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ASSESSMENT THE SAFETY AND SECURITY REQUIREMENTS OF THE X-RAY CLINICS IN AL-AZIZIA-WASTE

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Abstract

The two main parts of radiation are waves like sunlight, X-rays, and gamma rays, or small particles like beta and alpha particles. Medical X-rays are frequently utilized for diagnosing diseases and disorders including fractures and the state of vertebrae, joints, and other structures in the body. Excessive exposure to radiation (higher than 200 rems) causes radiation impacts burns are examples. Additionally, when administered at larger rates and doses acute radiation syndrome can be brought on by rapidly increasing the radiation dose, such as loss of hair, blistering redness, and ulceration of the skin. With a focus on healthcare workers who deal with ionizing radiation on the job, we evaluated the perception, knowledge, and mitigation of the hazards that are related to the radiological examinations in this work. For assessing their level of understanding of ionizing radiation, a questionnaire has been given to the technicians and other staff members who work in several X-ray clinics in Wasit's Aziziyah district. The results of a survey showing that the majority of radiography clinics are committed to safety and security measures. The majority of radiology clinics adhere to Iraqi Ministry of Health regulations. It was noted that there are just four clinics, which isn't enough given the size of population. Furthermore, there were none of the specialist radiological facilities like fluoroscopy, CT, or mammography. Al-Azizia is unique in that it has a huge population, which raises the possibility that more people will need radiological testing. Thus, Iraqi Ministry of Health and Environment must concentrate on the radiological element by expanding the number of specialized radiological centers, as it is a crucial requirement for medical diagnosis and treatment.

Keywords: X-Ray Protection; Diagnostic X-Ray Safety; X-Ray Clinic Shielding.

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1. Introduction:

Radiation can be defined as a sort of energy which is released as waves, like X-rays, sunlight, and gamma rays, or as microscopic particles of a substance, like alpha and beta particles (beta particles include positron and electron) [1]. Radiation is present everywhere and comes from various natural sources [2], such as cosmic rays, solar radiation, and radioactive materials (materials are composed of unstable nuclei with short half-lives. As an alternative, it could come from man-made sources like nuclear power plants and X-ray devices [3].

Radiation is classified into two types [4]. Nonionizing radiation is the first type which is a type of electromagnetic wave with a lower energy. There isn't enough energy to pull an electron out of orbit, but it can excite it, and ionizing radiation is the second: is a type of high-energy electromagnetic wave (gamma or X-ray) or heavy particle (beta and alpha). High enough energy to knock an electron out of orbit.

There are numerous exposure mechanisms that might result in radiation exposure (devices that use X-rays as their physical mechanism of action) , whether external or internal. In the case where X-ray inter to the body like fluoroscopy [5], which is medical device with high-flux X-ray beam it's commonly used to evaluate the intestine. In the case where the X-ray beam is outside the body, such as: diagnostic X-ray, Chest x-ray, dental Computed Tomography CT scan and mammograms the external exposure result [6]. All these medical devices expose workers, technicians, and patients to the dangers of ionizing radiation.

Despite the risks of dealing with medical devices that deal with ionizing radiation we believe it is just fair to emphasize the advantages of radiation in medicine, X-rays are frequently utilized for diagnosing diseases and conditions including fractures and others, along with state of the joints, bones, and vertebrae. Along with various diseases, it is utilized to assess if there is tumors or bleeding in the brain or the rest of the body [7]. Scientists concur that employing radiation in diagnostic procedures has advantages over disadvantages.

Therefore, in order to avoid the risks of exposure to x-rays in clinics, centers and hospitals (to protect the working staff and patient) By evaluating the degree of awareness and compliance with security and safety conditions, according to the International Atomic Energy Authority (IAEA) guidelines [8], as it is responsible for giving all instructions and instructions related to ionizing radiation by focusing on several points, the most important of which: The location of the X-ray machine, the layout of the X-ray room concern and the adjacent rooms in that place, the working staff have an equipment such as clinical dosimetry system to ensure that medical exposures within the permissible dose, staff or workers should be carried out an authorized procedure based on the ALARA principle, assign patient protection [8].

