Original Article

Effectiveness of structured teaching program on knowledge regarding hazards of radiation exposure among patients attending tertiary hospital, Karad

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Abstract

Background: Exposure to extremely high radiation levels can cause severe health implications such as skin burns or acute radiation syndrome and long-term health consequences, including cancer and cardiovascular disease. Unfortunately, many patients are often unaware of the hazards associated with radiation exposure.

Objective: To assess the current awareness of individuals attending the department of radiology regarding radiation exposure hazards and the effectiveness of the formal teaching program on radiation exposure hazards among them.

Method: The study was carried out in 50 randomly selected individuals aged 30-50 years hospitalized in the radiology department of Krishna hospital, Karad. To obtain socio-demographic details and expert status, we used a questionnaire for pre-test and post-test. Descriptive and inferential statistics were performed through Instat software to analyze the obtained data.

Result: Prior to the start of the training program, 60% of patients had no knowledge about the hazards related to radiation exposure. After attending the structured training program, the level of knowledge was good in 44% of patients, average in 48%, poor in 8% of patients. There was no significant association between the pre-test score of knowledge level and demographic variables, including age, occupation, and source of information. The significantly higher post-test score for knowledge level for hazards of radiation exposure was observed in patients as compared to the pre-test score.

Conclusion: The structured teaching program could be an effective method to improve the knowledge level in patients regarding the hazards associated with radiation exposure.

Keywords: structured teaching program, knowledge, radiology, hazards of radiation exposure.

INTRODUCTION

Ionizing radiation(IR) is a high-frequency electromagnetic wave with the propensity for damage to DNA [1].Under normal conditions, 80% of our exposure to IR comes from natural sources, the most noticeable of which is radon gas, while the other 20% emerges from man-made sources, predominantly medical X-rays. The World Health Organization declares IRas a carcinogenic material.

IRis believed to cause a multitude of DNA lesions, including double-strand breaks, single-strand breaks, oxidized bases, and baseline losses. The detrimental propensity of IRis largely attributed to the generation of electrons, which produce free radicals through their interaction with water. The free radicals, in effect, target DNA, proteins, and lipids. Damage harm is induced even by direct energy deposition. These forms of IR interactions with biological materials are commonly referred to as' targeted results,' because they only relate to the cells irradiated [2,3].

In recent decades, the increased use of IRin medical imaging for therapeutic and interventional considerations, coupled with an upswing in patient and health workers' sensitivity to radiation hazards, medical and dental X-rays constitute the dominant fraction of man-made sources of radiation exposure. Although studies have shown a dramatic rise in the incidence of health consequences following exposure to IRover the past two decades[4], reported evidence of inadequate awareness of radiation safety among various health care professionals at threat of occupational exposure reveals the immensity of the stated issue.

The leading research programs focused on the incidence of cancer and mortality of those members who in their occupations are regularly exposed to IR, such as radiologists, radiotherapists, nuclear industry workers, and military personnel involved in the testing of nuclear weapons. Apparently, most comprehensive and detailed research entailing details on the safety aspects of low-dose radiation exposure i.e., an exposure type that is notably vital in terms

of public radiation protection, are implemented in occupationally exposed groups of physicians and professional staff. Symptom and age-related mortality rates among personnel involved in the radiologydepartmentwere estimated in numerous studies to assess the long-term radiation exposure effects. Numerous significant health issues such as the augmented threat of skin cancer, leukemia, and increased incidence of cancer were reported in radiology technologists and radiologists. Higher risk of breast cancer wasindicated in low-to moderate-occupational radiation exposure in the U.S. cohort of radiological technologists. Nevertheless, the most pronounced breast cancer risk in women was observed when average annual doses (37 mGy) were substantially higher than those in subsequent years (1.3 mGy)[5]. Patients targeted with radiation therapy are typically irradiated to particular tumors at elevated doses of 40-60 Gy while the non-neighboring tissues end up receiving small radiation doses of up to 0.1 Gy. However, these exposures pose a range of issues, since partial-body exposures can possibly result in a unique risk than compared to whole-body exposures [6]. A higher mortality rate for breast cancer was also demonstrated in a US cohort of 5,466 female patients with scoliosis who were regularly examined with diagnostic radiography at a mean cumulative dose of 108 mGy to the breast in the range of 0-1700 [7].

