A Survey Analysis of Knowledge Levels of Urologists About Radiation Safety and Fluoroscopy Use

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August 23, 2020

Abstract

Purpose: To evaluate the awareness of the use of fluoroscopy in endourological procedures, as well as the theoretical and practical applications of preventive measures. Material and Method: Between May 2018 - April 2019, a 26-question survey prepared using Google Docs was sent to urologists via e-mail. Personal information, radiation training and behaviors related to radiation and fluoroscopy usage, and the use of protective equipment were queried. Results: A total of 226 participants fully completed and returned the email survey. Of the 226 participants 78 (34,5%) were academics, 44 (19,4%) were residents while 104 (46.1%) were experts. More than 60% of the participants stated that they participated in the operation requiring less than five fluoroscopy-use per week. The majority of operations requiring fluoroscopy consisted of endourological procedures. The lead apron was used by 93% of the participants, but the use of protective glasses and gloves was very low (3.5%). The majority of academicians, experts and residents did not use dosimeters (76.9%, 82,7 and 81,8%, respectively). More than 50% of the participants did not have literature information about the harmful effects of radiation due to the use of fluoroscopy. The most common complaints on the day of fluoroscopy were fatigue and headache. Conclusion: The lack of information regarding the radiation protection measures and harmful effects of radiation are common among urologists in Turkey. Therefore, systematic training programs on fluoroscopy use and radiation exposure should be provided during urology residency. Keywords: Urologist, fluoroscopy, radiation, radiation protection

INTRODUCTION

The frequency of endourological interventions has increased in recent years. Concordantly, the use of fluoroscopy has also increased during endourological interventions, especially in stone surgeries. [1] Therefore, surgeons and operating room staff members may be exposed to large amounts of radiation. This exposure has the potential to cause stochastic (mutations, carcinogenesis) and deterministic effects in the affected individuals [2,3].

The effects of ionizing radiation vary depending on factors such as the applied radiation dose, the duration of irradiation, and the amount of protection used. Dosages that occasionally exceed standard limits typically carry only small and short-term health risks. However, lifelong exposure to any intensity of radiation poses a greater health hazard than brief exposure to high amounts of radiation [4]. Therefore, the International Radiation Commission strongly recommend healthcare professionals not exceed 20 mSv of exposure per year during any five-year professional period [5]. Other safety principles, such as radiation protection with glasses, gloves, and thyroid shields (as low as reasonably achievable [ALARA]), maximizing the distance between the operating room staff and the x-rays, and minimizing the total fluoroscopy time must also be regarded. [6]

While radiologists are perhaps best known for using fluoroscopy, urologists (especially endourologists) also frequently use fluoroscopy, as do orthopedists and cardiologists [7-10][While there are many studies on the potential danger of radiologist exposure to radiation [9,10], few studies have focused specifically on the risks for endourologists [9,10]. Despite the routine use of fluoroscopy by urologists, there is not enough information about the recommended guidelines for using fluoroscopy and the best radiation protection protocols for these professionals [11,12]

In this study, therefore, we aimed to evaluate the urologists' use of fluoroscopy in endourologic procedures and their theoretical and practical applications as well as their knowledge of fluoroscopic protection measures.

MATERIAL and METHODS

Obtaining the ethics committee approval, a questionnaire was queried to urologists. The participants were informed that the results would be used for a scientific study. Urology specialists and residents from university hospitals, public hospitals, education and research hospitals, and private hospitals were included in the study. The 26-question questionnaire was prepared using Google Docs and was dispatched to urologists via email from May 2018–April 2019. The questionnaire was sent by e-mail, and then reminder emails were sent two times a week thereafter. Those who did not answer after one month were not included in the sample. In total, 400 people received the e-mail, and the 226 people who responded were included in the study. The identity and personal information of the respondents were kept confidential.

The questionnaire included questions about the following data: studied institutions and titles, average fluoroscopy shooting times, shooting techniques and how much exposure to doses of radiation were obtained in which positions, fluoroscopy usage positions, protective equipment, dosimeter and protective measures, and which operation was performed most frequently using fluoroscopy. In addition, there were questions about whether the literature's recommendations regarding the harmful effects of fluoroscopy were followed and whether any adverse effects occurred after the use of fluoroscopy. (Supplemental Table 1)

RESULTS

A total of 226 participants fully completed and returned the email survey. Of the 226 participants 78 (34.5%) were academics, 44 (19,4 %) were residents and 104 (46.1%) were experts. The data regarding the institution where the participants worked, the average number of weekly surgery days, the number of operations performed using fluoroscopy per week, and which type of surgery was used most are shown in Table 1.

