***Review Article***

# Doctors' knowledge on radiation exposure during CT scan prescriptions in Hassan II Hospital of Agadir-Morocco


## Abstract

The purpose of this study was to assess physicians' knowledge of radiation doses and potential health risks of radiation exposure from CT.

A standardized questionnaire was distributed to physicians. The questionnaire covered the demographic data of the prescriber, the frequency of referrals for CT scan examinations, the physicians' knowledge of radiation doses, the potential health risks of radiation exposure from CT scan and training on patients' radiation protection.

A total of 72 physicians (55%) completed the questionnaire. 99% of the practitioners' prescribe CT examinations for patients during their exercises but only 10% of physicians use the guideline during CT prescriptions. 38% of prescribers took into account the ratio benefit/risk related to x-rays during radiological exam prescription. While 4% of prescribers' explained the risk related to x-rays to the patients during radiological exam prescription, 14% of physicians have correctly estimated the effective dose received during an abdomen pelvic scan compared to the dose of a standard chest x-ray radiograph in an adult. 54% of doctors underestimated the lifetime risk of fatal cancer attributable to a single computed tomography scan of the abdomen pelvic and 8% of practitioners have received formal training on risks to patients from radiation exposure.

Recurrent training in advanced radiation protection of patients could lead to significant improvements in knowledge and practice of CT prescribers.



**Key words:** CT Scans, Physicians' knowledge, Patient' Radiation Exposure.


## 1. Introduction

Every day in each hospital, Physicians use various X-rays technologies to screen diagnose, stage and treat cancers with the aim of saving thousands of lives. The use of CT in medical diagnosis delivers radiation doses to patients which are higher than those from other radiological procedures.

The biological effects of low doses received during medical diagnostic imaging can cause harm. The cancer radiogenic is well documented[1,2], indeed the lifetime attribute to the risk of cancer is 1 for every 82 in high-use groups [3] and 1 in every 1000 CT abdomen pelvic examination [4]. For example, in the United Kingdom, it has been estimated that 100 to 250 death cases occur each year because of the radiological exposures [5,6].

In any diagnostic procedure the dose of radiation delivered should be [7, 8] enough to answer the relevant clinical question. Moreover, it should be and as low as reasonably achievable to minimise the risk to the patient.

It is very important that physicians who prescribe radiological imaging should be well trained in deciding whether diagnostic imaging is necessary and have an accurate knowledge of the associated risks.

The absence of studies on doctors' knowledge in Moroccan Hospitals and the lack of knowledge on the medical exposure per inhabitant in Morocco [9,10] initiated us to undertake the current study.

The aim of this study is to assess knowledge of patient radiation exposure from CT examinations prescribed in Hassan II Hospital.

## 2. Materials and Methods

The concerned population included the prescribers of CT scans in Hassan II hospital. In total, the entire population studied comprised 130 practitioners. The participants in this study have received a standardized questionnaire.

The 16 sections of the questionnaire were designed to evaluate the current practice regarding the prescriptions of CT examinations. The questionnaire covered five main areas:

The first requested demographic data of prescriber (department, gender, qualification, years of experiences).

The second part included questions and aimed at:

- Prescription frequency of CT scans,
- The use of medical imaging examinations guide before prescription.
- Knowledge of benefit /risk ratio of the use of x-rays,
- Routine patient's information about possible health risks.

The third tackled doctors' knowledge on radiation doses which can be assessed into two approaches:

- Compare the average of effective dose received during Abdomen pelvic CT scan ($D_{AP}^{CT}$~11 mSv) and Radiography Skull ($D_{SC}^{R}$ =0,07 mSv) examinations [4].
- Evaluate the effective dose received during Abdomen pelvic CT scan examination.

The fourth dealt with prescribers' knowledge of the risk of cancer induction after one CT scan Abdomen pelvic examination.

Finally, we asked doctors if they had already received training with regards to radiation protection.

## 3. Results

### 3.1. The study population

Out of the 130 physicians' practitioners in our hospital, 72 participated in the questionnaire giving a response rate of 55%. There were 42 men (sex ratio 1.4). The study group contained the General practitioners, Interns, Surgeons and Medical specialists. The percentage of each specialty was respectively 10%, 19%, 36% and 37%. The average professional experience for all participants was 10,29 ± 6,83 years with 58% of them having more than 10 years of experience.

