Migration Letters

Volume: 19, No: S8 (2022), pp. 599-607

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Patients' knowledge of and Perspectives Regarding the Risks and Dosage of Diagnostic Radiation

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Abstract

Background: Medical imaging is an increasingly important source of radiation exposure for the general population, and there are risks associated with such exposure; however, recent studies have demonstrated poor understanding of medical radiation among various groups of health care providers. Ionizing radiation is a helpful diagnostic tool in a wide range of medical specialties. However, it imposes a risk of radiation exposure to both patients and healthcare professionals. The study aims: Evaluate the level of knowledge of patients toward radiation exposure hazards and radiation dose. Methods: The study was a qualitative cross-sectional study in Jeddah, KSA from January to July. Data were collected through a self-administered online questionnaire that was distributed electronically to the patients who underwent the diagnostic radiological procedure. Data were represented in terms of frequencies and valid percentages for categorical variables. A one-way analysis of variance test was used to compare numerical variables between subgroups. Results: The mean knowledge score was below average (5.08 ± 2.952). Patients aged between 18 and 25 years, and single patients had significantly higher mean scores. Patients who were advised about the hazards of radiation showed a significantly higher mean score. These informed patients had the highest mean score in the entire sample population. Conclusion: The level of knowledge of patients toward risks of radiation exposure is inadequate. Further research is required for investigate patients' awareness regarding the risks and dosage of diagnostic radiation on a national level. Awareness promotions are highly recommended to improve the level of knowledge.

Key words: *Knowledge, perception of patients, the hazards, dose of diagnostic radiation.*

Introduction

Radiation has been extensively used in the diagnosis and treatment of many diseases. Different imaging modalities involve radiation, and in particular, high radiation dose investigations such as computed tomography (CT) are increasingly resorted to [(1)]. Subsequently radiation has proven adverse biological effects that vary with the dose and duration of exposure [(2-4)], the level of clinician awareness of such matters including associated risks is important. Since clinicians refer patients for such investigations, they obviously bear some responsibility under the Ionizing Radiation (Medical Exposure) regulations [(5, 6)]. Internationally, there has been an increasing concern that the knowledge of referring doctors about radiation doses of commonly performed imaging investigations and their awareness of associated risks of radiation exposure are insufficient [(3, 5, 7)].

Ionizing radiation is considered a non-invasive diagnostic intervention [(8)], which can help

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in the process of decision making regarding a medical condition in terms of pharmacological or interventional strategy [9]. The ionizing radiation is used in a couple of techniques, including X-ray, computed tomography (CT) scan, and magnetic resonance imaging (MRI) [10]. Individuals who are at the highest exposure level of ionizing radiation during the intervention, either for treatment or diagnostic purposes, are healthcare professionals (HCPs) and the patients [11]. The radiation doses can be simply estimated by a dosimeter [12]. However, the dose of radiation exposure to patients or medical staff cannot be directly observed with naked eyes while measuring by a dosimeter [13].

Although HCPs working in radiological specialties have good training in radiation safety [14], patient's education is also necessary in order to minimize their risk of cancer or any other hazards of radiation exposure [15]. Medical professionals, including vascular surgeons, cardiologists, and gastroenterologists, have training on the hazards of radiation exposure [16]. This is of particular importance in the case of intravascular interventions [17]. These procedures impose a similar risk of radiation exposure on both patients and doctors [18]. Therefore, monitoring the radiation exposure is mandatory [19].

Other types of interventions may require a higher radiation dose, which is mainly required for some patient's clinical factors and certain amount of dose is required for diagnosis [20]. The medical staff can be protected by using dosimeter, which determines the degree of exposure [21]. Previous reports showed that patients receive a significantly higher dose of radiation during diagnostic procedures [22]. Several studies have explored the level of knowledge of healthcare professionals toward diagnostic radiation hazards [23] though there is lack of data about the level of knowledge of patients about the risk that they are exposed to ionizing radiation [24]. Therefore, the aim of this study was to explore the level of knowledge of the population toward the risks and hazards of radiation used for diagnostic procedures and radiation dose.

