

Reappraisal of Treatment Volume Determination for Recurrent Gastroesophageal Junction Carcinoma (GJC)

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ABSTRACT

Objective: Gastroesophageal junction carcinoma (GJC) is a frequent type of upper gastrointestinal tract cancer with rising incidence. Local recurrence may be frequent during the course of disease. Management of patients must be performed on an individual basis by use of multidisciplinary strategy. Surgery serves as the main modality of management for GJC, nevertheless, radiation therapy (RT) may also be used for treatment. RT may play an integral role as the supplementary or definitive therapeutic option, and recurrent disease may also benefit from irradiation. Treatment of recurrent MCC may be more challenging, however, RT has been used for recurrent GJC management to achieve optimal therapeutic outcomes. In this original research article, we sought to evaluate treatment volume determination for recurrent GJC.

Materials and Methods: The main purpose of this study was to evaluate treatment volume determination for recurrent GJC irradiation based on CT only or fused CT-MRI. We have conducted a comparative analysis for assessment of treatment volume determination by CT simulation images only or by integration of MRI.

Results: Ground truth target volume served as the reference for comparative assessment, and results revealed that use of fused CT-MRI based treatment volume determination has been identical with ground truth treatment volume determination in this selected group of patients with recurrent GJC.

Conclusion: Multimodality imaging with incorporation of MRI in RT treatment volume determination process may be utilized for patients with recurrent GJC. Clearly, further studies are required to shed light on this critical issue.

Keywords: Gastroesophageal Junction Carcinoma (GJC); Radiation Therapy (RT); Magnetic Resonance Imaging (MRI)

Abbreviations: GJC: Gastroesophageal Junction Carcinoma; RT: Radiation Therapy; MRI: Magnetic Resonance Imaging; IGRT: Image Guided Radiation Therapy; IMRT: Intensity Modulated Radiation Therapy; ART: Adaptive Radiation Therapy; LINAC: The Linear Accelerator ; ICRU: International Commission on Radiation Units and Measurements

Introduction

Gastroesophageal junction carcinoma (GJC) is a frequent type of upper gastrointestinal tract cancer with rising incidence [1-7]. Local recurrence may be frequent during the course of disease. Management of patients must be performed on an individual basis by use of multidisciplinary strategy. Surgery serves as the main modality of management for GJC, nevertheless, radiation therapy

(RT) may also be used for treatment. RT may play an integral role as the supplementary or definitive therapeutic option, and recurrent disease may also benefit from irradiation. Treatment of recurrent MCC may be more challenging, however, RT has been used for recurrent GJC management to achieve optimal therapeutic outcomes. Improved treatment results may be achieved in cancer management in the millenium era with several advances in technology. Within this context,

quality of life issues and normal tissue sparing may be considered as pertinent aspects of contemporary irradiation. Incorporation of sophisticated therapeutic approaches and technologies such as molecular imaging methods, automatic segmentation techniques, Image Guided RT (IGRT), Intensity Modulated RT (IMRT), stereotactic RT, and adaptive RT (ART) may improve RT results [8-49]. Nevertheless, improvements in target definition may be considered as an important part of contemporary irradiation approaches. Currently, common practice includes utilization of Computed Tomography (CT) simulation for acquisition of radiation treatment planning images, nevertheless, integration of other imaging modalities such as Magnetic Resonance Imaging (MRI) may substantially add to the accuracy of target definition as addressed in other studies [50-93]. In this original research article, we sought to evaluate treatment volume determination for recurrent GJC.

