
Analysis of Causes for Reject X-Ray Films as a Quality Assurance Element in Diagnostic Radiology in Jos University Teaching Hospital(JUTH)

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Abstract

The film reject rate and Quality Assessments studies were carried out at the Jos University Teaching Hospital. The rejected films were collected and counted with respect to type, size and reasons for rejection was carried out for two calendar years. The observed reject rates were found to be nearly independent of the type of X-ray examination, which 68% of waste film reflected the nature of the techniques and skills employed. The mechanical influence of equipment (machine fault is 11%, film rejection due to poor processing (dark room fault) was found to be 8% and for film rejection due to wrong identification, fogged film, uncooperating patient (patient movement) are 5%, 5% and 3% respectively. The deterioration in the quality of films and film processing conditions, ineffective quality assurance programs and inadequate regular staff training form a possible explanation for observed waste films which could have been avoided.

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Introduction

A growing global radiation protection concern in diagnostic radiology is justifying the patient doses incurred during X-ray examinations. The concern originates from the fact that, when considering stochastic effects, even small radiation doses carry some risks. Therefore, clinically unjustified, avoidable repeated or unoptimized X-ray examinations may unnecessarily lead to increased risk of adverse health effects and hence need to be minimized (Rehani,1995). Among these, unoptimized X-ray examinations are difficult to manage, especially in situations having little experience. Considering the case of medical imaging where 10% of the films are wasted at screening at darkroom and Radiographer's level and 10% are of reject quality or perceived by the Radiologist and even much more without concern for loss (Rehani, 1995).

In Jos University Teaching Hospital(JUTH), it was observed that film reject was due to the following reasons such as poor quality films, poor techniques, poor processing, over penetration, under penetration, no exposure, cut off, coned off, double exposure, high fog, motion blurring, blank, artifact, basic fog, light fog, wrong identification, poor preparation, poor chemical or weak chemical was recognized as the various reasons for rejected films which was then prompted to initiate pilot research on radiation protection in diagnostic radiology.

The experience to be gained through a pilot study was foreseen to be useful in the carrying out of wide scale studies. Among the planned tasks in the pilot study was to undertake film reject rate analysis, which is one of the useful indices for assessing the extent of avoidably repeated radiograph and unoptimized X-ray examinations. Practices are aimed simply at keeping all radiation risks to health as low as is reasonably achievable (ALARA principle) social and economic consideration be taken into account under the constraint that no individual will be subjected to undue risk (IAEA, 1989). The film reject rate analysis identifies the factors responsible for the deterioration of radiographic images from which corrective solutions may be realized. This research is for two calendar years from the past records of film reject of the radiology department of Jos University Teaching Hospital (JUTH) for the year 2006 and the year 2007 were used for this research.

Reject Film Analysis/Recording

The Physicist act as the institutions Radiation Safety Officer (RSO) on matters relating to image quality/optimisation, patient Dosimetry, quality assurance (IAEA, 1995), and other matters relating to radiation protection as required. Their function and responsibility is to ensure that QA programs are carried out in the following:

I. Films Processing

For radiology departments the print film, the most important aspect of the constancy testing relates to the film processor. Substantial image quality and patient

Analysis of changes for reject X-ray through quality changes in the Diaprocessor chemistry, replenishment rate, and temperature and development time. As such, densitometry and densitometry measurements should be performed regularly on the processor (RANZCR 2002, BSA 2002, Craig et al, 2001). Once established that tolerance levels have been exceeded, investigative action is warranted to determine the cause of the problem. Any artifacts appearing on the test films should be investigated

II. An analysis of the reasons for rejecting images, whether produced on film or in digital form (Honea et al, 2002), is a fundamental aspect of the QA program and should be undertaken by a Senior Medical Imaging Technologist. Errors of positioning and image labeling may emerge which can be remedied by appropriate instruction. Over or under exposure errors may be indicative of a fault with a particular X-ray tube in a particular room or point to a case of mismatched film-screen combinations, for example. It is important to note that reject analysis should be conducted as part of an educative rather than a punitive process. Cooperation, not alienation of Medical Imaging Technologists and others, is a key to a successful QA program.

III. Record Keeping

Another key element of any QA program is proper record keeping so that any long term trends associated with a particular item of equipment can be identified and acted on before image quality and/or patient dose are compromised. Control charts, which plot the behavior of a measured parameter as a function of time, represent a convenient way to keep records of constancy tests. In any event, such record keeping should at least extend to noting (ARPANSA, 2007). If not, it might not be possible to find anyone who remembered what was done (IAEA, 1976).

