Contents

1. Radiobiology of Radiation Therapy 1

Govardhan HB, Anurita Srivastava, Tejinder Kataria

The Time-Scale of Effects in Radiation Biology *1*; DNA Damage *1*; Direct Action *1*; Indirect Action *2;* DNA Repair *2*; Acute and Late Effects of Radiation *2*; Cell Death *2*; The Five "Rs" of Radiobiology *3*; Linear Energy Transfer *4*; Relative Biologic Effectiveness *4*; Oxygen Enhancement Ratio *5*; Dose Rate Effect in Radiotherapy *5*; Dose Fractionation in Radiotherapy *6*; The Concept of Therapeutic Index *7*

2. Radiation Pathology 10

Shyam Singh Bisht, Tejinder Kataria, Govardhan HB, Deepak Gupta

Part I: Radiation Pathology—General *10*; Epithelial and Parenchymal Lesions *10*; Stromal Lesions *11*; Part II: Radiation Pathology—Organ Specific *13*; Heart *13*; Lungs *14*; Treatment and Prognosis *15*; Liver *15*; Kidney *16*; Brain *17*; Salivary Glands *19*

3. Brachytherapy 22

Anurita Srivastava, Tejinder Kataria

Principles of Brachytherapy *22*; Clinical Applications of Brachytherapy *22*; Classification of Types of Brachytherapy *23*; Properties of an Ideal Source *23*; Radionuclides and their Properties *24*; Room Shielding *25*; Dosimetry Units and Source Specification *25*; Source Specification *25*; Dose Rates *26*; Implant Dosimetry Systems *26*; Dose Specification and Reporting *28*; Advances in Brachytherapy *28*

4. Advances in Radiotherapy Techniques 30

Anurita Srivastava, Tejinder Kataria, Ashu Abhishek, Govardhan HB, Ruchi Singh

Two-dimensional (2D) Radiotherapy (Conventional Radiotherapy) *31*; Three-dimensional (3D) Radiotherapy *31*; Intensity-modulated Radiotherapy *32*; Intensity Modulated Arc Therapy *32*; Volumetric Modulated Arc Therapy *32*; Image-guided Radiotherapy *33*; Adaptive Radiotherapy *33*; Stereotactic Radiotherapy *34*; Particle Therapy/Hadron Therapy *35*; Brachytherapy *37*

5. Image-guided Radiation Therapy 42

Shikha Goyal, Tejinder Kataria

Role of Imaging in Radiation Oncology *42*; Image-guided Radiation Therapy: The Concept *43*; Errors and Margins *43*; Offline versus Online Corrections *43*; IGRT Technology Solutions *44*; Guidelines for Medical Personnel and Implementation *49*; Image-guided Radiation Therapy: Clinical Benefits *50*; Concerns with IGRT *50*; Clinical Applications: Current and Future *50*

6. Lasers in Head and Neck Surgery 53

Kumud Kumar Handa, Dilip Kumar Samal

Types of Surgical Lasers *53*; Laser Safety *54*; Laryngeal Malignancies *55*; Benign Laryngeal Lesions *57*; Office-based Use of Lasers *58*; Recent Advances *58*

7. Emergencies in Cancer **61**
Sandeep Jain, Kuldeep Sharma
Structural or Obstructive Emergencies *61*; Metabolic Emergencies *63*; Treatment-related Emergencies *64*

8. Nutrition and Cancer **67**
Kuldeep Sharma, Kajal Pandya Yeptho
Goals of Nutrition Therapy in Cancer *67*; Cancer Treatment and its Nutritional Implications *69*; Nutrition Management of Symptoms *70*

9. Central Nervous System Tumors **74**
Vikash Kumar, Deepak Gupta, Tejinder Kataria, Kushal Narang
WHO Classification *74*; Low-grade Gliomas *75*; High-grade Gliomas *77*; Ependymoma *81*; Meningiomas *84*

10. Surgical Management of Head and Neck Cancers **90**
Ajay Kumar Dewan, Abhinav Dewan
Principles of Surgical Treatment *90*; Surgery of Primary Lesion *91*; Surgical Treatment of Neck *93*; Management of N_0 Neck *93*; Clinically Node Positive Neck *94*; Conservation of Organ versus Preservation of Organs *94*; Complications in Head and Neck Surgery *94*

