ELSEVIER

Technology and Health Care 2 (1994) 215–216

TECHNOLOGY AND HEALTH CARE

Guest Editorial

Special issue on magnetic resonance

The evolution of Nuclear Magnetic Resonance from the first physical discoveries in the 40s, to the use in molecular structure identification and, more recently, in biological and clinical applications, has been marked periodically by major new applications, followed by intensive periods of technological development and advances in instrumentation. The rapid development in the 80s of Magnetic Resonance Imaging (MRI) and in vivo Spectroscopy (MRS) certainly represented one of the most fascinating examples of integration on basic and applied research in biomedicine.

Clinical instrumentation is now widely available, providing high quality three dimensional mapping of anatomy and physiology, performing an invaluable role in the study and evaluation of disease. Despite this widespread application and routine use, the pace of developments in MR have not yet plateaued. Technological advances continue, providing greater speed and the opportunity to perform a wider range of studies in a given individual. The functional role of MR is rapidly developing, accompanied by advances in metabolic mapping and measurement techniques using MRS. In the long term, combination of these techniques in a single examination will allow local anatomy to be precisely identified by MRI, functional properties of organs such as heart, measurement of perfusion, and brain function studies to be performed, together with direct measurement of tissue metabolism – providing information on metabolic changes causing, or resulting from, functional defects.

This special issue comprises five papers (three on MRI and two on MRS) providing examples of the range of applications and illustrating important developments in clinical applications.

Quantification is an essential requirement in clinical MRS and functional MRI. Both methodologies require improved quantification of the physical parameters affecting image contrast and characterizing spectral changes.

The role of multi-nuclear MRS in investigating physiology and metabolism in cancer has developed considerably in the past seven years. Experience with model systems and, more recently, with cell suspensions and extracts, have provided much evidence that the metabolic changes reflect, and in some cases predict, the effects of a range of therapies. Initial clinical studies, despite the early stage of development of methodology, are also showing considerable potential. A rich review on the subject is provided in this issue by M.O. Leach (Sutton, UK).

Notwithstanding the increasing number of potential applications of MRS in cancer and in other human pathologies, it is now clear that it is not possible to carry out coherent clinical research in MRS, without standardization, quantitative spectral measurements and data analysis techniques. The adoption of globally accepted standards would be of great benefit to investigators, manufacturers and clinical users. In the light of these considerations, an International Workshop of experts on "Standardization in Clinical MRS Measurements" was therefore jointly organized in New York (August 1993) by the National Institutes of Health (USA) and the EEC BIOMED 1 Concerted Action "Cancer and brain disease characterization and therapy assessment by quantitative MRS". A full report of the event is published in this issue, with the co-authorship of several experts who attended the meeting.

The problems and advantages of quantitative tissue characterization by relaxometric MRI – with or without application of conventional and novel contrast agents – are considered in the paper by Hoehn-Berlage and Bockhorst (Cologne). The results of this study, carried out on experimental models, clarify the major potentials and limitations of in-vivo relaxometry in the non-invasive discrimination of pathological from normal brain structures, and indicates the additional potential of contrast agents in exploiting functional differences between tissues.

The last two papers of the issue explore the basic principles, perspectives and technological progress in two new applications of MRI in medicine from the University and Swiss Federal Institute of Technology

SSDI 0928-7329(94)00027-1

of Zürich. Developments in MR technology have led to commercially available open access MR systems, suitable for the direct monitoring of interventions such as biopsies and non-invasive ultrasound therapy. Practical applications of MR to monitor these techniques requires rapid reconstruction of the images, and the authors describe a real-time reconstruction device for this purpose. Visualization of the coronary arteries is a major objective in the diagnosis of coronary artery disease. The authors of the last paper review the recently developed technique of MR angiography, and describe a multi-slice examination, combined with breath-holding, allowing acquisition of data, followed by semi-automatic analysis and 3D reconstruction.

Franca Podo
Laboratory of Cell Biology
Istituto Superiore di Sanità, Rome, Italy
Martin O. Leach
CRC Clinical Magnetic Resonance Research Group
The Institute of Cancer Research and
The Royal Marsden NHS Trust
Sutton, Surrey, UK