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# Assessment of Target Definition for Extramedullary Soft Tissue Plasmacytoma: Use of Multımodalıty Imaging for Improved Targetıng Accuracy

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**Abstract**

Objective: Extramedullary soft tissue plasmacytoma is a relatively rare type of plasma cell neoplasms mostly occurring in the head and neck region and mucosal area of the upper aerodigestive passages. Radiation therapy (RT) may be utilized for management of extraosseous soft tissue plasmacytomas. improved target definition may be considered as a highly important component of current sophisticated RT approaches. While the most common practice includes the utilization of Computed Tomography (CT) simulation for acquisition of RT planning images, incorporation of other imaging modalities such as Magnetic Resonance Imaging (MRI) may add to the accuracy of target definition. In this original research article, we assess target definition for extramedullary soft tissue plasmacytoma.

Materials and Methods: The patients who have been referred to Department of Radiation Oncology at Gulhane Medical Faculty, University of Health Sciences for radiotherapeutic management of extramedullary soft tissue plasmaytomas were assessed for target definition based on CT only or fused CT-MRI.

Results: Comparative analysis has revealed that utilization of fused CT-MRI based target definition has been identical with ground truth target volume definition for assessed patients with extramedullary soft tissue plasmacytoma.

Conclusion: CT may serve as a preferable method for imaging and dose calculation purposes. However, integration of other imaging modalities may contribute to optimization of target definition for improved targeting accuracy. Our results support the utility of multimodality imaging for precise radiotherapeutic management of extramedullary soft tissue plasmacytomas. Clearly, future studies are needed to shed light on this critical issue.

**Keywords:** Extramedullary soft tissue plasmacytoma; Radiation therapy (RT); Magnetic Resonance Imaging (MRI)

## Introduction

Extramedullary soft tissue plasmacytoma is a relatively rare type of plasma cell neoplasms mostly occurring in the head and neck region and mucosal area of the upper aerodigestive passages [1-4]. To establish the diagnosis of solitary plasmacytoma, a histological verification of clonal plasma cells at a single site is needed. Also, there should be no bone marrow involvement, no clonal plasmacytosis, no bony involvement, no anemia, no hypercalcemia or renal impairment [2-4]. Solitary plasmacytomas may present with single bony lesions referred to as "medullary" or as soft tissue lesions mostly within the mucosal area of upper aerodigestive passages. Radiation therapy (RT) may be utilized for management of extraosseous soft tissue plasmacytomas [5]. Advances in patient management has been reflected by improved therapeutic outcomes, and quality of life issues and normal tissue sparing have been critical considerations for RT. Integration of contemporary therapeutic concepts and technologies such as molecular imaging methods, automatic segmentation techniques, Image Guided RT (IGRT), Intensity Modulated RT (IMRT), stereotactic RT, and adaptive RT (ART) approaches have considerably contributed to radiotherapeutic management [6-

45]. Nevertheless, improved target definition may be considered as a highly important component of current sophisticated RT approaches. While the most common practice includes the utilization of Computed Tomography (CT) simulation for acquisition of RT planning images, incorporation of other imaging modalities such as Magnetic Resonance Imaging (MRI) may add to the accuracy of target definition as addressed in several studies [46-84]. Herein, we assess target definition for extramedullary soft tissue plasmacytoma with this original research article.

## Materials and Methods

The patients who have been referred to Department of Radiation Oncology at Gulhane Medical Faculty, University of Health Sciences for radiotherapeutic management of extramedullary soft tissue plasmaytomas were assessed for target definition based on CT only or fused CT-MRI. A comparative analysis was undertaken for evaluation of target definition based on CT simulation images only or by incorporation of MRI. The main outcome measure of the study was to investigate the utility of multimodality imaging for target definition, however, contouring of critical organs, interobserver and intraobserver variations were also assessed. The ground truth target volume has been used for comparative analysis and for comparison purposes, and it has been defined by attending physicians following meticulous assessment of all imaging and relevant data with detailed colleague peer review and consensus. Decision making process for optimal patient management has involved multidisciplinary input from experts on surgical oncology, radiation oncology, medical oncology and hematology. Individualized assessment included consideration of patient, disease, and treatment related characteristics. Patient age, prior treatments, symptomatology, lesion size, performance status, lesion localization and association with surrounding normal tissues, expected results of offered treatments, patient preferences and logistical issues were all considered in decision making.