Methods

A qualitative, cross-sectional study was performed in Jeddah, KSA from January to July where an online self-developed questionnaire was distributed, via a link to Google forms to the patients who underwent the diagnostic radiological procedure. Only those who completed the questionnaire were included in the analysis. Data were collected through a self-administered questionnaire. The responses were divided into two sections: the first section included questions on socio-demographic data. The second section was questioned on knowledge of radiation exposure hazards and radiation doses in different diagnostic procedures.

The knowledge of respondents was evaluated by calculating the scores for correct answers. Each correct response was given one point. Data were represented in terms of frequencies and valid percentages for categorical variables. Mean, standard deviations, minimum and maximum values were used to describe the numerical variables. A one-way analysis of variance (ANOVA) test was used to compare numerical variables between the subgroups. All p-values <0.05 were considered as statistically significant. IBM SPSS (version 28) was used to perform all statistical calculations.

Results

Table (1) shows all socio-demographic data for study participants. Three hundred and fifty-seven participants responded to this online questionnaire in this study. Out of 357 participants, age was subcategorized into four groups, starting with 18–25 years old and ending with more than 56-year old. Most of the respondents (58%) belonged to the age group 18–25 years old. On the other hand, the age group who were greater than 56-year old had the least number of responses (3.4%). Single participants constituted 57.7% of

participants, while widowed participants were 0.8%. The educational level was also evaluated, in which 74.8% had a university degree or higher, while 0.8% only were illiterate.

Table (2) show participants were also asked about their knowledge about the use of radiation in different diagnostic procedures, where 65.5% of patients knew that ionizing radiation was used in X-ray, 48.2% mentioned that radiation was used in CT, 35% agreed that radiation was used in ultrasound. Also, 41.5% responded with a positive response that MRI required radiation. On the other hand, 38.4% and 36.4% of patients mentioned that radiation was not used in barium swallowing test and rectal barium test, respectively.

Table (3) show patients were also asked about their knowledge of exposure to radiation during a diagnostic procedure. The questions revealed that 48.7% mentioned that radiation exposure does not increase the risk of cancer, while 56.3% of participants agreed that repetitive exposure to radiation could increase the cumulative risk of cancer. Also, 37.3% and 42.6% of participants denied being exposed to radiation in airports and at home, respectively. Additionally, 23.5% showed that the risk of cancer due to CT in adults is 1/1,000. Moreover, 91.6% of patients mentioned that they should be told about the reason for X-ray if needed for them.

Table (4) shows that the total knowledge score was calculated for included questions evaluating knowledge about the dose of radiation and radiation hazards. The minimum score report was zero, while the maximum score was 13. The average knowledge score was 5.08 ± 2.952. The mean for total score was compared over different demographic data and influencing factors using one-way ANOVA at the level of significance p-value <0.05. It was shown that patients aged between 18 and 25 years old had significantly higher (p-value <0.001) mean score (5.79). Additionally, single patients had significantly higher (p-value = 0.009) mean scores as compared to other groups (5.41). Patients who were told about the hazards of radiation showed a significantly higher mean score (p-value <0.001) as compared to those who were not provided with this information. It is worth mentioning that this group of patients had the highest mean score as compared to the whole sample population (8.28).

Figure (1) show participants were asked about the type of information provided to them regarding their radiological investigation. It was shown than 65.3% of the patients were told the reason for their investigation, while 63.6% were not informed about the radiation dose that they will be exposed to. Additionally, 73.7% of patients were not told about the hazards of exposure to radiation, and 67.5% were not told about other related risks.

