Evaluation of Diagnostic Accuracy of Abdominal Ct Scans by Assessment of Image Quality and Confidence

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Abstract:
The study's objective is to assess the diagnostic accuracy and image quality of the abdomen CT scan by the recommendations of the International Commission on Radiological Protection. As a result, research that can be quantified and measured is done on a representative sample. The CTDIvol data was gathered over three months at the Al Makkased Islamic Charitable Society Hospital in Jerusalem from 123 CT adult belly exams. The study's findings suggest that, in comparison to many other hospitals throughout the world, Al-Makkased hospitals are using the belly examination more frequently. The samples were contrasted with the ICRP's global reference value. Two radiologists were supplied samples with low CTDIvol levels to assess the picture quality and confidence. The study report It was discovered that whereas 39% of the low CTDIvol samples did not affect the picture quality, 61% of the remaining samples did. The first radiologist reported a picture quality of 77% and a certainty of 91%; the second reported a picture quality of 79% and a certainty of 90%. The study discovered that the CT belly examination's CTDIvol was higher than the ICRP's global reference value, that 57 out of 123 samples had low CTDIvol, and that their proportion was 46%. This analysis does not include Japan. The overall picture quality was judged to be fair, while diagnostic certainty was found to be outstanding. Findings highlight discrepancies in radiation dose levels and underscore the importance of balancing dose reduction with diagnostic efficacy, contributing to improved imaging practices and patient safety.

Keywords: *Image Quality CTDIvol; Computed Tomography; Diagnostic Confidence; Radiation Dose.*

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تقييم الدقة التشخيصية للأشعة المقطعية للبطن من خلال تقييم جودة الصورة والثقة

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ملخص:

هدفت الدراسة إلى تقييم دقة التشخيص وجودة صورة الأشعة المقطعية للبطن بناءً على توصيات اللجنة الدولية للوقاية من الإشعاع. ونتيجة لذلك، فإن البحوث التي يمكن قياسها كميًا يتم إجراؤها على عينة تمثيلية. تم جمع بيانات CTDIvol على مدى ثلاثة أشهر في مستشفى جمعية المقاصد الخيرية الإسلامية في القدس من 123 فحص بطن للبالغين. وتشير نتائج الدراسة إلى أنه بالمقارنة مع الكثير من المستشفيات الأخرى في جميع أنحاء العالم، فإن مستشفيات المقاصد تستخدم فحص البطن بشكل متكرر أكثر. تمت مقارنة العينات مع القيمة المرجعية العالمية الخاصة بـــ ICRP. تم تزويد اثنين من أخصائيي الأشعة بعينات ذات مستويات CTDIvol منخفضة لتقييم جودة الصورة والثقة. كشفت الدراسة إلى أن 39% من عينات CTDIvol المنخفضة لم تؤثر على جودة الصورة، في حين 61% من العينات المتبقية فعلت ذلك. أبلغ أخصائي الأشعة الأول عن جودة صورة تبلغ 77% ونسبة يقين 91%؛ وأفاد الثاني بجودة صورة تبلغ 79٪ ونسبة يقين 90٪. اكتشفت الدراسة أن CTDIvol لفحص البطن بالأشعة المقطعية كان أعلى من القيمة المرجعية العالمية لـــ ICRP، وأن 57 من أصل 123 عينة كان لديها CTDIvol منخفض، وأن نسبتها كانت 46%. هذا التحليل لا يشمل اليابان. تم الحكم على جودة الصورة الإجمالية بأنها عادلة، بينما وجد أن اليقين التشخيصي رائع. تسلط النتائج الضوء على التناقضات في مستويات جرعة الإشعاع وتؤكد أهمية الموازنة بين تقليل الجرعة وفعالية التشخيص، مما يساهم في تحسين ممارسات التصوير وسلامة المرضى.

