

# Computed Tomography and Patient Risk: Facts, Perceptions and Uncertainties

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## ABSTRACT

**Aim:** To assess the role of computed tomography for management of Covid-19.

**Study design:** Prospective study

**Place and duration of study:** Department of Radiology, Ghulam Muhammad Mahar Medical College Teaching Hospital Sukkur from 1<sup>st</sup> November 2020 to 31<sup>st</sup> December 2021.

**Methodology:** One hundred cases within various ages 5-55 years for analyzing their risk for CT scanning on them by highlighting the facts related to CT scan, patient perceptions and uncertainties regarding it. A 50 radiologist and 50 emergency doctors were also asked questions regarding their knowledge about CT scan risks and their responses were also documented. However previous CT record of patients suffering from carcinoma was also analyzed for understanding the fact related with CT imaging.

**Results:** The mean age of patients undergoing CT scan was 39.5±5.6 years. There were 55% males who underwent CT scans while 45% females. The usual dosage for various radiological procedure shows that highest dose deliverance was given to the patients of CT pulmonary angiogram and coronary angiography. Only 50% of radiologists knew that CT scan is associated with high risk of malignancies. There were only 10% emergency medical doctors who also knew CT imaging relation with malignancy risk. Only 54% patients considered abdomen pelvic scan to be associated with increasing lifetime risk of cancer while 23% of the patients considered chest scan to be associated with escalating the risk of cancer.

**Conclusion:** Computed tomography scan is related with a high risk of radiation exposure. There is a dire need of perception development and risk understanding with medical professionals and general public for minimizing this risk.

**Key words:** Computed tomography, Risk, Facts, Perception, Uncertainties

## INTRODUCTION

With the introduction of computed tomography (CT) in 1970s there had been a revolutionary advancement in medical diagnostic and patient treatment.<sup>1,2</sup> Surgical improvement, treatment of cancer, perfection in traumatic injury location as well as stroke and cardiovascular treatment have been some of the few benefits of CT imaging technique.<sup>3,4</sup> Computed tomography imaging has a short time advantage in identifying a diagnosing the medical condition than any other imaging techniques. Exploratory surgeries which were required for only diagnosing the targeted infectious or traumatic areas have become defunct due to CT imaging technique with only a requirement rate up to 13-15%. Moreover the requirement of indoor admissions has also decreased due to this imaging facility<sup>5,6</sup>.

Computed tomography scan imaging has also advanced in context to its various types with introduction of CT of coronary arteries, angiographies and many more. An estimated value of CT imaging performed in recent years shows that 62million of CT imaging is conducted per year only in the United States of America. While four decades before only 3 million CT scans were performed annually<sup>7</sup>.

Besides all the advantages related with CT scan imaging the use of radiation as a principle of CT imaging has created an increased radiation related risk in patients. Computed tomography scan has recently been reported to be responsible for 75.4% of radiation dosage in comparison to all the imaging techniques<sup>8,9</sup>. The increase reliability on CT scans has thus enhanced the risks of radiation exposure among patients of various ages and medical conditions all over the globe. Recent literature has also reported its association with increasing the risk of various types of carcinomas due to high doses of radiations. This has risen serious concern especially in pediatric medical community<sup>10</sup>.

The present study was designed for analyzing patients risk regarding CT scan by analyzing their and medical professional perception and uncertainties about this procedure. The results of this study give a detail insight on pros and cons of this technique.

## MATERIALS AND METHODS

After IRB permission, this prospective analytical study was conducted at Department of Radiology, Ghulam Muhammad Mahar Medical College Teaching Hospital Sukkur from 1<sup>st</sup> November 2020 to 31<sup>st</sup> December 2021. A total of 100 cases within various ages 5-55 years for analyzing their risk for CT scanning on them by highlighting the facts related to CT scan, patient

perceptions and uncertainties regarding it. A 50radiologist and 50 emergency doctors were also asked questions regarding their knowledge about CT scan risks and their responses were also documented. However previous CT record of patients suffering from carcinoma was also analyzed for understanding the fact related with CT imaging. However, their names and addresses were not disclosed at any level of research and data interpretation. All patients under went CT imaging. The risk of radiological exposure was kept under high consideration and was tried to be minimized as much as can. In the present study various dose optimizing strategies were performed including manual or automated scanner adjustment in accordance of patient size in case of solid-state scintillating detectors. Also, reconstruction methods were used for electronic circuits having decreased background-noise. A specialized questionnaire was designed including questions regarding their perception about CT scans and facts which causes uncertainties in them. The responses were documented in form of closed ended questions and entered in SPSS-26.

## RESULTS

The mean age of patients undergoing CT scan was 39.5±5.6 years. There were 55% males who underwent CT scans while 45% females. The usual dosage for various radiological procedure shows that highest dose deliverance was given to the patients of CT pulmonary angiogram and coronary angiography while posterior anterior chest view had the lowest required dose for the radiological imaging procedure (Table 1).

