Difference in Radiograph Image Between Prints Directly on CR Modality with Print Through PACS

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Abstract. The radiology quality control program often called the Quality Control of Radiology, is a program of activities aimed at monitoring and maintaining radiology equipment systems, especially in the diagnostic section to determine the performance of the equipment. Quality control is available in several types of testing tools acceptance testing, routine performance evaluation, and maintenance. Radiographs produced by Computed Radiography and PACS need to be confirmed to obtain For optimal results on Computed Radiography and PACS, Quality Control is needed to monitor the performance of the Computed Radiography and the PACS. One of them is ensuring that the density values printed on the Computed Radiograph and PACS are the same. The purpose of this study was to determine the differences in the results of chest radiographs Computed Radiography print with PACS printout. The research method used is quantitative analytics. The population in this study is all results of chest radiography at the Radiology Installation of Salatiga Hospital. Samples taken at In this study, 1 chest radiograph per day was printed using two methods, namely the method through Computed Radiography and PACS. Done every day for 7 working days. The radiographs printed by CR have a higher density value. While the radiograph that are sent first to the PACS have much lower agglomeration density due to data compression during the transmission process.

Keywords: quality control · computed radiography · density · PACS

1 Introduction

Computed Radiography is the process of digitizing images using sheets or photostimulable plates for image data acquisition. In CR the image receiver used is a photostimulable phosphor plate or Imaging Plate which was first introduced in 1981 in Brussels [3]. The exposed imaging plate is then inserted into the imaging plate reader. In the IP Reader, the tape will automatically open and the IP issued. Then the IP is scanned, deleted, and returned to the cassette so that it can be used for further examination. The scanned image is then entered into a computer for processing and then displayed on a monitor or film [3].

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The Picture Archiving and Communication System (PACS) is an inter- and intra-institutional computing system that manages the acquisition, transmission, storage, distribution, display, and interpretation of medical images. As such, the system is highly integrated with the imaging process of the Department of Radiology and with clinical practice based on radiological imagery. In recent years, there has been.

Significant growth in PACS implementation, mainly due to tangible advantages such as improved workflow, increased yield and productivity, fast and simultaneous remote access to image data, electronic archiving, the possibility of improved image quality, and cost-effectiveness, leading to the increased overall quality of patient care.

Almost all of the Radiology Installations in hospitals in Indonesia have used Computed Radiography and PACS aircraft to support their services. This Computed Radiography has helped a lot of radiographers to get good radiographs to present optimal diagnostic information. PACS also helps a lot to speed up the process of radiology services with other agencies. To ensure that the radiographs produced on Computed Radiography and PACS are optimal, Quality Control is needed to monitor the performance of the two media. One of them is by ensuring that the density value printed on the Computed Radiography is the same as density on printed radiographs from PACS. This is what makes the author think to test whether Computed Radiography and PACS are still available within the recommended tool standards.

2 Literature Review

The Quality Control program has the aim of ensuring that the radiographic results of the radio diagnostic tools used have an optimal level of quality. According to JCAHO, the Quality Control program is a prerequisite for the feasibility of equipment to be sold or used. Even the Department of Health and the Council of Radiation Control Program Director (CRCPD) make this program a set of guidelines and regulations.

Since electronic display devices are responsible for image display in all digital images, it is important to evaluate them for optimal display according to standards. Many groups who published guidelines for QC procedures including the National Electronics Manufacture's Association (NEMA), the Society of Motion Picture and Television Engineers (SMPTE), the Digital Imaging and Communication in Medicine (DICOM) group, and the AAPM. As noted in this issue, not a single set of recommendations is held by the health community. Medical physicists and radiologists should be consulted for setting the standard display at the facility to the general standard adopted [2].

The digital image is an image changed from analog to digital, which is processed digitally so that it can be manipulated or image processing on the monitor screen. Digital imaging system consists of Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Ultrasonography (USG), and Computed Radiography (CR).

The concept of Computed Radiography using a Photostimulable Phosphorus Plate as an image receiver was first introduced at the international congress in Brussels in 1981. In 1981, Fuji Film Company introduced the concept of Computed Radiography using the Photostimulable Phosphorus system. Computed Radiography was first used in the medical world in 1983 in Japan. Computed radiography is the same as conventional radiography. However, images are obtained in digital format using an imaging plate instead of film. Computed Radiography is the process of digitizing images using photostimulable phosphor imaging plate for image data acquisition [3].

The process of producing digital images on Computed Radiography in a nutshell, namely the Imaging Plate (IP) produces a latent image when exposed to X-rays. Then into IP, it is inserted a slot on the image plate reader device will transfer and scan with a helium-neon laser (emitting red light with a wavelength of 633 nm) so that the crystals on IP produce blue-violet light with a wavelength of 390–400 nm. This light is then detected by a photo sensor and sent through an analog-digital converter to a computer for processing. After the image is obtained, the IP is transferred to another part of the imaging plate reader device to remove any remnants of the image so that the IP can be reused [2].

