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Evaluation of Target Definition for Radiotherapeutic Management of Recurrent Merkel Cell Carcinoma (MCC)

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Abstract

Objective: Merkel cell carcinoma (MCC) is a relatively rare type of skin cancer which typically follows an aggressive disease course. Local recurrence is frequent for patients with MCC. Management of patients should be performed by use of a multidisciplinary approach. Surgery is a principal mode of treatment for MCC, however, radiation therapy (RT) may also be used in certain circumstances. We assessed target definition for radiotherapeutic management of recurrent MCC in this original research article.

Materials and methods: The aim of this study has been to assess target definition for radiotherapeutic management of recurrent MCC based on Computed Tomography (CT) only or fused CT-MRI (Magnetic Resonance Imaging). We conducted a comparative analysis for evaluation of target definition by CT simulation images only or by incorporation of MRI. Main objective of the study has been to assess the integration of multimodality imaging for target definition.

Results: Ground truth target volume has been used as the reference for comparative analysis, and results revealed that use of fused CT-MRI based target definition was identical with ground truth target volume definition in selected group of patients with recurrent MCC.

Conclusion: Multimodality imaging with integration of MRI in RT target definition procedure may be used for patients with recurrent MCC despite the need for further supporting evidence.

Keywords: Merkel Cell Carcinoma (MCC); Radiation therapy (RT); Magnetic Resonance Imaging (MRI)

Introduction

Merkel cell carcinoma (MCC) is a relatively rare type of skin cancer which typically follows an aggressive disease course [1-7]. Local recurrence is frequent for patients with MCC [1-7]. Management of patients should be performed by use of a multidisciplinary approach. Surgery is a principal mode of treatment for MCC, however, radiation therapy (RT) may also be used in certain circumstances [1-7]. RT may have a role as supplementary or definitive therapeutic option, recurrent disease may also benefit from irradiation [1-7]. Given the relative rarity of MCC, literature data from case series, retrospective studies, experiences from big treatment centers, and collaborative guidelines have been followed for optimal patient treatment [1-7]. RT has been utilized for MCC management, sometimes for its improved toxicity profile compared to other therapeutic options [1-7]. Treatment of recurrent MCC may even be more challenging.

Improved patient management may be observed by better treatment results in the millenium era. In this context, quality of life issues and normal tissue sparing are considered as more critical aspects of current radiotherapeutic management. Integration of contemporary treatment 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) may improve RT results [8-49]. However, advances in target definition can be thought as a critical part of modernized RT strategies. Common practice includes the use of Computed Tomography (CT) simulation for acquisition of RT planning images, however, incorporation of other imaging modalities such as Magnetic Resonance Imaging (MRI) may clearly add to the precision of target definition as mentioned in several other studies [50-93]. Herein, we assess

target definition for radiotherapeutic management of recurrent MCC.

Materials and Methods

Department of Radiation Oncology at Gulhane Medical Faculty, University of Health Sciences currently serves as a tertiary cancer center with a huge patient population from several places from Turkey and allied countries. In this context, a variety of cancers are treated annually for decades. The aim of this study has been to assess target definition for radiotherapeutic management of recurrent MCC based on CT only or fused CT-MRI. We conducted a comparative analysis for evaluation of target definition by CT simulation images only or by incorporation of MRI. Main objective of the study has been to assess the integration of multimodality imaging for target definition, nevertheless, delineation of normal tissues, interobserver and intraobserver variations have also been evaluated. Ground truth target volume was used for comparative analysis and for comparison purposes, and it has been 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 and hematology. 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 taken into account.

A Linear Accelerator (LINAC) furnished with the capability of contemporary IGRT techniques was used for RT. After 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 were utilized for evaluation.

Results

We have conducted this study to evaluate the use of multimodality imaging with incorporation of MRI for target delineation in a selected group of patients referred for recurrent MCC RT. Treatment of patients have been performed in our Radiation Oncology Department of Gulhane Medical Faculty at University of Health Sciences, Ankara. Prior to treatment with RT, patients were individually evaluated by a multidisciplinary team of experts from surgical oncology, medical oncology and radiation oncology. Briefly, we have conducted a comparative assessment based on either CT only imaging or by fused CT-MRI to explore the use of this sophisticated strategy. Optimal radiation treatment planning procedure included consideration of lesion sizes, localization and association with surrounding critical structures. Radiation physicists were involved in radiation treatment planning processs with consideration of reports by American Association of Physicists in Medicine (AAPM) and International Commission on Radiation Units and Measurements (ICRU). Accurate radiation treatment planning procedure included critical consideration of electron density, tissue heterogeneity, CT number and HU values in CT images. Main consideration in radiation treatment planning was to achieve optimal coverage of target volume with minimized exposure of surrounding normal tissues. Ground truth target volume has been used as the reference for comparative analysis, and results revealed that use of fused CT-MRI based target definition was identical with ground truth target volume definition in selected group of patients with recurrent MCC.

Discussion

MCC is considered as a relatively seldom type of skin cancers mostly following an aggressive disease course [1-7]. Local recurrence may be encountered after initial management [1-7]. Treatment of patients should be handled by experienced centers which utilize a multidisciplinary therapeutic strategy. Surgery serves as the main modality of management for patients with MCC, nevertheless, RT may also play a role in treatment [1-7]. RT may be used as a supplementary or definitive treatment modality, and for management of recurrent disease [1-7]. Taking into account the relative rarity of MCC, literature data from case series, retrospective studies, experiences from big treatment centers, and collaborative guidelines are for exploited for optimal management [1-7]. RT has been used for MCC treatment, sometimes for its improved toxicity profile compared with other treatment modalities [1-7]. Management of recurrent MCC may even be more challenging due to several factors.

Optimal patient management may be achieved and improved treatment results could be obtained through several advances in the millenium era. Within this context, quality of life issues and critical organ protection may be considered as pertinent aspects of contemporary RT strategies. Incorporation of sophisticated therapeutic concepts and technologies such as molecular imaging methods, automatic segmentation techniques, IGRT, IMRT, stereotactic RT, and ART may further improve radiotherapeutic outcomes [8-49]. Nevertheless, improved target definition may also be considered as a critical part of current irradiation approaches. In the meantime, CT simulation is still the widely accepted technique for acquisition of radiation treatment planning images, however, incorporation of other imaging modalities such as MRI may improve the accuracy in target definition as addressed by other studies [50-93].

Conclusion

In conclusion, multimodality imaging with integration of MRI in RT target definition procedure may be used for patients with recurrent MCC despite the need for further supporting evidence.

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Conflict of Interest

There are no conflicts of interest and no acknowledgements.

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