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Digital Repeat Analysis in Digital Mammography

Jakubiak RR[1], Gamba HR[1], Peixoto JE[2], Munhoz CS[1]

[1] Technological Federal University of Paraná/Academic, Physics Department, Curitiba, Brazil

[2] National Institut of Câncer- INCA, Praça Cruz Vermelha, 23 – CEP 20230-130, Rio de Janeiro, Brazil.

Abstract

This procedure has as an objective establishing the main reasons to mammography rejection. The rejection analysis is an important tool from the quality control programs, which contributes to the evaluation of the image´s quality standard. The analysis methodology is based on the recommendations from *Honea et al.*. For a two months period, the rejected examinations in the technician´s workstation and also in the PACs (Picture Archiving Communication System) were evaluated in order to number the causes of examination rejection after introducing a digital mammography system. The results show the possibility of separating the rejections into two types: the ones which would lead to more expositions, contributing to the increase of dose for the patient, and the ones which would lead to the need of reorganizing the results presentation, creating more work and increase of expenses.

Keywords: Digital radiology, Analysis of rejection , dose reduction

Introduction

According to Ordinance No. 453/98 of the Health Surveillance Secretariat of the Ministry of Health that was published in 1998, quality control in radiology sector is of fundamental importance and is required for its implementation that makes use of ionizing radiation[1]. This quality control program has three main goals: to improve the quality of the radiographic image, reduce costs and doses given to patients and has among the main proceedings, a refined analysis of rejected tests, assessing its causes and classifying them according with them. This procedure is of fundamental relevance to identifying, evaluating and correcting human error or equipment failures that may be poorly calibrated to the patient providing an extra dose of radiation which is harmful to health[3].

Methodology

The methodology is based on recommendations from Honea et al.[2], rejected following examinations before and after printing in order to quantify the needs of rejection after introduction of a CR system. The recommendations of the Ministerial Order 453/98 item 4.44 (vii) have been followed in the

collection period, which should be two months. Many tests were printed and only then evaluated by doctors, or have rejected the monitor working.

This monitoring of rejection before the impression is very important because it allows you to track the pattern of rejection fully, because one of the most relevant factors to be monitored is the dose to the patient. It was used in the study were two mammography Lorad Afinitty equipment com Computed Radiography (CR) Fuji Profet One.The methodology was implemented in two stages, first collected all the films were rejected over a period of two months in the year 2011, approximately 185 and then drew up a study to determine the most frequent causes of rejection which led to a data evaluating and scoring the tests that were discarded before and after processing. This table is described below (Table 1).

Table 1 - Causes of rejected exams

Causes of rejection	Causes of rejection
Motion artifact	Wrong film size
Grid artifact	Wrong images positioning
IP artifact	Despised by the medical examination
Artifact of skin fold	Identification data over the images
Compression plate artifact	Wrong patient identification
Artifact for deodorant, talcum powder or ointmen	Lack of Identification
Metal artifact	Wrong patient name
Wrong positioning	Problems in mammography equipment
Inadequate exposure	Markers missing or wrong
Windowing (dark)	Without rejection cause
Windowing (ligth)	Images reversed in the film
decentralized structure	Wrong images size
Identifying the area of interest	Stereotactic Calibration
Structure without clipping	Tests
Structure cut	Film damaged

Results

The charts 1 and 2 below show the result of an analysis conducted in 2011 for about two months, covering the rejections that occurred before and after printing.

The results show the possibility to refine the analysis, separating the rejections that lead to new expositions, which contribute to patient dose increasing, and rejections that would lead only to the need to reorganize the presentation of results, generating more work and demanding increasing in costs. In a department of radiology, both aspects are relevant.

The total rejection rate was 3% of the total of examinations performed.

