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Awareness of hazards of diagnostic use of radiation during pregnancy among women in Al-Madinah, KSA

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Abstract

Imaging of pregnant women presents a unique challenge to radiologists because of the concern about the radiation risk to the conceptus. To assess awareness of radiation hazards during pregnancy among females in Al-Madinah. A cross-sectional survey questionnaire study was conducted on married and non-married adult females who lives in Al-Madinah. This study included 403 female participants; their age ranged from 16-64 years. 128 participants were health field staff. 201 of participants claimed that they experienced an education regarding radiation hazards during pregnancy. 262 participants chose the 1st trimester as the riskiest time to radiation exposure during pregnancy. Ultrasound was the highest choice (268 times) between participants as the safest imaging modality during pregnancy. 61 answered yes there is a safe level of radiation exposure for a pregnant, during pregnancy and 40% of them chose the answer that cardiac catheterization can be done during pregnancy. Efforts should be done to increase the public orientation about the radiation risks and the safest imaging modalities that can be used during pregnancy. Furthermore, efforts should also be directed to increase the orientation of health working-staff with the safe levels of radiation during pregnancy.

Keywords: Awareness; Radiation-Risks; Pregnancy; Women; Orientation; Health-working-staff.

1. Introduction

Ionizing radiation such as X-ray machines and radioactive isotopes (radionuclides) are used daily in hospitals and clinics. The use of imaging for a pregnant women represents a particular challenge to radiologists because of the concern about the radiation risk to the fetus [1]. Many women have concerns about radiation exposure and its effects during pregnancy. Misperception of the risk regarding the use and safety of low dose radiation can lead to termination of an otherwise wanted pregnancy, and this usually happens due to lack of information among the public [2].

Exposure to radiation during pregnancy associated with harmful effects to the fetus and this depends on several factors including radiation dose, stage of gestation and exposure frequency [3, 4]. American College of Radiology, and American College of Obstetrics and Gynecology have inferred that the outright dangers of fetal impacts, including childhood cancer induction, are little at conceptus dosages of 100 mGy and insignificant at portions of under 50 mGy [1].

British Institute of Radiology published that routine supervision of entire categories of staff who works with radiographic methods including nuclear medicine show that 98% of staff usually expose to less than the public ionizing radiation dose limit of 1 mSv per year. Just few pregnant staff will need to alter their duties to ensure that the dose to

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the fetus during the declared term of pregnancy will remain less than the legal dose constraint of 1 mSv[5]. Studies done among radiology laborers indicate limited knowledge in medical professionals about radiation dangers caused to patients during common imaging tests[6].

1.1. Aim of the study

To assess awareness and knowledge of radiation hazards during pregnancy among females in Al-Madinah.

2. Material and methods

2.1. Study Tool

The tool used in this study was developed by researchers after extensive reviewing the relevant and current literature. The self-administrative questionnaire was designed by authors. This cross-sectional survey questionnaire study was conducted on females in Al Madinah, Saudi Arabia. The participants in the study included all married and non-married adult females who lived in Al-Madinah excluding the females who lived outside Al-Madinah and males. *Sample size:* 384, calculated using *openepi* program at 95% confidence interval. *Sampling technique:* Non-Probability Sampling of Convenience sample type was used.

The Research objectives were covered by questionnaire that had multiple questions with different choices of answers either yes or no questions or multiple response answers questions.

Documenting informed consent occurred for participants through the clear question of their acceptance to share in the research in the google form after explaining the research to the participants, ensured that the participants understand the research and that they freely consent to participate.

The 1st group of questions covered the demographic data of participants including age, marital status, education level, occupation either health field or non-health field staff.

The 2nd group of questions were targeted towards receiving educations about radiations hazards by the participants and from where they get these training knowledges.

The 3rd group of questions comprised knowledge of participants about different aspects of radiations hazards in pregnancy like; The most sensitive / risky time to radiation exposure during pregnancy (1st, 2nd, 3rd trimester or all pregnancy, which of the Imaging modalities can be safely used during pregnancy.

