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ARTICLE

Evaluation of awareness and knowledge of CT technologist regarding diagnostic reference levels in Iran

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Abstract – The purpose of this study was to determine the level of knowledge and awareness regarding radiation protection and Dose Reference Levels (DRLs) among 102 Computed Tomography (CT) technologists working in various Iranian hospitals. A questionnaire including 20 multiple-choice and open-format questions was divided into demographic information, general radiation protection knowledge, and DRL knowledge.
Regarding radiation protection knowledge concerning CT, about 56.9% of participants exhibited awareness of the dose display on the CT machine's console, and about 78.4% selected the correct dosimetric units expressed CT dose. Unexpectedly, 90.2% of participants failed to define the concept of dose optimization. A significant association ($p < 0.05$) was established between technologists' radiation protection and DRL knowledge and a degree of education, type of hospital, and job experience. In addition, the findings reveal a correlation between radiographers' DRL knowledge and their propensity to enroll in training courses. 26.5% of participants exhibited awareness of DRLs in CT practice, while 49% and 76.5% of participants were unable to correctly identify DRLs concept and function. To reduce patient dose in accordance with the As Low As Reasonably Achievable (ALARA) radiation protection principle, CT technologists must improve their knowledge of radiation dose and local DRLs should be defined at least at the local level.

Keywords: DRL / CT technologist / questionnaires / radiation protection

1 Introduction

CT scans have significantly increased in popularity over the past few decades due to their numerous medical benefits. CT scans expose patients to significantly higher radiation exposures than other diagnostic imaging modalities, despite the increased patient benefits of CT imaging (Bourguignon, 2021). Higher radiation doses increase the risk of cancer and stochastic effects in patients. DRL are an optimization tool used to determine whether the doses delivered to the patients follow ALARA principle. Several studies have investigated the diagnostic reference level awareness and knowledge among CT technologists in different countries (Bawazeer, 2022, Abdulkadir, 2021). The outcome of this study could aid in the identification of knowledge and awareness gaps among technologists, as well as in the implementation of specific measures to address those gaps.

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2 Method and materials

The perceived knowledge of DRLs and radiation protection among CT technologists in Iran was evaluated using a multiple-choice and open-format questionnaire. Twenty inquiries were contained within three sections of the questionnaire. The first section consists of eight queries designed to collect demographic information (gender, age, background and propensity to participate in training courses, work experience, type of hospital, level of education, and number of daily CT examinations performed in their hospitals). The second section consisted of six questions regarding technologists' awareness of radiation protection, scan protocols for optimization in CT, and the quantity used in CT to convey the dose amount. The third section evaluated CT technologists' DRL knowledge.

3 Result

About 28.4% of the participants had more than 10 years of clinical experience. Approximately 66.7% of participants

