

# Assessment of the Knowledge Level of Patients About Radiation: An Invisible Enemy in the Endourology Clinic

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## What's known on the subject? and What does the study add?

Radiation is part of endourological surgery. Considering the harmful effects of radiation and considering the insufficient level of knowledge of the patients as shown in our study, we think that it is necessary to inform the patients about this issue separately.

## Abstract

**Objective:** This study aimed to measure the level of knowledge of patients on the role of radiation used in the endourological intervention.

**Materials and Methods:** Between January and February 2020, patients were asked to fill out an anonymous questionnaire before the procedure. The questionnaire included questions on demographics, ionizing radiation, and planned procedure.

**Results:** Of the 118 respondents, 35.6% were female and 64.4% were male. The mean age was  $55.6 \pm 15.3$  years. Moreover, 25.4% of the participants were in the geriatric age (GA) group, and 17.4% were in the young age (YA) group. None of the GA group were aware of the risk when radiation was not used in the planned procedure, and the result was significant ( $p=0.006$ ). Only 57% of the YA group and 34.4% of the GA group were aware of the harmful effects of radiation ( $p=0.027$ ). Patients with higher education levels gave correct answers to the questions of whether the surgical procedure can be performed without radiation and whether they have knowledge about the negative effects of radiation ( $p=0.05$ ,  $p=0.036$ ).

**Conclusion:** The results suggest that patients still have insufficient knowledge about fluoroscopy (X-ray), which has an important place in endourological surgeries, and they do not have enough knowledge about their planned procedure.

**Keywords:** Ionizing radiation, awareness, endourology, patient

## Introduction

Given the important place of endourology in urological surgery, the use of fluoroscopy has increased in parallel. Fluoroscopy is widely used for not only treatment but also imaging. In addition to these medical applications, X-ray, which is the main component of fluoroscopy, has well-known risks (1). However, it is not possible to completely abandon these methods. The patients exposed to the procedure and the healthcare professionals working in these units are most affected by the radiation used for medical purposes (2). For this reason, it is important to increase the level of knowledge by educating healthcare professionals and patients in these units to minimize the risks of exposure during procedures performed using radiation-emitting devices.

Radiation exposure has two known effects: The first is the deterministic effect when a certain threshold is crossed, and the other is the stochastic effect that occurs with the cumulative effect in the long run (3,4). Depending on the developments in endourological interventions and these known effects of radiation, approaches related to ultrasound-guided intervention instead of fluoroscopy are adopted (2). However, it would take time for an imaging tool with a high learning curve, such as ultrasonography, to become widespread compared with an imaging tool such as fluoroscopy, which is found to be easy to use by endourologists. Thus, the best measure for now, apart from prevention, appears to be avoiding the unnecessary use of fluoroscopy.

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This study aimed to measure the level of knowledge about the harmful effects of radiation and the role of radiation used in the procedure in patients hospitalized in the urology clinic in arriving at a diagnosis and/or providing treatment and in whom endourological interventions are planned.

## Materials and Methods

After obtaining approval from the local ethics committee of Zonguldak Bülent Ecevit University (protocol no: 2019-202-18/12) and the consent to participate, patients who underwent endourological interventions in the urology clinic from January to February 2020 were asked to fill in a questionnaire before the procedure. The questionnaire consisted of 18 items. The participants were informed verbally that the results of this questionnaire would be used for scientific purposes and that their personal information would not be obtained.

Patients aged >18 years, not illiterate, and undergoing a procedure with fluoroscopy for the first time were included. Those undergoing a procedure without fluoroscopy and refusing to participate in the survey were excluded.

Through the survey, the demographic characteristics of the participants (such as their age, gender, education, profession, and knowledge about the procedure), risks that may arise when radiation is not used in the planned procedure, harmful effects of radiation, and warning signs of radiation were evaluated.

## Statistical Analysis

The survey questionnaire used in this study was self-adapted and has not yet been validated. Descriptive statistics for categorical variables were expressed as numbers and percentages, and the chi-squared test was used to determine the relationship between the categorical variables using SPSS version 18.0 (SPSS Inc., Chicago, IL, USA). The significance was accepted as  $p < 0.05$ .

## Results

Among 237 patients hospitalized during the study period, 118 met the inclusion criteria. The mean age of the participants was  $55.6 \pm 15.3$  (range, 18–86) years. Moreover, 76 participants were male, 42 were female, 101 were married, and 17 were single. Regarding the highest level of education, 92 (78%) respondents graduated from primary school, 20 (16.9%) from high school, and 6 (5.1%) from university. The summary of demographic data is presented in Table 1.