The 4th group of questions were targeted to the staff working in the medical field to see if there is knowledge about the safe level of radiation exposure for a patient during pregnancy, their responses about the ability to perform cardiac catheterization on a pregnant patient and can a pregnant employee continue to work in the X-ray department.

2.2. Administrative and Ethical Consideration

This prospective research was conducted after approval of the institutional board of ethics numbered 046-1439. Participants were reassured that participation in this study was voluntary and they may withdraw from the study at any time, if they wish. Confidentially and privacy were maintained by data coding to eliminate identifying data with personal information. Researchers provided the participants with the questionnaire involving covering page that included the ethical considerations, the purpose of the study and the right to accept or refuse to participate. The researchers published the link of the electronic questionnaire for the period from June to September 2018.

2.3. Data Analysis

The gathered data were analyzed using IBM SPSS software (release 25), SPSS Inc., for Windows (Microsoft), United States of America). Statistical methods included descriptive analysis, such as number and percentage, frequencies, Total Unduplicated Reach and Frequency (TRUF).

3. Results

This study included 403 female participants; their age ranged from 16-64 years (mean age 27.8+/- 8 years). Twenty-seven (6.7%) of them were < 20 years, 258 (64%) from 21-30 years, 77 (19.1%) from 31-40 years and 41(10.2%) >40

years. One hundred and five (43%) of them were married, 207 (51.4%) single, 16 (4.0%) divorced and 5 (1.2%) widowed.

Only 245 out the 403 participants answered the question related to their work and their responses were 128 (52.2%) health field staff and 117 non-health field staff (47.8%).

Regarding the education level of participants, only 289 out of 403 of participants answered, 27 (9.3%) postgraduate level, 207 (71.6%) were university level, 46 (15.9%) high school level, 8 (2.8%) intermediate level, one (0.4%) not educated.

Two hundred and one (49.9%) of participants claimed that they experienced an education regarding radiation hazards during pregnancy while 202 (50.1%) did not have any education regarding radiation hazards during pregnancy. The 403 participants in this study expressed that they had the knowledge of ionizing radiation hazards during pregnancy through different methods through 813 choices; the Internet was the most common source of knowledge by 222 times, 173 through studies, 160 times in hospitals, 158 times from relatives and 100 times through reading books. 300 times were the maximum combination of choices by participants regarding the education of radiation hazards during pregnancy and it was between the internet and hospital (Table 1, Section 1).

Table 1 Responses of participants for different questions in the study

I- Participants choice for source of knowledge of ionizing radiation hazard during pregnancy	Total Choices (813)
Internet	222
Studies	173
Hospitals	160
Relative	158
Books	100
<i>The maximum combination of choices by participants was the combination between the internet and through the hospital</i>	300
II- Most risky time to radiation exposure during pregnancy according to participants choice	Total Choices (403)
First trimester	262
Second trimester	23
Third trimester	5
All pregnancy	113
III- Participants choice for imaging modalities that can be safely used during pregnancy	Total Choices (499)
Ultrasound	268
X-ray chest and extremities	95
Contrast Imaging	50
CT	41
MRI	38
Nuclear Radiation	7
<i>The maximum combination of choices by participants was between X-ray of chest and extremities and ultrasound</i>	339

Regarding the most sensitive/risky time to radiation exposure during pregnancy, 262 (65.0%) out of 403 participants chose the 1st trimester, 23 (5.7%) chose the 2nd trimester, 5 (1.2%) chose the 3rd trimester and 113 (28.0%) chose in all pregnancy (Table 1, Section 2).

The 403 participants respond to the question (the imaging modalities that can be safely used during pregnancy), they answered the question through 499 choices as follows; 268 times were Ultrasound, 95 times were X ray chest and

extremities, 50 times were contrast Imaging, 41 times were CT, 38 times were MRI and 7 times were Nuclear Radiation. The maximum combination of choices by participants was between X-ray of chest and extremities, and ultrasound in 339 times (Table 1, Section 3).

