Cancer Therapy & Oncology
International Journal
ISSN: 2473-554X

Juniper Publishers
key to the Researchers

Research Article
Volume 25 Issue 1 - September 2023
DOI: 10.19080/CTOIJ.2023.25.556155

Cancer Ther Oncol Int J

Reevaluation of Postradiotherapy Seroma Changes in Locally Advanced Breast Cancer

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Submission: August 31, 2023; **Published:** September 12, 2023

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Abstract

Objective: In this study, we evaluated posttreatment volume changes for locally advanced breast cancer.

Materials and methods: Primary goal of this study has been to evaluate volume change of seroma for locally advanced breast cancer. We have carried out a comparative analysis of treatment volume changes by CT simulation images with integration of MRI. While we primarily focused on evaluation of incorporated multimodality imaging for treatment volume determination, we also assessed critical organ contouring along with interobserver and intraobserver variations. Ground truth target volume has been utilized for comparative analysis, and it was determined by board certified radiation oncologists after detailed evaluation of all imaging and relevant data with thorough colleague peer review and consensus.

Results: Seroma target volume was used as the reference for comparative evaluation, and 20% decreasing in seroma was revealed after radiotherapy with the use of MRI in our selected group of patients with locally advanced breast cancer.

Conclusion: Multimodality imaging may be suggested to improve seroma target changes in patients with locally advanced breast cancer despite the need for further supporting evidence.

Keywords: Seroma; Breast cancer; Radiation therapy (RT); MRI (Magnetic Resonance Imaging)

Introduction

Globally, breast cancer is the most frequently diagnosed malignancy, accounting for over two million cases each year. It is also the leading cause of cancer death in women worldwide. In the United States, breast cancer is the most common female cancer, and the second most common cause of cancer death in women.

Once a diagnosis of breast cancer is established, it is important to accurately define the initial extent of disease since this information will affect treatment recommendations. This topic will review the clinical manifestations, differential diagnosis, and staging following a diagnosis of breast cancer. The factors that modify breast cancer risk, the treatment approach to in situ and invasive breast cancer, and the use of prognostic and predictive factors when making adjuvant treatment decisions are separate topics [1-7].

While the use of high effective doses may clearly contribute to improved local control outcomes, adverse effects of irradiation should also be considered to maintain patient's quality of life. In the millennium era, there have been several advances in technology which improved the delivery of irradiation. Molecular imaging methods, automatic segmentation techniques, Image Guided RT (IGRT), Intensity Modulated RT (IMRT), stereotactic RT, and adaptive RT (ART) have been introduced for facilitating optimal radiotherapeutic management of patients [8-49]. Admittedly, best therapeutic results could be obtained through close collaboration among related disciplines for cancer management.

Tumor boards bring together surgical oncologists, radiation oncologists, medical oncologists, imaging, and other relevant specialists to discuss about patient, tumor, and treatment characteristics to find out the management strategy for individualized optimal management. From the standpoint of radiation oncology, optimal target volume determination and normal tissue sparing are among the critical considerations for optimal radiotherapeutic management. While definition of larger target volumes may result in excessive radiation induced toxicity, determination of smaller treatment volumes may eventually lead to treatment failure. Within this context, efforts to improve target definition may translate into improved radiotherapeutic results

from the perspectives of local control and toxicity. For the time being, Computed Tomography (CT) simulation constitutes the commonly practiced method for acquisition of radiation treatment planning images, however, inclusion of other imaging modalities such as Magnetic Resonance Imaging (MRI) may potentially add to the accuracy of target definition which has been addressed by other studies [50-99]. In this study, we evaluated seroma volume changes in patients with locally advanced breast cancer.

Materials and Methods

For several decades, we have been treating a high patient population from many places from Turkey and abroad at Department of Radiation Oncology at Gulhane Medical Faculty, University of Health Sciences. Within this prospect, a plethora of benign and malignant tumors have been irradiated at our tertiary cancer centre for a long time. Primary goal of this study has been to evaluate posttreatment seroma volume changes based on CT only or fused CT-MRI in patients with locally advanced breast cancer. We have carried out a comparative analysis of treatment volume determination by CT simulation images only or by integration of MRI. While we primarily focused on evaluation of incorporated multimodality imaging for treatment volume determination, we also assessed critical organ contouring along with interobserver and intraobserver variations. Ground truth target volume has been utilized for comparative analysis, and it was determined by board certified radiation oncologists after detailed evaluation of all imaging and relevant data with thorough colleague peer review and consensus. Decision making procedure for individualized patient management has involved multidisciplinary input from experts on surgical oncology, radiation oncology, medical oncology. Patient, disease, and treatment related factors were all considered. Patient age, previous treatments, symptomatology, lesion size, performance status, lesion localization and association with normal tissues, contemplated outcomes of alternative treatment alternatives, patient preferences and logistical issues have also been considered.