### 3.2. Current Prescribers Practice Regarding CT Examinations

99% of respondents to the survey were prescribers' of CT examinations. The physicians' non prescribers were Medical specialists in dermatology.

Only 8% of our study group used a guideline for prescribing the less irradiating exam. It was constituted by 33% of Interns and 20% of General practitioners.

38% of them said that they always take into account the benefit /risk ratio of X-rays when prescribing a scanner, while 54% sometimes use it and 8% never. The benefit/risk of X-rays is still considered by 42% of senior doctors and only 17% of juniors.

Only 4% of practitioners have always informed patients about the probable risks due to their exposure to X-radiation, while 68% did so occasionally and 28% never. Thus only 5% of Physicians seniors have always passed such information to the patient, while Interns represent 0%.

### 3.3. Knowledge of Doses and Health Risks Related to Radiations by Doctors

On the assessment of the effective dose received during an abdomen-pelvic CT compared to chest X-ray front, 14% of our practitioners had correctly assessed that dose. 11% had overestimated it while 54% of practitioners had underestimated it and 21% have no answers, regardless of the different specialties (Figure N°1).

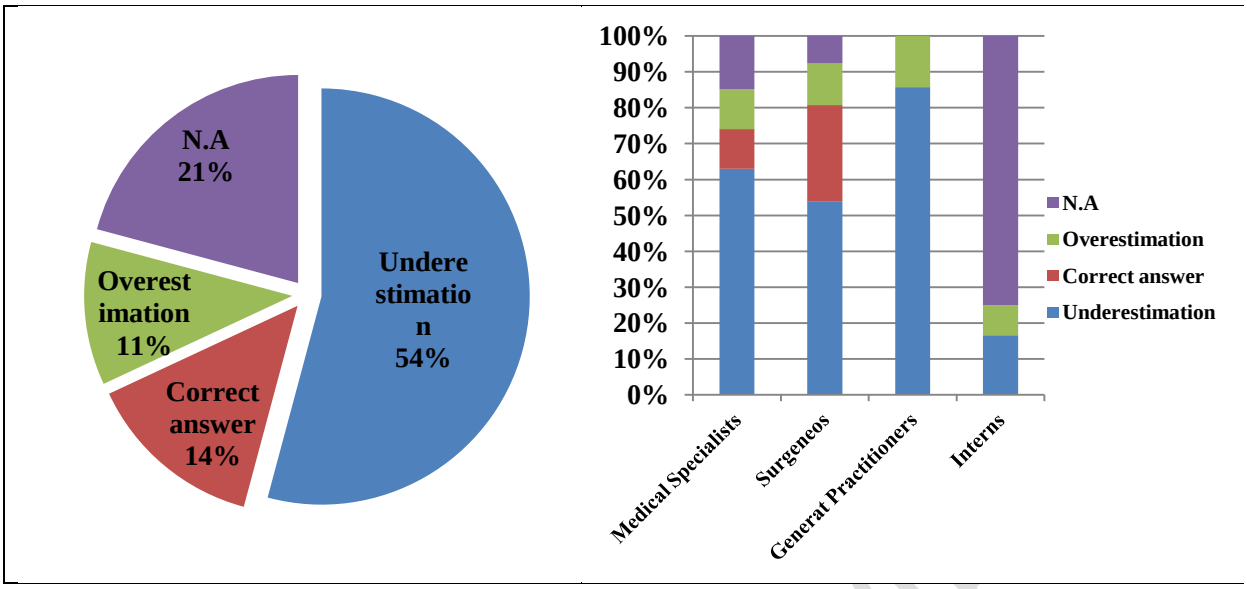


**Figure N°1**: Assessment of knowledge of the effective dose received during an abdomen-pelvic CT comparatively to an adult chest radiography by physicians per speciality.

During the absolute evaluation of the dose delivered during a standard abdomen-pelvic CT, with reference to natural radiation in Morocco estimated to average 2.5 mSv per year, 8% of practitioners had correctly assessed the dose. 10% of prescribers had overestimated it, 58% underestimated it while 21% had expressed no opinion (Figure N°2).

