Chapter 1
Introduction

Modern 3D conformal radiotherapy (3D-CRT) and its technological developments (intensity-modulated radiation therapy, image-guided radiation therapy, stereotactic radiation therapy) permit administering the prescribed radiation dose to the target volume, applying dose-escalation regimens, while limiting dose to healthy tissues.

The advances of radiation techniques increase the need for both greater accuracy in delineating gross tumor volume (GTV), clinical target volume (CTV), and organs at risk (OARs), and more accurate quantitative evaluation of the dose delivered to the CTV and OARs. For these reasons, delineating GTV, CTV, and – especially – OARs plays a fundamental role in the radiation treatment planning.

From planning to delivery of radiation treatment, radiological imaging is indispensable for identifying clinical volumes. The phase of planning is traditionally based on computed tomography, often performed without contrast, but this method is rather limited for defining some OARs, especially structures with similar electron density to adjacent structures.

Associated morphological (computed tomography, CT, magnetic resonance, MR) and functional imaging (positron emission tomography, PET, single photon emission computed tomography, SPECT, functional magnetic resonance, fMR) can optimize volumes delineation and the collaboration between the radiation oncologist, the radiologist and the nuclear physician, in order to interpret accurately individual imaging methods, is necessary.

These rationales have been the starting point of this book. This textbook is divided into three sections. The first section briefly recalls anatomy and physiopathology of radiation-induced damage. The second section describes modeling, radiation dose constraints for organs at risk according to the most recent evidence and technical notes for volumetric acquisition of OARs in different anatomical districts. The third section identifies individual OARs of four anatomical regions (brain, and head and neck, mediastinum, abdomen, pelvis) on axial CT scans; for each, OAR anatomo-radiological limits (craniocaudal, anteroposterior, and laterolateral) are shown and reported in special summary tables and on CT scan images, together with an iconography of OARs.

This work represents a multidisciplinary model aimed at improving quality assurance in the delicate phase of contouring. However, it is desirable that each radiation therapy center adopt its own model, comparing it with experiences reported in the literature, with the perspective of profitable growth and conscious interactivity.

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