Considering the questions targeted the 128-staff working in health care; for the question “Is there a safe level of radiation exposure for a pregnant woman during pregnancy”, only 121 out of the 128-staff working in health care participants answered this question; and their responses were as follows; 61 answered yes, 14 answered no, 46 answered I did not know. For the question; (Can cardiac catheterization be performed for a pregnant patient?), only 125 out of the 128-staff working in health care participants answered this question; and their responses were as follows; 50 said yes can be performed and 15 said no it cannot be performed and 60 participants answered I did not know. For the question; (Can a pregnant employee continue to work in X-ray department?), only 121 out of the 128-staff working in health care participants answered this question; and their responses were as follows; 35 said yes can continue, 68 said no she can't continue and 18 participants answered I do not know (Table 2).

Table 2 Responses of questions for participants working in health care (128-staff)

Participants choice for the question; (Is there a safe level of radiation exposure for a pregnant, during pregnancy?)		
Yes		61
No		14
Don't know		46
Participants choice for the question; (Can cardiac catheterization be performed for a pregnant patient?)		
Yes		50
No		15
Don't know		60
Participants choice for the question; (Can a pregnant employee continue to work in x ray department?)		
Yes		35
No		68
Don't know		18

4. Discussion

The aim of this study was to highlight the level of awareness and knowledge of radiation hazards during pregnancy among females in Al-Madinah, Saudi Arabia. To our best of knowledge, no research exists that studied the awareness of women about the hazards of radiation during pregnancy either in Saudi Arabia or worldwide.

Lack of information among the public regarding the safety of low-dose radiation exposure may prompt a misperception of the hazard and to termination of an otherwise wanted pregnancy[2]. The current study found that, the majority of participants claimed that they did not have any education regarding radiation hazards during pregnancy, which necessitate the need for further education in our community, in order to minimize the unwanted effects.

For those who had some form of education on radiation hazards during pregnancy, the current study showed that the internet was the most common source of knowledge chosen 222 times, and combination of internet and through the hospital was chosen 300 times. These results were different from results of a study done on medical students and interns, which showed that the most common source of knowledge was in the form of lectures (21.3%), tutorials/workshops (7.3%), or a combination of these 5.2%[7] and this may be attributed to the nature of the sample of participants studied. This highlights the importance of the social media as a source of information to the public necessitating the increase of the sources of information about education of radiation hazards through the social media.

Radiation hazards all through pregnancy are identified with the phase of pregnancy and the absorbed dose. Potential radiation effects vary, depending on the fetal phase of development and the magnitude of the doses. These dangers are increasingly huge during organogenesis and in the early fetal period, to some degree less in the second trimester, and

least in the third trimester[8]. The Results of past studies demonstrated that, the baby is most sensitive to radiation impacts between 8 and 15 weeks of pregnancy[1, 8]. Those results coincided with the results of participants' choices in this current study where they chose the 1st trimester to be the most sensitive time to radiation exposure in 262 (65.0%), 2nd trimester in 23 (5.7%), 3rd trimester in 5 (1.2%) and in all pregnancy in 113 (28.0%). This means that the orientation that the radiation risks are more in 1st trimester is high in our community in-between participants of this study.

Ultrasonography and Magnetic resonance imaging (MRI) are not related with hazard and are the imaging methods of choice for pregnant patients, but they should be used prudently and just when use is required to respond to a significant clinical inquiry or generally provide medical benefit to the patient[9]. Utilization of CT and related contrast material should not be withheld if clinically indicated yet remembering the dangers and advantages of the examination. MRI should be considered as a safer alternative to CT imaging during pregnancy in which they are equivalent for the diagnosis in question[10]. Not all radioisotopes can be utilized securely during pregnancy. Radioactive iodine (iodine 131) promptly crosses the placenta, has a half-life of 8 days, and can unfavorably influence the fetal thyroid, particularly if used after 10-12 weeks of gestation. Whether for diagnostic or therapeutic treatment purposes, iodine 131 should not be utilized during pregnancy. If a diagnostic test of the thyroid is indicated, Technetium 99m is the isotope of choice[9]. In this current study the orientation of participants for the imaging modalities that can be safely used during pregnancy is high for the use of ultrasound as a safe imaging modality as it was chosen 258 times while the orientation for the use of MRI as a safe modality is low as it was chosen 38 times and also they could not differentiate between CT and MRI based on which one is more safe; CT was chosen 41 times while MRI 38 Times while they considered the nuclear radiation was the least safest modality which matched the data mentioned in literature. These data give the alarm that we have to increase the public orientation about the safest imaging modalities

