

Knowledge of Radiation Risks and Protection among the Final Year Medical Students and Intern Doctors

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Abstract:

Background: Investigative imaging techniques used in medicine constitute the highest radiation source to which humans are constantly exposed apart from the normal background radiation from nature. The aim of this study is to assess awareness of radiation protection measures among the final year medical students and medical intern doctors

Materials and methods: This is a questionnaire based cross sectional study conducted at the department of Radio-diagnosis in Yenepoya Medical College Hospital. The study was conducted in accordance with the ethical norms as laid down in the Declaration of Helsinki. Informed written consent was taken from the subjects before enrolling them for the study. The questionnaire is a structured and self administered one containing 18 closed ended multiple choice questions consisting of knowledge of radiation safety principles, barriers to protect transfer of radiations, precautions to be taken, hazards of radiation, etc which will be distributed among 41 final year medical students and 41 intern doctors. The total mean score ranged from 0 to 18, with higher scores representing greater knowledge about radiation doses and the associated risks. All the MBBS medical students in their final year of training prior to graduation and intern doctors who were willing to participate in the study were included. First to third year MBBS students, postgraduates and radiographer students were excluded from the present study.

Results: The study population consisted of 41 medical students and 41 medical interns. Total of 39 female and 43 male students. The mean age of the students was 22.05 ± 0.21 and interns were 23.39 ± 0.54 . All the students and interns responded to the entire 18 questionnaire, assessing the various aspect of knowledge among participants. Overall total score of the entire 18 questionnaire was higher in interns than the students. This difference was non-significant.

Conclusion: Care should be taken to train health care professionals to eliminate the risk of exposure to radiation at regular intervals and radiological protection should be a subject of periodic training.

Keywords: Ionizing Radiation, Radiation Protection, Questionnaire, Medical education, Interns, Medical Students.

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I. Introduction

Investigative imaging techniques used in medicine constitute the highest radiation source to which humans are constantly exposed apart from the normal background radiation from nature. Most of the methods used in diagnostic radiology and nuclear medicine can produce ionizing radiation whose dose depends on different factors associated with the patient and the apparatus.^(1,2) In the early period of radiation diagnostics, no one believed that ionizing radiation could have adverse effects on living organisms, given its unquestionable advantages. Radiology pioneers have been exposed to high doses of radiation that have contributed to numerous dermatoses, hematological conditions, cataract or cancer diseases.⁽³⁾

The bulk of radiation doses from artificial sources to which the general population is exposed include ionizing radiation from medical applications. This is the result of a steadily increasing demand for radiological exams with particular reference to multidetector computed tomography (MDCT), which alone accounts for about 50% of total patient exposure to radiation.

Several studies show that primary care providers are unaware of the risks associated with the radiation use. Doctors who are responsible for requesting radiological examinations tend to underestimate the actual doses involved, have poor knowledge of the possible risks to the health of populations and do not discuss with their patients the potential risks of CT scans.⁽⁴⁾

Physician awareness of medical radiation has been of growing interest.^(5,6) Consequently, programs of public interest have attempted to raise awareness of this important issue. The fundamental issue is that lack of

radiation risk knowledge poses a threat to patient safety by potentially increasing their exposure to medical radiation and its associated risks, especially radiation-induced cancer.

The aim of this study is to assess awareness of radiation protection measures among the final year medical students and medical intern doctors

II. Material And Methods

This is a questionnaire based cross sectional study conducted at the department of Radio-diagnosis in Yenepoya Medical College Hospital , Mangalore, Karnataka from May 2019 to October 2019. A total 82 adult subjects (41 medical students and 41 medical interns) aged ≥ 18 years were for in this study.

Study Design: Questionnaire based cross sectional study.

Study Location: This was a tertiary care teaching hospital based study done in Department of Radio-diagnosis at Yenepoya Medical College Hospital , Mangalore, Karnataka.

Study Duration: May 2019 to October 2019

Sample size: 82

Sample size calculation: Sample size was estimated on the basis of a single proportion design. At 5% level of significance and margin of error , estimated proportion of 94.4% based on the study by Dellie ST et al⁴ , the sample size was calculated to be 82.

Subjects & selection method: All the MBBS medical students in their final year of training prior to graduation and intern doctors who were willing to participate in the study were included from May 2019 to October 2019. First to third year MBBS students, postgraduates and radiographer students were excluded from the present study.

Validation of study tool – This structured and self administered questionnaire has been finalised after discussion and validation from four experts.

Inclusion criteria:

All the MBBS medical students in their final year of training prior to graduation and intern doctors who are willing to participate in the study

Exclusion criteria:

1. First to third year MBBS medical students
2. Postgraduates
3. Radiographer students

Procedure methodology

The study was conducted in accordance with the ethical norms as laid down in the Declaration of Helsinki. Informed written consent was taken from the subjects before enrolling them for the study. The questionnaire is a structured and self administered google form containing 18 closed ended multiple choice questions consisting of knowledge of radiation safety principles, barriers to protect transfer of radiations, precautions to be taken, hazards of radiation, etc which will be distributed among 41 final year medical students and 41 interndocctors. Only one of these choices was the correct answer. A 'correct' answer was given one mark and no mark was given for 'incorrect/do not know' answers. The total mean score ranged from 0 to 18, with higher scores representing greater knowledge about radiation doses and the associated risks.

