

Assessing Physician Awareness of Ionizing Radiation Doses from Chest CT Scans during COVID-19 in Sanandaj Educational Centers

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Citation: Asra Karami, Meysam Mirzaie-Peyhani, Mazhar Aminrasuli, Faraz Malek, Foad Ghaderi et al. (2024) Assessing Physician Awareness of Ionizing Radiation Doses from Chest CT Scans during COVID-19 in Sanandaj Educational Centers, J Adv Radiol Med Imaging 8(1): 101

Received Date: October 25, 2024 **Accepted Date:** November 25, 2024 **Published Date:** December 30, 2024

Abstract

Introduction: The assessment of physicians' awareness levels in Sanandaj educational centers regarding ionizing radiation doses related to the use of chest CT scans during the COVID-19 pandemic is crucial. This assessment can prevent unnecessary procedures. Additionally, it ensures that when necessary, these procedures are not overlooked. Through this approach, costs incurred by patients and insurance organizations due to unwarranted requests can be reduced.

Methods: The study is a descriptive-analytical cross-sectional study conducted in 1401. It uses a questionnaire among physicians in educational centers in Sanandaj to investigate the reasons for requesting chest CT scans and their awareness of the radiation dose associated with chest CT during the COVID-19 era, along with its consequences.

Results: There were differences in the level of awareness regarding radiation safety; in general, specialists were more aware than general practitioners. With the exception of more aware clinicians requesting fewer scans, awareness had no discernible impact on the overall number of lung CT scan requests. A higher knowledge of radiation dangers was connected with education level, particularly during COVID-19, with specialists being more informed than general practitioners.

Conclusion: This study emphasizes how important it is to educate Physician on radiation protection, ionizing radiation, and radiation dosages, particularly with regard to pregnant women and children. Raising awareness can lower the risk of cancer and cut down on needless referrals. Therefore, it is essential to set up training sessions and update the medical curriculum so that medical students learn this information.

Keywords: Computed Tomography scan, SARS-COV-2, Radiation Dose, Awareness

Introduction

Clinical findings from pneumonia or respiratory infection are useful for diagnosing COVID-19 [1]. Computed Tomography (CT) is fast, sensitive, and widely used, leading to a large volume of confirmed COVID-19 patients being referred for CT monitoring of disease progression. However, increased CT scanning has raised concerns about radiation exposure [2].

Low-dose chest CT can be used to diagnose early COVID-19, reducing radiation risk versus standard CT [3]. However, easy access to low-dose chest CT as a diagnostic tool has increased its overall utilization, which requires caution to balance diagnostic benefit with radiation exposure concerns [4].

COVID-19 chest CTs deliver 100–250 milligrays of radiation, below annual limits for high-exposure populations. In radiobiology, under 100 milligrays is considered low dose. But in oncology, permissible doses are only 2 milligrays daily and 60 over 6 weeks, which can cause DNA damage, cell death, organ damage, and toxicity. While CT radiation is less than annual limits, oncology standards suggest much lower acceptable doses [5]. Therefore, CT use for COVID-19 should be limited to complex cases or initial test-negative patients requiring urgent care, to balance diagnostic needs with radiation exposure risks [2].

Ali Chaparian et al. found the majority of CT scan tests requested showed no abnormalities, indicating a need to decrease unnecessary imaging to limit radiation exposure. The researchers highlighted that better education is required to improve physicians' knowledge of properly justifying CT scans based on clinical guidelines [6]. Christoph et al. found patients receive very little information on the risks and radiation exposure from CT scans. Additionally, patients, emergency physicians, and radiologists all lacked understanding of CT radiation doses [7].

Excessive CT scan radiation doses have serious consequences for people's lives due to low public awareness about ionizing radiation. Physicians' knowledge and awareness in this field are crucial to minimizing unnecessary tests and reducing harmful biological effects. Our study aims to investigate physicians' awareness in Sanandaj educational centers regarding radiation dose in relation to CT scans of the lungs during the COVID-19 pandemic. This research aims to prevent unnecessary and dangerous radiation exposure while ensuring it is not overlooked when necessary. Additionally, reducing unnecessary requests can help decrease costs for patients and insurance organizations.

Materials and Methods

A study conducted in 2022 among physicians in Sanandaj, Iran, investigated why lung CT scans were requested and doctors' awareness of their radiation dose and impacts during COVID-19. After ethical approval, questionnaires were distributed anonymously to physicians in relevant centers after explaining the study's goals.

Participants were asked to assess their knowledge regarding radiation doses, ionizing radiation, radiation in the pediatric population, radiation in pregnant women, and radiation risks. The appropriate sample size was estimated using a sample size calculator from Raosoft, Inc. The appropriate sample size with a margin of error of 5% and a confidence level of 95% in the software was 81.

