More from Less

Applying Digital Radiology

As Head of the Radiology Department at the University Hospital Herlev – part of Europe's largest medical school in Copenhagen, Denmark – Prof. Dr. med. Henrik S. Thomsen is proud of the difference in productivity and patient friendliness that digital radiology has already made to his department. Modernizations and expansions in the last couple of years have not only meant better diagnoses for more patients, but also a shift in the complexity of cases they have been able to deal with easily.

WHO/WHERE

University Hospital Herlev Copenhagen, Denmark, 711-bed regional hospital with a number of departments from the University of Copenhagen. Department of Radiology: Prof. Dr. med. Henrik S. Thomsen, Mr. Ian Røpke, Mr. Carsten Varney

CHALLENGE

Improving productivity and effectiveness of the Radiology Department with digital X-ray

SOLUTION

Philips DigitalDiagnost as part of an extensive upgrade and expansion program

Renovation of the Radiology Department began in 2000, and consisted of updating radiological equipment in the central and emergency units, building a new MR center and, most recently, merging ultrasound into the department. While the new MR center has pride of place in the new department, significant changes have occurred everywhere. Updating the equipment was necessary not least because delays in getting the budget had meant much of the equipment was up to 20 years old. While this in itself was less than ideal, it did mean that the department could skip a generation of equipment and change straight from film to fully digital radiology. The biggest effect of this change has been in the conventional X-ray examinations.

Renovation and Innovation

Renovating the radiological rooms involved more than replacing the generators and detectors. The department seized the opportunity to renew the lighting and décor, and to move the radiographer's workstations into a booth inside the examination room. These changes create a friendlier atmosphere for the patient and, because the radiographer now stays in the room all through the examination, the whole X-ray experience is less daunting.

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Philips DigitalDiagnost replaced analog systems in two of the rooms in the central radiology unit, and in the two emergency X-ray rooms too. Three of the four rooms have both Bucky tables and wall stands. The fourth room only has a wall stand. The department also uses a number of computed radiography (CR) cassettes with the DigitalDiagnost, for awkward angles, such as oblique hip projections, and sensitive situations, like bed-bound patients, where digital detectors cannot be used. In the emergency rooms the wall stands tilt (for hand

PHILIPS

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The Radiology Department uses CR with DigitalDiagnost for awkward angles and sensitive situations where digital detectors cannot be used, for best workflow and wider applicational range.

Prof. Thomsen & his team decided on Philips DigitalDiagnost because it offered them "the nicest images, adequate for diagnosis, with the lowest radiation."

examinations, for example), and a newly available innovation here will make the wall stands mobile in the horizontal as well as the vertical. This was originally a request from the Radiology Department in Herlev, to allow them to capture different images without having to move the patient from the table and to minimize the CR cassette handling. It has now become a standard part of the Philips radiography portfolio.

One of the main attractions of the Digital Diagnost for the department is its ergonomics. A well-designed system, at the workstation and in the examination room, requires less concentration and physical effort to operate, leaving the radiographer more time and energy to look after the patients. There is legislation on minimum requirements for workplace ergonomics in Scandinavia, and when they were looking for a digital radiology system in Herlev, Philips was a clear leader in this respect.

Speed and Simplicity

While the overall throughput of the department (not including ultrasound) has grown by 5 % a year since the renovation began (to 115,000 examinations in 2002), throughput for the type of examinations where Digital Diagnost systems are used has grown by 17 % in the same period. But Prof. Thomsen is quick to stress that this does not do full justice to the contribution made by the DigitalDiagnost systems. They not only make things faster, they also make things easier, and there has been a shift to more complex examinations in digital radiography (DR) rooms. Within the DR rooms there has been a 24 % increase in the number of resource-intensive examinations, such as X-ray of the thoracic or lumbar spine, or hip examinations.

Most of the growth comes from a simplification of procedures. There are 60 to 70 stages between a request for an X-ray examination and the radiologist's report arriving at the referring clinician's table. Digital X-ray eliminates or streamlines many of these steps. More patients can be handled, and complex cases become easier. "You cannot directly compare before and after", says Prof. Thomsen. "We have increased the throughput", says Prof. Thomsen, "but we have also gathered it into the DR rooms". One of the remaining analog radiography rooms is being decommissioned, and the other two now are used for simpler examinations. A severe lack of radiologists and radiographers in Denmark also limits the number of rooms they can run. "We have moved from seven rooms to five and a half, and have still increased our productivity". The efficient use of resources also means that some scheduled out-patient examinations are carried out in the emergency unit, to make use of the quiet periods there.

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Measuring the benefit in financial terms is not directly possible. Denmark's socialized help system means that the department receives a flat financial allocation. "We are not paid per patient", explains Mr. Ian Røpke, Economist for the Radiology Department, "but we do get more value for our investment in the digital radiography rooms, it is financially sound in that way". The economic benefit comes from better logistics and freeing up space, budget and energy for other activities. The department plans to upgrade remaining analog rooms to digital in the coming years – depending on budget.

