



Research Article

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Tumor Size Changes After Systemic Therapy in Patients with Oligometastatic Bladder Cancer



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Abstract

Objective: The oligometastatic paradigm proposes that selected patients may benefit from aggressive multimodality treatment strategies combining systemic therapy with local ablative approaches such as surgery or radiotherapy. The magnitude of tumor response following systemic therapy and its implications for local treatment planning remain incompletely defined in oligometastatic bladder cancer. In this study, we aimed to evaluate tumor size changes after systemic therapy in patients with oligometastatic bladder cancer.

Materials and Methods: Patients diagnosed with oligometastatic bladder cancer who had available radiological imaging before and after systemic therapy were included. Tumor measurements were obtained from diagnostic imaging studies performed before initiation of systemic therapy and after completion of systemic treatment. Tumor size changes were assessed for both the primary bladder tumor and metastatic lesions using standardized radiological criteria. Comparative analyses were performed to document changes in tumor dimensions following systemic therapy.

Results: Patients with oligometastatic bladder cancer were analyzed. All patients completed planned systemic therapy. Comparative analysis of imaging studies demonstrated a notable reduction in tumor size following systemic treatment in the majority of patients.

Conclusion: Systemic therapy leads to significant tumor size reduction in patients with oligometastatic bladder cancer. These changes may have meaningful implications for radiotherapy planning and support the integration of adaptive and individualized radiotherapy strategies in this patient population. Further prospective studies are needed to optimize multimodality treatment approaches and improve clinical outcomes.

Keywords: Bladder cancer; Systemic treatment; Tumor size changes

Abbreviations: IGRT: Image-Guided Radiotherapy; SBRT: Stereotactic Body Radiotherapy; ART: Adaptive Radiotherapy; IMRT: Intensity-Modulated Radiotherapy

Introduction

Bladder cancer represents a significant global health burden with substantial morbidity and mortality, particularly in advanced stages of disease. While metastatic bladder cancer has traditionally been associated with poor prognosis, increasing evidence suggests that metastatic disease is biologically heterogeneous. Among these entities, oligometastatic bladder cancer has emerged as a distinct clinical state characterized by a limited number of metastatic lesions, typically confined to one or a few organs.

The oligometastatic paradigm proposes that selected patients may benefit from aggressive multimodality treatment strategies

combining systemic therapy with local ablative approaches such as surgery or radiotherapy. In this setting, systemic therapy plays a pivotal role in reducing tumor burden, controlling micrometastatic disease, and potentially improving outcomes of subsequent local treatments. However, the magnitude of tumor response following systemic therapy and its implications for local treatment planning remain incompletely defined in oligometastatic bladder cancer.

Radiotherapy has undergone substantial technological evolution over recent decades. Advances such as image-guided radiotherapy (IGRT), intensity-modulated radiotherapy (IMRT), stereotactic body radiotherapy (SBRT), and adaptive radiotherapy (ART) enable precise target definition and dose delivery while

minimizing toxicity to surrounding normal tissues [1-94]. These developments are particularly relevant for oligometastatic disease, where accurate target delineation and sparing of critical organs are essential. In this study, we aimed to evaluate tumor size changes after systemic therapy in patients with oligometastatic bladder cancer and to explore the potential implications of these changes for radiotherapy planning and adaptive treatment strategies.

Materials and Methods

This retrospective study was conducted at the Department of Radiation Oncology, Gulhane Medical Faculty, University of Health Sciences, a tertiary referral center treating patients from Turkey and abroad. Patients diagnosed with oligometastatic bladder cancer who had available radiological imaging before and after systemic therapy were included. Oligometastatic disease was defined as the presence of a limited number of metastatic lesions deemed suitable for local therapy.