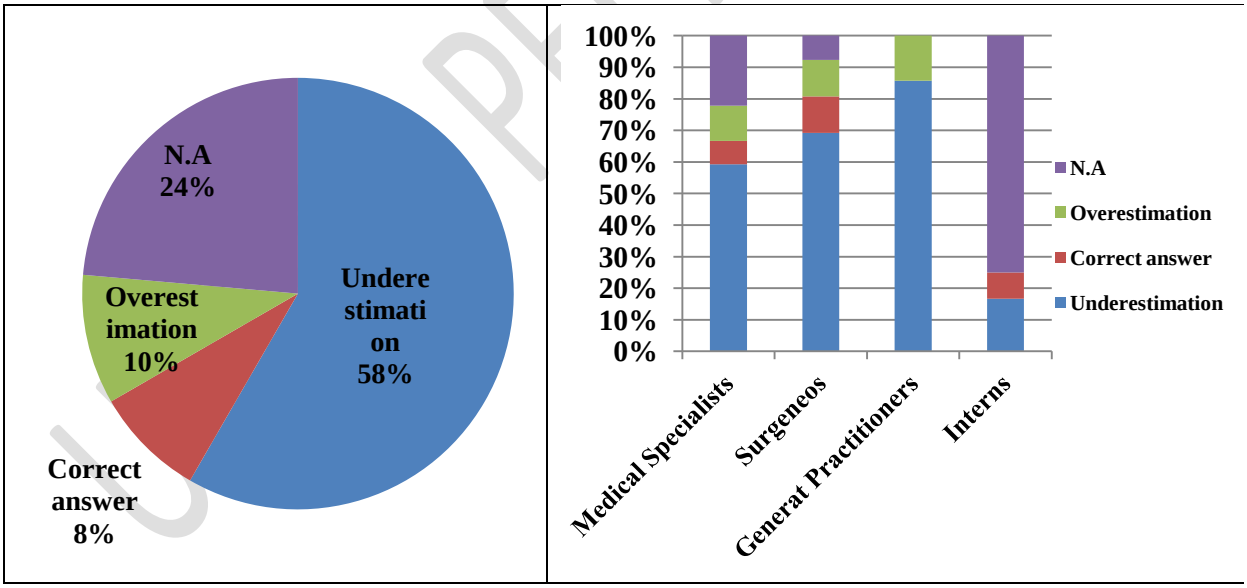


**Figure N°2**: Assessment of the knowledge of effective dose received during an abdomen-pelvic CT comparatively to annual background exposure in Morocco by physicians per speciality.

Estimations of doses delivered were misjudged, and the risk of radiation-induced cancer were greatly underestimated since a large majority of practitioners (58%) had replied that there was no risk of radiation-induced cancer due to the realization of one abdomen-pelvic CT (**Figure N°3).**

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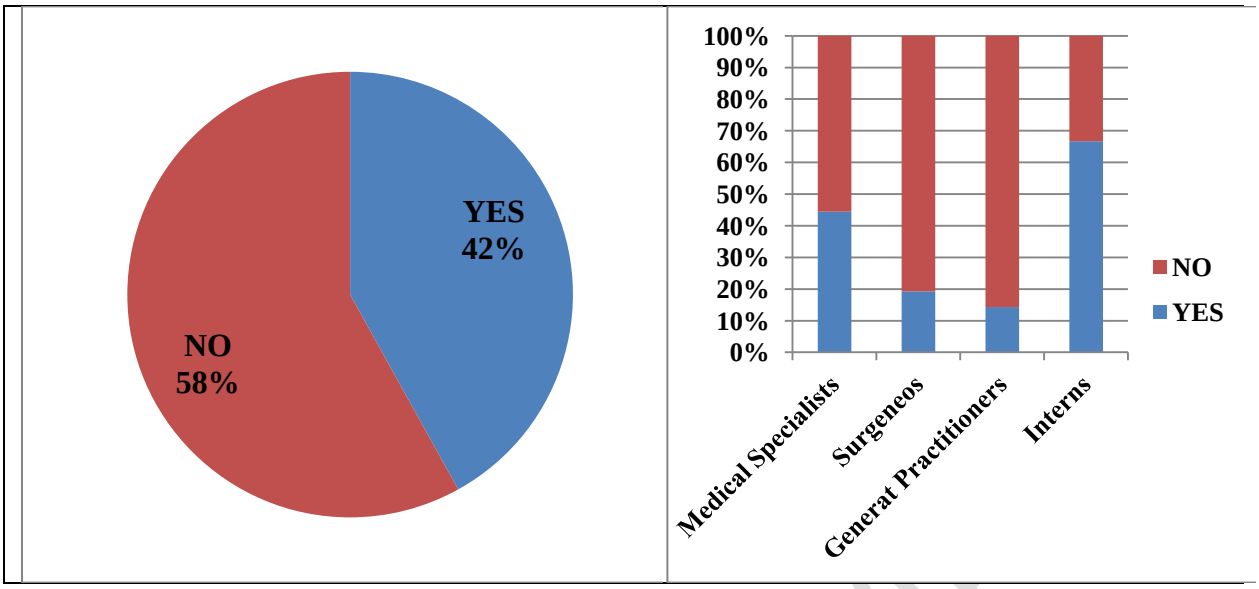