Materials and Methods

Our Department of Radiation Oncology at Gulhane Medical Faculty, University of Health Sciences serves as a tertiary cancer center with the capability of treating a huge patient population from several places from Turkey and other countries. Within this context, we have been irradiating a plethora of cancers annually for decades. The main purpose of this study was to evaluate treatment volume determination for recurrent GJC irradiation based on CT only or fused CT-MRI. We have conducted a comparative analysis for assessment of treatment volume determination by CT simulation images only or by integration of MRI. Primary objective of this original research article was to evaluate the inclusion of multimodality imaging for treatment volume determination, however, contouring of critical structures, interobserver and intraobserver variations were also assessed. Ground truth target volume has been utilized for comparative analysis, and was defined by board certified radiation oncologists after detailed evaluation of all imaging and related data with thorough colleague peer review and consensus. Decision making procedure for optimal treatment has involved multidisciplinary input from experts on surgical oncology, radiation oncology, medical oncology. Individualized patient evaluation included consideration of patient, disease, and treatment related factors. Patient age, previous treatments, symptomatology, lesion size, performance status, lesion location and association with critical structures, contemplated outcomes of therapies, patient preferences and logistical issues have been all considered. The Linear Accelerator (LINAC) furnished with the capability of contemporary IGRT techniques has been utilized for RT. Following rigid patient immobilization, planning CT images were acquired at CT simulator for radiation treatment planning. Then, acquired RT planning images have been transferred to the delineation workstation through the network. Target volumes and normal tissues have been defined on these images and structure sets have been generated. Either CT simulation images only or fused CT-MR images have been used for assessment and comparative analysis.

Results

This original research article was designed to assess the utility of multimodality imaging with integration of MRI for treatment volume determination in a selected group of patients with recurrent GJC. Treatment of patients was executed at our Radiation Oncology Department of Gulhane Medical Faculty at University of Health Sciences, Ankara. Before irradiation, patients have been assessed individually by a multidisciplinary team of experts from surgical oncology, medical oncology and radiation oncology. Briefly, we carried out a comparative analysis based on either CT only imaging or by fused CT-MRI to assess the utility of this contemporary approach. Optimal radiation treatment planning procedure included consideration of lesion sizes, localization and association with surrounding normal tissues. Radiation physicists were involved in radiation treatment planning processes with consideration of reports by American Association of Physicists in Medicine (AAPM) and International Commission on Radiation Units and Measurements (ICRU). Precise radiation treatment planning procedure included consideration of electron density, tissue heterogeneity, CT number and HU values in CT images. Primary objective of radiation treatment planning has been to achieve optimal coverage of treatment volume with minimal exposure of surrounding critical structures. Ground truth target volume served as the reference for comparative assessment, and results revealed that use of fused CT-MRI based treatment volume determination has been identical with ground truth treatment volume determination in this selected group of patients with recurrent GJC.

Discussion

GJC can be considered as a frequently encountered type of upper gastrointestinal tract cancers with rising incidence. Recurrent disease may be observed despite initial management. Treatment of patients should be done on an individual basis by use of a multidisciplinary approach. Surgery is the main therapeutic modality for management of GJC, however, RT may also be used for management. RT can have an important role as the supplementary or definitive therapeutic option, and recurrent disease may also be treated by RT. Management of recurrent GJC may be more challenging, nevertheless, RT can be utilized for recurrent GJC management to achieve optimal therapeutic outcomes. Better therapeutic results may be achieved in cancer management in the millenium era by virtue of several advances in technology. Within this context, quality of life issues and critical organ protection may be considered as critical aspects of sophisticated RT strategies. Integration of contemporary treatment strategies and technologies such as molecular imaging methods, automatic segmentation techniques, IGRT, IMRT, stereotactic RT, and ART may further improve therapeutic outcomes [8-49]. However, precision in target definition may be considered as an indispensable component of sophisticated RT strategies. Meanwhile, widely accepted practice includes use of CT simulation for acquisition of radiation treatment

planning images, however, incorporation of other imaging modalities such as MRI may add to the precision of target definition as addressed in other studies [50-93]. In this original research article, we aimed to assess treatment volume determination for recurrent GJC. In conclusion, multimodality imaging with incorporation of MRI in RT treatment volume determination process may be utilized for patients with recurrent GJC. Clearly, further studies are required to shed light on this critical issue.

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