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EXPLORING THE EFFECTS OF RADIATION DOSE ON IMAGE QUALITY AND PATIENT SAFETY

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ABSTRACT
In the past few decades, man has created hundreds of radionuclides artificially for a range of uses, including smoke alarms, illuminating displays, radiation, and medical diagnosis. These uses result in higher radiation exposure levels to Man. Man-made applications have a direct impact on the demographic groups that use them, in contrast to natural background radiation exposures, which influence the entire population. The majority of man-made sources are under control, and the amount that people are exposed to is directly correlated with the nation's level of industrial and economic development.In CT imaging, survey or localizer radiographs are essential. However, radiologists and radiographers frequently lack knowledge of the localizer radiograph's many roles and functions. The issue of radiation exposure has received significant attention in the public consciousness community, despite its advantages for diagnostics. According to recent studies, CT procedures make up roughly 10% of all diagnostic imaging tests and 62% of the total effective radiation exposure dosage related to healthcare. .
Keywords:radiologists understand, CT imaging, patient positioning

1. INTRODUCTION

For ATCM to function well, the patient must be positioned precisely at the gantry iso-centre because misalignment can result in improper current modulation and impact dosage output [1][11]. Localizer radiographs guarantee precise modification and validation of the scanned anatomical area covered, as well as allowing dose management software to optimize radiation for picture acquisition. This helps reduce patient dose by efficiently optimizing the scan's length or range [12]. Over the past ten years, there have been comparatively few systematic, scoping, or literature reviews that exclusively focus on localizer radiographs, despite improvements in CT technology and dosage management [3]. A thorough evaluation of the present procedures in the CT imaging industry with regard to localizer radiographs and their effects on radiation dose and image quality has not yet been conducted [2]. A comprehensive examination of the combined impacts of localizer radiographs and their improvements in clinical applications is lacking, despite the fact that specific studies have concentrated on different features of these radiographs [15]. Therefore, our objective is to look at the different ways that localizer radiographs can be used, especially when it comes to optimizing [4]. In order to improve patient safety over the past 10 years and offer insight into real-world applications, we also want to look into the function of localizer radiography in precise dosage estimation [6].What technological developments, clinical uses, and contemporary procedures surround the employment of localizer radiographs, and how do they affect CT test radiation dose and image quality[16].

2. LITERATURE REVIEW

A useful and effective way to combine novel concepts and topics in a field is through scoping reviews [8]. The recommended strategy for assessing the quantity of available evidence for this mapping overview was the scoping review methodological framework outlined by Arksey and O'Malley.