The distribution of answers provided by the patients is presented in Table 2. Most of the patients knew about the planned procedures on them, but most were unaware of whether these procedures emit radiation and what kinds of hazards might occur if radiation was not used. Although most of the patients

were aware of the signs of radiation exposure, most responded negatively to the rest of the questions.


When the study population was divided into the geriatric age (GA; aged  $\geq 65$  years) and young age (YA; aged  $< 65$  years) groups, 90.7% and 78.1% of the patients in the YA and GA groups, respectively, stated that they knew about the procedure. Furthermore, 31.3% in the GA group and 38.4% in the YA group were aware of the use of radiation in the planned procedure; however, 17.4% in the YA group gave the correct answer to whether the procedure could be performed without radiation, but the GA group did not ( $p = 0.006$ ). Similarly, 16.3% in the YA group gave the correct answer to the question concerning the risk factors involved when performing the procedure without radiation, whereas only 3.1% in the GA group answered it correctly ( $p = 0.066$ ). When asked whether they had pre-existing knowledge about the negative effects of radiation, 57.0% in the YA group responded "yes," whereas 62.5% in the GA group said "no," and the difference was significant ( $p = 0.027$ ).

Women provided less reasonable answers to the questions, "Can the planned procedure be performed without radiation?," "What is the risk if the planned procedure is performed without radiation?" and "Did you received information about the negative effects of radiation?," and the results were significant ( $p = 0.049$ ,  $p = 0.018$ , and  $p = 0.043$ , respectively). When the answers to other questions were evaluated, no significant difference was found in terms of gender.

As regards educational status, patients who had at least high school education responded "yes" to the questions about whether the surgical procedure can be performed without

Questions	Answers	n	%
Gender	Male	76	64.4
	Female	42	36.6
Mean age		$55.6 \pm 15.3$	
Marital status	Married	101	85.6
	Bachelor	17	14.4
Level of education	Primary school	92	78
	High school	20	16.9
	University	6	5.1
Occupation	Unoccupied/retired	76	64.4
	Employee	39	33.1
	Student	3	2.5
Intervention to be applied to patients	Ureterorenoscopy	51	43.2
	Percutaneous nephrolithotripsy	25	21.2
	Double J stent insertion	21	17.8
	Retrograde intrarenal surgery	18	15.3
	Endoscopic approach to urethral stricture	3	2.5

**Table 2. Other questionnaire responses by the participants**

Questions	Answers	n	%
Which of the following examinations uses radiation?	Plain X-ray	70	59.3
	USG	2	1.7
	CT	3	2.5
	MRI	11	9.3
	Plain X-ray + CT + Fluoroscopy	5	4.2
	Plain X-ray + CT + Fluoroscopy + MRI + USG	1	0.8
	No idea	1	0.8
Do you know the planned procedure?	Yes	103	87.3
	No	15	12.7
Do you know whether the planned procedure uses radiation?	Yes	43	36.4
	No	75	63.6
Can the planned procedure be applied without a radiation-emitting device?	Yes	15	12.7
	No	27	22.9
	No idea	76	64.4
What is the risk if the planned procedure is applied without a radiation-emitting device?	She/he knew	15	12.7
	Did not know	103	87.3
Have you ever received information on the harmful effects of radiation?	Yes	60	50.8
	No	56	47.5
	No idea	2	1.7
Is there an age limit for the planned procedure?	Yes	8	6.8
	No	36	30.5
	No idea	74	62.7
Is the frequent repetition of the planned procedure harmful?	Yes	26	22.0
	No	8	6.8
	No idea	84	71.2
Have you had imaging containing radiation in the last 1 month?	Yes	108	91.5
	No	10	8.5
Can the planned procedure be applied to a pregnant patient?	Yes	4	3.4
	No	45	38.1
	No idea	69	58.5
Do you have radiation-emitting devices in your environment?	Yes	57	48.3
	No	41	34.7
	No idea	20	16.9
Which of our organs does radiation exposure affect most?	She/he knew	36	30.5
	Did not know	82	69.5
Do you know what this sign means? 	Yes	82	69.5
	No	36	30.5

USG: Ultrasonography, CT: Computer tomography, MRI: Magnetic resonance imaging

radiation and whether they knew about the negative effects of radiation, whereas most of the patients who had at least primary school said "no" ( $p=0.05$  and  $p=0.036$ , respectively). Answers to other questions did not appear to be affected by the educational background.

