How much dangerous is CT according to patients and how does dose bill affect their perception of ionizing radiation?

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Aims and objectives

Use of computed tomography (CT) has increased dramatically since its inception in 1970; for this reason in the last decades exposure to ionizing radiations in CT has constantly increased [1,2]. Most authors agree that patients should receive information about the estimated increase in cancer risks associated with CT, and according to the Euratom directive 59/2013, patients will have to receive dose bill in the radiological report [3-9]. In our work, we attempted to assess patients' understanding of relative radiation exposure by asking them to compare the amount of radiation exposure from CT compared to other carcinogenic factors before and after knowing their dose bill.

Methods and materials

114 patients referred for CT scan asked to rank 15 different carcinogenic activities, including CT exposure to ionizing radiation, from the most to the least dangerous one, as shown in Table 1. Of the 114 patients, 100 patients (mean age 58,51±16,27) fully completed the questionnaire. Patients' characteristics are summarized in Table 2. However, 45/100 patients (group a) had to fill the questionnaire before CT scan, 12/100 (group b) after oral communication of dose bill and 42/100 (group c) after communication of dose bill and written information on radiation dose exposure in CT, as shown in Figure 1.

Images for this section:

RANK	CARCINOGENETIC FACTORS
	SMOKING
	DRINKING ALCOHOL
	EXPOSURE TO IONIZING RADIATION FROM CT
	INHALATION OF PESTICIDES
	EAT FOOD WITH PRESERVATIVES
	EAT FOOD TREATY WITH NOT NATURAL DYES AND ADDITIVES
	NUCLEAR DISASTER
	ENVIRONMENTAL POLLUTION
	USE OF CONTRACEPTIVES
	BE OVERWEIGHT / OBESE
	VIRAL INFECTION AS HEPATITIS B VIRUS, HEPATITIS C VIRUS, HUMAN PAPILLOMA VIRUS
	LOW FIBER DIET
	LOW PHYSICAL ACTIVITY
	PROLONGED SUN EXPOSURE
	OCCUPATIONAL EXPOSURE TO ASBESTOS / NICKEL / COBALT

Table 1: Carcinogenetic agents that were ranked by the patients from the most to the least dangerous one.

Gender	
Male (number of patients)	47
Female (number of patients)	53
Age	
Mean age (years old)	58,51
Standard deviation(years old)	16,27
Age range (years old)	24-86
School education	
Illitterate (number of patients)	1
Primary school (number of patients)	34
Middle school (number of patients)	34
Secondary school (number of patients)	23
bachelor's degree (number of patients)	8
Smoking history	
Smokers (number of patients)	29
Previous smokers (number of patients)	37
No smoking (number of patients)	34

Table 2: Characteristics of the patients: gender, age, school education and smoking history.

Dear patient,
ionizing radiation exposure for a single chest radiography is lower than due to a transoceanic flight (i.e. flight Italy-USA), but a single generic CT exposes to an higher dose of ionizing radiation compared to chest radiographies as shown below:

DIAGNOSTIC PROCEDURE	N° OF EQUIVALENT CHEST RADIOGRAPHIES
HEAD CT	40
CHEST CT	180
ABDOMINAL CT	300

Moreover, there is a background radiation which we are all constantly exposed; in the table below we provide you data on the time needed for receiving an equivalent background radiation from different examinations:

DIAGNOSTIC PROCEDURE	TIME EQUIVALENT BACKGROUND RADIATION
CHEST RADIOGRAPHY	2,4-12 DAYS
HEAD CT	8 MONTHS
CHEST CT (HR)	5 YEARS
ABDOMINAL CT	2,5 YEARS

Finally, we provide you information on the level of ionizing exposure risk based on effective dose:

LEVEL OF RELATIVE RISK	EFFECTIVE DOSE
NONE	0
MINIMAL	<0,1 mSv
LOW	0,1-1.0 mSv
MEDIUM	1.0-10 mSv
HIGH	10-100 mSv

EXAMINATION	LEVEL OF RISK	DOSE RANGE (mSv)
HEAD CT	MEDIUM	0.9-4
CHEST CT	MEDIUM	4-18
ABDOMINAL CT	MEDIUM	3.5-25

Fig. 1: Written information on ionizing radiation exposure from CT provided to group c after CT.