During radiotherapy treatment of cancer patients, large doses of IRare used to destroy cancerous cells. However, moderate or strong radiation doses may harm the normal tissue surrounding the tumor tissues, causing secondary cancer eruption. [8]. On the contrary, studies have reported that low-dose radiation treatment is more effectivethan usual radiotherapy treatments as it offers tumor control with limited associated side effects. [9].It can cause DNA repair with immune responses and adequate anti-oxidant activity, ultimately ensuring significant regression of tumor growth. In fact, low-dose irradiation has triggered many pathways or mechanisms for anticancer effects, such as the generation of an antibody, interferon, and other cytokine secretion. Collaboratively, these mechanisms can impede tumor growth, lessen metastasis rate and prevent high-dose radiation-triggered carcinogenesis, evidenced in many animal models.

Considering natural radiation, a normal γ radiation is produced by rocks, dirt, and radon, with cosmic radiation and radionuclides found in the human body accounting to nearly one-fifth of the background radiation [10]. However, ambient radiation levels have been greatly influenced in recent decades byman-made sources of radiation globally, including nuclear power plants, nuclear testing, and atomic bomb blasts. Based on prevalence or mortality evidence, most epidemiological research assessing health results in areas with the highest rates of background radiation investigated the threats for cancer and non-cancer outbreaks. A positive relationship is reportedbetween radiation levels in the background and risk of disease in patients living in the area.[11].

Therefore, poor awareness and underestimation of radiation doses can contribute toexcessive ionizing imaging exams, leading to greater patient risk. Moreover, a lack of awareness can make it tough for patients to be informed about the dangers and advantages of the radiological test. Therefore, patients need to learn about radiation exposure and its associated risks throughtheir training, which is an indispensable part of the responsibility of the medical staff. The trainer should ensure that sufficient information is made available to the patient about the pros and cons associated with this therapy regimen [12].

Although most divisions in the radiology department shield the technician and the nurse, the patient's radiation safety is not considered. A lead bib and collar is worn over the neck and thorax patients have reported successful shielding of radiosensitive organs such as the thyroid and breast, and are approved for regular use in dental X-rays and head CT examinations. Reducing the exposure duration, widening distance from the source, and protecting patients and industrial workers have proved to be of considerable relevance in protecting patients, personnel, and members of the public from possible radiation hazards.

Radiation safety is an intrinsic part of every radiology department's functioning infrastructure. The key radiation safety guidelines are to provide informed safety from inappropriate radiation exposure to workers actively or passively concerned with radiation, without inordinately restricting the advantages of radiation exposure [13]. The radiation safety elements involve rationale for the background radiation protocol, the need for minimal radiation exposure consistent with the technique providing sufficient diagnostic information, the protection of personnel and patients from excessive radiation exposure and the control of radiation exposure to industrial employees and the operating environment. Regular monitoring of the radiation level system and supervision of services for radiation safety and routine educational events form an integral part of the duties of the concerned persons and the other system/hospital administrative authorities.

Therefore, the present study aimed toassess the knowledge regarding hazards of radiation exposure among patients attending the radiology department at the tertiary hospital through structured teaching method. We also compared pre-test and post-test knowledgelevel related to radiation exposure hazards in the patients.

METHODOLOGY

This study was based on the evaluative approach, which wascarried out in 50 randomly selected

Patients aged between 30 and50 years admitted in Krishna hospital, Karad. The study included patients who were present at the time of data collection and those who could read and write the Marathi language.Patients who were not willing to participate in the study or not physically fitwere excluded.A questionnaire for pre-test and post-test wasused to elicit socio-demographic information and status of knowledge. The questionnaire assessing knowledge composed of two sections:

A. Demographic variables of selected patients

It included characteristics such as age, sex, education, total monthly income, source, previous knowledge, religion, occupation, and residence.

B: Knowledge level questionnaire

It comprised of 20 questions in multiple-choice pattern to assess the level of knowledge about the hazards of radiation exposure among patients attending the radiology department. Ethical clearance for conducting the study was obtained

from the Medical Director, tertiary hospital, Karad and the consent form was duly signed and obtained from the participants.

DATA COLLECTION

The research investigator arranged the area of the selected ward and explained the purpose of the study to the 50 patients included in the study. The written informed consent was obtained from the patients.The pre-test included assessment of knowledge level through questionnaires.The structured teaching program was conducted on the same day, which continued for seven days. The post-test of the study was carried out on the seventh day of the teaching program using the same questionnaires. The data collected was tabulated and analyzed.

Data analysis

Descriptive and inferential statistics were performed to analyzethe obtained data using instat software.