Statistical analysis

Questionnaire was prepared as a Google form and distributed among the study participants for the response. The collected data was than exported to excel sheet and presented as frequency and percentage, continuous data is presented as Mean \pm SD. Chi-square tests were performed to test for differences in proportions of categorical variables between two groups. The data was analysed using SPSS v23 operating on Microsoft windows. The level $P < 0.05$ was considered as the cut-off value or significance

III. Result

The study population consisted of 41 medical students and 41 medical interns. Total of 39 female and 43 male students included in present study, who were equally distributed among the two groups of medical student and interns. (Table 1)

		Medical student	Medical intern
Gender	Female	20	19
	Male	21	22

Table 2: Age of study participants.

	designation	N	Mean	SD
Age	Medical student	41	22.05	.218
	Medical intern	41	23.39	.542

The mean age of the students was 22.05±0.21 and interns were 23.39±.54, which was statistically significant. (Table 2)

Table 3: Correct responses by the participants to the questionnaire compared using chi-square test.

Questionnaire	Medical student	Medical intern	p-value
	Count	Count	
X rays were discovered by	35	35	NS
Which organ among the following is most radiosensitive	29	34	.191
Which of the following part needs longest exposure for an X ray	27	21	.179
SI unit for the measurement of absorbed dose is	9	24	.001*
Which type of investigation implies high irradiation dose	29	32	.448
The principle biological risk from chronic exposure to X rays is	27	35	.04*
Protective material used for protection against radiation risk	35	33	.557
Fetus is most susceptible to radiation during	25	34	.027*
Which of the following investigation has no radiation risks	28	31	.461
Occupational and non-occupational doses will remain well below	30	36	.095
Please select which age group is most sensitive to radiation	29	23	.169
Which investigative modality is the most safest during pregnancy	35	36	.746
In women of reproductive age group nonemergency X ray examination	8	23	.001*
Which of them does not use ionizing radiation	36	33	.36
Which among the following is an absolute indication for X ray	33	31	.594
Which of the organ part is least affected by diagnostic radiation	5	3	.457
Standard measure for radiation protection during exposure portal	24	23	.823
CT uses	31	34	.414

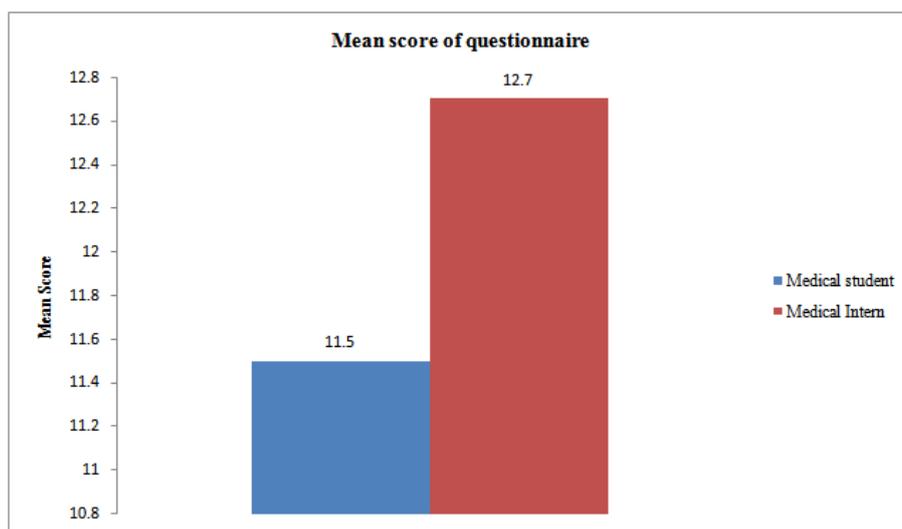
*p-value <.05 is statistically significant; NS – Not significant.

All the students and interns responded to the entire 18 questionnaire, assessing the various aspect of knowledge among participants. Many questions were answered correctly by both the interns and students. However some questions, medical students responded significantly correct answers compared to the interns. (Table 3) medical students responded accurately for the SI unit of measurement, the principle biological risk, fetus susceptibility to radiation questions than the interns.

Table 4: Total score of complete questionnaire compared among the student and interns using student t-test.

Designation	N	Mean	SD	P-value
Medical student	41	11.58	4.08	.200
Medical intern	41	12.70	3.76	

*p-value <.05 is statistically significant.



Overall total score of the entire 18 questionnaire was higher in interns than the students. This difference was non-significant. (Table 4)

IV. Discussion

As future physicians, medical students must fully understand the magnitude and implications of radiation doses and risks that accompany common imaging studies for which they will refer their patients. Nonetheless, the significance of this problem is expressed in the move towards the correct use of medical imaging as well as the widespread adoption of concepts of radiation safety including as small as reasonably achievable (ALARA). There is growing concern that this general lack of awareness makes it difficult, if not impossible, to educate patients adequately about the risks and benefits of a particular study. In addition, the widely observed underestimation of the dose of radiation can result in more imaging studies than is required, which is not without harm to the patient.