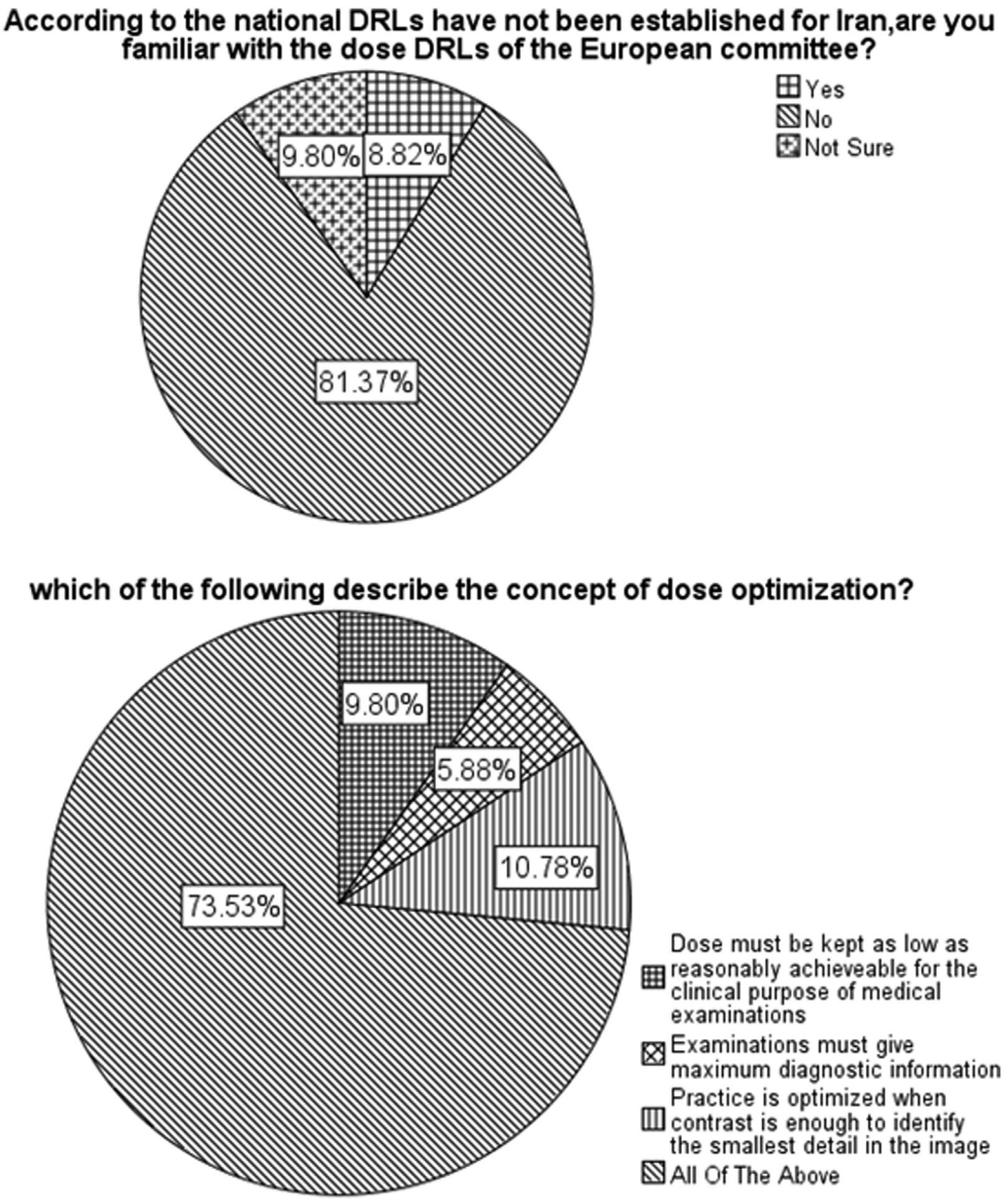

Fig. 1. CT technologists' knowledge regarding to the dose DRLs of the European Commission (2014) (upper panel) and CT technologists' knowledge regarding the dose optimization concept (bottom panel).

worked in public hospitals and 21.6% in private hospitals. Approximately 87.4% of participants held a bachelor's degree, while 5.9% held an associate's degree and 15.7% held a master's degree. This study demonstrated that 56.9% of participants were aware of the dose display on the CT console. Half of the participants felt that CTDI volume served as a more effective measure for evaluating the radiation dose. The outcomes of the dose optimization concept's description yielded unexpected results, with around 90.2% of CT technologists providing wrong responses (Fig. 1 bottom panel).

26.5% of the participants demonstrated knowledge regarding DRLs in CT scans. Meanwhile, 49% of the participants expressed uncertainty regarding their understanding of DRLs, and 24.5% reported having no knowledge about DRLs. A majority of the participants exhibited familiarity with DRLs, but a significant proportion (49%) of the participants were unable to accurately identify the appropriate description of DRLs. In addition, the majority of technologists (76.5%) were unable to correctly identify the function of DRLs, and only 23.5% chose the correct description. 9.8% of the CT technologists were familiar with how to conduct a dose survey in practice.

The results indicate that 81.4% are unfamiliar with the European Commission's dose DRLs from European Commission 2014 (European Commission Diagnostic Reference Levels in Thirty-Six European Countries) (Fig. 1 upper panel).

Only 40.2% of technologists have participated in retraining courses, while 72.5% of technologists desire to

participate in retraining courses, according to the findings of this study.

4 Discussion

To protect patients from the radiobiological effects of ionizing radiation exposure, it is essential to assess patients doses and establish DRLs. If the CT technologist lacks adequate knowledge of radiation protection and DRL issues, he/she may be responsible for inadvertently increasing the patient's radiation exposure for a particular imaging examination. Hence, it is imperative to assess the proficiency and awareness of CT technologists about diagnostic reference levels.

4.1 Awareness and knowledge about radiation protection

More than half of the CT technologists who participated in this study answered correctly the majority of queries regarding CT radiation protection and optimization. When queried regarding the notion of dose optimization, a significant majority of participants, including 90.2%, offered comments that were found to be inaccurate. This percentage was observed to be greater than the findings of Bawazeer's (2022) study, where around 60.6% of CT technologists were found to have supplied incorrect responses, which was higher than Bawazeer's study (2022), in which approximately 60.6% of CT technologists provided incorrect responses. This may be because this theoretical definition of dose optimization is included in the majority of educational and training programs. In addition, the majority of CT technologists were conversant with the dose display on the CT console, demonstrating a high level of protection optimization experience in practice.

Previous studies have indicated that the level of awareness and knowledge regarding radiation protection and dose optimization among CT technologists varies. (Bawazeer, 2022; Almohiy *et al.*, 2020; Paolicchi *et al.*, 2013; Bayatiani *et al.*, 2023). their may be the result of various educational programs, the implementation of guidelines, and retraining courses in various nations. Paolicchi *et al.* (2013) demonstrated that radiological staff training for CT examinations of adults is a critical factor in optimizing CT protocols and can substantially reduce radiation doses for staff and patients. According to the findings of Bayatiani *et al.* (2023), the level of awareness among radiology technologists regarding the principles of radiation protection for pregnant mothers and fetuses was determined to be 53%. The research conducted in their study was carried out in the city of Arak, Iran. However, our study was conducted on a national scale. Furthermore, our research encompassed a sample size of 102 radiology technologists, which is larger in comparison to the sample size of 71 participants in their study.