الكلمات المفتاحية: *جودة الصورة CTDIvol؛ التصوير المقطعي؛ الثقة التشخيصية؛ جرعة الإشعاع.*

1. Introduction

Various medical imaging modalities, including conventional X-ray, CT, MRI, ultrasound, and others, are used to create images of different human body sections as a standard diagnostic tool for identifying, preventing, and treating internal disorders (Murphy et al., 2019). Since CT molality has transformed medical diagnosis decision-making (Esses et al., 2004), the majority of orientations have been toward CT scans. As a result, better surgery, treatment, and diagnosis of cancerous tumors improved treatment following injury and major trauma, and improved treatment of diseases have all resulted (Mettler Jr. et al., 2009), making the average annual radiation equivalent dose of CT scanning the highest in comparison to other sources of medical imaging (Sherer et al., 2013) When compared to other radiological instruments, a computed tomography machine exposes the patient to significant radiation dosages. However, it offers a fantastic image (Tsalafoutas & Koukourakis, 2010). The amount of radiation utilized in every radiological examination, the amount absorbed by patients, and the associated radiological dangers must all be understood by imaging professionals (Huda et al., 2011). Dosimetry measures based on the CT dose index (CTDI) are now used by CT scanners (McNitt-Gray, 2002). CTDI statistics connect patient exposures to the radiation dosage used to perform a specific CT examination using general "dose/CTDI" conversion factors (Huda et al., 2010). As with all medical imaging, the sensitivity and visibility of CT scans are unique characteristics that are influenced by the radiation dose and picture quality. The tube current (emerge), slice scan duration, and tube peak kilovoltage all affect how much radiation is emitted during a CT scan. Contrarily, image contrast, spatial resolution, image noise, and artifacts are all factors that affect the quality of a CT picture (Goldman, 2007). The area of the body between the chest and pelvis is called the belly, and its top surface is formed by the diaphragm. The abdomen and pelvis separate at the level of the pelvic bones. A CT scan of the abdomen is a diagnostic imaging procedure used to identify disorders of the colon, small intestine, and other internal organs and the origin of persistent pain. Fast, painless, non-invasive, and accurate, CT scanning. anatomy of the abdomen.

Digestive tract: cecum, appendix, small intestine, big intestine, and stomach

The liver, gallbladder, and pancreas are examples of organs connected to the digestive tract. The kidneys and ureters, which are technically placed outside the peritoneum but behind them, are examples of organs connected to the urinary system. The spleen is among the other organs. (Fox et al., 2008).

1.1 Problem Statement and Significance of Study

Part of the images of the X-ray examinations are of high quality and within high quality and part of the quality is not good, the quality of the image depends on the amount of radiation in the CT, the number of rays monitored in the CT by DRLS and its values has been determined for the tests, some countries adhere to these values and others do not adhere to them, the Commitment in DRLS affects image quality. Although computed tomography device is one of the best modalities in producing digital images with high quality and resolution, However, the dose used is high with the different types of examination performed on it, (CT device is considered one of the most modalities given radiation), and it has been found that the amount of errors examinations present is large, this leads to a re-examination procedure and thus exposed to a harmful overdose For a patient's body or a wrong diagnostic process, Therefore, standards must be set to avoid recurrence and obtain high-quality images.

1.2 Reasons for The Study

The dose used is high with the various types of examinations performed on the computed tomography device, even though it is one of the best modalities for producing digital images with high quality and resolution (the CT device is considered one of the most radiation-giving modalities), and it has been discovered that the amount of errors examinations present is large, leading to a re-examination procedure and exposing the patient to a harmful overdose. To prevent recurrence and acquire high-quality photos, standards must be created for a patient's body or a poor diagnostic procedure.

1.3 Objectives and Questions for Research

By addressing the following questions, the study's ultimate goal is to evaluate picture quality and diagnostic confidence for the abdomen CT examination at Al-Makkased Hospital about diagnostic reference values of ICRP.

- How steadfastly does Al Makkased Hospital adhere to radiation doses?
- What proportion of dosages are low doses?
- What is the diagnostic sample confidence ratio?

This refers to determining the patient's suitable dose while utilizing the smallest percentage and attaining the highest image quality.

- It is not helpful to find an excessive dose that is damaging to the patient.
- Adjustment and improvement of all examination methods regarding radiation dosage and image quality
- Achieving diagnostic confidence • Evaluating the safety and quality of CT scans.