The exposed Imaging Plate is then inserted into the imaging plate reader. The cassette will automatically open and the IP will be ejected, scanned, deleted, and returned to the cassette so that it can be used for further examination. Scanned images later entered into a computer for processing and displayed on a monitor screen and reconstructed to be printed on a laser imager [3].

3 State of the Art

A measure of the level of development (in the form of a device/product, procedure, process, technique/method, or science (Fig. 1).

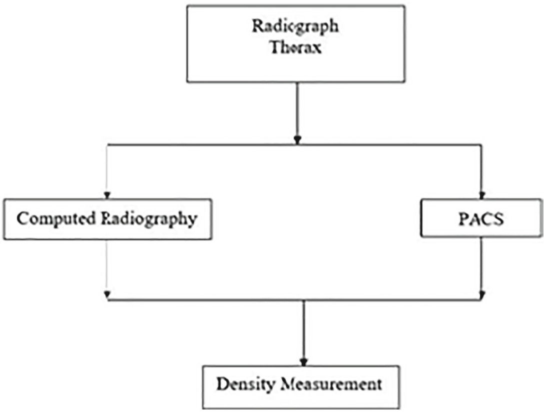

Fig. 1. Radiography Density Measurement Flow

4 Methods

4.1 Authors and Affiliations

This research uses analytical quantitative research.

4.2 Population and Sample

The population in this study were all results of chest radiographs at the Radiology Installation of Salatiga Hospital. The sample taken in this study was 1 thorax radiograph every day, printed using two methods, namely the CR print method and the PACS print method.

4.3 Techniques of Data Collection

The data collection method that will be carried out by the author is as follows:

- Experiment
- The author experimented by printing chest X-rays for 7 days and then comparing the prints with CR and PACS.
- Observation
- The author made observations on the Computed Radiography and PACS printers at the Radiology Installation of the Salatiga Hospital.
- Documentation
- To strengthen the data, the authors document and attach documents related to the research.

Measuring Point	**Densitometer Measurement**						
	Day ke- 1	***Day ke- 2***	***Day ke- 3***	***Day ke- 4***	***Day ke- 5***	***Day Ke- 6***	***Day ke- 7***
Clavicula	0,95	1,04	1,19	1,2	0,77	1,00	1,24
Pulmo	1,88	1,77	1,7	1,53	1,42	1,74	1,57
Cardio	0,5	0,41	0,55	0,76	0,56	0,48	0,77
Soft Tissue	1,3	1,2	1,21	1,8	1,6	1,34	1,9
Outside the Object	2,2	1,44	2,44	2,08	2,03	1,46	2,09

5 Result and Discussion

5.1 Densitometer Measurement Results with CR

Measuring Point	**Densitometer Measurement**						
	Day ke- 1	***Day ke- 2***	***Day ke- 3***	***Day ke- 4***	***Day ke- 5***	***Day Ke- 6***	***Day ke- 7***
Clavicula	0,7	0,84	0,99	1,05	0,62	1,05	0,84
Pulmo	1,52	1,37	1,46	1,49	1,23	1,49	1,37
Cardio	0,45	0,3	0,43	0,51	0,41	0,51	0,3
Soft Tissue	1.02	0,91	0,95	1,32	1,24	1,32	0,91
Outside the Object	2,02	1,33	2,02	1,82	1,71	1,82	1,33

5.2 Densitometer Measurement Results with the PACS Print Method

Following the results listed above, it can be seen that from density measurements on the radiographs printed by CR and PACS there are differences in density values, where the density value decreases when printed by PACS. The chest radiograph printed by CR has a higher density value, this is because the printed radiograph does not experience data compression first, it just changes from digital data to analog data that occurs due to data transfer from the monitor to the printer. While the radiographs that were sent first to PACS have density values that are far adrift. This happens because the radiographic image is compressed. Data compression is data compression performed on digital images to reduce the redundancy of the data contained in the image so that it can be stored or transmitted efficiently. The data compression technique that occurs is Lossless Compression. An image compression technique where none of the image information is removed. In this technique, the image will experience a decrease in color resolution.

Image compression is an application of data compression on digital images. The goal is to reduce excess image data so that it can be stored or sent efficiently. There are two kinds of image compression methods, namely the lossless and lossy methods [1].

Lossless compression is more often used for virtual images, such as technical drawings, icons, or comics. In addition, the Lossless compression method is also more often used for content that prioritizes image quality, such as medical imaging or scanned results for archiving needs. In cases like this, the Lossy method cannot be used because the lossy compression method will cause image blur, especially when used at low bit rates [1].

According to D, Putra (2010) the compression process can result in loss of information in the resulting image. Therefore we need a criterion to measure the truth of the compression results which are often called fidelity criteria.

Acknowledgment. The next research plan is to compare the density produced in the print using Direct Radiography with the print using PACS.

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