**Figure N°3:** Assessment of knowledge on radiation-induced cancer after one abdomen-pelvic CT by physicians per speciality.

### 3.4. Further Education and Training:

Only 8% of clinicians had already benefited from training in radiation protection of patients. The more detailed analysis showed that neither Intern, General Doctor nor Surgeon had received training of this type while only 20% of Medical Specialists have received such training.

## 4. Discussion

Our study group showed that Physician' knowledge of radiation exposure from medical imaging is insufficient, and that is due to the fact that they don't inform their patients of the risks of radiation exposure, and they underestimate radiation exposure of frequently used diagnostic imaging and the associated risks.

- Only 8% of physicians of this study used a guideline during prescriptions of CT exam. Yet the European directive on the radiation protection for medical purposes requires justification of the radiological procedure which is one of the necessary steps to obtain the radiation protection of patients as part of a quality assurance process [11].The lack of use of referral guidelines could be explained by the Moroccan radiologists by the absence of national protocols [12].

- 38% of prescribers in our study group took into account the ratio benefit/ risk. This result is much lower than 70% reported by Gervaise et al. in a similar study for a population of French hospital doctors [4].

- Only 4 % of our physicians group have explained the x ray risk to the patients during prescription. This result is much lower than 22% reported by Lee et al. in a similar study for a population of emergency physicians in USA [13] and than 25% reported by Gervaise et al. in a similar study for a population of French hospital doctors [4].

- The knowledge on radiation doses in our study group is limited. In detail, we asked to compare the average effective dose received during an abdomen pelvic CT scan in adults to a standard chest radiograph. Only 14 % of the study participants answered correctly. This result is lower than 30% reported by Lee et al. in a similar study for a population of emergency physicians in USA [13]. And it is also less than 32,5 % obtained by Merzenich et al. in a similar study in Germany [14]. It is more than 13 % reported by Gervaise et al. in a similar study for a population of French hospital doctors [4].

- The physicians' knowledge on the lifetime risk for the development of cancer after one abdomen pelvic CT examination was answered correctly by only 42% (approx.1 cancer death per 1,000 deaths) of responds in our study group[15,16]. This result is higher than 12,5 % reported by Jacob et al. for a population of hospital doctors [17]. It is approximately the same as the 31% obtained by Rice et al. for a population of paediatrics surgeons [18]. It is higher than 39% reported by Gervaise et al. in a similar study for a population of French hospital doctors [4].

- The poor knowledge results achieved in this study could be explained by many factors: About 92% of the questioned doctors reported that they have never undergone formal training on patients' radioprotection. This reflects a poor knowledge of the principles of radiation protection by our clinicians. This result is higher than 75 % reported by Gerben et al. for a physician population of the Australian emergency departments [19], and higher than 34% reported by Gervaise et al. in a similar study for a population of French hospital doctors [4].

## 5. Conclusion

The objective of this study was to explore the physicians' knowledge on patients' radiation protection during their prescriptions of CT scan examinations. The obtained results showed that the physicians' knowledge on patient's radioprotection is characterized by:

- 8 % of physicians used a guideline during prescriptions of CT exam.
- 38% of prescribers took into account the benefit/risk ratio.
- Only 4 % of our doctors have been explained the x ray risk to the patients during prescriptions.
- 14 % of the physicians have correctly approximated the radiation doses received during an abdomen pelvic CT scan.
- 42% of physicians' have estimated the lifetime risk for the development of cancer after one abdomen pelvic CT examination in a correct way.
- 92% of doctors have never undergone formal training on patients' radioprotection.

We recommend training during the university curriculum of interns and also the periodic ongoing training of all doctors from all specialties with the aim of improving their understanding of medical radiation exposure.

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