Considering the working status of the patients, 97.4% of those who were unemployed/retired responded "no" to the question "Can the planned procedure be applied without a radiation-emitting device?" and the result was significant ( $p=0.018$ ). The answers given to other questions were not significantly different according to the occupational groups.

The relationship of the answers with age, gender, educational status, and occupation is summarized in Table 3.

## Discussion

With the widespread use of X-rays in medical applications and the emergence of the harmful effects of radiation, the need for awareness regarding protection from radiation has intensified. At present, fluoroscopy, which is an important source of X-rays, is widely used in the endourology clinic. Although radiation exposure in medical devices is minimized by technology, it is not completely negligible. The International Commission on Radiological Protection considers that lowering the dose of radiation rarely carries a risk of cancer (5). Therefore, the importance of complying with the "as low as reasonably achievable principle" is emphasized. Patients with nephrolithiasis having a recurrence rate of approximately 50.0% within 5 years are more likely to be exposed to radiation recurrently (2). According to Ferrandino et al. (6), considering the lifetime risk of developing cancer to be 0.15% by radiation used for one session in patients with stones, it is inevitable to take precautions in this regard.

Studies have evaluated the levels of knowledge of patients about radiation, and most of the patients evaluated were those in the radiology outpatient clinic and emergency room (7-9). In general, the awareness levels of the patients were low.

To our knowledge, this cross-sectional study is the first to evaluate the awareness of ionizing radiation among patients hospitalized in a urology clinic. Although the answers may not be satisfactory, the responses appear to be influenced by the educational background, so there is a need to further focus on education.

In the study by Ceylan et al. (7), most of the patients stated that ultrasonography and magnetic resonance imaging contained radiation. In our study, only 4.2% of the patients knew accurately the examinations using radiation. In addition, 49.7% of the patients did not receive training on the effects of radiation.

**Table 3. Relationship of the answers with age, gender, educational status, and occupation**

	Questions		n*	p
Age (years)	Do you know whether the planned procedure uses radiation?	65>	33 (38.4%)	0.525
		65<	10 (31.3%)	
	Can the planned procedure be applied without a radiation-emitting device?	65>	15 (17.4%)	0.006
		65<	0	
	What is the risk if the planned procedure is applied without a radiation-emitting device?	65>	14 (16.3%)	0.066
		65<	1 (3.1%)	
	Have you ever received information on the harmful effects of radiation?	65>	49 (57.0%)	0.027
		65<	11 (34.4%)	
Gender	Do you know whether the planned procedure uses radiation?	women	11 (25.6%)	0.063
		men	32 (74.4%)	
	Can the planned procedure be applied without a radiation-emitting device?	women	1 (6.7%)	0.049
		men	14 (93.3%)	
	What is the risk if the planned procedure is applied without a radiation-emitting device?	women	1 (6.7%)	0.018
		men	14 (93.3%)	
	Have you ever received information on the harmful effects of radiation?	women	17 (28.3%)	0.043
		men	43 (71.7%)	
Educational status	Do you know whether the planned procedure uses radiation?	a	63 (84.0%)	0.250
		b	40 (93.0%)	
	Can the planned procedure be applied without a radiation-emitting device?	a	6 (8.0%)	0.027
		b	9 (20.0%)	
	What is the risk if the planned procedure is applied without a radiation-emitting device?	a	6 (8.0%)	0.05
		b	9 (20.9%)	
	Have you ever received training on the harmful effects of radiation?	a	31 (41.3%)	0.036
		b	29 (67.4%)	
Occupation	Do you know whether the planned procedure uses radiation?	c	36 (92.3%)	0.398
		d	64 (84.2%)	
		e	3 (100.0%)	
	Can the planned procedure be applied without a radiation-emitting device?	c	8 (20.5%)	0.055
		d	6 (7.9%)	
		e	1(33.3%)	
	What is the risk if the planned procedure is applied without a radiation-emitting device?	c	10 (25.6%)	0.018
		d	4 (5.3%)	
		e	1 (33.3%)	
	Have you ever received information on the harmful effects of radiation?	c	24 (61.5%)	0.661
		d	33 (43.4%)	
		e	3 (100%)	

p<0.05 significant, \*: Correct answers, a: At least primary education, b: At least high school education, c: Employed, d: Unemployed/retired, e: Student

Unsurprisingly, 47.5% of the patients did not know the harms of radiation and 1.7% were unaware of the subject. Sweetman and Bernard (10) emphasized that the level of knowledge about the harmful effects of radiation is affected by age and education. Similarly, in our study, the level of knowledge about the harmful effects of radiation is high in the YA group with a higher education level.