11. Radiation in Treatment of Head and Neck Cancer **97**
Tejinder Kataria, Ashu Abhishek
Three-dimensional Conformal Therapy *97*; Intensity-modulated Radiotherapy *97*; Image-guided Radiotherapy *98*; Brachytherapy in Head and Neck Cancer *106*

12. Principles of Breast Cancer Surgery **112**
Kanchan Kaur, Hemant Singhal
Diagnosis and Staging *112*; Planning of Breast Cancer Surgery *113*; Breast Conserving Surgery *113*; Contraindications of Breast Conserving Surgery *115*; Surgical Considerations in Planning Breast Conserving Surgery *115*; Salient Features of Breast Conserving Surgery *117*; Mastectomy *118*; Types of Reconstruction *118;* Risk-reducing Mastectomy *118;* Sentinel Node Biopsy *118*; Complications in Breast Surgery *119*; Postoperative Follow-up and Monitoring *120*

13. Carcinoma of Breast **122**
Shyam Singh Bisht, Tejinder Kataria, Kushal Narang
Noninvasive Breast Cancer *122*; Lobular Carcinoma in situ *122*; Paget's Disease *123*; Evidence for Conservative Approach *124*; Ductal Carcinoma in situ *124*; Early Breast Cancer *126*; Risk Factors *126*; Breast Cancer Prevention Strategies *128*; Natural History *128*; Screening in Breast Cancer *129*; Prognostic and Predictive Factors *131*; Management of Breast Cancer *133*; Technical Issues in Radiation Management of Early Stage Breast Cancer *139*; Accelerated Partial Breast Irradiation *140*; Follow-up of Patients Treated with Breast Conservation Surgery and Irradiation *142*; Sequelae of Irradiation in Breast Cancer *142*; Endocrine Therapy *144*; Locally Advanced Breast Cancer *146*; Epidemiology *146*; Natural History *146*; Clinical Presentation *147*; Diagnostic Workup *147*; General Management and Treatment Results for Locally Advanced Breast Cancer *147*

14. Lung Cancer **159**
Tejinder Kataria, Govardhan HB, Deepak Gupta, Ashu Abhishek
Etiology *159*; Pathology *159*; Clinical Presentation *160*; Workup and Staging *161*; Staging *161*; Prognosis *162*; General Management *162*

15. Carcinoma of Esophagus **177**
Trinanjan Basu, Tejinder Kataria

Etiology *177*; Applied Anatomy *177*; Patterns of Spread *179*; Diagnostic Staging *179*; Staging *179*; Diagnostic Investigations *179*; Staging Investigations *180*; Prognostic Groups *181*; Prognosis of Esophageal Cancer *181*; Principles of Management *181*; Definitive Radiation and Chemoradiation Therapy *182*; Radiotherapy Technical Details *185*

16. Gastric Cancer **193**
Trinanjan Basu, Tejinder Kataria

Epidemiology and Etiology *193*; Anatomy *193*; Pathology *193*; Dose and Treatment Delivery *200*

17. Carcinoma of Anal Canal **204**
Trinanjan Basu, Ruchi Singh, Tejinder Kataria

Etiology *204*; Anatomical Aspects *204*; Pathological Aspect *205*; Clinical Features *205*; Staging Investigations *205*; TNM Staging *205*; Management *205*

18. Carcinoma of Rectum **210**
Trinanjan Basu, Nimesh Dahima, Tejinder Kataria

Anatomical Considerations *210*; Etiology *210*; Clinical Presentations *211*; Pathology *211*; Staging *211*; Management *211*; Surgery *212*; Total Mesorectal Excision *212*; Abdominoperineal Resection *212*; Low Anterior Resection *213*; Radiation Therapy Technique *213*; Target Volume Definition *213*; Dose-fractionation *213*; Important Discussions Regarding Radiotherapy in Rectal Carcinoma *214*

19. Surgical Principles in the Management of Pancreatic Cancer **217**
Savio G Barreto, Adarsh Chaudhary

Preoperative Approach to the Patient *217*; Surgical Management *218*; Complications of Pancreatic Surgery *222*