RESULT

Baseline characteristics

Table 1 presentsthe demographic characteristics of patients.Out of the 50 participants, 56% were males and 44% were females. The subjects belonged to either Hindu(62%) or Muslim religion (38%). The majority of patients (44%) belonged to the age group of 26-30 years while there were 28% of patients in 31-35 yearsof age group, 14% in 21-25 years group, and 14% of patients belonged to the age group of 36-40 years. More than half (60%) went for secondary school education, 24% obtained primary school education, and 16% had obtained a graduate degree. Around 52% were farmers while 30% and 14% were engaged in service and business, respectively. A maximum number of patients (58%) belonged to the income group of below 5,000, 32% in the range of 5,000-10,000 INRand 10% of patients belonged to the income group of 10,000-15,000INR.A majority number of patients (70%) belonged to a joint family while the rest fractions (30%) were from the nuclear family.

Table 1. Socio-demographic characteristics of the patients

Demographic variables (n=50)	Frequency (f)	Percentage (%)
Age		
21-25 years	7	14%
26-30 years	22	44%
31-35 years	14	28%
36-40 years	7	14%
Sex		
Male	28	56%
Female	22	44%
Religion		
Hindu	31	62%
Muslim	19	38%
Educational status		
Primary	12	24%
Secondary	30	60%
Graduate	8	16%
Occupation		
Farmer	26	52%
Service	15	30%
Business man	7	14%
Others	1	2%
Total monthly income (In INR)		
5,000-10,000	16	32%
10,000-15,000	29	58%
15,000-20,000	5	10%
Type of family		
Nuclear family	15	30%
Joint family	35	70%
Previous knowledge about the hazards related to radiation exposure		
Yes	20	40%
No	30	60%
Sourceof knowledge		
Newspaper	2	4%
T.V	14	28%
Magazines	4	8%
Others	30	60%
Residence		
Rural Urban	21 29	42% 58%

Pre-knowledge regarding hazards associated with radiation exposure

Around 60% of participants did not know about the hazards related to radiation exposure while the remaining 40% knew about the same.

Effect of structured training program on the knowledge of participants about the hazards associated with radiation exposure

After attending the structured training program, the level of knowledge was good in 44% patients while it was average in 48% of the subject population. In 8% patients, the knowledge level remained poor (Table 2).

Table 2. Assessment of post-test knowledge level in the participants

Knowledge level	Score	Frequency	Percentage
Good	**11-20**	**22**	**44**
Average	**8-10**	**24**	**48**
Poor	**0-7**	**4**	**8**

Further, comparison of knowledge level for hazards of radiation exposure before and after structured teaching program in patients showed significant differences (p-value<0.0001), with higher mean score for post-test (11.74) as compared to pre-test score (8.98; Table 3).

Table 3. Comparison of pre-test and post-test mean score for knowledge level for hazards of radiation exposure

Test	Mean	Standard Deviation	T Value	p-value
Pre-Test	8.98	1.755	4.069	<0.0001
Post-Test	11.74	3.585		

Examining effect of demographic variables on pre-test scores for level of knowledge in patients

There was no significant association between the pre-test scores and demographic variables, including age, occupation, and source of knowledge (Table 4).

Table 4: Effect of demographic variableson pre-text score for knowledge level related to radiation exposure

Demographic Variable	Good	Average	Poor	Chi Square	p-value
Age					
21-25	1	3	3	2.432	0.6569
26-30	2	11	9		
31-35	2	2	10		
36-40	0	4	3		
Occupation					
Farmer	3	13	10	4.848	0.3033
Service	2	3	10		
Business Man	0	4	3		
Other	0	0	1		
Source of knowledge					
Newspaper	0	0	2	5.173	0.2700
Tv	3	7	4		
Magazines	0	3	1		
Other	2	10	18		

DISCUSSION

Given their rapidly increasing role in oncological treatment, a thorough understanding of radiation therapy and its position in cancer care should be a fair training goal for primary medical providers so they can effectively pass on the knowledge to the patients. Nevertheless, data are emerging that record the underutilization of radiation therapy and the corresponding adverse effects on survival of patients [14,15]

Our analyses underline and extend to the details that need interventions to bridge the gap in knowledge regarding the impact of radiation therapy in cancer care [16]. We have reported that the great majority of the participating patients do not have oncology-specific knowledge and agree that they will benefit from further therapies. Furthermore, we found that the majority of patients indicated a lack of faith in when to contact oncology for radiation, both in the setting of an oncological emergency and in the cancer diagnostic setting. These results raise awareness among primary medical care providers about the need for further education related to radiation oncology, and they may serve as a template for the practitioners and nurses of the radiology department to work in close collaboration to bridge these disparities.