2. Literature Review

Thorley described the impact of resolution on image quality as follows in earlier investigations. (Goldman, 2007) covered CT radiation dosage and image quality as well as how to assess them. They discovered that the four fundamental elements of image contrast, spatial resolution, noise, and artifacts all affect the quality of CT images. These variables interact to determine sensitivity (the capacity to detect low-contrast structures) and the visibility of details. The capacity to detect low-contrast structures in a subject is primarily constrained by noise and consequently linked to radiation dose (using a lower dose while the image is being created will decrease the image noise and we will be able to distinguish between low-contrast structures and high-contrast structures). Sampling has a limit on spatial resolution, but the reconstruction filters have a significant impact. As a result, certain procedures must be followed, including the right kilovolt peaks, amperages, slice thicknesses, and reconstruction filters. The correlation between visual quality and spatial resolution was discussed in (Hounsfield, 1976). Larger matrices have a more spatial resolution (Larger matrices Have Higher Spatial Resolution), but they also have higher image grain. Picture quality suffers as a result. A lack of photons entering the detectors after passing through the patient's body causes picture grain. When particular information is required for some disease, spatial resolution may be more crucial in the organs. patient dosage the patient's size and average absorption must also be considered since they impact the image grain if the number is more than three. Therefore, you must select the proper matrix. The anomaly is solved by continuous, time-consuming computer work, although this only addresses a tiny portion of the issues. Computed tomography has no rivals, yet it is constrained by the noisy photons' tolerance range. There are discussions over how biological motion affects CT resolution (Hounsfield, 1976). He noted that both voluntary and involuntary activities, such as those of the muscles, the respiratory system, and the heart, occur often in the human body. This motion will result in linear and stellate artifacts and have an impact on computed tomography picture resolution. To boost resolution, we need to shorten the scan time, thus researchers presented a fourth-generation CT scanner technology that shortens scan duration to 2 seconds. Enhancing CT's spatial resolution will result in development, benefits, and dangers (Wang & Fleiskhmann, 2018). One of the most important advantages of a CT scan is detecting small anatomy that's hidden, and small pathological structures that are not recognized such as calcification, lung nodules, and temporal Bone. By improving the factors that affect spatial resolution we can improve spatial resolution. First, to improve spatial resolution by focal spot size, we should use a small size of the focal spot in all scanning conditions because using a large focal spot will decrease the spatial resolution due to the repulsion of electrons, and using a dynamic focal spot will reduce the focal spot blooming. Deflecting the x-ray tube anode in the longitudinal and fan angle directions increases spatial resolution while also improving the sampling of the detectors. To evaluate how matrix size affected the spatial resolution and picture quality of ultra-high-resolution computed tomography, (Hata et al., 2018) (U-HRCT). When they employed 320-mm FOV and a 2048 matrix size, they discovered that the greatest spatial resolution was 0.14 in terms of overall quality, solid nodule, ground-glass opacity, emphysema, intralobular reticulation, honeycombing, and vessel clarity. In addition, they discovered that the 1024 and 2048 matrices performed better than the 512 matrices. In order of 512,1024, and 2048, the quantitative noise was greatly reduced, except for the noise and streak artifacts. In U-HRCT scans, a larger matrix size than a 512-matrix size preserved spatial resolution and enhanced image quality and lung disease evaluation despite an increase in image noise. Using two crucial elements, namely the tube current and the electric voltage.