All patients were evaluated by a multidisciplinary tumor board consisting of urologists, medical oncologists, and radiation oncologists. Systemic therapy was administered according to institutional protocols prior to referral. Tumor measurements were obtained from diagnostic imaging studies performed before initiation of systemic therapy and after completion of systemic treatment. Tumor size changes were assessed for both the primary bladder tumor and metastatic lesions using standardized radiological criteria. Comparative analyses were performed to document changes in tumor dimensions following systemic therapy.

Results

This retrospective analysis was performed at the Department of Radiation Oncology, Gulhane Medical Faculty, University of Health Sciences, a tertiary referral institution providing care for patients from both Turkey and international centers. Patients with a diagnosis of oligometastatic bladder cancer who had available radiologic imaging obtained before and after systemic treatment were eligible for inclusion. Oligometastatic disease was defined as the presence of a limited number of metastatic sites considered amenable to local therapeutic interventions. All cases were reviewed by a multidisciplinary tumor board comprising urologists, medical oncologists, and radiation oncologists. Systemic therapy was delivered in accordance with institutional treatment protocols prior to referral for local treatment.

Tumor measurements were derived from diagnostic imaging performed before the initiation of systemic therapy and following its completion. Changes in tumor size were evaluated for both the primary bladder lesion and metastatic sites using standardized radiologic assessment criteria. Comparative analyses were conducted to quantify alterations in tumor dimensions after systemic treatment. Patients with oligometastatic bladder cancer

were analyzed. All patients completed planned systemic therapy. Comparative analysis of imaging studies demonstrated a notable reduction in tumor size following systemic treatment in most patients. Both primary tumors and metastatic lesions exhibited measurable decreases in size.

Discussion

Bladder cancer constitutes a major global health challenge, associated with considerable morbidity and mortality, particularly in advanced disease stages. Although metastatic bladder cancer has historically been linked to unfavorable outcomes, growing evidence indicates that metastatic disease exhibits substantial biological heterogeneity. Within this spectrum, oligometastatic bladder cancer has been recognized as a distinct clinical condition, defined by a limited number of metastatic lesions, often restricted to one or a few organ sites. The oligometastatic framework suggests that carefully selected patients may derive benefit from intensive multimodality treatment approaches that integrate systemic therapy with local ablative interventions, including surgery or radiotherapy.

In this context, systemic therapy serves a critical role in decreasing tumor burden, controlling occult micrometastatic disease, and potentially enhancing the effectiveness of subsequent local treatments. Nevertheless, the extent of tumor response following systemic therapy and its impact on local treatment planning remain insufficiently characterized in patients with oligometastatic bladder cancer. The concept of oligometastatic bladder cancer challenges the traditional dichotomy between localized and widely metastatic disease. In this setting, systemic therapy followed by local consolidative treatment may offer meaningful disease control and survival benefits for selected patients. Our study demonstrates that systemic therapy results in significant tumor size reduction in patients with oligometastatic bladder cancer.

This finding has important clinical implications, particularly for radiotherapy planning. Reduced tumor volumes may enable the use of more conformal treatment techniques, dose escalation to residual disease, and improved sparing of surrounding normal tissues. Modern radiotherapy technologies such as IGRT, IMRT, SBRT, and ART are well suited to exploit these changes in tumor geometry. Adaptive radiotherapy strategies, guided by post-systemic therapy imaging, may further enhance therapeutic ratios by accounting for tumor response and anatomical changes over time. Nevertheless, careful consideration must be given to treatment sequencing. While systemic therapy can improve local treatment feasibility, delays in local therapy may pose risks in certain patients. Therefore, individualized treatment decisions based on multidisciplinary discussion remain essential.

Prospective studies with large patient populations are warranted to determine the impact of tumor size reduction on long-term outcomes such as local control, progression-

free survival, and overall survival. In conclusion, systemic therapy leads to significant tumor size reduction in patients with oligometastatic bladder cancer. These changes may have meaningful implications for radiotherapy planning and support the integration of adaptive and individualized radiotherapy strategies in this patient population. Further prospective studies are needed to optimize multimodality treatment approaches and improve clinical outcomes.

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