A Linear Accelerator (LINAC) furnished with sophisticated IGRT techniques has been utilized for RT. Following robust patient immobilization, planning CT images were obtained at CT simulator for radiation treatment planning. Then, acquired RT planning images have been transferred to the delineation workstation via the network. Treatment volumes and normal tissues have been outlined 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 data analysis.

Results

We designated this original research article to assess the utility of multimodality imaging with incorporation of MRI for treatment volume determination for a selected group of patients with locally advanced breast cancer. Irradiation of patients was performed at our Radiation Oncology Department of Gulhane Medical Faculty at University of Health Sciences, Ankara. Before irradiation, patients were individually evaluated by multidisciplinary collaboration of surgical oncology, medical oncology and radiation oncology disciplines. Briefly, we executed a comparative analysis based on either CT only imaging or by fused CT-MRI to evaluate the use of this sophisticated strategy. Optimal RT planning procedure included consideration of lesion sizes, localization, and association with nearby critical structures. Radiation physicists were included in RT planning process with consideration of reports by American Association of Physicists in Medicine (AAPM) and International Commission on Radiation Units and Measurements (ICRU). Precise RT planning process included consideration of electron density, tissue heterogeneity, CT number and HU values in CT images. Primary objective of RT planning has been to achieve optimal coverage of treatment volumes along with minimized exposure of surrounding critical structures. Ground truth target volume was used as the reference for comparative evaluation, and our results revealed that use of fused CT-MRI based treatment volume determination was identical with ground truth target definition in our selected group of patients with locally advanced breast cancer. 20% decreasing was noted in seroma volume in our selected locally advanced breast cancer patients with the use of MRI.

Discussion

For patients with LABC, the traditional prognostic and predictive factors might still be valid. A recent retrospective analysis of the SEER database including 36,500 patients with stage III breast cancer concluded that the breast cancer specific mortality was remarkably high and depended on stage (IIIA vs. IIIB vs. IIIC), expression of estrogen and progesterone receptors, histologic grade, nodal status, and race. The cumulative breast cancer specific mortality at 20 years from diagnosis varied between 43% in patients with estrogen receptor positive stage IIIA carcinomas to 69% in patients with stage IIIC hormone receptor negative breast cancer. Late relapses after 5 years varied by stage at presentation but was much higher in patients with hormone receptor positive disease (62–65%) than in those with hormone receptor negative disease (21–28%). Advances in systemic and radiation therapy as well as in surgery in recent years are slowly improving the prognosis in patients with LABC.

In this study, we focused on seroma changes in locally advanced breast cancers treated by radiotherapy. We documented changes in tumor size following radiotherapy in patients with locally advanced breast cancers. We have revealed that there was a mean decrease of 20% in seroma size after radiotherapy in our selected group of patients with locally advanced breast cancer. Clearly, response assessment after therapeutic strategies may be critical. Widely accepted endpoints in studies focusing on neoadjuvant therapeutic strategies include pathological complete response rates, overall survival, and toxicity. Nevertheless, our results may have some critical implications from the standpoint of

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oncological management for patients with locally advanced breast cancers and further studies may be needed.

Conflict of Interest and Acknowledgement

There are no conflicts of interest and no acknowledgement.

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How to cite this article: Bora U, Hakan G. Reevaluation of Postradiotherapy Seroma Changes in Locally Advanced Breast Cancer. Canc Therapy & Oncol Int J. 2023; 25(1): 556155. DOI: 10.19080/CTOIJ.2023.25.556155

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How to cite this article: Bora U, Hakan G. Reevaluation of Postradiotherapy Seroma Changes in Locally Advanced Breast Cancer. Canc Therapy & Oncol Int J. 2023; 25(1): 556155. DOI: 10.19080/CTOIJ.2023.25.556155

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DOI: 10.19080/CTOIJ.2023.25.556155

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