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Assessment of knowledge about radiation risk among fellows and residents in pediatric department in Tabuk city

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Abstract

Background: The study aimed at investigating the knowledge in pediatric residents and fellows in two Saudi hospitals, putting shedding lights on the information available for patients and their relatives concerning the risk assessment of radiation used in radiological investigations for children.

Methods: This study was a cross sectional study based on a questionnaire of multiple-choice questions. The questionnaire was distributed to 40 pediatric residents and fellows from two hospitals in Tabuk city in Saudi Arabia, military hospital (NWAFH) and KKH. Statistical analysis of the data was done using SPSS, version 17.0 (SPSS, Chicago, IL, USA). The percentage of participants who gave correct answers was calculated for each question. Individual questions were analyzed using Chi-squared test of independence. All statistical significance valueswere $P < 0.05$.

Results: Only35 fromthe 40 questionnaires were completed then analyzed (87.5%). Only 10 surveyed (34.5%)was considered competent torisk radiation knowledge for commonly performed radiological examination. Regarding to the Percentage of correct answers,at least 50% (adequate knowledge was considered withsevenminimum score of correct answers out of thirteen).

Conclusion: The knowledge of radiation doses and risks from common radiological tests was sub-optimal amongthe fellows and residentsin pediatric department. Awareness of radiation hazards for fellows and residents during radiation exposure risk examinationsshould be considered an essential part of medical education.

Introduction

Techniques of the use of ionizing radiation in the medical sciences received special concern and considered the foundation in medical practice, especially in pediatric medicine. The use of imaging techniques has grown dramatically in recent years, mostly in the emergency care field [1].

The rapid increase in the use of ionizing radiation in diagnostic examinations on pediatric patients, as well as using such nuclear techniques in other medical investigations resulted in persistent need for adequate information to be available to the patients and cognation [2].

In United States, the computed tomographic (CT) examinations has been raised from twenty six millions in 1998 to almost seventy million in 2008, and the nuclear medicine step increased from twelve millions to approximately twenty millions through the same interval [3].

The lowest radiation dosage which is carcinogenic is about(10–50P) mSv. The normal dosage of exposure for single chest radiograph is about 0.02 mSv, and for abdominal CT is about 9 mSv[4]. The CXR radiation is less than background radiation been received all over the year (0.01 mSv\ day). Almost 0.015 mSv has been received through3-hour in airline flight [5].

Generally, the radiation exposure risks and doses to the children from CT examinations are more complicated to be calculated from the CT scanner parameters. A study carried out in 2002 revealed that there is increased sensibility to radiation in the children comparingwith adults of aboutten times, and the girls are more radiosensitive than the boys. Furthermore, the lifetime risks of radiation are higher for the children due tohigher expected years of life after exposure to radiation than the adults [6].

According to study published in 2006, 87 percent of pediatricians minimized radiation dose of chest radiation and 94 percent minimized radiation dosage from CT [7].

It is essential for pediatricians to recognize the general issue on protection from radiation. There are no available data and knowledge's about radiation exposure risk knowledge in Tabuk city. Despite this evidence many articles have shown that there is not sufficient knowledge on radiation protection in

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general practitioners and different specialists in Tabuk city .

Our goal in this study was to collect intensive data on the risk of radiation knowledge among pediatrician in Tabuk city.

Rationale

- The purpose was to assess the radiation exposure risk and collect knowledge son fellows and residents in pediatric department in Tabuk city.
- There is no similar study was conducted in Tabuk city.
- It has appeared in different studies that medical professional's knowledge on radiation dangers and dosage are inadequate.

Radiology possesses a great role in modernistic medicine. Many of interventional and diagnostic radiology procedures comprise exposure to ionizing radiation. Although imaging benefits generally outweigh the risks associated with radiation exposure.

There is increasing concern about the harmful biological effects of ionizing radiation on the living organisms. A publication issued by the National Radiation Protection and Measurement Council for 2009 entitled "Ionizing Radiation Exposure of the Population of the United States" reported seven-fold rise in exposure to radiation of United States population from the medical radiation since early 1980s[8]. The random effects of radiation, particularly the risk of cancer, are the most fearsome and the least got along with since it has no minimum threshold dose and its harmful effects need at least 1-2 decades for appearance[9].

The review of published scientific literatures showed that the knowledge of radiation dose and the risks involved in radiation tests are very limited. Many studies have been conducted, mostly among physicians of different disciplines, medical students, trainees, and family practitioners [10].

Amazingly, studies among radiologists are rare. These studies showed that medical professionals have limited knowledge about risks of radiation to the patients through common tests, and that they were disabling to answer correctly patients' common questions [11]. It is essential for physicians to have good awareness about radiation exposure dose levels and risks associated with using ionizing radiation; they are responsible for the investigations technicalities and procedures to be followed for the medical diagnosis of patients at large. Nevertheless, the radiologist has an important task in determining the appropriateness of the radiographic tests of an individual patient and discussing differences in opinions and disagreements with the patient and physician. Radiology doctors have to answer the patient's fears and convey the knowledge about radiation risks to their clinical colleagues[12]. Using of radiological images is recently growing in pediatrics, particularly, multidetector computerized tomography (MDCT) [13]. Following "Directive 2013/59/Euratom of the Council of December 5, 2013", each person subjected to medical radiation must be well informed and the radiation exposure must be properly justified[14].