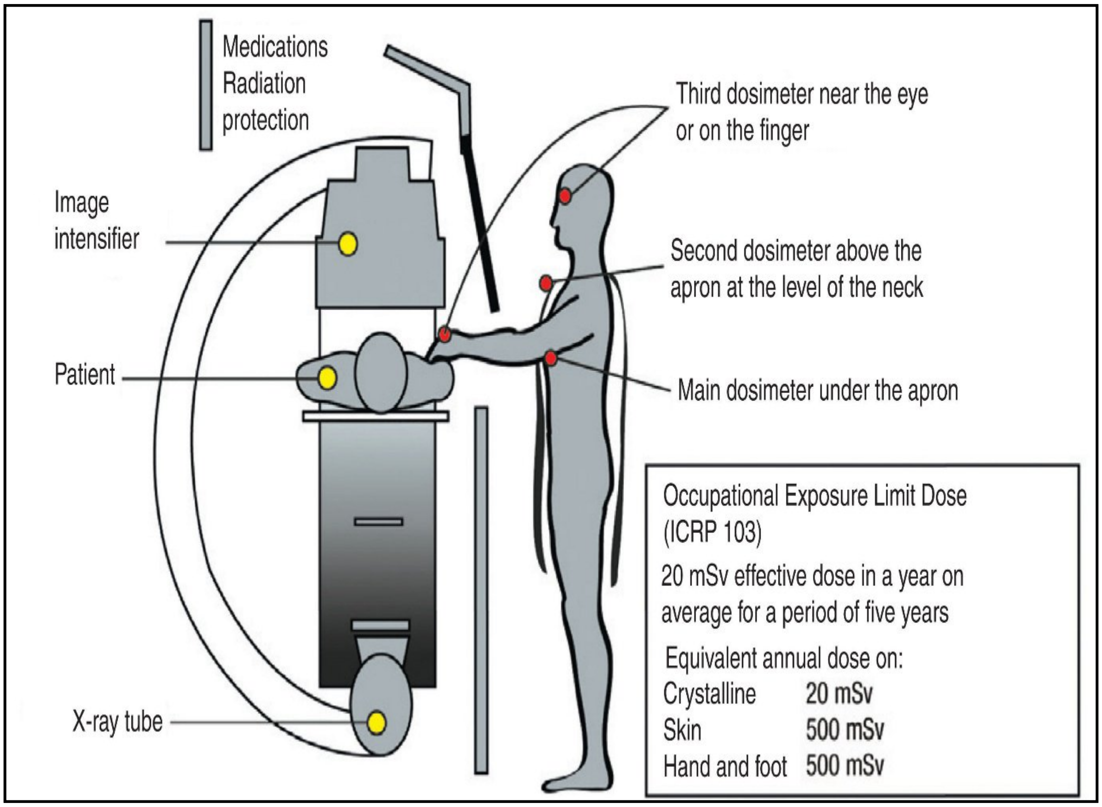

Figure 1: Importance of radiation dosage (source:web)

Covidence (Covidence, Melbourne, Australia) was used to compile, upload, and de-duplicate search results. In order to determine citations' eligibility, two reviewers independently screened the titles and abstracts [10]. Two reviewers separately evaluated the screening of the entire texts that were obtained. However, because they do not account for differences in patient size and shape, existing dosage measures such as CTDIvol and DLP are considered insufficient [5]. As a result, when scanned with the same imaging conditions, patients of varied sizes could obtain the same CTDIvol.

3. METHODOLOGY

Despite the fact that a subject's height and size affect their radiation dosage (DLP), individuals undergoing neck CT scans did not have their body weight or shoulder breadth regularly monitored. Centimeters were used to record the outcome. Reducing the amount of subjective judgment and tube current selection required to provide the appropriate image quality was the aim of ATCM. Shortly after section MDCT was built, our institution solely used the fixed mA technique[13]. In this context, CT techs manually chose the tube current based on their subjective assessments of the patients' body sizes, which frequently led to variable image quality.