Use of x-ray in diagnostic radiology requires good practice and appropriate dosage experience associated with all types of procedures. The International Commission for Radiological Protection (ICRP) and the National Council for Radiation Protection and Measurement (NCRP) have established guidelines for the safe application of all types of radiological procedures and the safety of personnel. Extensive review of the literature showed a worldwide concern about how much doctors know about this topic. Several publications have shown that medical students know very poorly about ionizing radiation and radiation protection.⁽⁷⁾ Reports of the awareness of radiation exposure by doctors and related hazards have shown significant underestimation of the exposures associated with various imaging studies.

Interns have been confirmed to have avoided assisting patients in need of medical assistance during radiological examinations and medical students stop being in the control console area during a dose-stricken radiological exposure in that area. Study conducted by Wong CS (2011) found that knowledge of medical doctors, including the interns and students is unsatisfactory.⁽⁵⁾

However it is astonishing to identify that medical students had a significant accurate response for the questions which related to the theory knowledge than the interns for questionnaire related to SI unit, principle of risk with radiation, fetal susceptibility to the radiation. Overall mean score among the medical students and interns was statistically insignificant; however interns mean score was greater than the medical students.⁽⁷⁻¹⁰⁾

V. Conclusion

Medical interns received the highest rates of accurate answers to questions relating to radiation protection compared to medical students. The analysis revealed a varying level of knowledge among the study population about ionizing radiation. At the same time, it is noteworthy that the respondents were well aware of the potential cancer consequences of large doses of ionizing radiation, Training in the field of radiological safety should be a focus of regular medical student, and interns training regardless of the position and length of service.

Appendix

QUESTIONNAIRE

(Correct answers are in italics and are highlighted)

Age (in completed years): _____

Gender: Male/ Female

Current designation in the hospital: Medical student/medical intern

1. X rays were discovered by:

(a). Becquerel

(b) Wilhelm Conrad Roentgen

(c) Marie Curie

(d) Thomas Edison

2. Which organ among the following is most radio-sensitive:

(a) Liver

(b) Pancreas

(c) Thyroid

(d) Pineal

3. Which of the following part needs longest exposure for an Xray image?

(a) Thoracic

(b) Abdomen

(c) Spine

(d) Pelvis

4. SI unit for the measurement of absorbed dose is :
- (a) **Gray**
 - (b) Becquerel
 - (c) Sievert
 - (d) Don't know
5. Which type of investigation implies higher radiation dose:
- (a) **Total body MDCT**
 - (b) Colour doppler
 - (c) MRI
 - (d) Xray abdomen
6. The principle biological risk from chronic exposure to X rays is:
- (a) **Increased risk of cancer**
 - (b) Radiation burns
 - (c) vomiting and diarrhoea
 - (d) headache
7. Protective material used for protection against radiation risk:
- (a) Aluminium
 - (b) Iron
 - (c) **Lead**
 - (d) Plastic
8. Fetus is most susceptible to radiation during:
- (a) 28-30weeks
 - (b) **2-7 weeks after conception(organogenesis)**
 - (c) 32-34weeks
 - (d) 38-40weeks
9. Which of the following investigation has no radiation risks:
- (a) Fluoroscopy
 - (b) **MRI**
 - (c) PET
 - (d) Technetium bone scan
- 10 Occupational and non-occupational doses will remain well below maximum allowable levels when:
- (a) **exposure is as low as reasonably possible**
 - (b) exposure is high
 - (c) exposure is medium
 - (d) exposure is highest
11. Please select which age group is most sensitive to radiation:
- (a) **Children**
 - (b) Adolescents
 - (c) Adults
 - (d) Elderly
12. Which investigative modality is the most safest during pregnancy?
- (a) PET CT
 - (b) Xray
 - (c) CT
 - (d) **USG.**
13. In women of reproductive age group, non-emergency X ray examination that entail pelvic irradiation should be restricted to:
- (a) Last 10 days of menstrual cycle
 - (b) **First 10 days of menstrual cycle**
 - (c) No restrictions
 - (d) Don't know
14. Which of them does not use ionizing radiation?

- (a) CT(Computed tomography)
(b) Mammogram
(c)MRI(Magnetic Resonance Imaging)
(d)Barium studies
15. Which among the following is an absolute indication for X ray/ CT during pregnancy:
(a)Abdominal trauma
(b) Tuberculosis
(c) Upper respiratory tract infection
(d) Low backache
16. Which of the organ/part is least affected by diagnostic radiation?
(a)Thyroid gland
(b)Gonads
(c) Eyes
(d)Chest
17. Standard measure for radiation protection during exposure (portable radiography)?
(a)Stand behind any wall/pillar
(b)At least 6 feet away from X-ray tube
(c)No need of protection
(d)Isolate the room.
18. CT uses:
(a) gamma ray
(b) radio frequency signals
(c) X rays
(d)ultraviolet waves

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