It is essential for pediatricians to be aware of general issue about radiation protection. Unfortunately,these data are not availablein Tabuk and not well known, alsothe dose reference levels (DLR) for pediatric population is not well known[15]. However, the pediatric diagnostic procedures are known and fast growing. CT Benchmark Report 2007 in US showed that from sixty eight million (MDCT) examinations, 11 percent were performed on pediatric population[31].

Abuse of radiation is related to higher cancer disease rates. The estimated cancer risk resulted from abuse of diagnostic x-rays in UA and UK is 5700 and 500 cases yearly, respectively [17]. Among children, the situation is more critical because they have a longer life and their tissues are more sensitive to radiation. Therefore, the correct use of diagnostic radiographs should be emphasized among physicians by obtaining proper knowledge of radiation doses. Since most radiation tests are requested by non-radiologists, they should have a basic idea of the dose of radiation from these tests before ordering[18].

Medical investigations and treatment are considered the largest source of man-made radiation dose. Natural background radiation is the largest source of exposure to human radiation by 50%, including terrestrial background which is 3%, internal background by 5%, space background by 5%, thoron and radon (37%).

However, exposure to radiation caused by medical sources amounts to about 48%, while the remaining 2% comes from occupational exposure, consumer products, and industrial exposure that include nuclear power plants exposure [19].

Materials and methods

This study was a cross sectional study based ona questionnaire of multiple-choice questions. The questionnaires were distributed to40pediatric residents and fellows of 2 different hospitals in Tabuk city that is located in north of Saudi Arabia, King Salman military hospital and King Khaled hospital.

The questionnaires were designed and based on back ground of previous experience literatures related to the same topic [20], to identify the extent to which participants in the study are familiar with the general concepts of radiation protection and radiation exposure risks in common radiological investigations in pediatric medicine. The questionnaires consisted of 13 questions; they were divided into 2 sections: the first part related to personal demographic data of participants and the second part included the specific questions about protection from radiation.

Particularly, the first 3 questions were consisted of demographic data such as gender, age and professional years. The next questions investigated the knowledge on common radiation protection measures and doses in radiological investigations. The last question referred to self-assessment about the personal awareness and knowledge about "radiology risk dose". The questionnaires were distributed by radiologist resident that requested participants to fill it individually and unnamed and return it back within the same day.

Statistical analysis of the data was done using SPSS, version 17.0 (SPSS, Chicago, IL, USA). Before data analysis, all variables were reviewed to ensuredata entry accuracy and missing values. The percentage of participants who put correct answers was calculated for each question. Individual questions were analyzed using Chi-squared test of independence. All statistical significance value was $P < 0.05$.

Results

A total of 35 responses were received from 40 questionnaires distributed (87.5 % response rate). Out of the participants, residents were the dominant group in number, followed by fellows (Table no. 1). The mean score of correct answers was 7 out of 13(53.8 %). Range of scores differed from 4- 16 out of seventeen correct answers. Mean scores of the two groups are given in (Table 1). Statistical difference in mean scores was found between residents and fellows with P value of <0.05. The participants percentage who scored >53.8 % was 48.9 % (n = 22).

Table (1): Participants number in each group and their mean scores

participants	Participant's number, *n* (%)	Mean score out of 13	Standard deviation
Residents	19(54.3 %)	9.1	±2.5
Fellows	16 (45.7 %)	9.2	±1.6
Total	35 (100 %)	7	±2.6

The fellows and residents population were considered by: 5 trainees of first year; 14trainees of second and third year and 16 fellows that have completed the training recently (Table 2). The mean age of participants was 37years old.

The results indicated that there were insignificant differences found in percentage of correct answers related to years of training and sex, however the correct responses percentage in younger participants was higher (p = 0.042). There was a significant correlation in participants that attended workshops on the radiation protection; they showed higher percentage of correct answers. The results revealed that23% of participants had no awareness that ionizing radiation is not used in (MRI); 69% had no ability to define radiation dose average in children (1–5 years age) subjected to (MDCT)abdominal scan; 72% could not able answering the question about technique of ionizing radiation that means longer exposure, in terms of time (Table 2).