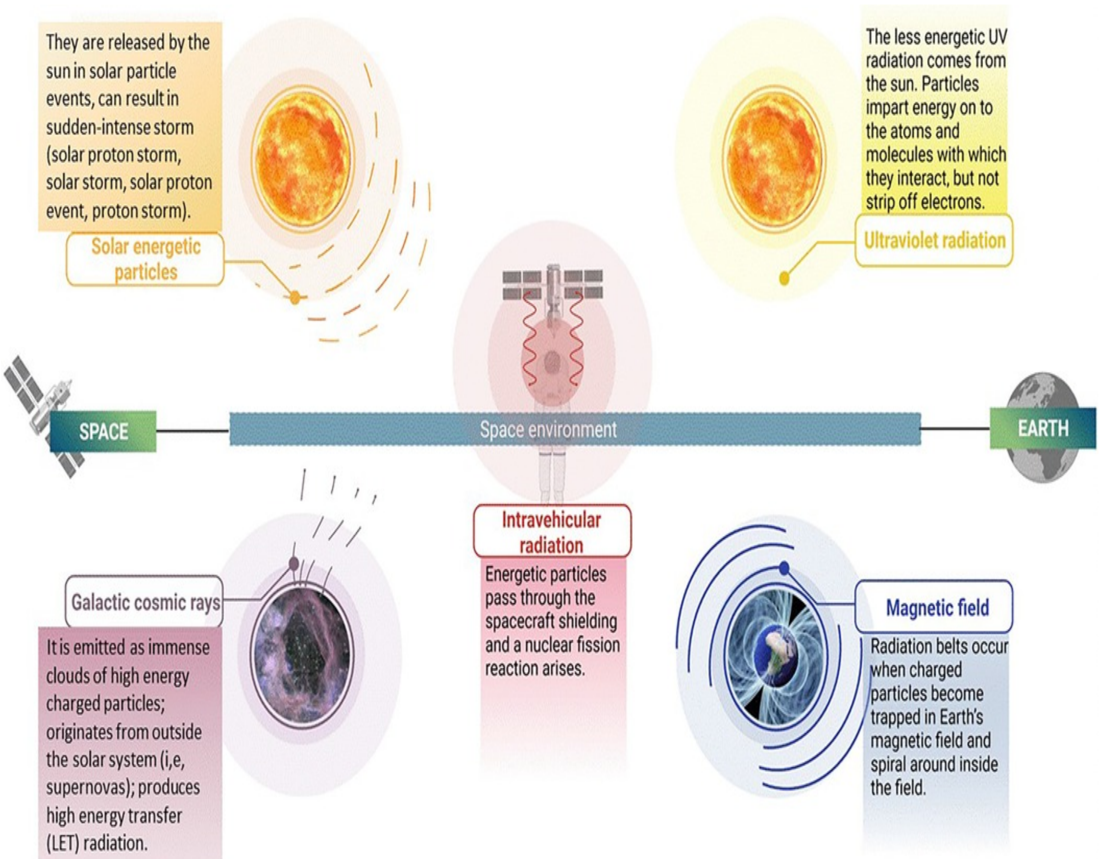

Figure 2: radiation exposure dosage (source:web)

Because of the neck's extremely radiosensitive organs (such as the thyroid and lens) and its widely variable form and attenuation inside the person, it was the perfect body part to employ combination ATCM on [7][14].

4. ANALYSIS AND DISCUSSION

In order to maintain the total radiation dose as low as reasonably achievable (ALARA), it is crucial to remember the principles of radiation safety and radiation dosimetry as CT applications grow in popularity [9]. But for image quality to continue being used for diagnosis, it must remain high enough.

Table 1: BinomialLogistic Regression

	B	S.E.	Wald	df	Sig.	Exp(B)
What is the effectiveness of specific vaccines, such as measles, HPV, or pneumococcal conjugate vaccines, in low-income countries?	-.645	.416	2.412	1	.020	.524
How can vaccine hesitancy and refusal be addressed in low-income countries?	.432	.338	1.631	1	.202	1.541

What are the optimal vaccination schedules and strategies for low-income countries?	.192	.052	13.420	1	.000	1.212
How can vaccine supply chain and logistics challenges be overcome in low-income countries?	.268	2.089	.016	1	.898	1.307
How can radiation dose be optimized in fluoroscopy procedures?	-.645	.416	2.412	1	.020	.524
What are the effects of radiation dose on image quality in pediatric imaging?	.432	.338	1.631	1	.202	1.541
Can iterative reconstruction algorithms reduce radiation dose while maintaining image quality?	.192	.052	13.420	1	.000	1.212
What are the long-term risks of radiation exposure from medical imaging?	-.645	.416	2.412	1	.020	.524

Additionally, more research is required to properly define what constitutes a "acceptable" image quality for radiologists who work with the head and neck. The most reliable indicators of image quality might not be blinded evaluations. Furthermore, the study did not assess the accuracy or conspicuousness of abnormality. Investigating this in a clinical context is not feasible. It's very possible that different radiologists will have different standards for acceptable image quality.

Table2:RotatedFactorMatrix

	Factor		
	Health System Factors	**Political and Governance Factors**	**Economic Factors**
What is the cost-effectiveness of vaccination programs in low-income countries, and how can resources be optimized to achieve the greatest impact?	-.011	.889	.154
How do vaccination programs in low-income countries affect health outcomes, such as hospitalization rates, disease transmission, and economic productivity?	.085	.473	-.069
What are the key factors influencing vaccination coverage and effectiveness in low-income countries, and how can these factors be addressed?	.913	.205	-.069
How do immunization efforts affect the reduction of vaccine-preventable illness morbidity and mortality rates in low-income nations?	.802	-.150	-.158
How can vaccination programs in low-income countries be evaluated and monitored to ensure accountability, transparency, and continuous improvement?	.733	.282	.251
What is the impact of vaccination programs on reducing health inequities and disparities in low-income countries?	.221	-.598	.150
How can vaccination programs in low-income countries be strengthened to respond to emerging threats, such as pandemics and disease outbreaks?	.662	.453	-.593
What are the social and cultural factors that influence vaccine acceptance and uptake in low-income countries, and how can these factors be addressed?	.762	-.269	-.048