In the present research, an attempt was made to assess the efficacy of the standardized teaching program on awareness of radiation exposure hazards among patients attending the tertiary care hospital's radiology department, Karad. The organized teaching curriculum, based on the goals, was implemented for the research. This was deemed the most appropriate tool for determining the degree of information. The research method adopted for the study was a pre-test and post-test method for one group of experiments. A convenience sampling technique was used to select the sample for

the study. Kaplan in his research report had stated that the majority of radiation oncology patients felt that they had not been provided enough information on care prior to treatment and that more than 83% of patients with complications in treatment needed more information [17].

In view of the observed results, we went in for providing a well-designed or structured training program for the participating patients. The program was scheduled as a 7-day program in which the patients received the basics related to radiation exposure. Further, a test was conducted at the end of the training session. A profound rise in the level of knowledge was observed in the patient, which was confirmed by the results obtained in the test schedule.As compared to the pre-test score, there was a significantly higher post-test score for knowledge level for hazards of radiation exposure. Therefore, the structured teaching program appeared to be an effective method for educating and improving the knowledge level in patients who had no basics about the hazards related to radiation exposure. The observed result is in corroborated with the reports published elsewhere [18,19].

Further, it was also noted that there was no significant association found between the pre-test of patients and demographic variables, including age, occupation, and source of information. It was observed that more than half (60%) of the patients received secondary school education and a majority of them worked as farmers, which also adds to the fact that they would have no idea related to the basics of radiation exposure or hazards due to the therapeutic regimen. However surprisingly, no significant correlation was observed with the stated demographic variables on the pre-test score in the selected patients. Based on the above results it is pertinent to state that nurses or technicians engaged in the radiology department should be suitably trained with adequate techniques to impart basic knowledge about the same to the patients prior to the start of therapy.Communicating research results to others is a common connection in the research process, the acquisition of new scientific information is important to direct nursing practice, nursing education, nursing science, and administrators of nursing care. The role of nurses is to provide health education with a formal training system to improve people's health in society [20]. Therefore, health awareness can be achieved by combining health education with a standardized teaching system. The word "radiation" might sound disastrous but the reality is radiation is a regular part of our entire lives. Radiation is energy, which travels through space, either as waves or as particles of high speed. Patients who do not know about radiation exposure may be given the formal training plan by nurses[21].Nurses should concentrate on helping the community at risk, and accordingly design the training material and sessions. They should also considerto perform a formal training curriculum and providing awareness on exposure to radiation to each patient prior to the start of radiation[22].The results for the study stress upon the need to provide patients with the knowledge of radiation exposure risks. Therefore, it would be helpful if nurses provide details related to the health effects of radiation-related to patients.

The present analysis had some limitations, which need to be addressed specifically. The research was limited to the effectiveness of the standardized teaching system and the level of information about radiation exposure, without considering other variables. Due to the low sample size and the limited area of settings, it was difficult to generalize the study results. The research was further confined to the selected patients admitted to Krishna hospital, Karad.

The following consideration for future work is suggested in light of the findings:

- Consistent technical education should be offered to nursing personnel as they are regularly involved in radiation therapies in nuclear medicine, oncology, and fluoroscopic procedures where radiation exposure is significant.
- Hospitals and training organizations need to follow a collaborative approach to the learning process.
- The nursing program should include radiation protection training schedules as nurses are exposed to radiation in their everyday routine. General safety procedures should be communicated to health-care staff before they undertake clinical practice.
- A related analysis can be carried out to determine the efficacy of a formal teaching program.
- A similar analysis can be carried outon a larger sample and a larger region of the settings.
- A comprehensive analysis may be carried out to assess the effectiveness and reliability of a patient-based standardized teaching program.

CONCLUSION

Radiation therapy plays a vital role in cancer treatment with multimodality, a procedure that has been shown to yield better outcomes. The current research examined the effectiveness of an awareness program in improving the knowledge related to radiation exposure risks among patients in the department of radiology. Considering the fact that the vast majority of patients receive no information related to radiation oncology prior to the start of the therapy regimen and there is a lack of confidence about the suitability of consultation on radiation oncology, conducting more training programs in radiation oncology would benefit the patients.The present study demonstrates a need for a more structured education program while at the same time raising awareness about this improved version of radiation therapy. It is noteworthy to state that nurses can impart the formal training system to patients who are unfamiliar with exposure to radiation. Although patients may eventually learn about radiation therapy during their course of care, at the time of initial consultation we encourage for any information that can increase patient awareness, as this is usually the period when they are asked to provide informed consent for treatment. Such results would encourage the practitioners and patients specifically in departments of radiation oncology to establish collaborative strategies for greater understanding of the role and the related hazards of radiation therapy in multidisciplinary cancer treatment.

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