So, in our study we focusing the extent to which the clinics in Wasit district are committed by Energy Authority (IAEA) guidelines of safety and security and by filling out a questionnaire

2. Theory:

X-rays can be described as a type of electromagnetic radiation that has energies ranging from 100eV to 10MeV. X-rays differ only in wavelength and energy from radio waves, light, and gamma rays. X-rays are wavelike, with wavelengths ranging from about 10 to 103 nm. X-rays have several properties, including [9]:

Shorter wavelength electromagnetic radiation is what X-rays are (few nm), they move at the same speed as light in a straight line, magnetic and electric fields do not affect X-rays., visible light-opaque materials are not opaque to X-rays, fluorescence is produced by X-rays in substances such as cesium iodide, calcium tungstate, etc., X-rays result in a latent picture

to form on the photographic film, ionization and excitation are caused by X-rays in the materials they pass through, X-rays cause the substances they pass through to undergo chemical changes and when exposed to X-rays, living things experience biological repercussions. Cells may become harmed or even die.

When rapidly moving electrons are stopped through a target material, X-rays are generated. Moving electrons contain kinetic energy. In a case when an electron is abruptly stopped, its kinetic energy will be converted to heat and X-rays. This conversion happens with target substance. Which is why, interaction regarding the electron with the target is the cause of X-ray generation [10].

After the electron arrives at target, it will interact in 4 ways as follows [11].

i. Target atoms are ionized when a quick-moving electron hits the target's surface layer and collides with atoms there. In this procedure, the incident electron removes an electron from the atom by transferring enough energy. Target atoms are ionized as a result of this tiny energy transfer. Prior to coming to rest, the majority of its energy is released in the form of heat in target. The displaced electron, often referred to as a secondary electron, might have enough energy to cause additional ionization of the target atoms. They're few in number and they produce their own track, which is referred to as the delta rays.

ii. Characteristic X-rays: This interaction between incident electron and electron in K shell produces characteristic X-rays. The incident electron directly strikes the K shell during this operation, transferring enough energy to remove the K shell electron. An electron that is traveling inward from the outer shell fills the hole in the K shell.

iii. Interaction with the nuclear field: On rare occasions, incident electron gets closer to the nucleus of atom in the target. The positive nucleus attracts the electron because it is a negative particle. It is designed to partially orbit the nucleus, then it slows down and extinguishes with less energy. Bremsstrahlung, also known as X-ray photons, are the result of energy loss. The energy of the X-ray photon is determined by how strongly the electron is caused by nuclear attraction to slow down. The photon energy ranges from 0 to its greatest value.

iv. The electron may immediately collide with the nucleus and come to a complete stop. Bremsstrahlung radiation represents the full electron energy. High energy X-rays can be produced by this type of contact, which is quite uncommon.

The interaction of ii, iii, and iv is often extremely infrequent in the diagnostic range of energies, which results in reduced X-ray emission. The contact process and heat production are dominated (> 99%) by the ionization collision.

The International Atomic Energy Agency's guidelines must be followed in order to protect workers and patients from the dangers of these radiations because X-rays are one of the types of ionizing radiation and repeated exposure to them causes cancer [12]. So, the X-ray room should be designed with radiation safety and protection in mind in order to minimize worker exposure. The shielding equipment in an X-ray room is one of the crucial factors in its design. The type of diagnostic examination, the workload of the facility, the occupancy factor, and the directions of the primary beam created by the X-ray tube are only a few of the many variables that influence the design of the X-ray room and its radiation shielding.

3. Result and discussion:

A radiology technician is a member of the medical team who administers radiotherapy and performs diagnostic imaging procedures. They receive training in radiology's fundamental patient care procedures as well as anatomy, fault site identification, examination techniques, equipment protocols, and radiation safety.

In order to deliver useful diagnostic data and frequently save many patients' lives,

a radiology technician uses medical radiology equipment, however this task entails more than merely setting the instrument down and pressing the start button. The technician must be aware of the hazards to which he may be subjected during the various phases of his employment and should take safety measures for radiology technicians to mitigate such risks. A radiology technician could focus on radiotherapy, which is the use of high doses of radiation for treating cancer and other diseases, or they may focus on a specific imaging method, like cardiovascular radiography, bone densitometry, mammography, computed tomography, MRI, quality management, nuclear medicine, ultrasound, or general radiographs.