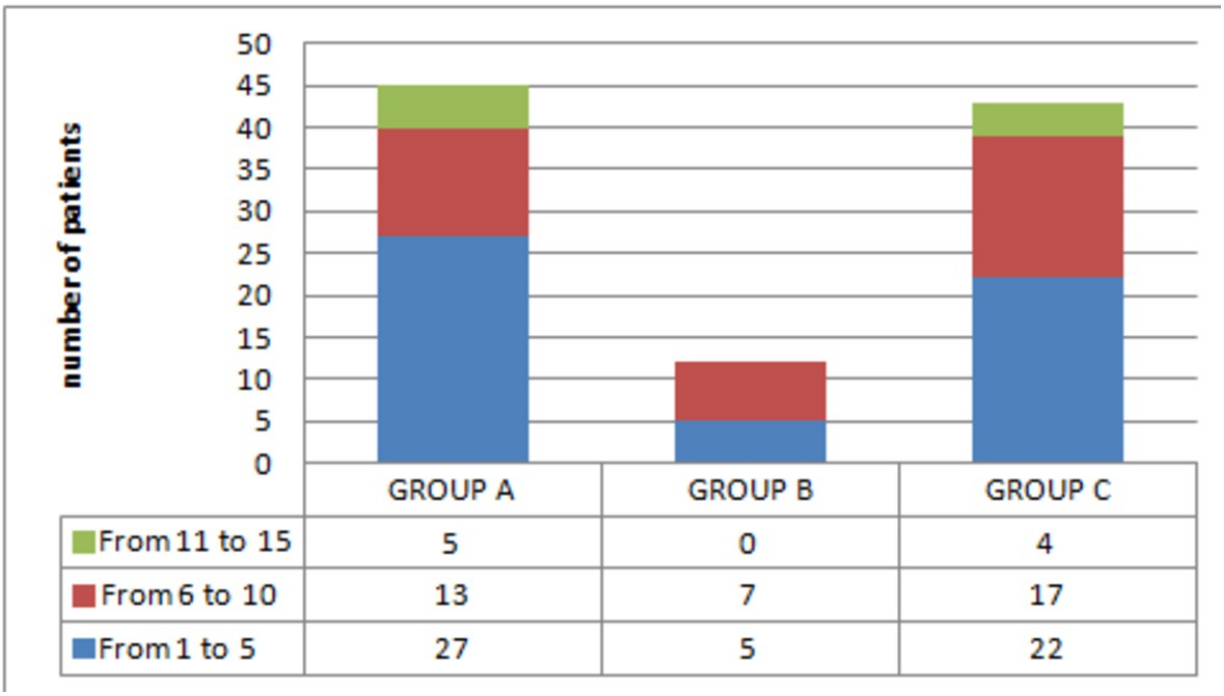
Results

12.00

Normal 0 false false false EN-GB X-NONE X-NONE

Ionizing radiation exposure was ranked among the first 5 dangerous activities by 54 of the 100 patients and among the last 5 dangerous ones by 9 patients. Table 3 shows the distribution of the different rank assigned to ionizing radiation risk from CT compared to the other carcinogenetic activities by the three groups. Comparing the 3 groups, there was no difference in ranking CT between the three groups of patients (p=0,35) or comparing group a and group c (p=0,57).

Images for this section:



	GROUP A	GROUP B	GROUP C
From 11 to 15	5	0	4
From 6 to 10	13	7	17
From 1 to 5	27	5	22

Table 3: Distribution of the answers by the three groups in regard to risk ranking of ionizing radiation exposure from CT compared to other 14 carcinogenetic factors.

Conclusion

CT is being widely used in the diagnosis of a variety of diseases, due to its increased availability and rapid technological developments. However, given the increasing concerns about unnecessary radiation exposure from medical imaging, it is important to assess people perception of radiation risk. It has been reported that medical professionals have limited knowledge about radiation doses in different radiological procedures, regardless of the field of expertise. On the other hand, patient's point of view has not been deeply evaluated. In our experience, most of the patients have concern about radiation exposure from CT, but just in 54% of cases it was perceived as a real dangerous activity compared to other carcinogenetic factor. The knowledge of dose bill, provided with or without written information on ionizing radiation exposure from CT, seems not to affect patient perception of risk related to ionizing radiation due to CT.

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