The mean duration of fluoroscopy was less than 30 seconds for 112 (49.6%) respondents, while it was 31–60 seconds in 246 (20.4%) and [?] 61 seconds in 68 (30.1%). Only 16 (6.8%) academicians, 10 (9.6%) experts and 2 (4,5%) residents reported that they determined their own dose when using fluoroscopy. The majority of both experts and academics reported that they obtained the imaging in automatic mode and were unaware of the radiation dose information. When asked how the mSv dose was determined, four of the academics and six of the experts were found to adhere to textbook data. More than 80% of the 226 surveyed urologists stated that there was no available literature about fluoroscopy doses. In addition, 210 (93%) participants reported that they always used lead aprons, while 118 (52.5%) stated that they used thyroid protectors along with lead aprons. Eight (3.5%) of the urologists used a combination of lead gowns, thyroid protectors, and goggles together; only two urologists reported using lead screens. Six respondents (2.7%) reported that they did not use any protectors, while 16 people did not take any protective measures at least some of the time. One urologist shared that he did not believe in the reliability of lead protectors but still used them (Table 2).

The twelfth question was asking about the proper method of fluoroscopy positioning, and 16 (20.5%) of the academics, 22 of the experts (21.2%) and eight of the residents (18.2%) answered this question correctly. For the 13th question regarding the position of patients to fluoroscopy for reducing the radiation dose. Thirty-eight (48.7%) of the academics, 44 (42.3%) of the experts and 22 (50%) of the residents answered this question correctly (Table 3).

The questionnaire also revealed that 156 (69%) of the participants thought that additional surgery would not be required in fluoroscopy-used surgeries for any reason, while the remaining 70 (31%) reported that additional interventions would be needed. In addition, 50% of the experts and 66.1% of the academics responded that they had not read the literature about the potential damage caused by fluoroscopy ($p<0.09$) (Table 3).

Approximately 35% of urologists were receiving help during fluoroscopy shooting. 80.5% of the participants did not use dosimeters (Table 2). The most common adverse effects after radiation exposure were fatigue and headache, followed by eye symptoms (red eye, etc.) and anxiety on the day of use of fluoroscopy in the participants (Figure 2).

After beginning to train in the urology, the number of urologists who had have biological children was 150, while the total number of children was 170. Of these 68 of them were boys (40%) while 102 of those were girls (60%).

DISCUSSION

The harmful effects of radiation should be taken into account because ionizing radiation, to which personnel are exposed during diagnosis and treatment, can pose a serious health problem, especially in recent years, because of increased endourological procedures. Therefore, for urologists, other health care professionals, and patients, controlling ionizing radiation exposure has utmost importance [13]. However, clinicians are unaware or underestimate the radiation levels to which they or their patients expose [14-16].

Time, distance, and protective equipment (a lead vest, neck collar, gloves, glasses) are important measures to protect people from radiation. In two studies by Soylemez et al. [11,17], urologists' use of lead gowns was found common, although, the use of safety glasses, gloves, and dosimeters was rare. In a study by Bagley and Cubler-Godman, the radiation dose in the neck of the urologists performing ureterorenoscopy was 0.3 mSV while the radiation dose in the hands was 12.7 mSV, while those in the hands was 12.7 mSV [9]. In another study by Elkhousy et al., demonstrated that 97% of urologists used lead gowns, and 68% used thyroid shields, while protective gloves and glasses were used by 9.7% and 17.2%, respectively [18]. Another study revealed that 75% of urologists used lead gowns, while other protective equipment was rarely used [17]. In our study, the number of participants using glasses and gloves was very low Although the dose handled in surgeries using fluoroscopy was high [9], as in our study, the rate of urologists using gloves and glasses was rare. A small number of urologists reported that they did not use protectives during surgeries due to their heavy structure and non-ergonomic design. The reasons for not using protectives in another study were similar [17]. One interesting finding is that almost 35% of the urologists did not trust their protection although they took protective measures.

One of the primary measures of radiation protection is that the amount of annual dose exposed should not be exceeded [19]. Therefore, it is necessary for urologists, like radiologists, to use dosimeters. In a previous study, the dosimeter usage rate of all staff working in the urology theater was found to be 46.5% [1]. In another study, the proportion of urologists who never used dosimeters was reported as 56% [13] In our study, the proportion of those who used dosimeters was around 20%, lower than the reported rates in literature. In general, it can be deduced that using dosimeters among urologist low. This issue might be explained by that either urologists are underestimating the dose of radiation exposure or they are under-trained on the importance of using a dosimeter.

