT: Image Guided RT; IMRT: Intensity Modulated RT; ART: adaptive RT; LINAC: Linear Accelerator

Introduction

Hypopharyngeal cancer remains to be a major public health concern with its critical incidence around the globe [1]. Surgery, radiation therapy (RT), and systemic treatments may be utilized alone or in combination for management of hypopharyngeal cancer with respect to patient, disease, and treatment characteristics [2-7]. The head and neck region are associated with critical body functions. Hypopharyngeal tumors have tendency for lymphatic and systemic spread. Also, the critical localization of these tumors in close association with critical structures poses an important concern for surgical management. Recently, stereotactic

irradiation has emerged as a viable treatment technique for management of a variety of cancers throughout the human body. Hypopharyngeal cancers may recur after initial therapy. Some patients refuse to undergo multimodality management and prefer surgery as initial treatment. Even after multimodality treatment, local recurrence may develop during the follow-up period.

Critical advances in technology have occurred during the last decades. Automatic segmentation techniques, molecular imaging methods, Image Guided RT (IGRT), Intensity Modulated RT (IMRT), stereotactic RT, and adaptive RT (ART) techniques

have been introduced for improved irradiation results [8-49]. Stereotactic irradiation offers a highly precise radiotherapeutic modality with improved stereotactic localization of well-defined targets under image guidance. High doses of radiation may be delivered in a single fraction or with a limited number of fractions, and highly conformal treatment with steep dose gradients around the target may allow for optimal irradiation with an acceptable toxicity profile. While external beam RT is still widely accepted as a viable treatment modality for hypopharyngeal cancer management, stereotactic irradiation may also be utilized in certain circumstances. In this study, we evaluated target definition for salvage stereotactic irradiation of patients with hypopharyngeal cancer after initial surgery alone.

Materials and Methods

Department of Radiation Oncology at University of Health Sciences, Gulhane Medical Faculty serves as a tertiary cancer center for patients from Turkey and abroad. A wide spectrum of benign and malignant tumors is irradiated at our department by using contemporary RT approaches. For of this study, the endpoint was targeting definition for salvage stereotactic irradiation of patients with hypopharyngeal cancer after initial surgery alone. All included patients have been referred to Department of Radiation Oncology at Gulhane Medical Faculty, University of Health Sciences for salvage stereotactic irradiation of hypopharyngeal cancer after initial surgery alone. We performed a comparative analysis of target definition by Computed Tomography (CT) simulation images for stereotactic RT planning and with Magnetic Resonance Imaging (MRI). CT simulations of the patients have been done at the CT-simulator (GE Lightspeed RT, GE Healthcare, Chalfont St. Giles, UK) available at our institution. Also, MRI of patients have been acquired and utilized for comparative analysis.

A Linear Accelerator (LINAC) with the capability of sophisticated IGRT techniques was used for stereotactic irradiation. Following rigid patient immobilization, planning CT images have been acquired at CT-simulator for stereotactic RT planning. Afterwards, acquired stereotactic RT planning images were sent to the delineation workstation via the network. Target volumes and critical structures have been defined on these images and structure sets were generated. Also, target definition was also performed on MRI for comparison purposes. All patients underwent stereotactic RT at Department of Radiation Oncology at Gulhane Medical Faculty, University of Health Sciences for salvage stereotactic irradiation of hypopharyngeal cancer after initial surgery alone.

Results

In this study, we investigated target definition for salvage stereotactic irradiation of hypopharyngeal cancer after initial surgery alone. Stereotactic irradiation procedures were carried out at our Radiation Oncology Department of Gulhane Medical Faculty at University of Health Sciences. Prior to salvage stereotactic RT, all

included patients are thoroughly assessed by a multidisciplinary team of experts from surgical oncology, radiation oncology, and medical oncology. Stereotactic RT planning has aimed at achieving optimal target coverage without violation of normal tissue dose constraints. IGRT techniques including kilovoltage cone beam CT was used, and salvage stereotactic irradiation was performed by Synergy (Elekta, UK) LINAC. As the primary outcome of the study, we found that CT and MRI defined target definition resulted in differences. Taking this into account, we used fused CT and MRI for ground truth target volume definition for salvage stereotactic irradiation of hypopharyngeal cancer after initial surgery alone.

Discussion

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From the standpoint of radiation oncology, results may have implications for increased adoption of multimodality imaging-based target definition for salvage stereotactic irradiation of hypopharyngeal cancer after initial surgery alone, however, there is still need for future studies to shed light on this critical issue.

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