The questionnaire consisted of 29 questions. 10 questions for demographic information, including gender, age, specialty, education level (intern or resident), year of graduation, medical center, any specific formal courses about radiology in their curriculum, self-rated level of knowledge regarding radiology, any history of attending courses related to radiation hazards and protection, and the most frequent radiological examination usually requested. The second part of the questionnaire consisted of 19 questions divided into five sections: radiation doses, ionizing radiation, radiation in children, radiation in pregnant women, and radiation hazards. All the questions were in Persian, with formats such as multiple-choice questions and open statements.

Rawashdeh et al. (2020) used this questionnaire in their study [8]. Initially, permission was obtained from the designer for translating and validating this questionnaire in Iran. The translation process started with the forward-backward method; the original version was first translated into Persian by two translators, then the two versions were reviewed by the research team, and finally the final Persian version was compiled. Afterwards, the final Persian version was given to two other translators to independently back-translate it into English.

After obtaining the initial translated version, in order to validate the questionnaire, it was distributed among 15 physicians who were not included in the study. These individuals were asked to carefully review the questionnaire, mark any ambiguous items, and write their suggested phrases. Then, the prepared questionnaire was sent to 10 experts in the field of working with ionizing radiation, protection, and radiobiology, as well as radiographers who have a background in work, experience, teaching, and research in this area, to review the questionnaire for content validity. Their opinions were also incorporated after team consensus (content validity).

Statistical Validation

To assess reliability, Cronbach's alpha coefficient was calculated in SPSS version 27.0, and a value of 0.79 was obtained.

The data obtained from the completed questionnaires were transferred to the statistical package of software for social sciences (SPSS, version 27.0, United States of America) for statistical analysis.

Each question was examined, and any significant relationships between the answers were looked into using the Cross Tabulation (Chi-Square Test) of independence. Mann-Whitney U test was employed to compare the replies of various groups. For every test, a statistical significance of $p < 0.05$ was taken into account.

Results

Finally, 81 doctors completed the questionnaire; 58% (47 people) were men and 42% (34 people) were women (table 1), and they were in the age range of 26–57 years. In addition, 56.8% of the respondents were general practitioners, and 43.2% were specialists (internal medicine, infectious diseases, pediatrics) (table 2).

Table 1: The number of male and female physicians who completed the questionnaire

| Gender | Frequency | Percent |
|--------|-----------|---------|
| Man | 47 | 58.0 |
| Female | 34 | 42.0 |

Table 2: The number of general and specialist physicians who have completed the questionnaire

| Level of education | Frequency | Percent |
|--------------------|-----------|---------|
| general | 46 | 56.8 |
| specialist | 35 | 43.2 |

Among the physicians who completed the questionnaire, 84% stated that they had attended formal courses on radiology during their education, and 43.2% reported having poor knowledge about radiology. Only 3.7% of them considered their knowledge excellent, while 40.7% and 12.3% rated their knowledge as average and good, respectively. 86.4% of physicians have stated that they have not participated in courses related to radiation dose and its associated risks. Additionally, the most common radiological examination requests, in order, are for radiography (33.3%), CT scans (4.9%), MRI (0%), and ultrasound (61.7%).

In the final section of the questionnaire, which looked into radiation safety awareness, 46.91% of respondents knew that the risk of cancer increased with dose. And 13.6% understood that radiation exposure should be maintained as low as possible (ALARA) (chart 1). 35.80% of the doctors were aware that any radiation-related activity should be justified in comparison to the available alternatives, and 90.12% correctly answered the question that doctors and technicians who perform ionizing radiation procedures should always wear protective equipment and stay as far away from the source of radiation as possible.

In this study, a questionnaire was used to assess the level of awareness of doctors at Sanandaj educational facilities about the radiation dose received from a CT scan of the lung based on their educational level. The answers to questions 5, 6, 7, and 9 revealed no significant variation in doctors' awareness of the radiation dose received during a lung CT scan based on their level of schooling. In other words, general practitioners and experts have similar levels of awareness of these issues. In question 8, there is a considerable difference in doctors' awareness of the amount of radiation dosage received from a CT lung scan based on their level of education. In other words, specialist doctors are more conscious of the radiation exposure from lung imaging than general practitioners. To draw judgments about their level of awareness, use the Mann-Whitney test's mean rank. The findings indicate that general physicians have the lowest level of awareness in questions 5, 6, 8, and 9, whereas specialty doctors have the highest level of awareness. In question 7, general practitioners demonstrated better levels of awareness than expert doctors.