In the study by Ceylan et al. (7), 28.8% of the patients gave a negative answer to the question of whether there is a radiation-emitting device in their environment. In parallel with this study, a significant portion of our patients is also unaware of whether such a radiation source exists in their environment, regardless of their age, gender, education level, and occupation. Again, in the study by Ceylan et al. (7), 56.4% of the patients gave correct

answers when they were shown a "radiation warning sign." Similarly, in our study, 69.5% of the patients correctly stated the meaning of the radiation warning sign shown to them, regardless of their age, gender, education level, and occupation.

According to the model established by the Biological Effects of Ionizing Radiation Subcommittee of the U.S. National Institute of Science, any amount of radiation carries a risk of cancer. Based on this model, 1 in 1000 patients per 10 mSv effective dose would eventually develop radiation-induced cancer, regardless of their age or gender (11,12).

We are exposed to 2-3 mSv of natural radiation per year, depending on the region we are in (10). Thus, it is inevitable to reduce radiation exposure as much as possible. In recent years, technical developments in medical imaging have provided a large degree of control (10). However, considering that cancer development takes years, we cannot rely on this issue.

When the patients were asked whether the planned procedure uses radiation, the majority of the patients said "no." Again, the majority of them stated that they did not know the resulting damage if radiation was not used in the planned procedure. When they were asked whether repeating the planned procedure carries a risk, there is an age limit for the planned procedure, and the procedure can be applied to pregnant women, the majority of the patients responded negatively regardless of their age, gender, education, and profession. However, considering that the majority of the patients were unaware of whether the planned procedure uses radiation, the negative responses given by the patients also indicate that they are not fully informed of the planned procedure.

Physicians have the legal and ethical obligation to adequately inform and educate patients so that patients can make decisions about their medical treatment (13-15). It is also possible to add the threshold risk values of an application to these laws. The radiation-induced effects of certain diagnostic and interventional procedures may well exceed this threshold. Many studies have observed that patients are generally uninformed about the risk involved in radiation and alternative procedures (16,17). Ceylan et al. (7) stated that 40.9% of the patients did not receive information from their physicians about the planned procedure. Likewise, Fartum et al. (18) received a similar response from the majority of their patients. However, in a study conducted by Karsli et al. (19) on physicians, most of them stated that consent should be obtained from patients in terms of the risk of cancer development before performing examinations involving radiation. Although it was not specifically asked in our study, the answers indicate that the patients did not receive sufficient information about the planned procedures from their physicians.

## Study Limitations

This study has some limitations. First, the small number of patients prevents us to make sufficient inferences. Second, administering the questionnaire in preoperative hospital conditions may have put pressure on the patients to answer the questions. In addition, conducting a preoperative questionnaire survey prohibited us from distinguishing whether the patients had received information on radiation before or they obtained it right before surgery. Therefore, we think that a survey to be conducted at the time of diagnosis or follow-up can provide a better perspective. Finally, the heterogeneity of the patients limited the interpretation of our results. Thus, more accurate results can be obtained with multicenter studies conducted on a large number of patients with homogeneous characteristics.

## Conclusion

In today's science, although endourological interventions have been developed to cause less trauma to the patients, they are not completely free of risk. Moreover, the risks of radiation used in imaging should not be ignored. Providing more information so that patients can take this risk into account when making their decision about the procedure is a legal obligation, apart from being an ethical responsibility. In addition, patients who have received detailed information about the planned procedure and planned imaging method also have the opportunity to search for alternative treatment approaches and thus guide physicians.

## Ethics

**Ethics Committee Approval:** After obtaining approval from the local ethics committee of Zonguldak Bülent Ecevit University (protocol no: 2019-202-18/12).

**Informed Consent:** Informed written consent was obtained before operation from all individual participants included in the study.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Concept: R.G., Design: R.G., Data Collection or Processing: C.Ö., Analysis or Interpretation: C.Ö., Literature Search: R.G., Writing: R.G.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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