20. Pancreatic Cancer **228**
Shikha Goyal, Tejinder Kataria, Vikraman Subramani

Epidemiology *228*; Prevention and Early Detection *228*; Biology and Molecular Mechanisms *228*; Pathology and Pathogenesis *228*; Clinical Evaluation *229*; Staging *229*; Primary Therapy *229*; Adjuvant Therapy *230*; Locally Advanced Disease *233*; Palliation and Support *234*; Irradiation Techniques *234*; Treatment Algorithm, Controversies and Future Possibilities *235*

21. Hepatobiliary Malignancies **242**
Shikha Goyal, Tejinder Kataria

Epidemiology *242*; Etiology *242*; Prevention and Early Detection *243*; Biologic Characteristics *243*; Pathology and Pathogenesis *243*; Clinical Evaluation *244*; Primary Therapy *245*; Locally Advanced Disease and Palliation *247*; Irradiation Techniques *248*; Treatment Algorithm and Future Directions *250*

22. Radiation Therapy in Hematologic Malignancies **256**
Manoj Tayal, Tejinder Kataria, Kushal Narang

Acute Leukemias *256*; Chronic Leukemias *259*; Lymphomas *259*; General Radiation Therapy Guidelines *264*; Classic Radiation Fields *265*; Non-Hodgkin's Lymphoma *268*

23. Principles of Care of Pediatric Malignancies **276**
Ruchira Misra

Incidence *276*; Genetic Basis for Cancer *276*; Principles of Assessment and Investigations in a Child with Suspected Cancer *276*; Principles in the Management of Childhood Cancers *278*; Supportive Care in Pediatric Malignancies *282*

24. Radiation Therapy in Gynecologic Cancers **285**
Malolan S Rajagopalan, Sushil Beriwal

Cervical Cancer *287*; Endometrial Cancer *291*; Vulvar Cancer *294*; Vaginal Cancer *297*

25. Prostate Cancer **301**
Ajaypal Sandhu, Steve Davis

Diagnosis and Prognosis *301*; Surveillance *303*; Surgery *303*; Androgen Deprivation Therapy *303*; Brachytherapy *303*; Dose Escalation and Intensity-modulated Radiation Therapy *305*; Image-guided Radiation Therapy *306*; Hypofractionation and Stereotactic Body Radiation Therapy *307*; Proton Therapy *307*; Postprostatectomy Radiation Therapy *308*; Palliative Radiation *308*

26. Castration-resistant Prostate Cancer **311**
Sandeep Batra, Vikash Kumar, Tejinder Kataria

Rationale and Molecular Pathways *311*

27. Ocular Malignancies: An Overview **314**
Trinanjan Basu, Tejinder Kataria

Anatomy *314*; Classification *314*; Metastatic Carcinoma to the Posterior Uvea *314*; Malignant Melanoma of the Posterior Uvea *315*; Retinoblastoma *316*; Radiation Toxicities to Eye *318*

28. Soft Tissue Sarcoma **321**
Shyam Singh Bisht, Tejinder Kataria, Rahul Patil

Etiology and Epidemiology *321*; Pathology *322*; Pathologic Features and Natural History *323*; Management *325*; Primary Therapy *326*

29. Drug Discovery and Clinical Trial Process **331**
Dinesh Chand Doval, Sanjay Gupta

Why do we Need Clinical Trials? *331*; Drug Discovery Process—A Long Journey *331*; Preclinical Testing *332*; Clinical Testing *332*; Clinical Trial Endpoint/Outcome *333*; General Endpoint Considerations in Oncology Clinical Trials *333*; Molecular Biology and Genetics in Oncology *334*; Clinical Research Market (Size and Trends) *334*; Clinical Trials—Dr DC Doval's Experience *334*

30. Quality Assurance of High Dose Rate: Brachytherapy (Remote Afterloading Unit) **336**
Karrthick KP, Ramu Mahendran, Samba Siva Selli R, Senni Andaver

Need for Quality Assurance in Radiotherapy *336*; Quality Assurance for Linear Accelerators *336*; Test Frequencies *336*; Quality Assurance of High Dose Rate: Remote Afterloading Unit *344*; Daily Quality Assurance *344*; Quality Assurance in Cyberknife *345*; Daily Quality Assurance *345*; Monthly Quality Assurance *345*

31. Pain Management in Cancer Patients **351**
Kuldeep Sharma, Tejinder Kataria

Common Terminologies and Concepts in Pain *351*; Management of Pain *351*

Index *357*