Conclusion: A stratified chest picture may be obtained at an 80% voltage while retaining image quality and cutting the dosage of contrast material by more than half (50%). Lauzier et al. (2012) explained the relationship between nonuniform spatial image noise distribution and short scan FBP, showing that nonuniformity can result in unexpectedly high image noise and streaking artifacts that affect CT MPI image quantification. They also demonstrated that statistical image reconstruction (SIR) algorithms can be a potential remedy to address the nonuniform spatial noise distribution problem and can also reduce radiation dose in the context of CT MPI. using data to check to account for the spatial distribution of noise, the mean and standard deviation were measured in several regions of interest (ROIs) and analyzed across time frames, and two low-dose scans at tube currents of 25 and 50 mA were reconstructed using FBP and SIR. CT MPI farm to the frame was used to investigate the spatial distribution of noise. Myocardial blood volume (MBV), first moment transit time (FMT), and normalized upslope (NUS), three quantitative perfusion measures, were assessed for two ROIs and compared to reference values derived from a high-dose scan carried out at 500 mA. Taguchi and Aradate (2000) the goal of desiccation helical and reconstruction on CT is to Create a computed tomography machine that can quickly and thinly take a volumetric scan on a greater size. One of these methods combines multi-slides with helix scanning. One of the key issues with the multi-slice continues to be the method for reconstructing the image. The following three factors led to a major image quality issue with the expanded approaches, though: (1) too many discontinuous changeovers in pairs of data samples for interpolation; (2) the presence of cone angles; and (3) extremely near slice locations of the complementary and direct data, resulting in a greater sampling interval. Slices are arranged in a circle with a pitch of 1, and there is a space between the pitch < 1 means overlap in slices). Therefore, they have proposed a new algorithm to overcome the problem (It consists of the following three parts: (1) optimized sampling scan (2) filter interpolation, and (3) fan-beam reconstruction. The algorithm enables us to achieve acceptable image quality and spatial resolution at a scanning speed about three times faster than single-slice CT. Both patients and radiologists are exposed to high radiation doses during tomography compared to other radiological examinations. An adult patient, for example, receives head doses ranging from 1 to 2 millisieverts, while whole-body doses range from 4 to 5 millisieverts, as well as the permissible doses for workers in the radiographic field is about 5 Sievert per year. The radiologists are responsible for the amount of dose given to any patient, so the dose of radiation should be reduced as much as possible while obtaining high image quality for the disease to be well diagnosed and examined, for this reason, the radiologist must have full knowledge of the relationship between the radiation dose and image quality. Reducing patient exposure by controlling KVP and mAs. In this search Huda et al. (2002), the effect of KVP and mAs on image quality in tomography is studied. Dewang et al. (2018) investigated the effect of low tube voltage on image quality, radiation dose, and low-contrast detectability (LCD) on CT scan heads. In this study, they used a solid phantom containing low-contrast objects that were scanned with a CT scanner at a standard 120 kV tube voltage and a low tube voltage of 80 kV with a tube current arrangement of 200, 250, and 300 mAs. The difference between image noise, noise-to-ratio contrast, and LCD values obtained with 80 and 120 kV at 200, 250, and 300 mAs were then compared So when they used low tube voltage the image noise increased, substantially with low tube voltage. However, with an identical dose, the use of 80 kV resulted in higher CNR compared with CNR at 120 kV. There were no statistically significant differences in CNR and scores of LCDS between 120 kV at 300 mAs and 80 kV at 200, 250, and 300 mAs ($P > 0.05$). The relative dose given at 80 kV against 200, 250, and 300 mAs is equal to 68%. they found that by reducing the tube voltage from 120 kV to 80 kV at head CT, the radiation dose can be reduced by 32% without degradation of CNR and LCD.

2.1 Computed Tomography (CT) - Abdomen and Pelvis

CT scanning is fast, painless, noninvasive, and accurate. Emergency cases reveal internal injuries and bleeding quickly enough to help save lives. Patients will be instructed not to eat or drink anything for a few hours beforehand. If the patient is allergic to contrast material, the doctor may prescribe medications to reduce the risk of an allergic reaction These medications must be taken 12 hours before your exam. This procedure uses to diagnose the cause of abdominal or pelvic pain and diseases of the internal organs, small bowel, and colons, such as infections such as appendicitis, pyelonephritis or infected fluid collections, also known as abscesses, and cancers of the liver, kidneys, pancreas, ovaries, and bladder as well as lymphoma kidney and bladder stone abdominal, aortic aneurysms (AAA), injuries to abdominal organs such as the spleen, liver, kidneys or other internal organs in cases of trauma (Abujudeh et al., 2010). CT scanning of the abdomen/pelvis is performed to guide biopsies and other procedures such as abscess drainages and minimally invasive tumor treatments, plan for and assess the results of surgery, such as organ transplants, stage, plan and properly administer radiation treatments for tumors as well as monitor response to chemotherapy.

Ravenel (2001) determined how changes in radiographic tube current affect the patient dose and image quality in unenhanced chest CT examinations. For each patient, six images of the same region were obtained at settings between 40 and 280 mAs, Patient effective doses were computed for chest CT examinations performed at each milliampere-second setting. Radiologists indicated whether any perceived improvement of image quality at the higher radiation exposures was worth the additional radiation dose. The differences in quality of chest CT images generated at greater than or equal to 160 mAs were negligible. Reducing the radiographic technique factor below 160 mAs resulted in a perceptible reduction in image quality. Radiographic techniques for unenhanced chest CT examinations can be reduced from 280 to 120 mAs without compromising image quality.

