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Preface: Disease Sites xv

Ravi A. Chandra, Lisa A. Kachnic, and Charles R. Thomas Jr

Contemporary Issues in Breast Cancer Radiotherapy 1

Lior Z. Braunstein and Jennifer R. Bellon

A series of landmark studies have increasingly emphasized the role of adjuvant radiotherapy for the definitive management of breast cancer. Although regional nodal irradiation, including the internal mammary nodes, was typically reserved for high-risk patients, there is now evidence of benefit to this approach even for those with a limited nodal disease burden. Similarly, low-risk disease has historically been treated with whole-breast tangents, although contemporary studies now support accelerated partial breast irradiation or the omission of radiotherapy in select cases. This article presents recent data informing these contemporary developments in the radiotherapeutic management of breast cancer.

Current Role of Radiation Therapy in the Management of Malignant Central Nervous System Tumors 13

Ahsan Farooqi, Jing Li, John de Groot, and Debra Nana Yeboa

The 2016 World Health Organization classification of central nervous system (CNS) tumors underwent significant restructuring and for the first time gliomas are classified according to both molecular and histologic parameters which guides glioma management. Radiation for intermediate-risk meningiomas improves the progression-free survival from historical controls, and studies are ongoing for atypical meningiomas. For brain metastases, use of stereotactic radiosurgery for a higher number of lesions has become clinical practice. Additionally, hippocampal-sparing whole brain radiation shows promise in preserving neuro-cognitive function. This article summarizes the evolving role of radiation therapy in the management of malignant CNS neoplasms.

Novel Radiotherapy Technologies in the Treatment of Gastrointestinal Malignancies 29

Shraddha Mahesh Dalwadi, Joseph M. Herman, Prajnan Das, and Emma B. Holliday

Over the past 2 decades, major technical advances in radiation therapy planning and delivery have made it possible to deliver higher doses to select high-risk volumes. This has helped to expand the role of radiation therapy in the treatment of gastrointestinal malignancies. Whereas dose escalation was previously limited by the radiosensitivity of normal tissues within and adjacent to the gastrointestinal tract, advances in target delineation, patient immobilization, treatment planning, and image-guided treatment delivery have greatly improved the therapeutic ratio. More conformal radiation modalities can offer further dose optimization to target volumes while sparing normal tissue from toxicity.

Radiation Therapy for Prostate Cancer 45

Sophia C. Kamran and Anthony V. D'Amico

Randomized controlled trials provide evidence-driven clinical decision making in the management of newly diagnosed nonmetastatic and oligometastatic prostate cancer. Advances in technology (eg, multiparametric MRI, MR/transrectal ultrasound fusion biopsy, image-guided radiation therapy, stereotactic body radiation therapy) have transformed diagnosis and treatment of prostate cancer while improving cancer control and quality-of-life outcomes. Exciting breakthroughs are revealing possible new indications for radiotherapy, particularly with respect to oligometastatic prostate cancer. Ongoing studies using next-generation androgen receptor–targeted agents hold promise to continue to improve important clinical outcomes, including metastasis-free prostate cancer–specific and overall survival in addition to health-related quality of life.

Gynecologic Malignancies 71

Gita Suneja and Akila Viswanathan

Gynecologic malignancies are among the most prevalent cancers affecting women worldwide, but they are heterogeneous diseases with varying risk factors, management paradigms, and outcomes. Gynecologic cancers mediated by human papillomavirus (HPV) are preventable and curable with early detection and treatment. Dramatic reductions in cervical cancer incidence and mortality have been achieved through cancer screening and HPV vaccination. Radiotherapy plays a central role in the management of gynecologic malignancies. For some cancers, radiotherapy alone can be curative. More often, radiotherapy is used in conjunction with surgery and systemic therapy to improve locoregional control and extend overall survival. This chapter reviews recent advances in radiotherapeutic management of gynecologic malignancies.