A radiology technologist must successfully finish at least two years of formal education in a four-year program at an academic institution or in a recognized hospital program, as well as a national certification exam.

Ionizing radiation is produced by the majority of radiological devices. Living things are affected negatively by radiation; severity of these effects depends upon the type of radiation, the dose, and the length of exposure. There is still no known threshold dose that can cause cancer in people, despite various experimental and epidemiological research [13]. Due to the fact that doses of X-rays that are used for diagnosis are so low, they are typically viewed as posing health concerns to people. Low-level X-ray radiation dose is now a more urgent issue due to the rise in X-ray radiation exposure among humans. It has been shown that collecting chest radiographs in order to demonstrate severity of lung damages by the X-ray or CT-scan is one of the most crucial diagnostic tests for corona disease, particularly in the present after introduction of Corona virus (COVID 19). As a result, a very large number of people are now exposed to radiation [14].

Because of an increase in the dosage and quantity of radiological exams, the majority of studies have focused on the cancer risk in children and adults. In spite of the fact that X-ray radiation for the medical images is clinically useful, it has been estimated that 20% of medical x-ray exams are unnecessary [15]. In U.K., there are 100–250 new cancer cases every year as a result of these and other preventable exposures. Even though there is just a little risk to each individual, there are likely to be many long-term health problems brought on by the large number of the people who are exposed to the X-ray radiations. Furthermore, it was discovered that medical practitioners often lack the knowledge needed to comprehend the risks associated with X-ray exposure and the safety measures that ought to be implemented to lessen these risks [16].

All of the medical clinics which specialize in the radiological examination have to go by rules, requirements, safety requirements, and security standards established by the International Atomic Energy Agency (IAEA) in order to obtain a license to operate as a clinic. Ionizing radiation is utilized in a variety of medical procedures, including CT, fluoroscopy, radiographic imaging, and angiography. The production of the highest-quality image using the least amount of radiation is the major objective of radiological imaging. The international agencies' permitted dose levels, however, could be exceeded in specific interventional uses and under certain conditions. Thus, it is imperative to consider seriously both the patient's and the medical practitioner’s safety [17].

In order to assess the technicians and other staff members' levels of knowledge regarding ionizing radiation as well as their awareness of radiation doses caused by radiological exams, a questionnaire was given to some of the X-ray clinic employees in Al-Azizia-Waste, Iraq. On the left bank of the Tigris River in Wasit Province sits the Iraqi town of Al-Aziziyah. It serves as the political and administrative hub of the Al-Aziziyah District and is situated around 80 kilometers northwest of Kut. Its estimated population in 2009 was 44,868 people. There are only a few X-ray clinics in Al-Aziziyah—six total—two private and four public. To assess the workers' knowledge of ionizing radiation and their awareness of doses of radiation that are associated with radiological exams, a questionnaire was presented to

them. The participants have been asked for personal information such as: academic level, Age, the duration of the fieldwork (year), illnesses, and routine medical checkup, as well as details on the radiographer's locations at time of the X-ray exam as shown in the following table (1) in order to calculate radiation dosage percentage to which a radiographer could be exposed: One representative from a private clinic declined to respond to the questionnaire, and one of the four government facilities is not operational. So, four clinics each received a questionnaire.

Table (1): shows the X-ray radiographer's personal data.