In this study, 61 (50.4%) out of 121 health staff participants who responded to the inquiry "Is there a safe level of radiation exposure for a pregnant, during pregnancy", chose yes there is a safe level of radiation exposure for a pregnant woman during pregnancy. Most diagnostic radiological methods expose the fetus to less than 50 mSv. This level of radiation will not increase birth defects or miscarriage. According to published data, the announced dose of radiation to result in an expanded frequency of birth defects or miscarriage is over 200 mSv[11]. There are no dose limits for radiation exposure of patients. There are, notwithstanding, imaging test that can be performed securely during pregnancy, especially those that don't include exposure of the lower pelvis. The choice to utilize radiation must be advocated by the clinicians requesting the test, contingent on the individual patient circumstance. When it has been determined that a medical procedure is justified, the procedure should be performed such that a good diagnostic exam is obtained with the least conceivable patient radiation dosage [12]. Efforts should be done to increase the orientation of the health staff with the safe levels of radiation during pregnancy.

Cardiac surgeries are absolutely indicated, sometimes during pregnancy were no alternatives are available. The most common procedure done during pregnancy are mitral balloon valvuloplasty and coronary angioplasty. Radiation dosages to the mother for such techniques are less than 20 mGy and the fetal hazard is limited, on the grounds that the fetus is outside the field of direct radiation[13]. There were some orientation in-between health staff participants of this study as 40% of them chose the answer that cardiac catheterization can be done during pregnancy. Even though the risks are limited, radiation exposure should be avoided as much as possible. The best time frame to perform intrusive methodology is the start of the second trimester, when organogenesis is finished yet the uterus is still small[13]. Efforts should be done to increase the orientation of health staff for the possibility of making invasive radiological procedures during pregnancy.

A pregnant laborer can keep working in an x-ray department. An evaluation of her dosimetry history ought to be attempted to guarantee that the fetal dose can be kept underneath 5 mGy (the limit in the United States). If radiation exposures are such that 5 mGy during gestation could be surpassed, endeavors must be made to lessen the radiation dose. If radiation exposures are not expected to approach 5 mGy, it isn't important to reassign the laborer. The worker must be informed of the potential dangers, local policies, and recommended dose limits [14]. In this study, 35 out of 121 health staff participants who answered the question (Can a pregnant employee continue to work in an x-ray department?) said yes the pregnant employee can continue in her work while 68 said no she can't continue, 18 participants answered I did not know. This work demonstrated that more effort is still needed for orientation of the public and health working staff about the nature of work in the health environments that have radiation exposure and permitted dose limits.

5. Conclusion

Pregnant ladies should inform their treating doctors they encounter, including their dentist, that they are pregnant before getting an X-ray or different procedures that utilize radiation. Decisions to expose the pregnant ladies to radiation exposure must include the need for the procedure, consideration of different modalities to assess the condition, knowledge of maternal and fetal dosage, and fetal gestational age.

Efforts should be made to increase the public orientation about the radiation risks during pregnancy and the safest imaging modalities that can be performed during pregnancy. Also, efforts should be directed to increase the orientation of health working staff with the safe levels of radiation during pregnancy for the possibility of making invasive radiological procedures during pregnancy and the nature of work in the health environments that have radiation exposure and dose limits that are permitted.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

There are no conflicts of interest.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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