QUALITY ASSURANCE AND IMAGE ARTIFACTS IN MAGNETIC RESONANCE IMAGING.

R.J.R.Knowles, John A. Markisz. Boston, Little, Brown and Company, 1988, 149 pp, $22.50.

This small (5 in. × 8 in.) spiral bound text is a useful reference for understanding magnetic resonance imaging (MRI) machine operational characteristics and identification of image artifacts. Illustrations are plentiful, including images, diagrams of pulse sequences, and graphs. The reader is assumed to know the fundamentals of nuclear magnetic resonance (NMR) and MRI although some basics are briefly reviewed in the earlier chapters. As the title suggests, the book is divided into two major sections, quality control (QC) of NMR imaging and the production and characteristics of image artifacts.

The QC section consists of eight chapters that begin with a general definition of a quality assurance program and levels of testing, comparing basic quality assurance to performance testing which would be more relevant to acceptance testing of the system. Measurements are characterized according to general imaging measurements, electronic measurements, or NMR measurements. Subsequent chapters discuss each of these in appropriate detail. In the MR image chapter the contributions of factors specific to the object and to the machine are separated. Operator adjustable parameters are discussed in some detail and recommendations on imaging measurements for QC are described. These recommendations include useful field of view, image uniformity, spatial linearity, spatial resolution, slice geometry oblique plane considerations, and signal-to-noise. The discussion on electronic measurements primarily relate to impedance matching and pulse shapes for the RF and gradients. Measurements of resonance frequency, spin density, and relaxation times are discussed under NMR measurements and their applicability to quality assurance.

The section on image artifacts consists of six chapters illustrated by a variety of images. In some examples the artifacts are subtle, probably both on the instrument display monitor but certainly in the published photos. The sources of the artifacts are classified as patient or machine in origin. Examples of the former are chemical shift, and motion, including voluntary, respiratory, cardiac, peristalsis and flow. Distortions of the image by foreign material in or on the patient are illustrated. The machine related artifacts that are discussed include problems with the shims, gradients, RF transmitter and receiver, and changes that occur with the duty cycle of the RF and gradients.

In general, the image quality in this small text is good; however, in a few cases the point of interest was not evident or discernible and more descriptive figure captions, arrows on the image, or more appropriate gray scale adjustment would have been helpful. Somewhat distracting is the display of sagittal and coronal images that are rotated 90° to the text but the figure captions are not, so that the reader must frequently turn the book back and forth in order to study the image.

In a field still rapidly changing with the introduction of new imaging sequences and techniques, identification of new artifacts or image characteristics, and techniques to enhance or suppress many of these, this text is certainly not complete. However, it does cover the major image characteristics and for the price is a valuable reference for all physicians, scientists, engineers, and technologists participating in NMR imaging.

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SOFTWARE

The following software package was sent to the Journal for review and was thought to be of sufficient interest to readers to be included under the Book Review section.

GRAPH—SCIENTIFIC PLOTTING/DATA TRANSFORMATION

MicroMath Scientific Software. Salt Lake City, MicroMath, Inc., 1988, 81 pp, $79.00

GRAPH is a program that simplifies the production of X-Y plots. MicroMath has developed a software package that incorporates many useful plotting features for scientists. The GRAPH package consists of two program disks and a handbook. The minimum hardware requirements are a dual floppy disk based PC with 512Kb of RAM. The program will support both IBM-PC Color Card compatible graphics or Hercules Monochrome Graphics Card compatible graphics. The GRAPH disks are not copy protected and MicroMath encourages the user to make backup copies. The program has a simple and logical menu structure with each function accessed by a single keystroke. Each menu is presented in windows which are layered in order to indicate the level at which current operations are occurring. Most users will find the operation of the program intuitive and will have little trouble in transforming and plotting data without the handbook. Data may be transformed several different ways. These include: natural log, log base 10, exponential, invert, square, or square root. Along with the experimental data, GRAPH is capable of plotting two general classes of model-independent curves, interpolating, and least squares along with several subcategories for each. Interactive graphic editing enables plots to be annotated with text, lines, and arrows. Several fonts are available including Greek characters. The entire plot or any portion of it can be reproduced on a digital plotter, laser printer or dot matrix printer with IBM graphics output capability. All of this is done with no more effort than it takes to log data into a research notebook.

The package is attractive on two counts: price and user interface. If you are not using any graphic software this package is a great value and easy to use. It costs a fraction of the popular spreadsheet and graphic packages. Even if you currently use one of the popular packages, you may find