The study discusses the two basic principles of radiation protection, which are as recommended by ICRP justification of practice and optimization of protection, 'justification' is the justification for the image to be photographed. The benefit of the image must be higher than the damage and the risks to the patient. 'It must be with the approval of the radiologist and a doctor a specialist in requesting the image and decides whether or not to take a photo, and the imaging of pregnant women and children and others is subjected to strict and severe standards to preserve their health 'The study provides a detailed examination of the diseases that can be detected in a tomography of the various body organs (chest, abdomen, spine, head, ... How to obtain a good quality image with little radiation exposure and explain the basic principles to reduce the radiation dose to the patient and follow the improvement justifications (Shrimpton et al., 1998). The quantity most relevant for assessing the risk of cancer detriment from a CT procedure is the “effective dose”. The unit of measurement for effective dose is millisieverts (mSv). On average, the organ studied in a CT scan of an adult receives around 15 mSv of radiation, compared with roughly 3.1 mSv of radiation exposure from natural sources each year (Goldman, 2007). Radiation dose is one of the most significant factors determining CT image quality and thereby the diagnostic accuracy and the outcome of a CT examination. Sources of blurring in CT include the size of the detectors (sampling aperture), the size of the voxels, and the reconstruction filter selected. Noise is caused by the variation in attenuation coefficients between voxels. The use of small voxels and edge-enhancing filters helps reduce blurring and improve the visibility of fine details. However, small voxels absorb fewer photons and therefore result in increased noise. Noise can be reduced by using large voxels, increasing radiation dose, or using a smoothing filter, but this filter increases blurring, Increased blurring reduces the visibility of small objects; increased visual noise reduces the visibility of low-contrast objects (Abujudeh et al., 2010).

3.Methodology

In medical imaging, we constantly work to preserve picture quality while lowering radiation exposure. As is well known, one of the most crucial diagnostic tools is the tomography machine, which accurately depicts all of the interior body components in a variety of ways for a more accurate diagnosis. Therefore, by examining samples taken from a hospital and outlining how to analyze them, we will demonstrate in this chapter how the radiation dosage influences picture resolution and image quality.

3.1 Setting for Research

Hospital of the Al Makkased Philanthropic Association A national hospital in Jerusalem that is also charitable and educational and is connected to the Al Makkased Charitable Society It started operating in June 1968. 250 patients can be treated there. Through its many sections, the hospital offers specialized services, namely: emergency, internal medicine, general surgery, specialized procedures for the bones, brain, nerves, heart, blood vessels, chest, cosmetic, obstetrics and gynecology, fetal and neonatal medicine, pediatrics with its specialties in genetic diseases, thoracic, digestive system, endocrinology, metabolism, and rheumatology, industrial college, radiology, outpatient clinics, physiotherapy, sterilization, pharmacy, and specialized laboratories for sleep, The hospital received a certificate of accreditation from Joint Commission International (JCI) in 2017.

3.2 Sample and Population

Probability sampling was used for the samples (Systematic sampling). Samples from Al-Makkased Hospital were obtained by entering the hospital's computer system in the tomography division. These samples were specifically chosen from the other samples so that the abdominal region would appear in the photos by the new standards: adult patient eligibility requirements (age more than 18), those who use oral contrast

3.3Exclusion Criteria

CT abdominal radiographs with contrast in pediatric patients (under the age of 18).

3.4 Samples Taken

The samples were obtained between January 1 and March 31 of 2021, and we focused on the CT scan modality, specifically the Abdomen CT scan to find 159 images. By excluding some samples, such as those from patients who received IV contrast, which has the number 9 on them, and samples from patients under the age of 18, which have the number 0 on them, we were left with 123 samples that were necessary for the study, which have the number 1 on them. To assess the impact of the low dose on the image quality, we first divided each sample into low and high CTDIvol categories based on the ICRP's international reference value, reaching 57 samples with low CTDIvol. We then gave the samples to two radiologists who were blind to the samples' contents and created a questionnaire for them to complete to evaluate the samples into two standards, the first standard is based on the image quality, and it has five scales (1 very poor, 2 poor, 3 (1 No confidence, 2 less confidence, 3 slight confidence, 4 moderate confidence, 5 high confidence).

