

### **Basic Principles and Clinical Applications of Helical Scan. Applications of Continuous-Rotation CT. Edited by Kazue Kimura and Sukehiko Koga. Tokyo: Iryokagakusha, 287 pp., 1993. \$88.**

A major advance in CT was introduced at the 1989 meeting of the Radiological Society of North America. Helical CT (also referred to as spiral CT) was demonstrated as an alternative to conventional "step and shoot" or "slice by slice" CT. Recognized for its fast volumetric scanning and retrospective imaging capabilities, helical CT is replacing conventional CT in most clinical applications. It will be widely accepted as the de facto standard method of CT in the foreseeable future. Although the number of relevant publications increases each year, this book is the first survey text on this new technique.

The book explains basic CT principles and performance and is a state-of-the-art summary of CT clinical applications in Japan, with an emphasis on helical CT. The 35 contributing authors are all Japanese; they represent six major Japanese medical institutions and the Toshiba Corporation. Extensive reference is made to publications in the Japanese literature, most of which are unfamiliar and inaccessible elsewhere in the world. The text has been translated into English and is remarkably well edited and readable.

The volume consists of 20 chapters divided into four major sections: (1) technical development of CT; (2) dynamic CT applications, including subtraction cineangiography of the CNS, evaluation of abnormal movements of the external ocular muscle, respiratory scanning in chest disease, and observation of tumor hemodynamics; (3) three-dimensional CT, including surface and multiplanar reconstruction techniques used in imaging the head and neck and benign pulmonary lesions and tumors; and (4) algorithms for helical CT and characteristics of helical CT scans.

The fourth, and largest, section begins with a scholarly review of helical CT in comparison with conventional CT, electron-beam CT, and MR imaging. Neurosurgical planning based on findings on helical scans is described, and its promise for clinical use is discussed. A three-dimensional helical CT contrast imaging method for vascular structures, CT angiography, is described. This technique permits synthesis of  $512 \times 512$  multiplanar and three-dimensional surface reconstruction images within a short time. Further postprocessing produces multiplanar and three-dimensional surface images, not the more familiar maximum- or minimum-intensity-projection or volumetric three-dimensional forms. It appears that CT angiography is in an earlier stage of development in Japan than we are accustomed to reading about in the current radiologic literature.

Helical CT assessment of the right cardiophrenic angle is reported and compared with conventional chest radiographs. Helical CT also

has applications in examination of the lungs, mainly detection and evaluation of lesions. It is claimed that pulmonary lesions as small as 3 mm can be detected by using helical CT, which makes mass screening possible. Cost and diagnostic efficacy and outcome are not addressed.

Cardiac motion artifacts have been a major problem in conventional CT studies of the heart. An ECG-gated helical CT method is outlined that facilitates morphologic diagnosis with sections scanned during diastole. Helical CT of the liver and pancreas is also explored. Because of the low contrast between some lesions and normal tissues, more effective contrast media is desirable for improved clinical usefulness.

The chapters on clinical applications of helical CT in specific areas are particularly interesting. Important similarities and differences between Japanese and North American clinical practice are found in every chapter. Specific applications included are reconstructive surgery of facial bones, orthopedic surgery, imaging of temporal and orbital trauma, imaging of orbital lesions, and imaging of adrenal glands. Imaging of the temporal bone is a primary example of an application that requires high-resolution images. As illustrated in the book, because of overlapping reconstruction, helical CT is superior to conventional CT in three-dimensional visualization of bony structures as small as 0.9 mm. Several examples of three-dimensional CT scans of the middle and inner ear are included, and their quality is superlative. A study on volume measurements based on conventional and helical scans is also informative. Finally, the application of helical CT in radiotherapy is discussed.

The book is timely and amplifies several well-known and some not so well-recognized applications of helical CT. The quality of the CT scans is superb. The same is true for the many other illustrations. The book would be even more valuable if more work done outside Japan were mentioned. We highly recommend this edited collection to residents as an introductory survey text, to radiologists and physicians as a reference, and to medical physicists and imaging system engineers as a source for the medical relevance of helical CT and information on the current state of CT developments and applications in Japan.

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