Table (1): Socio-demographic data of the study participants

	Frequency (n)	%
Age group		
18–25	207	58.0
26–40	85	23.8
41–55	43	12.0
>56	12	3.4
Marital status		
Single	206	57.7
Widowed	3	0.8
Married	129	36.1
Divorced	12	3.4

	Frequency (n)	%
Educational level		
Illiterate	3	0.8
Primary	4	1.1
Secondary	60	16.8
Intermediate	13	3.6
University education and higher	267	74.8

Table (2): Knowledge of participants toward radiation use

		Frequency (n)	%
X-ray	I don't know	21	5.9
	No	28	7.8
	Yes	234	65.5
CT	I don't know	24	6.7
	No	63	17.6
	Yes	172	48.2
Ultrasound	I don't know	27	7.6
	No	95	26.6
	Yes	125	35.0
MRI	I don't know	24	6.7
	No	89	24.9
	Yes	148	41.5
Barium swallowing test	I don't know	45	12.6
	No	137	38.4
	Yes	58	16.2
Barium rectal test	I don't know	45	12.6
	No	130	36.4
	Yes	59	16.5

Table (3): Knowledge of patients towards radiation dose and risk of radiation exposure

		Frequency (n)	(%)
Radiation can increase the riskof cancer	I don't know	30	8.4
	No	174	48.7
	Yes	75	21.0
The cumulative risk of cancer results from repetitive	I don't know	30	8.4

		Frequency (n)	(%)
exposure toradiation	No	51	14.3
	Yes	201	56.3
I am exposed to radiation in Airports	I don't know	30	8.4
	No	133	37.3
	Yes	115	32.2
I am exposed to radiation at home	I don't know	33	9.2
	No	152	42.6
	Yes	101	28.3
Have you heard before about posterior anterior radiation	I don't know	18	5.0
	No	264	73.9
	Yes	16	4.5
The total amount of radiation received from posterior anterior radiation is lower than the amount produced from chest X-ray	I don't know	48	13.4
	No	107	30.0
	Yes	101	28.3
The risk of cancer due to CT radiation in adults is	1/1,000	84	23.5
	1/2,000	51	14.3
	1/3,000	64	17.9
	1/4,000	7	2.0
	1/5,000	59	16.5
Do you think that you should betold about your need for X-ray?	No	10	2.8
	Yes	327	91.6

Table (4): Comparison of total knowledge score over different socio-demographic data

		Mean knowledge score	p-value
Age group	18–25	5.79	<0.001*
	26–40	4.26	
	41–55	4.28	

		Mean knowledge score	p-value
	>56	2.75	
Marital status	Single	5.41	0.009*
	Widowed	5.00	
	Married	4.77	
	Divorced	2.75	
Educational level	Illiterate	3.00	0.143
	Primary	5.00	
	Secondary	5.00	
	Intermediate	5.26	
	University education and higher	3.38	
Profession	Medical	5.55	0.380
	None medical	5.23	
Did your doctor mention the hazards of radiation	No	5.10	<0.001*
	Yes	8.28	