Shortening the duration of fluoroscopy use (especially in endourological procedures) is one of the most effective methods to reduce the radiation dose exposed in the operation room [20]. To shorten the usage period, measures such as intermittent fluoroscopy, distance and location of the image intensifier, retention of the last image on the screen, and the timer alarm are important [9,21] With the use of intermittent compression (pulse compression), the exposure dose can be reduced by 64% and the exposure time by 74% [22]. In a study involving 40 patients who underwent percutaneous nephrolithotomy, the mean duration of fluoroscopy was 33.7 sec in the patient group, where a specific intermittent protocol was applied for fluoroscopy, while it was 175.6 sec in the non-protocol group [23]. In our study, there was no difference

between the groups in terms of mean fluoroscopy time per case, but the duration of fluoroscopy use by experts was higher. More than 60% of the participants reported that there was no need for additional surgical interventions in surgeries requiring fluoroscopy where the fluoroscopy was not used. This finding showed that the shortening of fluoroscopy time is mostly in the hands of the operator. In our study, the majority of both academicians and experts stated that they shoot in motion and the use of intermittent shooting is relatively low among urologists. Routine use of measures such as keeping the first image on the screen, intermittent shooting, and the alarm method can reduce the radiation exposure to the surgeon and the operation team.

Another way to reduce radiation exposure is to increase the distance before pressing the shooting button because as the distance increases (inverse square rule), radiation exposure decreases [24]. In a study, although participants knew that the radiation exposure increased as the duration of fluoroscopy increased, more than half of the participants did not know the effect of distance on the exposure dose [25]. A study by Harris et al. demonstrated that the over couch systems (body dose 3.63 mSV, limb dose 3.72 mSv) caused more radiation exposure in the body and extremities than the under couch systems (body dose 0.31 mSv and limb dose 0.35 mSv), suggesting the importance of the placement of X-ray tube [26]. In this study we questioned the awareness of distance and radiation relationship with two questions (question 12 and 13). Interestingly less than half of the respondents answered these questions correctly. The reason for the wrong positioning of the fluoroscopy device may be that the device placed before or during the surgery is being positioned randomly. The fact that the urologist or technical team has insufficient information about radiation may be the major contributor to this issue. Thus, all personnel in the operation room, especially urologists, should be trained accordingly.

Many studies have highlighted the lack of awareness of radiation, the importance of training for radiation exposure and the use of protective equipment for healthcare professionals [27-32]. In a study performed in Europe, urologists had little knowledge of the effects of radiation exposure; half of them were unaware of the risk of malignancy, and only 28% used dosimeters [17]. Soye and Peterson found that physicians trained for radiation increased their awareness of radiation doses and protective equipment that occur during radiological procedures [33]. The question of how to adjust the fluoroscopy dose in the study revealed that 20,5% of academics, 9.6% of experts and 4,5% of assistants are determining the radiation doses themselves. The majority of the responders stated that they either shoot in automatic mode or do not know how to determine it. Besides, almost 50% of academics and experts stated that they have not read the literature about the harm of radiation. On the other hand, this rate was much higher in assistants (86.4%). However, it is clearly seen in our study that urologists do not have sufficient information and follow the literature about the negative effects of radiation.

Fluoroscopy use may cause acute adverse effects. In a study evaluating the adverse effects of fluoroscopy use on orthopedic surgeons, headache and fatigue were the most common complained symptoms [34]. However, 36% of the surgeons did not report any side effect after fluoroscopy use. More severe injuries such as skin erythema and edema can also be seen after a higher dose of radiation exposure such as percutaneous angioplasty, embolization, and stent placement [35]. In our study, although we did not observe any severe injuries among urologists, the rate of adverse effects was high (Figure 2). Only 23% of the participants did not report any adverse effects. In the long term, chronic exposure may lead to more fatal complications such as cancer [36]. Another continuing debate on this topic is that whether the radiation exposure can affect the sex offspring proportion. Although we observed female offspring dominancy in our study, further studies are required to confirm this effect of radiation [37]

The limitations of our study were as follows. Since an internet-based survey was conducted, the level of knowledge may not have been objectively measured in the responses. This situation paradoxically suggests that the awareness of urologists may have increased while investigating the answers to the questions. Although the correct answers of the survey results were shared, it was not observed whether the clinical habits of urologists changed. Finally, since we thought that independent variables, such as age, study area, and the number and variety of endourological interventions, were affected, multiple regression analysis was not

performed.

CONCLUSION

As we have revealed in our study, the knowledge of urologists about radiation exposure and protection measures is limited. On the other hand, in urology, it is important to increase the awareness to reduce radiation exposure and take protective measures due to increased use of fluoroscopy. For this reason, radiation training programs should be planned during the specialization period of urologists.

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