The Evolving Role of Radiotherapy for Head and Neck Cancer 91

David L. Schwartz and D. Neil Hayes

The length and quality of head and neck cancer survivorship continues to meaningfully improve. Radiotherapy has been central to this process through advances in treatment delivery, fractionation schemas, radiosensitizing systemic therapy, and thoughtful interplay with technical surgical improvements. The future looks brighter still, with ongoing progress in targeted biologic therapy, immuno-oncology, and molecular-genetic tumor characterization for personalized treatment. Head and neck cancer, a disease once fraught with nihilism and failure, is evolving into a major success story of modern multidisciplinary cancer care.

Radiation Therapy for Thoracic Malignancies 109

Victor Ho-Fun Lee, Li Yang, Yong Jiang, and Feng-Ming (Spring) Kong

Radiotherapy is the most commonly used nonsurgical modality in treatment of lung cancers, non–small cell lung cancer (NSCLC) in particular. Radiation therapy has been increasingly used as definitive radical treatment, either alone or in combination with concurrent chemoradiation for locally advanced disease. More recently with the advent of novel radiation

techniques and modalities such as stereotactic radiotherapy and proton therapy, radiotherapy can now be used as sole radical treatment of small solitary tumors. This article reviews the current indications and future directions of radiotherapy in lung cancer management.

Hematologic Malignancies 127

Yolanda D. Tseng and Andrea K. Ng

Radiation therapy plays a critical role in the management of a wide range of hematologic malignancies. The optimal radiation dose and target volume, and safe and effective ways of integrating radiation with systemic agents, vary depending on the histologic subtypes, stage at presentation, patient performance status, response to systemic therapy if given, treatment intent, and patient preferences. Limiting doses to surrounding organs without sacrificing disease control is of paramount importance. Reducing radiation doses and treatment volume in selected cases, and the use of advanced radiotherapy technology, can improve the therapeutic ratio of patients receiving radiation therapy for hematologic malignancies.

Pediatric Cancer 143

Sujith Baliga and Torunn I. Yock

In pediatric brain tumors, the intensification of chemotherapy has allowed for a reduction in radiotherapy (RT) volume to an involved field approach, particularly in patients with medulloblastoma. For patients with low-grade gliomas, the trend has remained to delay RT with chemotherapy; however, when RT is used, typically smaller clinical target volume margins are used. For patients with extracranial tumors, intensive chemotherapy to address systemic disease with local control is considered standard. Proton beam therapy shows significant promise in addressing both short-term and long-term toxicities in both central nervous system (CNS) and non-CNS pediatric tumors.

Malignant Soft-Tissue Sarcomas 161

Jeremy M. Brownstein and Thomas F. DeLaney

Soft-tissue sarcomas are cancerous growths of mesenchymal tissues, most commonly arising from fat, muscles, and other connective tissues. Sarcomas are rare, representing only a small fraction of solid malignant tumors. Because of their scarcity and a relative paucity of data, the management of sarcomas can be challenging, especially for those who infrequently encounter these tumors. Herein, the authors review the current literature regarding the diagnosis, workup, and treatment of adult soft-tissue sarcomas.

Bone Sarcomas and Desmoids 177

Jeremy M. Brownstein and Thomas F. DeLaney

Bone sarcomas are rare tumors arising in bone, representing only a small fraction of solid malignant tumors. Desmoids are benign, infiltrative soft tissue neoplasms. Because of their scarcity and a paucity of data, the management of these tumors can be challenging, especially for clinicians who

infrequently encounter these tumors. This article reviews the current literature regarding the diagnosis, work-up, and treatment of these uncommon mesenchymal tumors.

Contemporary Topics in Radiation Medicine: Skin Cancer **189**

Sarah J. Gao and Roy H. Decker

Radiation plays an important role in the management of a variety of skin cancers. This article discusses the role of radiation in the treatment of cutaneous squamous cell carcinoma, basal cell carcinoma, Merkel cell carcinoma, cutaneous T-cell lymphoma, and B-cell lymphomas.