*p-value at the level of significance <0.05

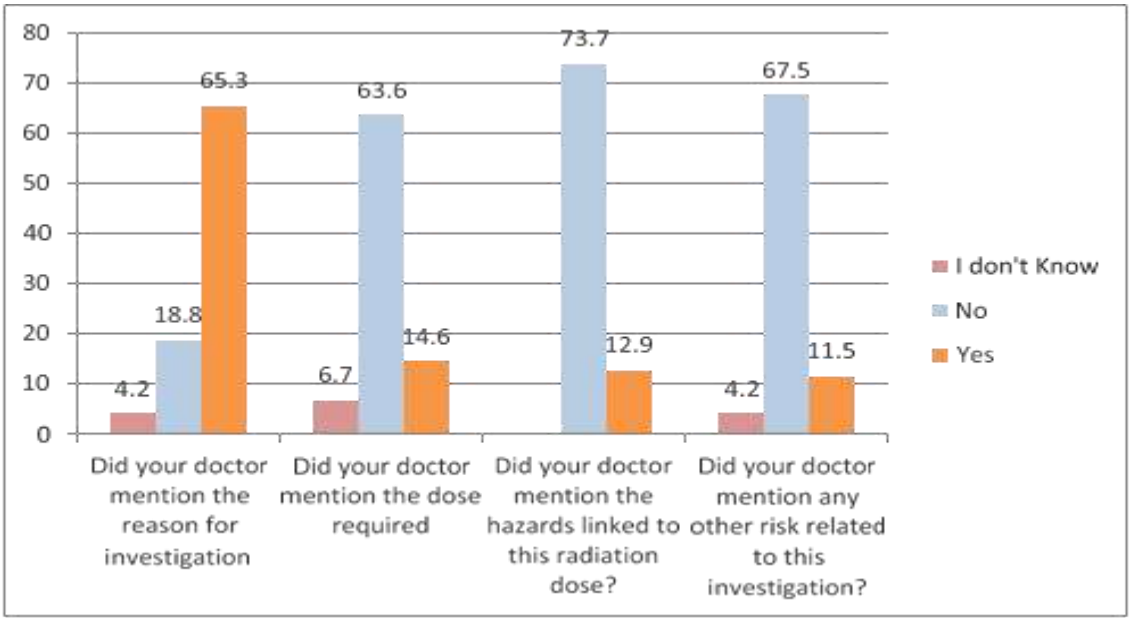

Figure (1): Information provided by treating physician

Discussion

Ionizing radiation played a very significant role in the improvement of radiological investigations over the past decade [15] [8]. However, some adverse effects can occur due to its use although the occurrence of these events is very rare [13][6]. Knowledge of patients about these hazards is essential [16] [9]. In the present study, the level of knowledge of

patients toward radiation dose and risk of exposure to radiation during diagnostic procedures was evaluated. It was revealed that the level of knowledge of patients was below average, where the mean knowledge score was 5.08 ± 2.952. It was also shown that patients aged between 18 and 25 years old, and single patients had significantly higher mean score. Moreover, patients who were told the hazards of radiation showed a significantly higher mean score.

The level of patients' knowledge was also evaluated in different clinical settings. In Saudi Arabia, the study conducted by Almatared et al., (2017) [(25)][18] investigated the level of knowledge of patients toward ionizing radiation on 375 patients and showed that the level of knowledge of patients was low in Nijran city. Similarly, the present study showed that the mean score for the knowledge section was below average. Additionally, the present study revealed that patients who got advice from their doctors about the hazards of exposure to ionizing radiation had the highest mean in the entire sample population.

Moreover, Sin et al., (2013) [(26)] [19] evaluated the awareness of the patients towards risks of radiological diagnostic procedures. The study recruited 173 patients only who underwent either CT or X-ray imaging. Additionally, revealed that the awareness of patients toward radiation safety and the risk of exposure were unsatisfactory. Furthermore, recommended awareness programs to improve the level of knowledge of patients towards radiation exposure risk. Findings of Sin et al., (2013) [(26)] [19] were similar to the findings of the present work; however, the present work recruited a larger sample size, which increases the reliability of the present outcomes. Moreover, the present work demonstrated the important role of physicians in increasing the knowledge and perception of patients towards radiation exposure risks.

Takakuwa et al., (2010) [(27)] [20] evaluated the level of knowledge of patients toward risk of CT investigations, specifically in the Emergency Department, recruited 383 patients who were admitted to the Emergency Department and were required to undergo a CT investigation for diagnostic purpose, and showed that the patients were not aware of the extent of risk due to exposure to radiation, especially the risk of cancer. Furthermore, showed that age, education level, and race were different factors influencing the level of knowledge of patients, as well as their attitude towards radiation exposure risk.

The present study also described a significant difference in the level of knowledge between different age groups, where the age group of 18–25 years showed a significantly higher score as compared to other age groups. However, the present work could not find a significant difference in the level of knowledge among different educational levels. The present study recommended that conduct further studies in the future to investigate the factors affecting knowledge levels of patients toward radiation exposure hazards and radiation dose.

Conclusion

The level of knowledge of patients toward the risk of exposure to radiation and radiation dose is relatively low. National awareness programs should be encouraged to increase their level of knowledge regarding the risk of this exposure. Additionally, healthcare professionals should be encouraged to advise their patients about the procedure that they will have its hazards and methods of prevention.

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