Materials And Method

The reject films were counted according to type, size and cause of the rejection, which with the assistance of three experienced staff were explained and noted in this study. The reject rate of interest is then tabulated for analysis using the Microsoft Excel program. The film reject rate under study was carried out for two calendar years in the two X-ray rooms at Jos University Teaching Hospital (JUTH).

Results

Reject Rate

The number of reject films is classified into six reasons for which they are rejected, which are poor technique, poor processing, machine fault, wrong identification, fog, un-cooperating patient or patient movement. The result of the raw data has been analysed as in table 1 and as well as figure 1 and 2. This result are reasons for all films rejected in JUTH respectively. The reject rate by reason of size as a percentage of this causes are observed as due to poor techniques, poor processing, machine fault, wrong identification, fog and un-cooperating patient or patient movement are 58%, 13%, 10%, 10%, 4% and 5% for size 10" x 8" film, 72%, 7%, 9%,

5%, 4%, and 3% for size 12x10 film, 79%, 6%, 6%, 2%, 2% and 5% for size 14" x 14" film, 61%, 5%, 18%, 5%, 10%, and 1% for size 15" x 12" film and lastly 68%, 10%, 12%, 3%, 5% and 2% for size 17" x 14" film respectively as shown in tables and figures below.

Table 1: Reject Rate by Reason by Size As A Percentage of Other Causes

Film Size	Poor Technique	Poor Processing	Machine Fault	Wrong ID	Fog	un-cooperating patient
10" x 8"	58	13	10	10	4	5
12" x 10"	72	7	9	5	4	3
14" x 14"	79	6	6	2	2	5
15" x 12"	61	5	18	5	10	1
17" x 14"	68	10	12	3	5	2

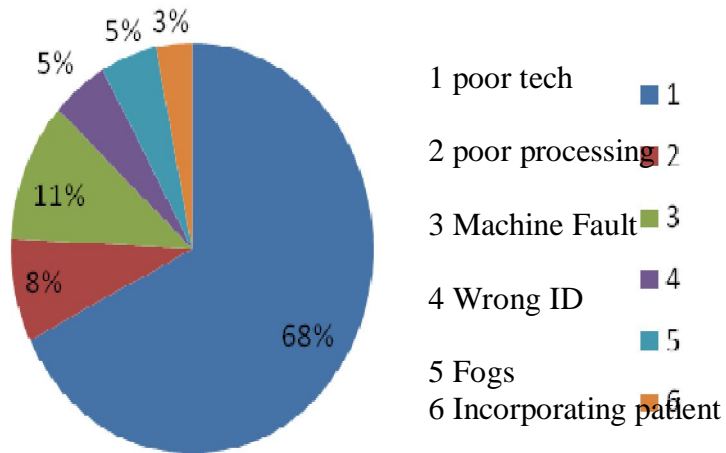


Figure 1: Film Reject Rate for all Sizes Films Over two Years

Analysis of Reject Rate Result:- The result in table 1 indicate that the mechanical influence of equipment leading to reject film was less than 20% which 10%, 9%, 6%, 18% and 12% for the various film sizes. In particular, the techniques and skills employed, contributed to about 58%, 72%, 79%, 61%, and 68% of the rejected films for various sizes. It can also be observed that for processing the film reject contributed about 13%, 7%, 6%, 5% and 10% respectively for various sizes. It may further be observed that the film reject rates due to wrong identification, fogging and incorporating patient (patient movement) are similar as they are about 10% or less

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across the studied sizes over the two years studied period in Jos University Teaching Hospital (see table 1) and nearly independent of the type of X-ray examination. It can therefore be also observed in figure 1 for overall film reject for the studied year period are 68%, 8%, 11%, 5%, 5% and 3% respectively. It can be concluded that a large proportion of waste film was due to the techniques and skills employed which amount to about 68% and dark room amount to about 11%. This influences on film rejection were observed significantly in chest X-ray examinations and apparently it is an evidence of improper patient instruction, the difficulty in selecting appropriate exposure factors was observed to be a source of majority avoidably waste film, the use of exhausted film processing chemical leads to underdeveloped and appear underexposed, the usual reaction is to increase the exposure of patient and the film in an attempt to compensate. This results in unnecessary patient exposure. If the processing is not properly controlled and fluctuates with time, some films might be incorrectly exposed and require repeating. Elevated reject rates in pelvis and special examinations is an evidence of this deficiency. The waste film implies unjustified dose to the patients through repeated exposures and unnecessary wastage of resources (Violation of ALARA Principle). The main approach to reducing cost must be to cut down technical film waste (Kofo, 1997). The usefulness of training programs in reducing the film reject rate has been demonstrated elsewhere (Watkinson et al, 1984).). Even in this study, the film reject results indicate that waste film could substantially be reduced through regular training. Finally, there is also a need to strengthen related quality assurance programmes for immediate corrective actions.

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