Table (2): Sample characteristic pediatrics fellows and residents

	Number	N. of correct answer	% of correct answer	*Prob.*
Age				0.042
≤35	20	10	50%	
>35	15	5	33.3%	
training Year				0.232
first year of pediatrics residency	5	3	60%	
Higher year of pediatrics residency	14	6	42.9%	
Fellow	16	4	25%	
Presence of lessons give awareness for radiation in high school				0.002
No	8	3	37.5%	
Yes	27	20	74%	
Presence of lessons give awareness for radiation in residency training				0. 768
No	25	18	72%	
Yes	10	6	60%	
Attendance of workshops concerned with radiation protection				0.898
No	29	10	34.5%	
Yes	6	2	33.3%	

Table (3): **The correct answer distribution for single questions in completely filled questionnaire**

Questions	Answers number and percentage		
	Correct	In-correct	No answer
Is MDCT investigation involved X-rays use?	33 (94.3%)	-	2 (5.7%)
Is Mammography requires ionizing radiation?	29 (82.9%)		6 (17.1%)
Involvement of MRI ionizing radiation?	25 (71.4%)	2(5.7%)	8 (22.9%)
DEXA involves use of X-rays?	10 (28.57%)	17 (48.6%)	8 (22.9%)
Which investigation involves higher exposure to radiation: renal scintigraphy, MDCT, Color Doppler?	29 (82.9%)	6 (17.1%)	-
What is the dose recommended by the European Commission in the diagnostic reference levels for chest x-ray in new born?	17 (48.6%)		18 (551.4%)
IS the body weight affect radiation dose of patient?	18 (51.4%)	14 (40%)	3 (8.6%)
Radiation dose the abdomen MDCT scan in child (1–5 years)?	8 (22.9%)	24 (86.5%)	3 (8.6%)
Performance of ortopantomography during pregnancy?	15 (42.9%)	16 (45.7%)	4 (11.2%)
The dose of Fetus radiation damage?	3 (8.5%)	23 (65.7%)	9 (25.7%)

The results proofed that there is lack of the knowledge in the general principle of radiation protection, such as the possible radiation exposure risks (ortho-panto-mography) during pregnancy (34%) (Table 3); dose of radiation associated with high probability risk of fetal malformation (49%) (Table 3).

Discussion

Radiation protection issue has very low awareness level among clinicians, regarding to underestimation of its risks and doses [36]. This study results get at line with other previous studies that the knowledge about radiation protection is Very scarce comparing to increased need of information by patients and their relatives. This deficiency of awareness of exposure to radiation doses is important for a large number of patients who receive insufficient or frequent diagnostic tests[20].

MDCT use has been widely increased, especially in younger age, which considers a problem in the issue of radiation protection and risks awareness. It is urgent for physicians to be having a good knowledge of radiation dose in common radiation investigations and exposure risks, to give adequate information to patients[37]. There are large epidemiological researches interested with assessment risk of cancer as a result of using MDCT in children [21].

The first serious risk reduction procedure is to limit the description of diagnostic tests that have little or no benefit in the diagnosis and detection of diseases in children using general practice by pediatricians [22]. A recent study in 2018, aimed at assessment of the knowledge level about doses of radiation in radiological examinations among interns and residents in KSA revealed that knowledge of radiation doses of radiological examinations is very low [23].

A study showed that large proportion of emergency doctors are having inadequate awareness of risks associated with commonly used MDCT scans, however doctors with broad experience, have more knowledge of risk associated with commonly used radiation and more likely to consider radiation dose of patients, so they conduct analysis of the risk-benefit only[24].

Inadequate training for radiation protection in medical staff and unsatisfactory decreased knowledge was reported [25]. Also cardiologists' knowledge was suboptimal, but can be greatly improved by focusing efforts to training [26]. Also the European Community guidelines recommend introducing courses related to radiation protection in basic training of dentist, surgeon, and all courses of physician [14].

Because of all above reasons, this study has been carried out among pediatric residents and fellows. The results agreed with those reported in many literatures, the knowledge gap regarding radiological doses and associated health risks among physicians are evident in various publications according to several professional reviews[26].

Of particular concern is the lack of knowledge about the level of dose during pregnancy that is likely to harm the fetus and the possibility or lack of evaluation of tumors in pregnant women, even in the United States of America, where it was widely in the number of children, so it has made numerous campaigns to raise awareness of the risk of radiation and try to reduce unnecessary imaging, especially for children. Researchers found that training sessions and radiation protection conferences remove the knowledge gap about radiation risk. The percentage of questionnaire correct answers to half or more questions rises to 72%, if students attended at least one lesson on radiation protection during residency and 74% if they follow lessons that focused on radiation protection in medical school[27]. So,the appropriate education can significantly reduce the lack of knowledge in radiation protection. On the other hand, this study indicated that among pediatricians who are still reducing the importance of doses and risks, some corrective measures should be implemented, such as: intensifying radiation prevention classes during medical school, stimulating the issue of radiation protection. An important element of radiation protection is to ensure that doctors have sufficient knowledge to enable them to make a balanced and accurate assessment of the risk-benefit ratio when considering radiation tests. The task of pediatric radiologists should be to inform and educate their colleagues about radiation protection and to increase their awareness of the risks of radiation and how to protect them[27].

Conclusions

This study conducted a survey on physicians from two hospitals in Tabouk region only. So that these results could not be widely applied at national level; however it gave an image of pediatricians with various educational sources have inadequate knowledge about risks

accompanied to common radiological investigations.

It is advised for more adequate training courses and practices in the radiation protection and it is essential that establishing a constructive cooperation between all the medical institutions in the Saudi Arabia is necessary in order to raise awareness of the dangers of radiation and how to overcome them and exert more effort in this regard from all government agencies and NGOs to increase knowledge among physicians.

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