

Organized for Ease

WHO/WHERE

Radiology Department,
Johannes Gutenberg University
Hospital, Mainz, Germany
Peter Mildenberger,
MD, PhD, Senior Radiologist,
Mrs. Ulla Roth,
Chief Radiographer



CHALLENGE

Achieving workflow efficiencies through the interoperability of digital and computed radiography, and the integration of modalities with RIS and PACS. Integration is implemented using DICOM standards, reducing both the administrative overhead, and the possibilities of transcription errors.

SOLUTION

Philips DigitalDiagnost
Philips Computed Radiography (PCR)

Peter Mildenberger, MD, PhD, is not just a Senior Radiologist in the Radiology Department (Head: Prof. Dr. M. Thelen) at the Johannes Gutenberg University Hospital in Mainz, Germany. He is also a driving force behind the development of the standards for DICOM and the IHE (Integrating the Healthcare Enterprise) initiative. Mrs. Ulla Roth, Chief Radiographer in the department, works with a mix of modalities and Picture Archiving and Communications Systems (PACS) from different manufacturers, and has a more immediately practical interest in the working of those standards. Together they have an impressive combination of theoretical and hands-on experience of the impact of an increasingly digital and computerized radiology environment on both radiographers and radiologists.

Digital transition

As part of a clinic providing a broad level of care, including the treatment of multiple trauma patients and both cardiac- and neuro-surgery, the Radiology Department at the Johannes Gutenberg University Hospital has to cover the full medical spectrum. It has 33 examination rooms in a number of different locations around the campus, and deals with approximately 400 examinations a day. Apart from its recognized work in cardiac diagnostics and interventions on a range of modalities, its focus in the conventional X-ray unit is trauma and skeletal diagnostics. With the exception of the mammography unit, the University clinic has converted all of its modalities to digital. In

“Getting both CR and DR from a single supplier is a very important part of the purchasing decision. This is an absolute competitive advantage for Philips.”

conventional X-ray, the department has a long history of using Philips – mainly because of the ergonomics of the systems (“They are great workplaces”, says Mrs. Roth), the image quality and the service and support (“The technicians are not only nice, they are competent and cooperative too”, she affirms).

When changing to digital, they looked at a number of systems and decided again for Philips. Now most of the examination rooms use Philips Computed Radiography (PCR), and more recently they have also been using a digital flat detector system, the Philips DigitalDiagnost. One advantage of the combination is that the DigitalDiagnost works well with the PCR for awkward projections and bed-bound patients. For Dr. Mildenberger “the attraction of working with Philips is not only the quality of the systems and application support, but also the fact that they offer complementary digital and computed radiography solutions”. On top of the interoperability of PCR and DigitalDiagnost, the consistency of images is also important. Both systems use the

PHILIPS



It's vital the X-ray system adapts to the multiple trauma patient. The Radiology Department agrees "DigitalDiagnost has an invaluable advantage for such cases", because the wall detector can be moved horizontally and vertically.



CR is used with DigitalDiagnost for awkward angles and sensitive situations where a digital flat detector cannot be used, i.e. axial shoulders or bed lung exposures.



Mrs. Roth, Chief Radiographer, stresses "getting both CR and DR from a single supplier is a very important part of the purchasing decision. This is an absolute competitive advantage for Philips."

same post processing algorithms, so there is little difference in how images are presented. This simplifies the reporting process by eliminating the need for the radiologist to adjust his or her interpretation for changing image characteristics. "Getting both CR and DR from a single supplier is a very important part of the purchasing decision", stresses Mrs. Roth. As the only major manufacturer offering both, "this is an absolute competitive advantage for Philips".

Convincing quality

Comparisons were made at the beginning to ensure that going digital did not mean sacrificing image quality. The staff in Mainz used traditional and digital technologies for successive examinations of patients who returned regularly. The quality of the digital images was generally better – particularly with the appropriate post processing. "One has to say that the CR systems from Philips are very good, we even see big differences to the CR systems from other suppliers that we have here in the hospital", says Dr. Mildenerger.

The digital flat detector of the DigitalDiagnost raised the level of quality again, showing itself to particular advantage for larger area, trunk skeleton examinations, such as spine or pelvis.

This helps in the multidisciplinary approach of the hospital to multiple trauma patients, which typically starts with a fast examination by CT (also from Philips) of skull, thorax, abdominal and pelvic regions. But Mrs. Roth adds that "the DigitalDiagnost has an invaluable advantage for such cases". Because the wall detector can be moved horizontally as well as vertically, the full quality of the DigitalDiagnost can be used for sagittal images of heavily injured patients while they are lying on their back – the X-ray system adapts to the patient, so the patient does not need to be moved.

Reduced dosage

Digital radiography also presents a good opportunity for reducing X-ray dosage. Dr. Mildenerger comments that in their in-house studies they noticed some degradation as the X-ray intensity was decreased, but this was not a significant issue for many diagnoses. Halving the dosage, from S400 to S800, is normally both reasonable and appropriate. "This means we get adequate images at significantly lower doses. But where fine details are important, for example, to detect or examine fractures, we continue to use traditional dosages to make the most of the increase in image quality" he says. Mrs. Roth also points out, that because the examination parameters are easily available for images made using DigitalDiagnost (from the PACS or printed on the film), it is easy to reduce the

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dosage for follow-up examinations. For example, for an ileus, the second and subsequent images could be made at half dosage. In fact the largest obstacle to doing this is the initial overhead of implementing the appropriate processes.

