

Patients' knowledge and awareness of radiation dose and risks from CT: do patients need a personalized communication of dose bill?

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Aims and objectives

In the last decades exposure to ionizing radiations in computed tomography (CT) has constantly increased [1]. Only a few years ago it was quite difficult to assess how much radiation had been delivered to a patient during a CT examination. Nowadays, the technical challenges of dose data reporting between CT scanners from different vendors have been met, making dose tracking a reality since these dose data are automatically stored in the picture archiving system of the radiology department (PACS) [2]. Many studies showed that knowledge about ionizing radiation was insufficient among medical students and physicians who requested radiological procedures, even among radiologists[3, 4]. According to the European directive 2013/59/Euratom, starting from February 2018 dose bill will be part of CT reports, but the impact of this information on patients has not been deeply evaluated[5]. Most authors affirm communication of CT risk to patients should be personalized, but no studies investigate if a tailored communication is needed. Aim of our study is to understand how patients' characteristics may condition the comprehension of this information.

Methods and materials

A total of 47 patients ($57,04 \pm 15,94$ years old) submitted to CT were included. Patients' characteristics are reported in Table 1. All patients were administered two questionnaires about their knowledge on radiation dose. The first questionnaire was administered after explanation of ionizing radiation necessary to be submitted to CT and the questions were aimed at understanding patients' perception of radiation risk. The second questionnaire was administered after written communication of dose bill and after providing to the patients detailed information on CT radiation risk. Collected data on patients' characteristics were related with the answers of questionnaires. P values <0.05 were considered statistically significant.

Images for this section:

Gender	
M (number of patients)	21
F (number of patients)	26
Age	
Mean age (years old)	57,04
Standard deviation(years old)	15,94
Age range (years old)	16-85
School education	
Primary school (number of patients)	13
Middle school (number of patients)	17
Secondary school (number of patients)	12
bachelor's degree (number of patients)	5
Smoking history	
Smokers (number of patients)	14
Previous smokers (number of patients)	17
No smoking (number of patients)	34
Nationality	
Italian (number of patients)	45
Ecuadorian (number of patients)	1
Ivorian (number of patients)	1
Anthropometric parameters	
Mean height (cm)	165
Mean weight (kg)	71
Underweight BMI<18 (number of patients)	1
Normal weight BMI 18-25 (number of patients)	20
Overweight BMI 35-40 (number of patients)	17
Obese BMI>40 (number of patients)	9

Table 1: Characteristics of the patients: age, sex, school education, smoking history, nationality and anthropometric parameters.

Results

Answers regarding patients' awareness of ionizing radiation risk due to CT before and after dose bill are reported in Table 2 and Table 3 respectively.

There was no difference attributable to school education in understanding data on dose bill and radiation risks for pregnancy and childhood. However, patients with lower school education understood that it is possible to keep in touch with pregnant and children after CT just after receiving written information (Table 4).

Patients with higher school education considered useful receiving dose bill together with information on ionizing radiation risks. Answers regarding patients' awareness of ionizing radiation risk due to CT before (Table 2) and after dose bill (Table 3) showed no correlation with sex and age.

Images for this section:

	YES	NO
Have you ever heard about radiation risk for x-ray, CT or Nuclear Medicine?	34	13
Which modality exposes to more radiation: a single CT scan or a generic x-ray?		
-CT scan	29	18
- Generic x-ray	11	36
-CT scan=generic x ray	7	40
Would you undergo a CT scan just for a personal doubt even if in absence of a medical indication?	22	25
Have you been submitted to previous CT scan during the last 5 years?	31	16
Do you think that performing more CT scans in a single person raises the radiation risk?	42	5
Do you think that pregnancy is a risk condition for ionizing radiation exposure?	38	9
Do you think that is possible to keep in touch with pregnant women and children after CT exposure?	21	26
Have you ever heard or seen that there are restricted access area next to CT?	39	8
Do you think that dose bill will be a useful information for you?	37	10

Table 2: Main questions asked before CT scan and responses.

	YES	NO
Which modality exposes to more radiation: a single CT scan or a generic x-ray?		
-CT scan	41	6
- Generic x-ray	4	43
-CT scan=generic x ray	2	45
Would you undergo a CT scan just for a personal doubt even if in absence of a medical indication?	27	20
Do you think that performing more CT scans in a single person raises the radiation risk?	41	6
Do you think that pregnancy is a risk condition for ionizing radiation exposure?	41	6
Do you think that is possible to keep in touch with pregnant women and children after CT exposure?	28	19
Do you think that dose bill will be a useful information for you?	21	26

Table 3: Main questions asked after CT scan and responses.



Table 4: Comparison of the number of patients who did not know that it is possible to keep in touch with children and pregnant women before and after CT examination, according to school education.

Conclusion

Education is the most important factor for preventing unnecessary CT examinations not only among physicians but also among patients. Improving of awareness of the patients about ionizing radiation and harmful effects should protect them from increasing lifetime cancer risk. Awareness of radiation risk could also increase through the creation of a patient's medical record of radiation exams performed in order to measure cumulative radiation. Adequate information about ionizing radiation risks provided together with dose bill may be useful, mainly in patients with lower school education, but its understanding is not related to patients' characteristics. However, there is not a standardized way of communicating information on ionizing radiation risks due to CT and it could turn to be useful a tailored communication.

Personal information

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