If we evaluate the causes that lead to the need of repetition, chart 1, we have the classification of inadequate exposure, with a percentage of 0.85%, that seems very low. However, despite of being classified under a different name, artifact rejection by anti diffuser grid, with 0.85%, can also be classified as inadequate exposure. For mammography that have movable grid, as Lorad Afinitty, low breast thickness should be selected for exposition at Auto Time with voltage values, defined by the AEC pre calibration, between the tension (kV) of 24 kV and 26 kV for the software to select the smallest scales of current and longer times of exposure available, to compose the current time product (mAs).

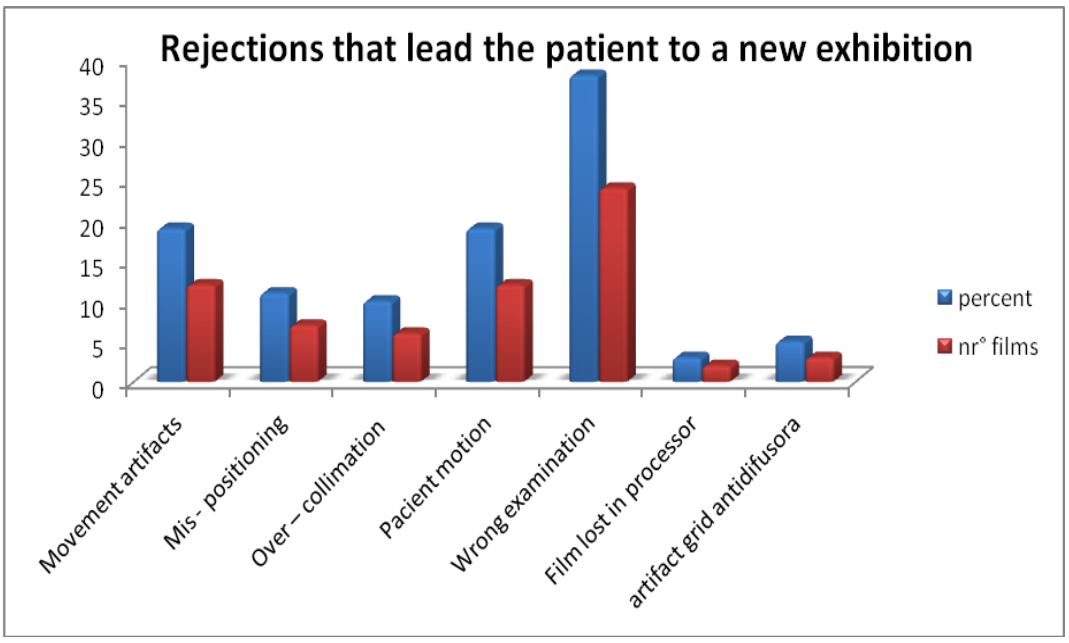

Chart 1 - Rejections that lead the patients a new exhibition

This selection allows complete oscillation of the grid, avoiding artifacts. The rejection by inadequate positioning is 2.56%. However, the exams rejected by doctors for not having diagnostic quality standard add 10.26%, and can incorporate rejections by inadequate positioning, inadequate exposure and artifacts of the grid, and would total 14.52%.

One of the relevant factors in rejections or poor quality images is the incorrect photocell positioning, which must be positioned in the region over the breast parenchyma. However, patients do not always bring the previous exams, so that the radiographers can evaluate the most suitable position of the photocell. With regard to the artifacts from the patient motion, may be caused by inadequate compression, which severely affect image quality, as well as improper orientation, selection of long time exposure factors that may also be related to optimal exposure factors to breasts of small thickness to prevent the grid artifacts.

The total of 21.37% of tests leads to the need of exam repetition.

The chart 2 present the remaining causes of rejections in a digital mammography service that does not lead to the need for repetition, but generates costs and work time consuming of the staff.

They totaled 78.63% of rejections in the service, while the highest rejection rate, 18,38%, corresponds to duplicate film, followed by 13.68% rejection without identification of causes, which even may be reasons that would lead to repetition, but were not properly identified by the professional conducting the exam or doctors. As to rejections by incorrect name of the patient, 11.11%, 7.26%, or lack of identification, 2.99%, can cause very serious problems of mismatch between reports and patient. Due to the existence of a process of tracking and checking of routine patient within the clinic, the errors were identified and corrected.

