From telepathology to virtual pathology laboratory: the new world of digital pathology

Klaus Kayser*, Gian Kayser**, Dominik Radziszowski***, Alexander Oehmann*
*UICC-TPCC, Institute of Pathology, Charite, Berlin, Germany [klaus.kayser@charite.de]
**Institute of Pathology, University of Freiburg, Freiburg, Germany [gkayser@ukl.uni-freiburg.de]
***AGH University of Science and Technology, Krakow , Poland, [radzisz@radzisz.com]

Abstract

Telepathology has left its childhood. Its technical development is mature, and its use for primary (frozen section) and secondary (expert consultation) diagnosis has been expanded to a great amount. This is in contrast to a virtual pathology laboratory, which is still under technical constraints.

Similar to telepathology, which can also be used for e-learning and e-training in pathology, as exemplarily is demonstrated on *Digital Lung Pathology* (Klaus.Kayser@charite.de) at least two kinds of virtual pathology laboratories will be implemented in the near future: a) those with distributed pathologists and distributed (>=1) laboratories associated to individual biopsy stations/surgical theatres, and b) distributed pathologists (usually situated in one institution) and a centralized laboratory, which digitises complete histological slides. Both scenarios are under intensive technical investigations.

The features of virtual pathology comprise a virtual pathology institution (mode a) that accepts a complete case with the patient's history, clinical findings, and (pre-selected) images for first diagnosis. The diagnostic responsibility is that of a conventional institution. The internet serves as platform for information transfer, and an open server such as the iPATH (http://telepath.patho.unibas.ch) for coordination and performance of the diagnostic procedure. The size and number of transferred images have to be limited, and usual different magnifications have to be used. The sender needs to posses experiences in image sampling techniques, as he cannot ask for assistance in acquiring and transmitting those images which present with the most significant information. A group of pathologists is "on duty", or selects one member for a predefined duty period. The diagnostic statement of the pathologist(s) on duty is retransmitted to the sender with full responsibility. First experiences of a virtual pathology institution group working with the iPATH server (Dr. K.D. Kunze, Dr. K. Kayser, Dr. M. Oberholzer, Dr. G. Haroske, Dr. I. Hurwitz) working with a small hospital of the Salomon islands are promising. A centralized virtual pathology institution (mode b) depends upon the digitalisation of a complete slide, and the transfer of large sized images to different pathologists working in one institution. The technical performance of complete slide digitalisation is still under development; and does not fulfil the requirements of a conventional pathology institution at present.

Virtual pathology can be combined with e-learning and e-training, that will serve for a powerful daily-work-integrated pathology system. At present, e-learning systems are "stand-alone" solutions distributed on CD or via internet. A characteristic example is the Digital Lung Pathology CD, which includes about 60 different rare and common lung diseases with some features of electronic communication. These features include access to scientific library systems (PubMed), distant measurement servers (EuroQuant), automated immunohistochemistry measurements, or electronic journals (Elec J Pathol Histol,(pathology-online.org). It combines e-learning and e-training with some acoustic support. A new and complete data base based upon this CD will combine e-learning and e-teaching with the actual workflow in a virtual pathology institution (mode a). The technological problems are solved and do not depend upon technical constraints such as slide scanning systems.

At present, telepathology serves as promotor for a complete new landscape in diagnostic pathology, the so-called virtual pathology institution. Industrial and scientific efforts will probably allow an implementation of this technique within the next two years with exciting diagnostic and scientific perspectives.