Swiss Neuroimaging: State-of-the-art 2004

This special issue of the Swiss Archives of Neurology and Psychiatry *is devoted to Neuroimaging, reflecting the growing use and quality of images in the field of Neuroscience for the purpose of research, diagnosis and therapy. It also represents a brief memento of the joint Meeting of the Swiss Societies of Neurology and Neuroradiology that takes place in Geneva in November 2004.*

Neuroimaging has grown as a result of the development of new visualisation techniques that allow us to image part or the whole of the nervous system for clinical and research questions. Neuroimaging also investigates the function of the nervous system as seen and analysed from a variety of viewpoints and disciplines, such as Neurology, Psychiatry, Neurosurgery, ENT, Ophthalmology, Neuroradiology and other related Clinical Neuroscience disciplines. The articles contained in this issue illustrate some of these new developments as currently available in Switzerland and elsewhere.

The Swiss Neuroscience groups have and continue to set the trend in the development and use of novel imaging and cartography methods for the non-invasive analysis of the human brain, for both clinical and scientific purposes. They are thus part of the leading groups in the patient imaging domain, as is reflected both in the contents of this issue and in the contributions presented at the joint annual meeting of the Swiss Societies of Neurology and Neuroradiology.

One area where Neuroimaging has progressed enormously is in its capability to go beyond anatomical analysis by providing functional imaging. Whether done with more standard methods such as SPECT and PET, or with functional MRI, areas of brain activity can be identified through imaging of increased metabolism and blood circulation. And it is likely that the role of these functional techniques will further progress with the development of high magnetic field scanners (3T and beyond). Swiss institutes have very actively contributed in this field and most likely will get more chances to do so with synergies developed between engineering and medical schools such as the Centre d'Imagerie Bio-Médicale, a cooperation between the Ecole polytechnique fédérale de Lausanne (EPFL) and the Universities and Hospitals of Geneva and Lausanne.

Further developments of MRI, such as diffusion tensor techniques and spectroscopy are starting to have an impact on Neuroscience research and patient management. Within this context, the article of P. Scheltens provides us with an insight into the use of modern Neuroimaging in dementia. Other imaging techniques, such as electromagnetic source imaging are under development to visualise brain function with high temporal resolution. Together, these functional imaging techniques provide instruments to identify areas of the brain in function and contribute in an important manner to the understanding of complex brain function or malfunction.

According to their high and increasing frequency, cerebrovascular diseases continue to be a focus for Neurology and Neuroradiology. All medical imaging techniques have and continue to evolve rapidly with MRI contributing at clinically important forefronts, such as e.g. stroke. Here, MRI has known a recent boost due to the emergence of new diagnostic methods such as diffusion and perfusion MR imaging techniques that now allow us to visualise the acutely ischaemic brain and its penumbra, as outlined in the paper by K.-O. Lövblad. Complementary, other imaging techniques, such as CTA (CT-angiography), have replaced conventional angiography reducing risk and evaluation time for patients in emergency situations; R. von Kummer summarises in his paper how CT technology can still provide us with indispensable information regarding acute ischaemia. The paper of A. Baird provides some additional insight on the impact of technological developments. The rapid imaging evaluation capability opened new treatment possibilities for patients in need with promising

results. Due to developments in minimally invasive and pharmacological strategies, ischaemic stroke can now be successfully addressed and damage limited or reversed by intra-arterial de-obstruction, as further outlined in the paper of M. Arnold et al. reporting on the pioneering Berne experience.

Increasing clinical experience and development of improved material technology has led the Interventional Neuroradiology to evolve into a specialty on its own. As A. Valavanis et al. explain in their article, for a subset of lesions, AVMs can nowadays be approached in a curative fashion with image-guided minimally invasive endovascular techniques. The advent of improved stent material and delivery system technologies allows for progressively accessing intracranial arteries with endovascular prosthetic devices, i.e. stents and alike. With such image-guided minimally invasive endovascular techniques it will be increasingly possible to reconstruct cerebral vessels with the use of stents to redirect flow and diminish intra-vascular forces having led to aneurysmal disease, as outlined in the article by D. A. Rüfenacht et al. Other minimally invasive image-guided direct puncture techniques concentrate on back-pain relief and here stabilisation concepts or targeted anti-inflammatory medicament deposition have changed in very practical manners the ways we today can care for many patients presenting with this frequent clinical symptom causing high medical costs.

With imaging becoming one of the main methods of evaluation of patients with neurological diseases and getting increasingly specific, there is a need to choose the best imaging method to efficiently answer each clinical problem. Knowledge of both neurological and neuroradiological issues are in great demand, and the two specialties getting closer may warrant a review of training conditions of both these specialties.

While these contributions represent only a portion of Swiss and international activity in Neuroimaging, they are characteristic of a field that has come to reach maturity in a few years and which will undoubtedly evolve further and keep stimulating younger generations of Neuroscientists to follow this exciting path. Thus our respective specialities are likely to continue merging in many ways that will allow insights into the healthy and diseased human brain and collaboration strategies are required to optimise common growth in the interest of our patients.

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