Survey information	*Clinic 1 privet*	*Clinic1*	*Clinic2*	*Clinic 3*
academic level	Diploma in Diagnostic Radiology	Master of Radiology and sonar technologist	Diploma in Diagnostic Radiology	Bachelor of Radiology and sonar technologist 4rd stage- Radiology and ultrasound technologist
Age	33	32	24	27
the time spent working in the field (year)	6	10	3	5
Radiology il affe	No	No	No	No
last day to schedule a routine medical checkup	2021	Year ago	year ago	year ago
The radiographer's whereabouts at the time of X-ray	Outside x-ray	In the room behind barrier	In room behind the barrier	In room behind the barrier room with cameras to monitor the patient

The answers were either Yes or No when asked if the four clinics in table (2) had permission from Ministry of the Environment's Radiation Protection Centre, if the photographer had continuously and repeatedly worn the film (LTD or film page) to record the cumulative dose, in the case where the radiographer had worked in other clinics of radiology (private as well as public) which causes doubling of the radiation dose over time

and in a case where radiologist had taken training and courses activities to raise

awareness and get knowledgeable about the most recent advancements in radiography and finally workers about the lead apron, children, pregnant women and worker staff wear a lead apron to protect them from needless radiation.

Table (2): Information on security and safety

Questions *Clinic2*	*Clinic 1* privet	*Clinic 1*	*Clinic3*
Does radiation protection center (Ministry of the Environment) have permission to operate the clinic?	ü	ü	ü	ü
Does the photographer use film continuously and periodically?	ü	ü	ü	ü
Does radiographer have any additional radiography clinics (public or private) under their belt?	ü	ü	ü	ü
Did the radiologist attend seminars and training sessions in his field of study?	ü	ü	ü	ü
Does radiation dose rate measure outside x-ray room?	ü	ü	ü	ü
Is there a lead apron to protect the patients at the radiology office?	ü	ü	ü	ü
Do you regularly and consistently apply lead aprons to critically ill patients, kids, and pregnant women (if any)?	ü	ü	ü	ü
Are visitors permitted to accompany patients during x-rays?	û	û	ü	û

After asking the participants about device's specifications, the number of the radiological devices in clinic, and device's date of production, the questions and answers were displayed in a table (3).

Table (3): Information about the X-ray equipment.

Questions	*Clinic1* Privet	*Clinic 1*	*Clinic 2*	*Clinic3*
Amount of X-ray machines in the clinic	1 (X-ray)	1 (X-ray	2 (X-ray and dental x-rays)	1 (X-ray)
product's manufacturing date	2018	-	-	-

Table (3) clarify that the most of the participants did not mention the date of manufacture of the devices, except for the private clinic number 1. The date of manufacture of the x-ray device is 2018, which is relatively recent. The more modern the device, the lower the radiation dose and the better the image quality, which is a slogan raised by most manufacturers of radiological devices.

In this survey, we discovered that there are only four radiology clinics in Al-Azizia, which is a very tiny number and does not correspond to the size of the population. It was also mentioned that there were no radiology-specific centers offering services including mammograms, fluoroscopy, and CT scans. The high population of Al-Azizia increases the possibility that someone will need a radiological checkup. According to survey findings, radiography clinics adhere to the strictest safety and security protocols as well as the requirements of the IAEA and the Ministry of Health and Environment of Iraq as shown in table 1.

Almost all radiographers wear page films, which are regarded to be very important for estimating the dose of the radiation that the radiographers might be exposed to [18,19], in regards to the security and safety information in table 2. Additionally, we found that when discussing radiation devices in all government clinics, the majority of clinic technicians omitted to indicate the x-ray devices' creation date table 3. Ministry of Health and Environment of Iraq must emphasize the supervisory function, strengthen its participation in these facilities, and keep an eye on how safety and security regulations are being applied to both staff and patients since radiology clinics have a very close connection to people's lives.

4. Conclusions:

In this article, we've discussed the findings of a study on radiation safety problems that was conducted to gauge the knowledge of medical professionals who don't work in the radiation field but who occasionally use ionizing radiation in their work. We discovered that the majority of radiography clinics adhere to the safety and security requirements set forth by the Iraqi Ministry of Health. There are only four clinics, which is a very tiny quantity compared to the size of the population. It was also mentioned that there were no radiology-specific centers offering services including mammograms, fluoroscopy, and CT scans. Al-Azizia is

distinguished by its dense population, which raises the possibility, i.e., raising the possibility that someone will need a radiological examination.

The Ministry of Iraqi Health and Environment as a result As a result, by increasing the number of specialized radiological centers, the Ministry of Health should pay attention to the radiological component as it is a crucial requirement for medical diagnosis and treatment.

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