

Reducing Radiation: MR and CT in the Era of Radiation Dose Concerns

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A Look Ahead: How Will New MR Techniques & Technologies Change the Landscape ?

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Abstract:

Medicine and medical science have rapidly evolved into a multifaceted world of enormous complexity. Medical knowledge and skills are constantly amplifying for several reasons, e.g. the increased understanding of the molecular origin of diseases and their individual development, the progress in the development of molecular and individualized targeted therapies, the continuous advancements in highly sophisticated medical technology including IT hard- and software, etc. As a consequence, present approaches for prevention, diagnosis and therapy could be considerably improved. Their practical application, however, is not any more manageable with the setting of traditional working processes. Single doctors will be replaced by multidisciplinary teams and conventional communication by sophisticated networks connecting a multiplicity of specialists including medical doctors, physicists, biologists, chemists, computer specialists, etc. The increased complexity of diagnostic and therapeutic information in medicine imperatively needs optimizing the working processes not only in the radiologic departments, but also in the entire hospitals as well as in the global medical system.

Within this context, particularly MR has become an essential and indispensable tool for medicine concerning early detection, diagnosis, therapy planning and guidance, treatment delivery and monitoring as well as for long-term follow-up. Actually, a lot of medical progress could be achieved because of the capability to non- or at least minimally invasively visualize morphologic, functional, metabolic and molecular information in individual patients. Imaging by MR combines numerous advantages: No use of ionization radiation is particularly important as MR will increasingly be applied and each individual will certainly undergo several imaging procedures within his or her lifespan. Important progress in biologic and molecular imaging could be achieved by multiparametric high-resolution imaging including DCE-MRI, DWI, ASL, MRSI, etc. Supplementary information from other imaging modalities like CT, US or PET are mandatory in some clinical situations for what precise spatial coregistration of imaging data will be necessary. Latest technological advances with MR/PET hybrid technology and novel PET-markers for e.g. proliferation, hypoxia, etc. will allow to more precisely detect and individually characterize diseases. Furthermore, MR imaging has become an ideal tool of preclinical research and clinical studies for translational research to bring laboratory findings more rapidly into practical clinical application and establish new therapies.

The continuous technological and methodological progress of MR will be escorted by a demand for optimizing data management. The constantly increasing number of referrals will put pressure on the patient throughput characterized by more examinations per time, more images per examination, more complex and multiparametric sequence protocols including multiple body part or even whole-body examinations integrating morphologic, functional and metabolic imaging. Examinations will be scheduled, planned and run semi-automatically. Exploiting the whole potential of MR, the Radiologists will be faced with the challenging demands to perform individualized and disease specific (personalized) examinations, to

immediately evaluate and report the morphologic-functional information using specialized software tools and speech recognition, to comprehensively demonstrate the findings in multidisciplinary conferences with multifunctional 3D- or 4D-image reconstructions, and furthermore, to perform image-guided minimal invasive interventions and focal therapies using MR hybrid technologies (e.g. MR-guided biopsy, RFA, HIFU).

The presentation will try to outline how innovations of MR may initiate changes in our medical landscape.