3.5 Approach to Research

3.5.1 Research Plan

a series of quantitative observational case studies, the author outlines some intriguing findings with samples, Through the collection of measurable data and the use of statistical, mathematical, or computer methods, quantitative research is the systematic analysis of phenomena.

3.5.2 Analytical Statistics

Proportions and figures were computed and acquired by the study of samples collected from AL-Makkased Hospital, by accessing the hospital's system, and the data were then analyzed using an Excel and Microsoft 365 sheet form.

3.5.3 Ethical Consideration

After the agreement from Palestine Ahliya University, the administration, and Al-Makkased Hospital, data will be used for scientific purposes only, far away from declaring the names of the patients.

3.5.4 Criteria of The Study

The criteria where accreditation in the study samples were given to two radiologists and asked how to evaluate the image quality, and what the confidence of the evaluation.

3.5.5 Tools of Data Collection

PACS of the radiology department of AL-Makkased hospital

4. Result and Discussion

The ICRP proposed DRLs as a way for optimization and justification of CT radiation doses, which are determined by CT dose index volume (CTDIvol) and dose length product (DLP) (Pema & Kritsaneepaiboon, 2020), but in our study, we only rely on CTDIvol of the abdomen samples of AL-Makkased hospital as a standard to compare it with an international reference value to assess the effectiveness of the CT scans. The samples were divided into low CTDI and high CTDI by the international reference value of each country, which was 16.2,15,13,15,15, and 10,20 mGy for the ICRP, UK, Australia, USA, Germany, Korea, and Japan, respectively (Pema & Kritsaneepaiboon, 2020; Rehani, 2012) In a prior study, the abdominal CT exam's DRLs were lower than the international DRLs of the UK, EC, US, Australia, and Japan, whereas, in the present study, the results showed an increase in the CTDIvol and showed that we were higher than the ICRP, UK, Australia, and USA. (Figure 1)

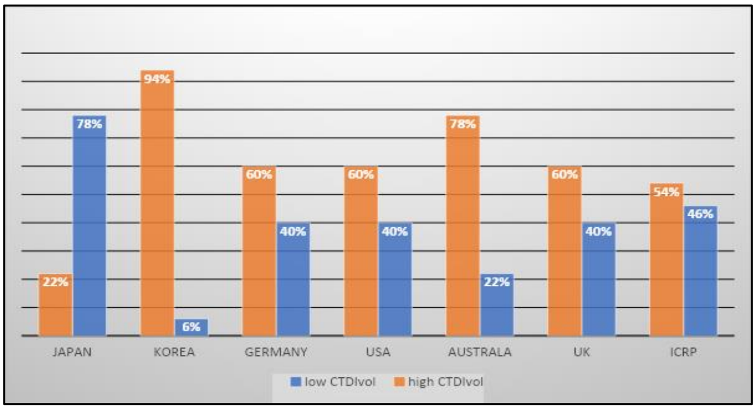

Figure 1: DRLs were lower than the international DRLs of the UK, EC, US, Australia, and Japan, however, the findings of the current study indicated a rise in the CTDIvol and showed that we were higher than the ICRP, UK, Australia, and the USA.