4.2 Knowledge and awareness about DRLs

26.5 % of participants were aware of DRLs in CT examinations, according to the results of the third section of the questionnaire assessing awareness of DRLs.

Compared to their comprehension of CT parameters and radiation protection, the technologists' understanding of DRLs was significantly lower than anticipated. Almohiy *et al.* (2020) and Foley *et al.* (2013) also reported limited awareness of DRLs among technologists, as did the present study.

The majority of participants were unfamiliar with the dose DRLs of the European Commission and the quantities used to introduce the DRLs, according to the results. The lack of participation in retraining courses and the absence of local and national DRLs may contribute to the inadequate level of CT DRL knowledge and absence of participation in retraining courses. Due to a paucity of sufficient patient dose data for establishing DRLs in low- and middle-income countries, the DRLs of other countries are used as a reference. Insufficient patient dose data for determining DRLs in a country may be the result of a lack of qualified personnel, instruments, appropriate methodology, and national-level coordination. Thus, radiological staff training is essential to refining CT protocols. As has been done in other countries (Hakme *et al.*, 2023; Benamar *et al.*, 2023), in order to give useful references suited to Iran, local DRLs must be established, and regional dose monitoring must be coordinated for a national DRL to reduce radiation doses for staff and patients.

In summary, CT technologists were found to have relatively excellent knowledge of radiation protection and dose optimization, but poor knowledge of DRL. Knowledge of radiation protection and DRL by CT technologists was significantly correlated with hospital type, level of education, and work experience. It would be possible to effectively reduce the patients' dose and radiation-induced adverse effects by establishing the local DRL.

Conflicts of interest

All authors declare to have no conflicts of interest in regards to this article.

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Ethical approval

Ethical approval was not required as it did not include any risk groups, participation was voluntary and the participants' identity was anonymous.

Informed consent

Informed consent was not required as it did not include any risk groups, participation was voluntary and the participants' identity was anonymous.

Authors contributions

AMD and SB did the conception of the study. All authors participated in the study design, questionnaire draft and data collection. All authors read and approved the final manuscript.

References

Abdulkadir MK, Piersson AD, Musa GM, Audu SA, Abubakar A, Muftaudeen B, Umana JE. 2021. Assessment of diagnostic reference levels awareness and knowledge amongst CT radiographers. *Egypt J Radiol Nucl Med* 52 (1): 1–8.

Almohiy HM, et al. 2020. Radiologists' knowledge and attitudes towards CT radiation dose and exposure in Saudi Arabia-a survey study. *Med Sci (Basel)* 8 (3): 27.

Bayatiani MR, Farzanegan Z, Seif F. 2023. Evaluation of the knowledge and observance of radiation protection for pregnant radiology technologists and pregnant patients in radiology and CT scan departments of Arak. *Radioprotection* 24; 58(1): 31–36.

Bawazeer OA. 2022. Assessment of diagnostic reference levels awareness and knowledge amongst CT radiographers in Saudi Arabia. *J Radiat Res Appl Sci* 15 (2): 98–105.

Benamar M, Housni A, Sadiki S, Amazian K, Essahlaoui A, Labzour A. 2023. Patient dose assessment in computed tomography in a Moroccan imaging department. *Radioprotection* 58 (1): 49–53.

Bourguignon M. 2021. Des doses patientes excessives en scanographie : de nouvelles préoccupations. *Radioprotection* 56 (2): 89–90.

European Commission (EC). 2014. Diagnostic Reference Levels in Thirty-Six European Countries. Part 2/2. Radiation Protection No 180. *Luxembourg: Publications Office of the European Union*.xx

Foley SJ, Evanoff MG, Rainford LA. 2013. A questionnaire survey reviewing radiologists' and clinical specialist radiographers' knowledge of CT exposure parameters. *Insights Imaging* 4 (5): 637–646.

Hakme M, Rizk C, Francis Z, Fares G. 2023. Proposed national diagnostic reference levels for computed tomography examinations based on clinical indication, patient gender and size and the use of contrast in Lebanon. *Radioprotection* 58 (2): 113–121.

Paolicchi F, Faggioni L, Bastiani L, Molinaro S, Caramella D, Bartolozzi C. 2013. Real practice radiation dose and dosimetric impact of radiological staff training in body CT examinations. *Insights Imaging* 4 (2): 239–244.

Rawashdeh M, McEntee MF, Zaitoun M, Abdelrahman M, Brennan P, Alewaidat H, Lewis S, Saade C. 2018. Knowledge and practice of computed tomography exposure parameters amongst radiographers in Jordan. *Comput Biol Med* 1;102: 132–137.

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