Concentrated Care

With the shortage of radiologists and radiographers in Denmark, the increase in patient throughput would not have been possible without harnessing appropriate technologies like the DigitalDiagnost. Apart from being able to fit more patients into the same time, digital radiography also gives the radiographers more time for the patients. Digital radiography frees up the minutes (and physical effort) taken in

Prof. Thomsen agrees DigitalDiagnost not only makes things faster, it also makes things easier. There's been a shift to more complex exams, with a 24% increase in resource-intensive ones.

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Hand X-ray with DigitalDiagnost

Chest X-ray with DigitalDiagnost

transporting, developing and returning with a film, by providing a digital image, without having to leave the patient, in 10 to 20 seconds, depending on the application. The radiographer can check the image on the screen and confirm the success of the examination while the patient is dressing. Then, on the occasions when it is necessary, they can adjust the image before print to film after the patient has left.

Mr. Carsten Varney, Chief Radiographer, reports that the radiographers feel less stressed, despite a larger workload, and enjoy the increased patient contact. "You can see and talk to the patients all the time during the examination", says Mr. Varney. This also brings benefits from better patient compliance, because they are not left alone.

Radiologist's View

For the moment, the images are still printed to film, and it is the handling of this film for archiving, retrieval and reading that places the current limit on expansion. The department was constructed in the early 1970s, when patients had conventional X-rays in a limited number of projections. The radiologist used four films, two old ones and two new ones, to make a comparison and prepare a report. Today, reading a CT requires up to 8 films of the old series and 8 of the new. This reduces the number of patients that can be put in the auto-alternator at any time, and makes the reading of images and preparation of reports more cumbersome. As Prof. Thomsen says, "we could take more patients, but we cannot turn them around, because of difficulties handling the images". Improved image handling begins with the introduction of a PACS, which will simplify the radiologist's workflows.

The first digital workstations for the PACS are already in place, but most of the reporting in Herlev will continue to be from film until the PACS has a sufficient bank of images. Because so much of a radiologist's work involves comparing examinations, both the old and the new images have to be on the same medium before a complete changeover can take place. As has often been reported, the physical difference in presentation between a light box and a screen is too great for the eye to adapt and make a reliable comparison. "We are in a big oncology center where we do a lot of comparisons over three months or four months. We need these images either all on screen or all on film", says Prof. Thomsen. He expects that the department will probably archive for a year or two while still doing routine reporting from film, and only then change over to full reporting from the screen.

In the meantime, the images on the printed films have been greeted as an improvement over conventional films by the radiologists. Furthermore, if the image is not optimal, or needs different windowing or contrast, they can pull it from the archive, and reprocess it, rather than needing a repeat examination. In the beginning, Prof. Thomsen indicates that they will also use the workstations when "we want to see particular details from the digital radiography, CT or MR", or to reprint images that have been lost.

Minimizing Dosage

In general, Prof. Thomsen sees a major advantage in European X-ray systems, like those from

Philips, as their careful ways with X-ray dosage. They adhere to the ALARA principle – As Low As Reasonably Achievable. From this point of view, the department decided on Philips DigitalDiagnost because it provided them with "the nicest images, adequate for diagnosis, with the lowest radiation". In Herlev, Philips technicians have been working with the radiographers and radiologists to try to reduce the doses further. Because of the sensitivity of the detector, the DigitalDiagnost will

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go as low as speed 1600 (a quarter or less of a standard dose). So far they have tried as low as speed 1200, with surprisingly good results. However, because these lower doses have yet to be mapped to appropriate types of examinations, speed 400 is still used for routine examinations, for the moment.

Post-processing plays an indirect role in controlling dosage too, particularly for musculoskeletal studies where both hard and soft tissue areas are of interest. Before, two examinations with different exposures would have been necessary, now post-processing provides the same information from a single image.

Maximizing Benefits

The improvements in the department are not finished yet. Apart from Philips groundbreaking Windows-based PACS, and the Philips 16-slice CT, the department is planning a second 16-slice CT for the near future.

Prof. Thomsen, Head of Radiology

Further proposals include electronic referrals and distribution of reports, and extending PACS access to the meeting rooms. Once this is in place, the radiologists will be able to consult with the referring clinicians on their home ground, combining the radiological and clinical conferences. "This is more effective, the radiologists move out to where the patients are", says Prof. Thomsen.

Such improvements in service are important in Herlev. Under Denmark's socialized health system, increasing productivity and quality of service is less a matter of economic performance; and more a matter of pride. Dealing with extra patients and offering them better facilities is a case of providing better care for more people. Providing quicker reports and better access to information and expertise is an instance of increasing the whole hospital's efficiency and effectiveness. For Prof. Thomsen and the Radiology Department at Copenhagen University Hospital in Herlev, digital radiology, and Philips DigitalDiagnost are proving to be a solid basis for such improvements.

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