The obtained results indicate that there is no significant difference between the level of ionizing radiation awareness among doctors at Sanandaj educational centers and the request for a CT lung scan, since the p value obtained in question 10 is more than 0.05. Given that the p value for questions 11, 12, and 13 was less than 0.05, it can be said that there is a significant difference—that is, physicians who are more aware of the dangers of ionizing radiation request CT lung scans less frequently. The level of knowledge has increased along with educational attainment, according to average ranks (mean rank), with general physicians having the lowest level of knowledge and specialists having the highest level.

In questions 14 and 16, the p-value is more than 0.05, but in question 15, there is a significant relationship ($p < 0.05$). The findings demonstrate that, across all questions, doctors at Sanandaj educational centers have become more aware of the risks that radiation poses to children and the need for lung CT scans during the COVID-19 pandemic. This has resulted in general practitioners having the lowest level of awareness and specialists having the highest level of awareness.

In all of the fifth section's questions, the degree of education has correlated with an increased awareness of the risks that radiation poses to expectant mothers; general practitioners exhibit the lowest level of awareness, while specialists exhibit the highest level of awareness. Nonetheless, during the COVID-19 outbreak, there was no discernible difference in the doctors' level of awareness regarding the risks of radiation to expectant mothers and their request for a CT scan of the lungs.

In questions 20 and 21, it is noted that general physicians have the lowest level of awareness and specialist doctors have the highest level of awareness of the dangers of radiation. This is consistent with an increase in education level. However, general practitioners have demonstrated the highest level of awareness in questions 22 and 23. The findings demonstrated that, during the COVID-19 outbreak, there was no discernible difference in physicians' knowledge of radiation risks and their request for a lung CT scan (table 3).

Discussion

The results of this study show that the level of awareness of physicians in Sanandaj educational centers about the dose of lung CT scan radiation varies according to the level of education. Specialist doctors are more aware of the amount of radiation received from lung imaging than general doctors.

Similar studies conducted in other nations have yielded similar results, i.e., The results of this study were consistent with previ-

ous studies, including the study by Rawashdeh et al., which demonstrated the general knowledge of referring physicians in the field of radiation dose, ionizing radiation, pediatric radioprotection, pregnant women radiation exposure, and the risks of low-level radiation [8].

The standard of medical care can be raised by applying these discoveries. Increasing physicians' awareness of the radiation dose from CT scans that they receive from the lung and ionizing radiation can help decrease the number of unnecessary requests for this imaging technique.

Planning training programs for physicians in the area of ionizing radiation protection is advised in light of the analysis of this study's data. Additionally, physicians need to be better informed about the adverse consequences of lung imaging techniques. However, Quinn et al. claim that there was no difference in the level of knowledge between physicians who participated in radiation safety courses and those who did not [9].

The findings of this research demonstrate a relationship between the volume of requests for lung CT scans during the COVID-19 pandemic and the physicians' knowledge of ionizing radiation and the risks that radiation poses to children at Sa-nandaj educational centers. Lung CT scan orders are less common among doctors who are more knowledgeable about ionizing radiation and the dangers it poses to youngsters. Bosanquet et al. also demonstrated that a low level of knowledge could be attributed to inadequate education at lower educational levels or may be due to the fact that physicians have primarily received training in the field of diagnostic imaging and image interpretation rather than radiation dose [10].

Only 13.9% of physicians reported being familiar with the ALARA principle, which is consistent with the findings of the study by Heyer et al., who reported a similar percentage of 15% [11].

Strengthening medical physicians' training programs about radiation dangers to expectant mothers is advised in light of the study's findings. More education on the adverse consequences of lung imaging procedures for expectant mothers is also required for medical professionals.

The limitations of this study included the lack of cooperation from physicians and insufficient time allocated for completing the questionnaire. Additionally, the lack of precise reference to the specialty field caused difficulties in data analysis. For this reason, conducting this study with a more accurate consideration of specialized medical fields is recommended.

Conclusion

Based on the results of this study, it is essential to raise awareness among referring physicians about radiation dose, ionizing radiation, children's radiation, Radiation of pregnant women and radiation protection principles. This awareness can help reduce unnecessary patient referrals to radiology departments using ionizing radiation, thereby minimizing non-essential radiation exposure and the risk of cancer. Consequently, organizing training courses and revising the medical curriculum for medical students during their general medical education is both necessary and crucial.

Acknowledgments

The research project of this article has been approved by the Ethics Committee of Kurdistan University of Medical Sciences (code: IR.MUK.REC.1401.309). The authors express their gratitude for the financial support provided by this university. We extend our thanks to all colleagues who assisted in translating the questionnaire, as well as the physicians and professors who participated in answering and completing the questionnaire.

Conflict of Interest

There is no conflict of interest.

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