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An evaluation of Radiology Technologist Experience with Patient Dose in the Radiology Department

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Abstract: An evaluation study of x-ray image doses at the Public Hospital Radiological Department sought to determine the causes of the repeat/rejected images and how it is related to the staff expertise. The reasoning behind this study was the maximization of patient safety from excess/unwarranted radiology doses at the department. This article will help develop a mechanism for quality control for the department to make digital x-ray as safe as possible at the facility. This study revealed that positioning error, machine problems, anatomy cutoff, artifacts, and body movement were the reasons for frequent repeat/reject x-ray procedures at the department. This article revealed that these errors had a strong relationship with staff causes. The leading cause of the errors coming up in the radiologic department is directly related to the radiology technologists' causes/competencies. Technologists with less than eight years of experience were directly/indirectly responsible for 87.5% of repeat radiation procedures. Technologists with over eight years of experience contributed to 12.4% of the repeat/rejected procedures. This study recommends implementing quality control methods more aggressively and improving on-the-job staff training to protect patients from unnecessary radiation.
Key Words: X-ray, Reject/repeat images, ALARA, Technologist experience.

1. Introduction

Patients are exposed to ionizing radiation during diagnostic x-rays, accounting for approximately half of all ionizing radiation fields to which ordinary people are exposed [1]. Multiple ionizing radiation exposures put people at risk for harmful doses of radiation, which can lead to issues like cancer later in life [2]. Despite these inherent dangers, the maximum dose of radiation that might cause or not create issues later in life is unknown, making it critical to protect patients from any unnecessary radiation as much as possible [3]. The responsibility will be greater on the radiology technologist to maintain patient safety and keep the dose at the low range of risks while ensuring good quality images.

The radiology technologists should keep in their mind "As Low As Reasonably Achievable (ALARA) standards when they perform an x-ray image [4]. This retrospective study investigates causes that may obstruct this goal at one of Saudi Arabia's public hospitals. The study focused on a range of objectives, including understanding the underlying causes of extra doses of irradiation to patients, creating guidelines for reducing digital x-ray retakes at the department, and coming up with recommendations and strategies for minimizing rejects at the department.

2. Methodology

The study was cross-sectional with data collected for rejected upper extremities, lower extremities, chest, skull, abdomen, pelvis, and spine radiographic images. Data collection occurred over three months in 2021 at General Hospital. Exclusion and inclusion criteria are the basis of selecting participants. After selecting study

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participants, in this case, all the x-ray rejects on the clusters mentioned it was considered the reject rates. Retake factors influenced image retakes in this study. These retake factors include anatomy cutoff, positioning error, artifacts, body movement, and machine problems. The data collected from influences of these factors involved the skull, upper extremity, abdomen, pelvis, chest, lower extremity, and spine. Figure 1 was an essential tool for data collection in the research. Categories used in this data collection instrument were Gender, Radiographic Procedures, kVp, mAs, Dose, Retake Factor, and Technologist experience.

3. Results

From the data collected, reasons for rejection of images included positioning error, artifacts, anatomy cutoff, machine problems, and body movements. The sample size in this study was made up of all the rejected x-rays. The basis for tracking the rejected radiographs included gender, radiographic procedure, technologist experience, retake factor, dose, kVp, and mAs. The distribution of radiography procedures for male and female genders for the procedures that made up the study's data is shown in Table 1.

Figure 2 illustrates a chart of the study's data, demonstrating that positioning error was the most common reason for repeat factors in the radiology department. Positioning error was responsible for the most significant dose of ionizing radiation in the patients that visited the institution. The anatomy cutoff was the second most common cause of reject/repeat procedures at the hospital. The third reason cause for rejection/repeat at the facility was machine problems, while the fourth reason was the artifacts. Body movements accounted for the minor reject/repeat procedures in this study. One groundbreaking finding in this study that pinned the rejection and repeated procedures on the radiology technologist indicated that technologists with eight years of working experience as junior technologists contributed to the highest repeat rates. The data shows that junior staff contributed to 87.5% of the repeat procedures. In comparison, the senior technologists with more than eight years of experience in the department only contributed to 12.4% of the errors, validating the finding of a greater likelihood of the errors originating from staff in the department.

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Retake X-ray

Notebook

File No.	Gender	Radiographic Procedures*1	KVp	mAs	Dose	Retake Factor*2	Experience

* Factors affecting image retake: -
1) Positioning error 2) Anatomy Cutoff 3) Artifacts
4) Body movements 5) Machine Problems
* Skull – Upper Extremity – Chest – Abdomen & Pelvis – Spine – Lower Extremity.

Figure 1 Data Collection Instrument.