A new approach for radiographers

While digital radiography produces better results and offers important advantages, it is more a different than a fundamentally easier way of working for radiographers. As Mrs. Roth explains it, many of the challenges that radiographers face in a digital working environment are procedural. On the other hand, with the rate of change in technologies and integration, and current trends combining IT and modalities, there is always something to learn, and radiology is full of opportunities. Getting to grips with such opportunities is largely a question of appropriate training. Mrs. Roth, who organizes



Dr. Peter Mildenerger, Senior Radiologist, is a driving force behind the development of the standards for DICOM and the IHE initiative.

many of the in-house trainings, praised Philips for the basic training they offer with the CR system. This training is given to radiographers and radiologists together, and she saw this as increasing the acceptance of digital radiography by everybody, and easing its integration into existing processes.

Integration

Perhaps the largest challenge facing radiographers is on the administrative side. Working digitally imposes strict requirements on accurate and consistent data entry at every stage of patient and examination handling. This is necessary to ensure the different software systems can identify and assign images and data correctly. As long as radiographers have to enter this data manually, there is a risk of transcription or typography errors, and images or reports going astray. Though most of the initial data entry in Mainz will remain manual for the foreseeable future, the DICOM (Digital Imaging and Communications in Medicine) standards on which Dr. Mildenerger is working help ensure consistency between the different systems.

A fully integrated process stretches from patient admission and order creation to the distribution of images to referring physicians. At the modality the digital workflow begins with transfer of

the information on patients and examinations from the administrative worklist in the Radiology Information System (RIS) to the examination worklist in the modality. Previously the Radiology Department used a proprietary system to transfer this information, but with increasing standardization by many manufacturers it is now done using the DICOM Modality Worklist Management (MWLM) –indeed MWLM is a standard feature of both PCR and DigitalDiagnost systems. Compared with transferring the information manually from request forms on paper, MWLM leaves the radiographer more time and energy to concentrate on the patient – important, seeing as it is the patient handling that remains the biggest single factor in the quality and speed of the examination.

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Complementary standard

Once the examination begins, Modality Performed Procedure Step (MPPS) tracks and communicates the status and the parameters of the examination to the RIS – making the progress available throughout the department in close to real-time, and automatically documenting the parameters used for the examination. To a degree, MWLM and MPPS complement each other: MWLM indicating what is required, MPPS documenting how it is achieved – MPPS can even fill in gaps in the initial request, such as whether the left or right wrist was X-rayed, if this information is not explicitly contained in the MWLM. MPPS was tested successfully with the Philips DigitalDiagnost in Mainz in 2002. “Philips worked with us to achieve this, making this among the first such MPPS exchanges in the world”, says Dr. Mildenerger. However, the



Hand X-ray with DigitalDiagnost



Chest X-ray with DigitalDiagnost



Peter Mildenerberger, MD, PhD,
Senior Radiologist

supplier of the RIS is still implementing the RIS side of the MPPS transfer, though this too should be running in Mainz late in 2003.

For the radiologists, for example, this will mean easy access to examination status, to tell when the images should be ready for reporting. For the radiographers it will not only guard against transcription errors, it will also provide a reliable record of the examination. "We have seen it in angiography, where MPPS has worked really well for years", says Mrs. Roth. Current processes will need to be adapted, and the changes established and adhered to rigidly to ensure the best possible results, but "it is an absolute advantage, because we have to fulfill the German X-ray regulations, and the more the system can document for us, the more welcome it is", she says. Dr. Mildenerberger agrees that the full, digital integration of the DigitalDiagnost, using its uncompromised MPPS functionality, increases its value to the department.

Digital workflow

The department started working digitally with their first PACS in 1996. Today every digital image in the hospital is stored in a central archive. While the principal driver of digital operation is to provide efficient and effective access to pictures and reports for the referring physicians in the 20 clinics on the campus, Dr. Mildenerberger stresses that there are benefits to the Radiology Department too. It means a visible improvement in the services they deliver, and saves the time and effort taken to physically transport film and paper around the hospital. But all of this relies on clear and confident storage to the PACS. When an examination is completed, the modality automatically adds

the patient demographic information to the DICOM header of the image, and sends the image to the archive. Using DICOM Storage Commitment (SC), a standard feature of DigitalDiagnost, the modality maintains a link with the archive until it receives confirmation that the image has been stored successfully. It then deletes the image from local memory. SC ensures that otherwise undetected problems

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between the modality and the archive do not cause data loss or duplication, (if the same image is archived more than once), which, in turn, avoids repeat examinations and confusion.

Details that make the difference

As Mrs. Roth stresses, digital radiography requires a shift in approach to ensure the valuable improvements it can mean to image quality, reducing dosage, and efficient and low-error workflows. The increasing integration of modalities with RIS and PACS is important in this regard. The development of open standards, such as the DICOM MWLM, MPPS and SC, make this integration possible. And by accommodating the DICOM standards in the applications and modalities, such as the Philips DigitalDiagnost, the integration becomes feasible. In his work promoting DICOM standards as part of the IHE initiative, Dr. Mildenerberger makes the advantages of integrated digital radiography and radiology both apparent and desirable.



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