Radiation Therapy for Benign Disease: Arteriovenous Malformations, Desmoid Tumor, Dupuytren Contracture, Graves Ophthalmopathy, Gynecomastia, Heterotopic Ossification, Histiocytosis **205**

Tony Y. Eng, Mustafa Abugideiri, Tiffany W. Chen, Nicholas Madden, Tiffany Morgan, Daniel Tanenbaum, Narine Wandrey, Sarah Westergaard, Karen Xu, and Lisa Jane Sudmeier

Although the use of ionizing radiation in malignant conditions has been well established, its application in benign conditions has not been fully accepted and has been inadequately recognized by health care providers outside of radiation therapy. Most frequently, radiation therapy in these benign conditions is used along with other treatment modalities, such as surgery, in instances where the condition causes significant disability or could even lead to death. Radiation therapy can be helpful for inflammatory/proliferative disorders. This article discusses the current use of radiation therapy in some of the more common benign conditions.

Radiation Therapy for Benign Disease: Keloids, Macular Degeneration, Orbital Pseudotumor, Pterygium, Peyronie Disease, Trigeminal Neuralgia **229**

Tony Y. Eng, Mustafa Abugideiri, Tiffany W. Chen, Nicholas Madden, Tiffany Morgan, Daniel Tanenbaum, Narine Wandrey, Sarah Westergaard, Karen Xu, and Lisa Jane Sudmeier

Although the use of ionizing radiation on malignant conditions has been well established, its application on benign conditions has not been fully accepted and has been inadequately recognized by health care providers outside of radiation therapy. Most frequently, radiation therapy in these benign conditions is used along with other treatment modalities, such as surgery, when the condition causes significant disability or could even lead to death. Radiation therapy can be helpful for inflammatory/proliferative disorders. This article discusses the present use of radiation therapy for some of the most common benign conditions.

Palliative Radiotherapy: Inpatients, Outpatients, and the Changing Role of Supportive Care in Radiation Oncology **253**

William Tristram Arscott, Jaclyn Emmett, Alireza Fotouhi Ghiam, and Joshua A. Jones

Palliative radiotherapy is an effective treatment in alleviating many symptoms of advanced cancer. Short courses of radiotherapy provide rapid

symptom relief and minimize impact on patients. Patients referred for palliative radiotherapy have many concerns beyond radiotherapy; often, these concerns are not fully addressed in traditional radiotherapy clinics. Discussions of prognosis, patient goals, and concerns are areas for improved collaboration. Innovative, dedicated palliative radiotherapy programs have developed over the past 20 years to provide holistic care to patients referred for palliative radiotherapy and have improved patient-focused outcomes. Advanced radiotherapy techniques may provide opportunities to further improve palliative radiotherapy outcomes.

Radiation Oncology Emergencies **279**

Mannat Narang, Pranshu Mohindra, Mark Mishra, William Regine, and Young Kwok

This article reviews the most common oncologic emergencies encountered by the radiation oncologist, including malignant spinal cord compression, intramedullary spinal cord metastasis, superior vena cava syndrome, hemoptysis, and airway compromise caused by tumor. Important trials evaluating different treatments for these emergencies are reviewed. The role of corticosteroids, surgery, chemotherapy, and radiation therapy in these patients is discussed and patient-specific treatment guidelines are suggested.

Imaging for Response Assessment in Radiation Oncology: Current and Emerging Techniques **293**

Sonja Stieb, Kendall Kiser, Lisanne van Dijk, Nadia Roxanne Livingstone, Hesham Elhalawani, Baher Elgohari, Brigid McDonald, Juan Ventura, Abdallah Sherif Radwan Mohamed, and Clifton David Fuller

Imaging in radiation oncology is essential for the evaluation of treatment response in tumors and organs at risk. This influences further treatment decisions and could possibly be used to adapt therapy. This review article focuses on the currently used imaging modalities for response assessment in radiation oncology and gives an overview of new and promising techniques within this field.

The Evolution (and Future) of Stereotactic Body Radiotherapy in the Treatment of Oligometastatic Disease **307**

Benjamin E. Onderdonk, Stanley I. Gutiontov, and Steven J. Chmura

This review outlines the history of the oligometastatic state from its first proposal to the current formulation. The article discusses the accumulating evidence for the biology of oligometastases, including clinical parameters, such as number and rate of progression, as well as ongoing molecular profiling efforts. The authors then discuss the current state of prospective clinical trials. They review the early site-specific as well as subsite agnostic studies using stereotactic body radiation therapy. Moreover, the article makes the case for why phase II trials should not be practice changing, and highlights the pivotal importance of accruing to phase III clinical trials.