A Linear Accelerator (LINAC) with the capability of sophisticated IGRT techniques has been utilized for irradiation. Following rigid immobilization of the patients, planning CT images have been acquired at CT simulator for RT planning. Thereafter, acquired RT planning images were sent to the contouring workstation via the network. Target volumes and critical structures were outlined on these images and structure sets were generated for patients. Either CT simulation images only or fused CT-MR images have been used for comparative assessment and analysis.

## Results

This original research article has been designed to assess the utility of multimodality imaging with integration of MRI for target definition in a selected group of patients who were referred for irradiation of extramedullary soft tissue plasmacytoma. Treatment of patients was carried out in Radiation Oncology Department of Gulhane Medical Faculty at University of Health Sciences, Ankara. Before management with RT, all patients have been assessed individually by multidisciplinary input from relevant disciplines of surgical oncology, radiation oncology, medical oncology and hematology. Briefly, a comparative evaluation has been performed for target and critical organ definition by use of either CT only imaging or by fused CT-MRI to investigate the utility of this contemporary approach. Precise RT planning process included consideration of lesion sizes, location and association with normal tissues in close vicinity. Radiation physicists with considerable expertise on their subject have been involved in RT planning procedures with consideration of reports by American Association of Physicists in Medicine (AAPM) and International Commission on Radiation Units and Measurements (ICRU). Optimized RT planning process has included utmost consideration of electron density, tissue heterogeneity, CT number and HU values in CT images. Prioritized objective of RT planning has been to maintain optimal encompassing of the target volume with minimal exposure of critical structures. Comparative analysis by use of the ground truth target volume as the reference has revealed that utilization of fused CT-MRI based target definition has been identical with ground truth target volume definition for assessed patients with extramedullary soft tissue plasmacytoma.

## Discussion

Extramedullary soft tissue plasmacytoma constitutes a rare type of plasma cell neoplasms which mostly occur in the head and neck region and mucosal area of the upper aerodigestive passages [1-4]. A histological verification of clonal plasma cells at a single site is required for establishing the diagnosis of solitary plasmacytoma. Additionally, there should be no bone marrow involvement, no clonal plasmacytosis, no bony involvement, no anemia, no hypercalcemia or renal impairment [2-4]. Solitary plasmacytomas could present with single bony lesions referred to as "medullary" or as soft tissue lesions typically within the mucosal area of upper aerodigestive passages. RT might be used for treatment of extraosseous soft tissue plasmacytomas [5]. Improvements in technology and treatment strategies have translated into optimized treatment results, hence quality of life issues and normal tissue sparing have recently been more critical aspects of radiotherapeutic management. Incorporation of state of the art technologies and evolutionary treatment concepts including automatic segmentation techniques, IGRT, molecular imaging methods, IMRT, stereotactic RT, and ART strategies critically improved management [6-45]. As a matter of fact, optimal target determination could be considered as a critical and indispensable component of contemporary sophisticated irradiation strategies. For the time being, most common practice includes the use of CT simulation for acquisition of RT planning images. CT may serve as a preferable method for imaging and dose calculation purposes. However, integration of other imaging modalities may contribute to optimization of target definition



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for improved targeting accuracy [46-84]. To conclude, our results support the utility of multimodality imaging for precise radiotherapeutic management of extramedullary soft tissue plasmacytomas. Clearly, future studies are needed to shed light on this critical issue.

## Conflict of Interest

There are no conflicts of interest and no acknowledgements.

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