

Comparison of Conventional Radiography and Digital Computerized Radiography in Patients Presenting to Emergency Department

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SUMMARY

Objectives

To compare the differences between conventional radiography and digital computerized radiography (CR) in patients presenting to the emergency department.

Methods

The study enrolled consecutive patients presenting to the emergency department who needed chest radiography. Quality score of the radiogram was assessed with visual analogue score (VAS-100 mm), measured in terms of millimeters and recorded at the end of study. Examination time, interpretation time, total time, and cost of radiograms were calculated.

Results

There were significant differences between conventional radiography and digital CR groups in terms of location unit (Care Unit, Trauma, Resuscitation), hour of presentation, diagnosis group, examination time, interpretation time, and examination quality. Examination times for conventional radiography and digital CR were 45.2 and 34.2 minutes, respectively. Interpretation times for conventional radiography and digital CR were 25.2 and 39.7 minutes, respectively. Mean radiography quality scores for conventional radiography and digital CR were 69.1 mm and 82.0 mm. Digital CR had a 1.05 TL cheaper cost per radiogram compared to conventional radiography.

Conclusions

Since interpretation of digital radiograms is performed via terminals inside the emergency department, the patient has to be left in order to interpret the digital radiograms, which prolongs interpretation times. We think that interpretation of digital radiograms with the help of a mobile device would eliminate these difficulties. Although the initial cost of setup of digital CR and PACS service is high at the emergency department, we think that Digital CR is more cost-effective than conventional radiography for emergency departments in the long-term.

Key words: Conventional radiography; digital CR; emergency department.

Submitted: July 30, 2013 Accepted: July 31, 2014 Published online: January 20, 2015

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Turk J Emerg Med 2015;15(1):8-12 doi: 10.5505/1304.7361.2014.90922

Introduction

Digital radiography (Digital CR) was first introduced in the 80s^[1] when the first radiograms were recorded on phosphorus-coated digital cassettes.^[2] The advantages of digital radiograms include manipulation of digital data at various stages between image acquisition and final interpretation. A wide dynamic range is obtained.

There are multiple advantages of digital CR to conventional radiography. Spatial resolution is higher and images can be recorded electronically. It allows Teleradiology and Picture Archiving and Communication System (PACS) applications. It does not require image re-acquisition. It mitigates workload by virtue of absence of stages such as dark-room and developing process.^[3,4]

The aim of our study was to compare the difference between conventional radiography and digital Computerized Radiography (CR) in patients presenting to the emergency department.

Materials and Methods

University Faculty of Medicine is a tertiary emergency department with nearly 65000 annual patient admissions. Patients are examined and treated at a total of 3 sites of care (emergency care unit, resuscitation, and trauma). Our study was conducted between January 2010 and June 2010.

All consecutive patients who presented to the emergency department and had a chest radiogram for any reason were included in this study, following permission from the University Faculty of Medicine Local Committee of Ethics. Hemodynamically unstable patients, those undergoing emergency operations, and those in need of a necessary intervention (ex. tension pneumothorax, evisceration, traumatic cardiac arrest outside the hospital) were excluded from the study. Only patients who consented were included in the study. To form a more homogeneous group, only chest radiograms were included. Chest radiograms were only obtained in patients who demonstrated need for the imaging by virtue of indication, diagnosis, comparison, and higher frequency of use.^[5] Three research assistants were involved in the study, each with 2 years experience. Research assistants were instructed in filling of the patient enrollment forms prior to study onset, but had no instruction on evaluating the quality of radiographs. VAS scores were determined based on personal perceptions of overall quality of the radiograms. The emergency department had a conventional radiography device before installing the Digital CR device. The conventional chest radiography group was therefore formed first, followed by digital CR. Digital CR was performed using the Kodak CR 975 digital radiography device. Emergency

service assistants evaluated the radiographs at terminals in the emergency department (emergency care unit, resuscitation, and trauma), and filled the appropriate scores. Ege University Faculty of Medicine Department of Emergency Medicine performs a mean of 175 radiographic examinations each day. A total of 621 chest radiographies, 301 conventional and 320 digital CR, were included in the study.

The quality score of the radiography was measured using visual analog scale (VAS-100 mm) in millimeters and recorded at the end of the study. The examination time was calculated by subtracting the radiographic examination time from the examination request time and recorded in minutes, and the interpretation time was calculated by subtracting radiographic examination time from the radiographic interpretation time and recorded in minutes.

All data from this cross-sectional study were transferred to digital medium and analyzed by SPSS 11.0 statistical software.

As a basic statistical analytical method, descriptive statistics, mean, standard deviation, and frequency tables were used. Continuous variables were presented as mean±standard deviation; categorical variables were presented as frequency and percentage. Advanced statistical analyses included Chi Square analysis to test the significance of the difference between the paired groups and Student's t-test to test the significance of the difference between the means.

Results

The mean age was 55.9±19.9 for conventional radiography and 57.3±18.6 for digital CR. No significant difference in age was detected between both groups (T:1.092, p=0.375).

Gender of the study population was distributed evenly, with 342 (53.3%) male patients and 279 (46.7%) female patients. The conventional radiography group was composed of 159 (25.6%) males and 142 (22.8%) females, whereas the Digital CR group consisted of 183 (29.4%) males and 137 (22.0%) females. Gender distribution was not different in both groups.

There was a significant difference between conventional radiography and Digital CR groups in terms of units (Care Unit, Trauma, Resuscitation) at which they were cared (Table 1).

There was a significant difference between conventional radiography and Digital CR groups in terms of the distribution of the hour of presentation (Chi Square: 25,068, p≤0,0001) (Figure 1).

Mean examination time and Interpretation time for conventional radiography and digital CR show a statistically significant difference.

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