Table 1 Male & Female Retake Images description

Female		Male	
A/P	19	**A/P**	31
Chest	22	**Chest**	38
LE	20	**LE**	19
Skull	4	**Skull**	4
Spine	15	**Spine**	14
UE	12	**UE**	19
Total	92	**Total**	125

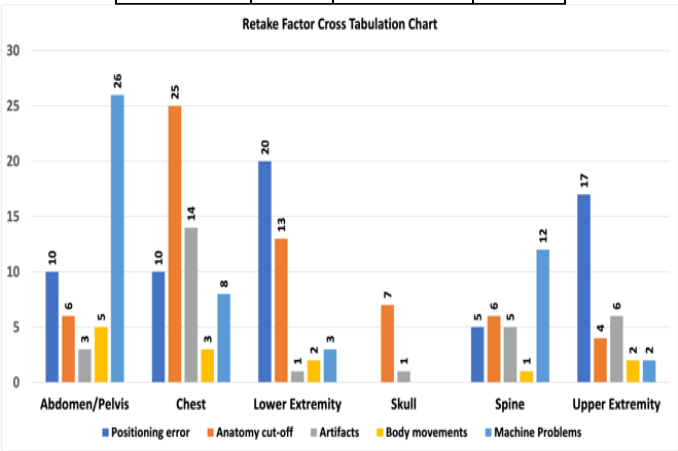

Figure 2 Retake Factor Cross Tabulation Chart

4. Discussion

The results of this study point back to the radiological department. The errors noted in the department are contingent on the competence of the radiological staff. Most of these errors occurred because of staff lack of experience or inadequate understanding of certain predisposing factors to the errors. According to the European Society of Radiology [5], radiologists are responsible for ensuring patient safety when performing radiographic procedures. It means that radiologic technicians and departments oversee keeping patients safe.

A major intervening factor contributing to most of these errors was staff experience and competence. Staff competence/accuracy is a common cause of radiological errors that contribute to rejection and repeat radiation procedures. Lack of experience is a precursor to errors in radiologic procedures. These findings were consistent with the findings of Akhtar et al. [6]; Stephenson et al. [3]; Hofmann et al. [7]. From the findings of this research, staff experience at the facility and quality control elements requires greater commitment dedicated to positively improving the conditions for improving staff competence and know-how to minimize the errors.

5. Conclusion

The goal was to determine the relationship between the technologist experience and the extra x-ray dose caused by retake images and what causes General hospitals in Saudi Arabia to reject or repeat imaging procedures. The rejection of radiographs and repeat procedures was due to a lack of technologist expertise. The construction of an in-house quality control drives aimed at radiology technicians at the department to build staff abilities that will allow proactive prevention of reject and repeat procedures at the radiologic department is recommended in this study. The high rejection/repeat radiology rates were caused by quality control difficulties in radiology at the hospital facility. Even though the study only had a limited sample size and was conducted in a tiny facility in southern Saudi Arabia, the findings are significant for radiology departments worldwide. To attain a higher level of patient safety, radiology departments should prioritize quality control procedures and in-house staff training to make personnel aware of circumstances that predispose patients to excessive ionizing radiation doses.

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تقييم تجربة أخصائي الأشعة مع جرعة المريض في القسم

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مستخلص. سعت هذه دراسة في قسم الأشعة بمستشفى عام إلى تحديد أسباب تكرار / رفض صور الأشعة السينية وعلاقتها بخبرة الموظفين بقسم الأشعة. كان السبب وراء هذه الدراسة تعظيم سلامة المرضى من جرعات الأشعة الزائدة / غير المبررة في القسم. كان الهدف من الدراسة هو التوصل إلى آلية لمراقبة الجودة للقسم لجعل الأشعة السينية الرقمية آمنة قدر الإمكان في المنشأة. وبالنظر لنتائج هذه الدراسة فقد تبين أن المنشأة والموظفين مسؤولون بشكل جماعي عن جرعات الإشعاع الزائدة للمرضى. ومن هذه الأسباب نقص الخبرة لدى بعض الموظفين وأيضا عدم مراقبة الصيانة الدورية لمعدات التصوير الطبي. وتشير النتائج أيضا إلى أن العاملين بالقسم لا يلتزمون بتطبيق المعايير المطلوبة التي يجب على المرافق الصحية والموظفين العمل بها في اقسام الأشعة التشخيصية. ومن ضمن النتائج تبين أيضا إلى أن الموظفين الذين تقل خبرتهم عن ثمان سنوات سجلوا أعلى أعداد من الصور المعادة وهذا دليل على أن الخبرة تلعب دورا مهما في مجال التصوير الطبي. وهذه قضية مهمة يجب على المنشأة والقسم تكريس جهودهم لحلها والأهم من ذلك ضمان سلامة المرضى من جرعات الأشعة السينية التي يمكن تجنبها.

بالنظر إلى النتائج، توصي الدراسة بتنفيذ أساليب مراقبة الجودة بشكل أكثر قوة، وتحسين تدريب الموظفين أثناء العمل لضمان حماية المرضى من الإشعاع غير الضروري.