

Digital radiography – Experience efficiency with automated system movements

Evaluation of an automated digital flat detector radiography system in a pediatric radiology department

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Background information

There are numerous factors that drive a radiology department to adopt digital imaging technology. The use of the Picture Archiving and Communications System (PACS) and hospital management's need to optimize operating costs for higher efficiency are only two examples.

With these factors and the impending obsolescence of the existing conventional radiography system in some regions, the radiology department decided on a fully automated digital flat detector radiography system, AXIOM Aristos FX. Reasons for this decision were the preference for a flat detector (FD) system and one that delivers a high level of automated system movements. Numerous independent studies have proven that flat detector imaging systems improve productivity and deliver significant dose-saving advantages.

Comparing FD and CR systems

This study was performed in a pediatric radiology department of a university

hospital with an annual patient throughput of 30,000 patients for general radiography. 40% of these imaging examinations are emergency cases with the patient throughput remaining at a stable level in recent years. There are two general radiography rooms. The AXIOM Aristos FX system is installed in one of them while the other room is a conventional radiography unit with a computerized radiography (CR) imaging system. The study focused on the comparative evaluation of the FD system and the CR system with regard to three key indicators: patient throughput, changes of workload within the rooms, and user satisfaction.

Methods and evaluation

The first part of the study focused on the comparative evaluation of overall patient throughput. A total of 193 patients were evaluated during the study, with 94 patients examined on the conventional/CR system and 99 patients examined on the AXIOM Aristos FX. Of these 193 patients,

five categories of examinations were evaluated; chest, abdomen, pelvis as well as upper and lower extremities. The examinations were further divided into those with a single exposure and those with two exposures (where frontal and lateral projections are standard). Throughput and average examination time of these procedures were also measured. Additionally, each examination was broken into three phases to analyze where the most benefits were experienced. The phases consisted of:

- Positioning phase: Patient positioning and placement of detector or CR cassette for each respective system.
- Execution phase: Execution of the imaging process including exposure, access to patient data, CR cassette processing, and visualization of image for FD system.
- Acquisition phase: Consisting of archiving via PACS for the two radiographic systems.

The second focus of the study assessed the workload distribution of patients to the two different radiographic rooms over the 1-year study period. Finally, the 14 users of the two imaging technologies were surveyed for their satisfaction with the systems, using the following criteria:

- User-friendliness of the systems
- Ease of use of the systems
- Image quality
- Speed of examination

Results of comparison

Comparative evaluation of the complete patient treatment time found a 30% reduction from 403 seconds to 266 seconds with the FD system compared to the CR system. The patient treatment time was defined as the time when the patient arrived at the waiting room to the time the acquired image was available on the internal network. On average, time savings between 48% and 59% were achieved

for the various examinations from chest to pelvis, with the greatest time savings for pelvis examinations. It was also measured that on average, 51% time savings could be achieved for single exposure studies and 55% for double exposure studies. Maximum time savings were achieved in the execution phase with up to 83% time savings for a double exposure study.

For workload distribution, it was observed that by the end of the study, 84% of patients were assigned to the AXIOM Aristos FX room. This is largely due to preference of the new technology by the users for its image quality, dose savings of up to 40%, and reduction in mAs values while achieving identical image density and contrast.

Eleven of the 14 users surveyed preferred the flat detector system on all performance criteria while three users found the flat detector and CR systems to be similar for one criterion each.

Concluding considerations

Some concerns were noted with respect to a total conversion to a digital department with only FD systems. As it is a pediatric department, the large size of the panel could not always be accommodated in patient beds and stretchers. Manual handling of the system and maneuvering of the patient bed within the examination room required some effort. Moreover, at the time of the study, automated and sequential acquisition of the entire spine and legs was unavailable on the flat detector system, long CR cassettes were employed for this imaging mode. This has since been addressed with a software upgrade on the system and retrofit of the ortho acquisition function and a new detector housing, which delivers the same performance as its successor, AXIOM Aristos FX Plus.



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