Korea was the least used country for the CTDIvol equal to 10mGy, according to the results of this chart, which shows the percentage of the low and high CTDIvol after comparison. As a result, the samples were divided into 6% that received a dose less than 10 mGy and 94% that received a dose greater than 10 mGy. The samples were separated into 22% that received doses less than 13 mGy and 78% that received doses greater than 13 mGy since Australia utilizes CTDIvol equivalent to 13 mGy. The samples were split into 40% that received doses less than 15 mGy and 60% that received doses greater than 15 mGy since the UK, Greece, and the USA use the same value of CTDIvol equal to 15 mGy. The samples were split into 46% of those given doses less than 16.2 mGy and 54% of those given doses higher than 16.2 mGy since the ICRP Organization uses CTDIvol equal to 16.2 mGy.
The samples were separated into 77% of those who received doses less than 20 mGy and 23% who received doses greater than 20 mGy since Japan is the nation where the CTDIvol is used the most. Then, using the CTDIvol of the ICRP to determine the impact of the low dose samples, which formed a percentage equal to 46% on the resolution, we headed to two different radiologists to view the images and make diagnoses because doing so is not our responsibility. After their evaluation, we discovered that 39% of the low CTDIvol samples don't have an impact on image quality. quality, the radiologists divided the samples into two standards, the first standard based on image quality and the second standard based on image confidence. After the first radiologist evaluated the images, we discovered that: 0% of the images had very poor quality, 0% had poor quality, 29% had a fair quality that ranged between moderate and slight confidence, 60% had a good quality that ranged between moderate and high confidence, and 11% had very good quality and high confidence. We may infer that we should have a certain standard for CT abdominal pictures to prevent noise and bad grayscale based on the radiologists' assessment, the data we have collected, and the studies we have discovered in the literature review. According to the data we have provided in the results chapter, we can support our conclusion that a high-resolution abdominal picture depends on the noise and the grayscale to be able to distinguish between two near organs so we can have a high-resolution image and diagnosable. and according to the radiologists' diagnoses and the CT dose index volume, we discovered that 22 of the samples have values between (3%-12%)less than 16.2mGy and that doesn't affect the resolution and 35 of the samples have values between (16%-59%)less than 16.2mGy and that does. The samples were then divided into two standards, the first standard was according to the quality of the images, and it was divided as follows: 0% have very poor quality, and 0% have poor quality. (Figure 2)

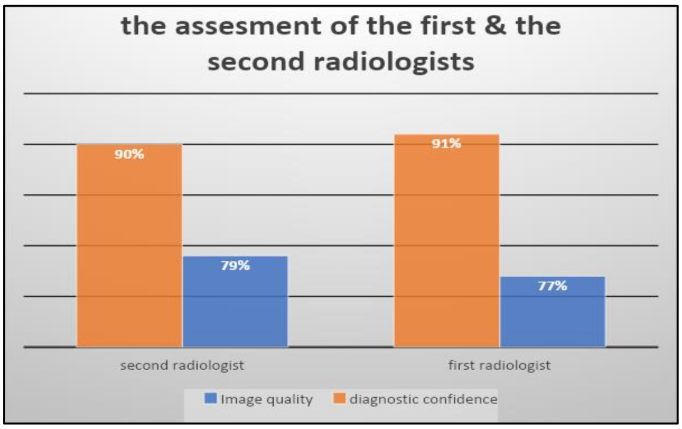

Figure: compares the findings of the first and second radiologists, and it is clear from the chart that there are only minor differences.

Then, based on the images we obtained from the Al Makkased Hospital, we headed to two different radiologists to evaluate the images since doing so was not our responsibility. We relied on the international reference value of the ICRP to determine the effect of the low-dose samples on the image quality, which formed a percentage equal to 46%. After the two radiologists evaluated the samples, we discovered that 39% of the low CTDIvol samples have no effect on image quality and the remaining 61% of low CTDIvol samples have an impact. (Figure 3). As a result, the samples were divided into two categories: the first standard was based on quality, and the second was based on the degree of confidence. (Figure 4).

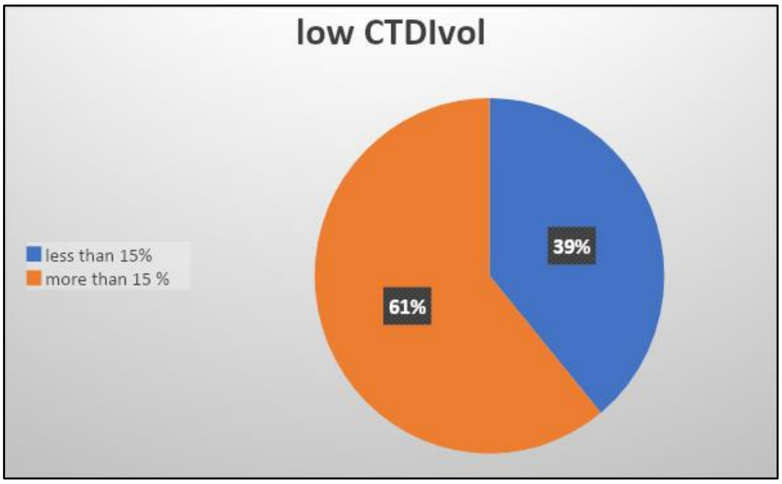

Figure 3: Following the two radiologist's reviews, we discovered that 39% of the low CTDIvol samples had no impact on picture quality while the remaining 61% of the low CTDIvol samples did.

