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Moving from Computed Radiography to Digital Radiography, a Collaborative Approach to Improve Image Quality

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Background
The University of New Mexico School of Medicine (UNM SOM) and the University of New Mexico Hospital (UNMH) have long worked together to deliver high quality patient care to the citizens of New Mexico and the surrounding region. One of the key ways that the Department of Radiology has worked to deliver the highest quality care to the patients of UNMH is by establishing a Quality Assurance Committee. The committee is composed of radiologists, technologists, medical physicists and support staff who all lend their expertise to review and help solve any quality assurance issues for the department. This poster is one example of how a “team” within the Quality Assurance Committee helped solve an important image quality issue within our department, and improved patient care.

Purpose
This project is an example of how to form a team (triad) comprised of radiologists, technologists, and physicists to utilize post-processing techniques in digital radiography (DR) in order to optimize image acquisition and improve image quality.

The Issue
After the installation of a new GE Discovery XR656 Digital Radiographic room, our radiologists began to identify images with “quality issues.” The issues ranged from images appearing under penetrated, to images with soft tissue that resembled “a plastic phantom.” It was readily apparent that all of the images identified as having quality issues were being produced from the new GE Discovery room.

The issue was brought up at a monthly Quality Assurance meeting, and a team composed of the quality assurance technologist, a medical physicist, and a radiologist was formed to carry out the investigation and to find a solution.

Investigation
The investigation proceeded by determining the common causes for image quality complaints:

- The Quality Assurance manager and technologist supervisors ruled out technologist error.
- The medical physicist ensured that the imaging system was functioning properly.
- Radiologists were interviewed for more information regarding exactly what the image quality issues were.

With the radiologist interview, a major clue was finally discovered. The lead markers on some of the images appeared to have a subtle shading in the center. See Figure 2. A quick test was then performed by reprocessing the image with a slightly different algorithm. Figure 3 shows the reprocessed image with a notable difference in the appearance of the lead marker and the patient’s anatomy.

Methods
After further review of the vendor supplied documentation, it was determined that there were many image processing settings that could be adjusted to create hundreds of different custom image processing algorithms. Figure 4 shows the GE Image Processing Preferences Editor interface. This interface not only allows the adjustment of typical image values, such as “Contrast” and “Edge” enhancement, but also vendor specific values such as “Tissue Contrast” and “TE-under/over Penetrated.”

- Various exam types from adult musculoskeletal (n=35), adult chest (n=4), and pediatric (n=7) were chosen for review.
- All the images in each exam type were reprocessed using five customized algorithms. In total, 673 images were reprocessed for review by the radiologists. Figure 5 shows an example of one group of reprocessed images.
- An image score sheet was created (Figure 6) allowing the radiologist to assign a numeric score to each of the processed images.
- Each image was scored based on seven properties: 1) overall image look, 2) soft tissue contrast, 3) high contrast, 4) latitude, 5) tissue equalization, 6) edge enhancement, 7) visualization of structures. Additional space allowed for additional comments not captured in scoring categories.
- Scores for each custom algorithm for each image set were summed. The algorithm with the highest score for each image set was then set as the default for each exam type.

Results
Default processing for each type of image study was changed to the algorithm with the highest score. Some elements of the custom algorithms were further adjusted upon request by the radiologists.

Due to this quality assurance project, the department of radiology can produce better quality images from the GE XR656 Digital Radiographic System. Soon after this project was completed, an additional GE XR656 system was purchased and installed at an offsite clinic. The custom processing algorithms were copied onto this new system to ensure image quality consistency between the two facilities.

Images taken on the GE systems and placed into the PACS “QC folder” for image processing reasons decreased. Feedback from radiologists was, overall, that image quality for these studies had improved.

Conclusion
This work is an example of the collaboration between radiologists, technologists, and physicists at the University of New Mexico to add value to the radiology department. The significant amount of work required to prepare the processing algorithms, reprocessing and scoring of the images was eagerly taken on by all team members in order to produce better quality images and improve patient care.

This process of team image optimization will now be implemented at the time of install for each new radiographic system at our facility.

References