What is the impact of vaccine shortages or stockouts on vaccination coverage and effectiveness in low-income countries?	.014	-.051	.893
What are the radiation dose thresholds for deterministic effects in medical imaging?	.221	-.598	.150
Can deep learning algorithms improve image quality in low-dose CT scans?	.662	.453	-.593
What are the effects of low-dose radiation protocols on image quality and patient safety in radiography?	.762	-.269	-.048
How does radiation dose affect image quality in computed tomography (CT) scans?	.221	-.598	.150
What is the optimal radiation dose for achieving diagnostic image quality in various medical imaging modalities?	.662	.453	-.593

Depending the automatic-tube current modulation (ATCM) technology allows the tube current to be automatically altered in different planes (x-y or z), producing constant image quality.

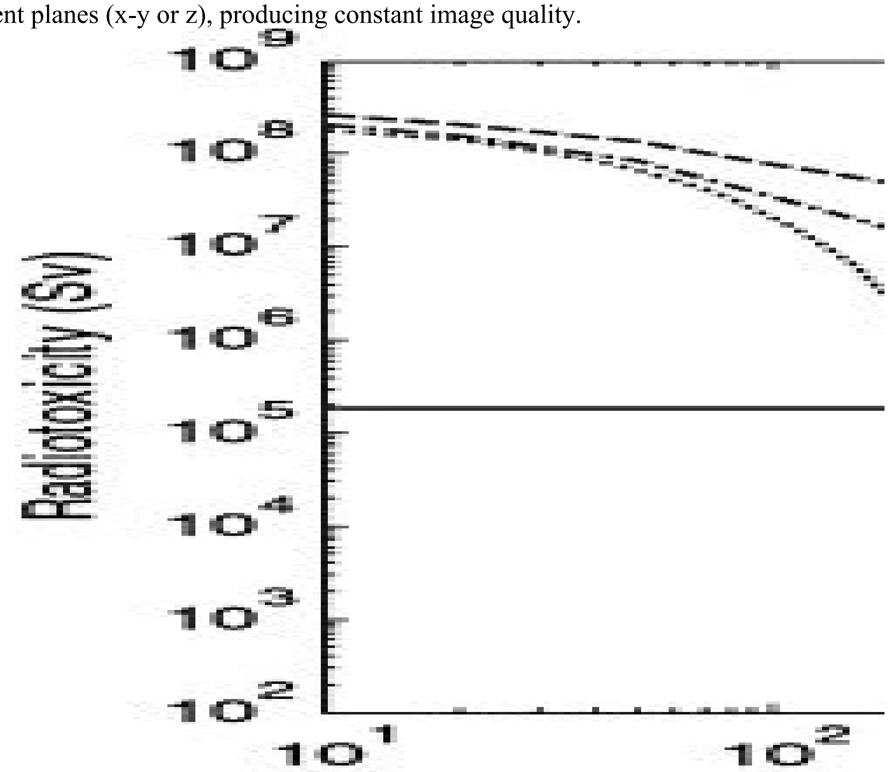

Figure 3: Radiation safety

While lowering radiation exposure is a good thing, a diagnostic imaging study's quality must also be maintained in order to produce a precise and conclusive diagnosis. Radiation exposure and image quality need to be carefully balanced.

5. CONCLUSION

Overuse of x-ray exams has detrimental effects on patients as well as the healthcare system. The health care system is impacted by overutilization because it wastes limited resources and causes needless restrictions, or "bottlenecks," in the system. Thus, radiology techs' and radiologists' important time is being wasted. Even with a triage system in place, patients who need an imaging test wait for a slot to open up while needless examinations are still performed.

'Time' is a crucial element in clinical patient management, as the literature shows. In severe situations, such severe poly trauma, survival is frequently determined by the decisions made within the "golden hour." In any event, needless tests are a waste of time, regardless of how serious they are. Patients will benefit from the proper evidence-based evaluation since it increases the likelihood that the right action will be performed quickly. throughout the waiting period and throughout needless tests, a patient's condition could worsen much more. This kind of waste of time adds up and impacts other patients who are waiting for a checkup, perhaps worsening their condition.

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