Table 1: Commonly applied dosage for radiological imaging

Examination	Average effective dose (mSv)	Range
Posterior anterior chest	0.02±0.01	0.007 -0.05
Head CT	2±3.1	0.9-4.0
Thorax CT	7±6.3	4.0-18.0
CT Pulmonary angiogram	15±5.5	13.0-40.0
Abdomen CT	8±4.5	3.5-25
Pelvic CT	6±3.2	3.3-10
Coronary angiography	16±9.1	5.0-32

It was observed that upon documenting the responses of radiologist and emergency medical doctor half of the radiologist such as 50% did not knew that CT scan is associated with high risk of malignancies and were also unknown about dosage required for various types of CT imaging. There were only 10% emergency medical doctors who also knew CT imaging relation with

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malignancy risk and rest of the 90% were un aware about the fact (Table 2).

When patients and parent of guardians of paediatric patients were questioned about their perception about risk of malignancies with CT imaging only 54% of them considered abdomen pelvic scan to be associated with increasing lifetime risk of cancer. While 23% of the patients considered chest scan to be associated with escalating the risk of cancer. Only 5% patients considered coronary CT scan to be associated with increasing cancer risk.

Other CT imaging was not considered by any of the respondent for to be associated with cancer risk (Fig. 1).

The previous data and medical history of patient's undergone CT scan also highlighted the fact that among paediatric patients the risk of cancer was increased by 24%. Patients who developed cancer had undergone CT scan at least a year prior to diagnosis of cancer (Fig. 2).

Table 2: Perception of Medical Practitioner about CT machine

Questions regarding CT radiations	Perception of Professionals			
	Radiologist (n=50)		Emergency Medical Doctor (n=50)	
	Yes	No	Yes	No
Do you know about CT radiation doses?	25 (50%)	25 (50%)	3 (6%)	47 (94%)
CT can cause cancer?	25(50%)	25 (50%)	5 (10%)	45 (90%)
Knowledge of potential danger in CT?	49 (98%)	1 (2%)	10 (20%)	40 (80%)
Is CT scan completely safe?	26 (52%)	24 (48%)	39 (78%)	11 (22%)

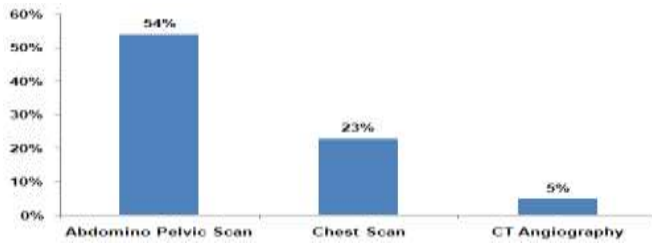


Fig. 1: Perception of Patients towards CT association with cancer risk

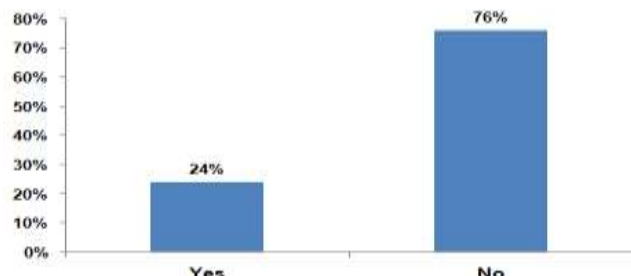


Fig. 2: Incidence of cancer with CT scan in pediatric patients

**DISCUSSION**

With advancement in medical technological procedures various advancement have been provide for health benefits and efficient treatment strategies. However, some of the advanced techniques have recently been evaluated for their health benefits as well as hazards. CT scan imaging is one such medical technique. Its usage of radiation dose has increased from 0.55 mSv-3.0 mSv within years and due to it the major source of radiation exposure to humans is considered through medical procedures<sup>11,12</sup>.

The present study results elaborated the fact that high dose of radiation are applied in various CT scan imaging procedures which increases the risk of carcinomas in pediatric as well as adult population. However the perception of the medical professionals in context to this is still not up to the mark. Patients are also not well educated about the risk involved. Similar results have been reported in various other studies which detailed the fact that 24% of the radiation exposure to humans was related through CT imaging<sup>13,14</sup>.

Radiations have been linked with neoplasia as been reported post atomic bombing in Japan<sup>15-17</sup>. A study also reported the fact that 1-2% of all the cancer occurring are the result of medical imaging and increased the need of new techniques to avoid this risk in future medical treatment.<sup>18</sup> Another study also predicted that if there would not be any changes in established imaging technologies then an additional 29000 cases of cancer and 14500 death is annually expected due to cancer related disease<sup>19</sup>.

**CONCLUSION**

Computed tomography scan is related with a high risk of radiation exposure. There is a dire need of perception development and risk understanding with medical professionals and general public for minimizing this risk. Use of new radiation techniques with reduced noise production can be a help in decreasing the cancer risk.

**Conflict of interest:** Nil

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