About 21.37% of total rejection examinations lead to its repetition. The rejection rate for inadequate positioning was of 2,56%. However, the examinations which were rejected by the doctors for not presenting diagnostic quality, sum 10,26%. These can incorporate both rejection for wrong positioning or inadequate exposition and grid artifacts, totalizing 14,52%.

The causes of rejection which did not lead to the need of repetition totalize 78,63%. However, they cause additional expenses and demand work time from the involved crew. The major rejection, 18,38%, correspond to duplicated film, followed by rejections without identified cause, with 13, 68%.

The rejections by incorrect patient´s name totalize 11,11%. From these, 7,26% were with changed identification and 2,99% were without identification. These errors can cause extremely useful tool to show the relevance of implanting the RIS protocols and the worklist tool. The analysis of

the rejection results may contribute to the definition of the sectors involved in the production of images which must be accompanied in a more continuous way.

One way to reduce this type of error was through the implementation of the HIS/RIS protocols and the *worklist* tool, so that the registration of patient identification occurs only once at the reception and is automatically transferred to the system.

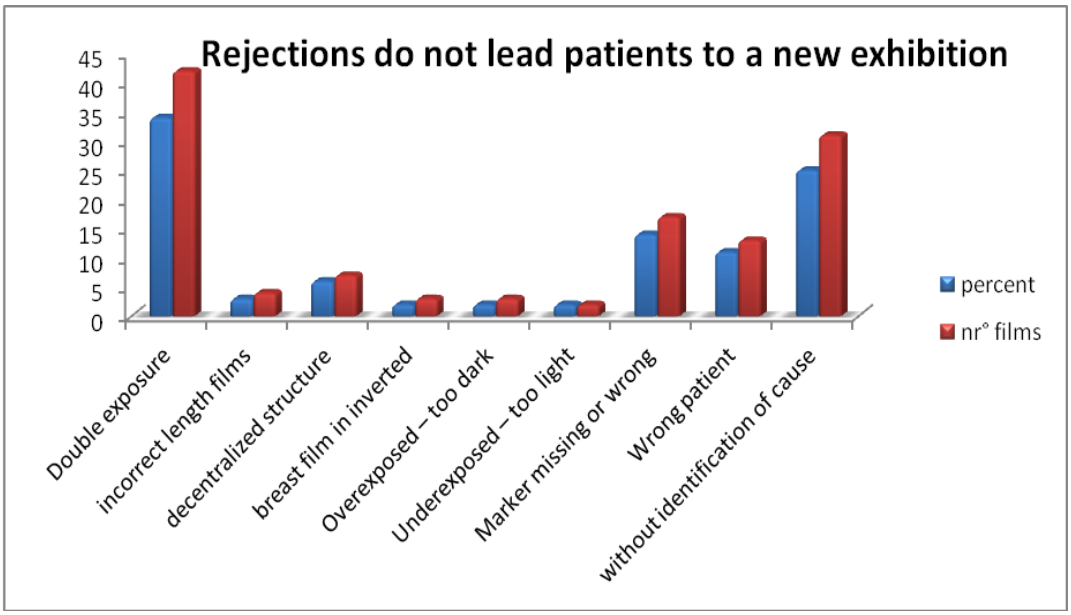

Chart 2 - Rejections do not lead patients a new exhibition

Conclusions

Changing system for CR technology makes it necessary to perform the analysis procedure of rejection of tests.

However, it is possible to extract data from the CR or PACs (Picture Archiving Communication System), analysis can be done through the registration of technicians who did the exams.The team being aware of the need for identification of faults, for a schedule of training and maintenance, making notes properly.With the reduction of rejection, there will be reduction of the dose to the patient.

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