Figure 4: The assessment of the first radiology

The assessment of the first radiologist to the image quality (Figure 4). Additionally, the second standard is determined by diagnostic confidence, which is divided into two categories. In this graph (Figure 5), 80% of the samples had moderate confidence, 20% had little confidence, and the remaining 10% were of fair quality.

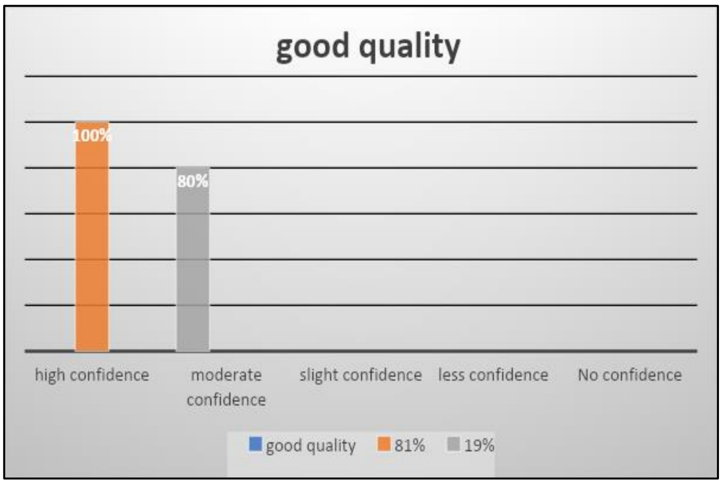

Figure 5: second assessment diagnostic confidence is being used.

According to this graph, (Figure 4b), 81% of the samples had high confidence in their quality, while 19% had moderate confidence. The percentage of samples in this graph that were of very high quality was 100% (Figure 6). The results of the second radiologist's assessment showed that 22 of the samples had values between (3%-12%) less than 16.2mGy, which did not affect the image quality, and 35 of the samples had values between (16%-59%) less than 16.2mGy, which did. As a result, the samples were divided into two groups, the first of which was based on the image quality, with the results being as follows: 0% of the samples had extremely poor quality.

Figure 6: The percentage of samples in this graph that were of very high quality was 100%.

Following the second radiologist's evaluation of the images, we discovered the following: 0% very poor quality, 0% poor, 28% fair quality with a confidence range between slight and moderate, 49% good quality with a confidence range between moderate and high, and 23% very good quality with a confidence range between moderate and high (Figure 7).

Figure 7: The second radiologist's evaluation of the images

The percentage of samples in this graph (Figure 8) that were of fair quality was 70% moderate confidence and 30% modest confidence.

Figure 8: proportion of the samples of good quality

The percentage of samples in this graph (Figure 9) that were very excellent was 100% high confidence. Additionally, based on the information we have gathered and the studies we have located in the literature review, we can draw the conclusion that a high-resolution abdomen image standard is necessary to prevent noise, poor grayscale, and the inability to distinguish between too close organs. The information we have presented in the results chapter can help to support this conclusion.

Figure 9: the proportion of samples of very good quality

5. Conclusion

The study examined the relationship between image quality and CTDI of the abdominal CT examination. The CTDI is one of the most widely used definitions that describe the dose so that we can know if the patient took a high or low dose, which brings us back to the image resolution. We can conclude that if we have a high value, it may be a high-resolution image and a good diagnostic process, but we cannot implement the ALARA principle; the opposite is true for a low value. However, in our study and after the examination of the two radiologists, they discovered that the image may be read and diagnosed properly even if the samples had a low CTDI compared to the ICRP reference. If we have a low value, it might be terrible picture quality, but the images will not be diagnosed.

6. Recommendations

- More study is needed to compare and examine the impact of CTDIvol amount on picture quality and diagnostic assurance in all types of CT examination.
- Additional survey research to detect differences across hospitals in Palestine and enhance the quality of images there.
- Continuous contact with the radiologists, and if a poor-quality image is noticed, the radiologist should be made aware of the issue to confirm it and prevent a repeat of it.

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