Digital (r) Evolution in Radiology (Walter Hruby, ed, Springer-Verlag/Wien, 2001)

AJNR Am J Neuroradiol 2001, 22 (8) 1630-1631
http://www.ajnr.org/content/22/8/1630

Book Review

Digital (r) Evolution in Radiology (Walter Hruby, ed, Springer-Verlag/Wien, 2001)

The world of medical imaging and information systems has evolved to such a degree that even the most technologically impaired radiologist is forced to have, at the minimum, a passing knowledge of picture archiving and communications systems (PACS), radiology information systems (RIS), computed/digital radiography, image fusion, and similar applications of digital information to radiology. Few radiologists have received formal training in these areas, and usually the best one can do is attend appropriate courses and exhibits at national meetings, read the occasional journal articles, and speak at length to vendors on these subjects. Furthermore, a minority of radiologists have a deep-seated interest in these areas; after all, our motivation and training have been directed toward imaging diagnoses and patient care. It certainly has not been directed toward the sometimes arcane world of what as a whole is called digital radiology. Unfortunately, or fortunately (depending on how you look at it), radiologists no longer have the luxury of handing off all these issues and problems associated with digital radiology to some bright computer engineer in the hospital. It is now clear that radiologists need to become nearly as conversant in these areas as they are in talking to their clinical colleagues about imaging findings and clinical care issues.

With this need arrives a newly published multiauthored book edited by Dr. Walter Hruby, entitled simply *Digital (r) Evolution in Radiology*. The majority of authors are from Europe (predominantly from Austria), which attests to the worldwide importance and applications of this technology. At the onset, I emphasize that despite the multiple authors, the majority of whom are not native English speakers, this book is evenly written, well illustrated and understandable, albeit with not infrequent annoying grammatical errors. It amazes this reviewer that the publisher, knowing that the first language of the majority of authors was not English, would produce a book such as this without appropriate proofreading and corrections.

The book is divided into four major categories: 1) The Basics of Digital Radiology, 2) The Planning of Digital Radiology: Practical Approaches, 3) Applications Using New Technologies, and 4) Current Development and Economic Issues. There are 34 chapters in toto, and while it makes no sense in this review to list each of them, suffice to say that most critical subjects are adequately covered.

The book eases the reader into the complexities of the digital age in radiology with introductory chapters on the basics of computer technology as it applies to digital radiology. It is stressed that digital radiology involves many aspects of information and image transfer and clearly is more than PACS; it includes, among other items, request entry, voice recognition, display of reports, fields for teaching and research, clinical data, and billing information. The evolution of PACS from an early curiosity to its dominant place in hospital and practice modernization makes for interesting reading, particularly in terms of what such a system can offer now. The evolution to a product that addresses a whole host of medical issues, explains its burgeoning success. Various parts of this book delve into those items that have caused widespread PACS implementation such as wide band networking, the need to handle and distribute ever increasing volumes of digital data, massive archiving requirements, rapid postprocessing demands, image merging, and improved workstation efficiencies and applications. If any radiologist needs to find justification for recommending a PACS system to a reluctant administration, sufficient ammunition is contained in the book. That justification is described in terms of work flow, image reporting, patient planning, improved billing, and overall economic savings.

After it is recognized by a practice and hospital that digital radiology is a necessity, the difficult and detailed work begins. One could ask what information is needed, and what questions should be asked when formulating a request for a proposal for PACS, an associated information system. In an outline and text format, these points are described; however, some of the graphics offered to help the reader are difficult to read (in places the print is too small and the details too excessive to be useful). Nonetheless, one could, with the assistance of this book, begin to assemble the components of a search for a vender, some of which may not immediately come to mind, such as security of data, project management team, standards of display across all modalities. Hints on scoring the bidding vendors is given, and these descriptions could help simplify choosing a vendor both for PACS and RIS, particularly when a committee, given the selection mandate, is composed of many persons covering many disciplines. The specialized needs of an RIS makes it difficult to implement radiology functionality with the same software as a generalized hospital information system (HIS); however, as the chapter on RIS discusses, there are basic parts of an RIS that should be present regardless of the platform used. What to look for in an RIS as it pertains to admission, scheduling, tests, reporting, and billing is succinctly described. Interestingly, the authors of the RIS section not only describe the proper way such a system should function but also scenarios in which an improperly connected or inadequately programmed software could result in

inadequacies of the system. One critical chapter describes why an integrated RIS/PACS communication serves a medical enterprise well. Single workstations that share RIS/PACS/HIS data are functional necessities for today's needs, and systems that are able to handle varying vendor components and techniques are explained as a well-defined future of radiology practices. The advantages and disadvantages of a total conversion to a filmless environment (neatly called the ''big bang theory'') versus phased integration of techniques onto PACS is described from the authors' real-life experiences.

To cover the multiple aspects of digital radiology, this book goes well beyond PACS and RIS, applying digital technology to radiology workflow and specific diagnostic imaging procedures such as positron emission tomography (PET), cardiac imaging, computed radiology, MR, and CT. The data generated by a completely digitized radiology department, which has within it all imaging modalities, are voluminous and, as this book emphasizes, necessitates planning for short- and long-term data storage. Expansion into digitally acquired imaging in the future (eg, digital mammography) will put increasing strain on archival expansion. Underpinning all of these issues is the network infrastructure. Guidelines for a large system structured to transfer images to multiple points are given.

The relative ease of displaying, manipulating, and interpreting digital images, whether static or functional, at a single workstation is an advantage for digital radiology. How this can be integrated into a large practice is dealt with by various authors in different chapters. As diagnostic imaging moves quickly and further into physiological studies (eg, functional MR, cardiac wall motion, time-resolved MR angiography, fluid flow, neuronavigation evaluations), to be able to interpret these examinations over a network solution with robust and flexible workstations is a necessity. What can be accomplished along these lines is described in detail with adequate illustrations to demonstrate the potential effectiveness of such displays.

The increasing emphasis on standard imaging integration with functional imaging, including what is termed *molecular imaging* (eg, PET/single-photon emission CT), requires optimal fusion of images. How this can be accomplished by software solutions, rather than the expensive hardware solution of blending modalities such as CT and PET into one piece of equipment, is described. The language and principles of image fusion are dealt with in an understandable fashion.

This book also offers diagnostic information. PET in oncology, what state-of-the-art MR cardiac imaging can accomplish and how it may supplement or replace current cardiac imaging (sonography, nuclear medicine), and how to apply spiral/multisection CT to volume renderings are examples of what is desired in this book. For the future-oriented reader, a lesson in art history and how it coincides with science and influences the future is described and beautifully illustrated. How this can be meaningful to radiology is left to the reader's imagination.

It is difficult to imagine a radiology practice or a radiologist to whom this book would not have significance. At the minimum, it should be on the shelf of every chief or service in radiology and it is reasonable to believe that it should be readily available in each department's library. In fact, this reviewer recommends the purchase of this book to virtually all practicing radiologists—it contains and explains the language of our current evolution in digital radiology. With the multitude of books in diagnostic imaging, many of which illustrate and convey much of the same information, it is good to see a text like this: one that puts together, in one volume, information vital for all radiologists in the foreseeable future.