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"EVALUATION OF RADIATION DOSE OF CT ABDOMEN AND THORAX"

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Abstract
Computed tomography is higher modality of X-ray imaging. In computed tomography the doses are generally expressed in $CTDI_{Vol}$, DLP. $CTDI_{vol}$ and DLP doses were obtained from routine Abdomen and chest CT examination. The study was carried out in 160 patients (100 abdomen & 60 thorax). The data were recorded & analysed with Origin software . The paired sample t test was used to compare $CTDI_{vol}$ (mGy) and DLP (mGy*cm) of both the abdomen and thorax. The mean of $CTDI_{vol}$ was 18.71 with S.D. 4.75, mean of $CTDI_{vol}$ was 35.21 with S.D. 16.81 and the mean of DLP was 806.0 with S.D. 112.7, mean of DLP was 713.9 with S.D. 134.4 respectively. There was significant difference ($p > 0.05$) in $CTDI_{vol}$ and DLP respectively. t-test was performed to compare $CTDI_{vol}$ and DLP of Abdomen & Thorax according to gender. the mean of $CTDI_{vol}$ in male was 16.2 ,in female mean was 16.9 and the DLP mean in male was 842.9 and in females 819.7, the mean of $CTDI_{vol}$ in male was 16.3 in females mean was 16.5 and the mean of DLP in males was 696.2 and in females mean was 759.7 respectively. There were no difference in CT radiation doses in the abdomen and thorax groups according gender.
The Pearson correlation coefficient ("r") was used to find the relation of BMI with $CTDI_{vol}$ and DLP in Abdomen & Thorax .There was a negative correlation of BMI with $CTDI_{vol}$ and positive correlation with DLP.There was a positive correlation of BMI with $CTDI_{vol}$ and negative coorrelation with DLP respectively.

Keywords: Computed Tomography, Computed Tomography dose Index Volume , Dose length product, Body mass index

Introduction
A CT scan is a diagnostic tool that's typically utilized to get a better image of any abnormalities within the organs. Typically, a traditional X-ray examination is followed by a CT scan examination.[1]. A CT scan used for diagnostic purposes will yield more detailed images of the organs since it uses many X-ray sources at once. Consequently, the patient receives a higher radiation dosage. Thus, the chance of potential stochastic effects, such developing cancer, is the main consideration when determining the radiation dose during a CT scan examination .[2]
Because multiple X-ray sources are used during a single scan, calculating the dose on a CT scan is more complicated than it is for traditional X-ray diagnostics. The total dose of all the X-rays used does not equal the dose of a CT scan.[3] Computed Tomography Dose Index (CTDI), which is the total radiation dose for a single scan; Size-SpecificDoseEstimate (SSDE), which is the estimated radiation exposure dose received by the patient; and the effective dose, which can be found from the Dose

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Length Product (DLP).[4]
The reference phantom is used to measure the CTDIvol value indication setting at the CT scan equipment.[1] To estimate the absorbed dose, it can be assumed that the size of this reference phantom is close to that of the patient. Assuming that the patient's size is close to the phantom's, the CTDIvol value is therefore adjusted to match the reference phantom's CTDIvol value. Consequently, even though this seems erroneous, the radiation dose received by a patient whose body size is roughly closer to that of the phantom is the same. Using the DLP value to obtain the CTDIvol value is one method that can be used, as shown in the equation [5]below:
DLP (mGy-cm) = CTDIvol x L

The scan length is denoted by L. The CT scan screen displays a metric called DLP, which is used to calculate the effective dosage value . The purpose of this study is to evaluate CT Radiation dose in Abdomen and Thorax according to BMI and Gender.[6]

Materials & Methods

This study carried out on Philips Ingenuity Core 128 slice CT Machine. In this study, we included patient who went through CT Abdomen & Chest .We used appropriated routinely protocol adult CT Abdomen & Chest to identify the patient radiation dose (CTDI & DLP). In this study we used 160 sample. In this examination, the dose was not determined in follow-up cases, uncooperative patients, and a dose of CECT procedure. We includes Patient's Coming for study of chest and abdomen. We included After the compilation of CT exam, we record the dose information page of that patient by clicking the picture from the monitor screen.(Figure.1&2)
And then we set that data in a format on the excel sheet after that we performed the Paired t-test for data analysis. The data were recorded & analysed with origin2024b software. Paired sample t test was performed to compare radiation doses ($CTDI_{vol}$ & DLP) among these two groups abdomen & thorax and also t-test was performed to compare $CTDI_{vol}$ and DLP according to gender. The Pearson correlation coefficient ("r") was used to find the relation of BMI with $CTDI_{vol}$ and DLP in Abdomen & Thorax.

Results

After CT Abdomen & Chest procedure out the inclusion criteria, a total 160 patients of both sex and different age group were included in the present prospective study. An informed consent was obtained from all the patients before they were subjected for evaluation. Out of 160 with percentage 62.5% Abdomen & 37.5%. patients thorax. the gender distribution between both groups (abdomen & thorax) in which 106 males with 66.2% and 54 females with 33.8%.
In **Table.1** The paired sample t test was used to compare $CTDI_{vol}$ (mGy) and DLP (mGy*cm) of both the abdomen and thorax groups, the mean of $CTDI_{vol}$ was 18.71 with S.D. 4.75, mean of $CTDI_{vol}$ was 35.21 with S.D. 16.81 and the mean of DLP was 806.0 with S.D. 112.7, mean of DLP was 713.9 with S.D. 134.4 respectively. There was significant difference ($p > 0.05$) in $CTDI_{vol}$ (mGy) and DLP (mGy*cm) respectively.
Table.2 The above table shows that the independent sample "t" test was used to compare $CTDI_{vol}$ (mGy), DLP (mGy/cm) according to gender for each group. In the abdomen group the mean of $CTDI_{vol}$ in male was 16.2 with S.D. 1.0, in female mean was 16.9 with S.D. 3.8 (p-value-0.122) and the DLP mean in male was 842.9 with S.D. 90.0 and in females 819.7 with S.D. 56.0 (p-value- 0.169) as well as in the thorax group the mean of $CTDI_{vol}$ in male was 16.3 with S.D. 0.0, in females mean was 16.5 with S.D. 0.7 (p-value- 0.137) and the mean of DLP in males was 696.2 with S.D. 87.4 and

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in females mean was 759.7 with S.D. 192.6 (p-value-0.083). And There was no difference ($p > 0.05$) in mean $CTDI_{vol}$ (mGy), DLP (mGy/cm) according to gender for each group. The Pearson correlation coefficient ("r") was used to find the relation of BMI with $CTDI_{vol}$ and DLP in Abdomen.There was a negative correlation -0.033 of BMI with $CTDI_{vol}$ and positive correlation 0.087 with DLP.(Graph.1) The Pearson correlation coefficient ("r") was used to find the relation of BMI with $CTDI_{vol}$ and DLP in Thorax. There was a positive correlation 0.0447 of BMI with $CTDI_{vol}$ and negative coorrelation -0.174 with DLP.(Graph.2)

Table.1: shows CTDI and DLP in abdomen and thorax groups

Groups	**Dose parameters**	**Mean**	**S.D.**
Abdomen	CTDI (mGy)	18.71	4.75
	DLP (mGy/cm)	806.0	112.7
Thorax	CTDI (mGy)	35.21	16.81
	DLP (mGy/cm)	713.9	134.4

Table.2: shows CTDI and DLP in abdomen and thorax groups according to gender

Groups	Dose parameters	Gender	Mean	S.D.
Abdomen	CTDI (mGy)	Male	16.2	1.0
		Female	16.9	3.8
	DLP (mGy/cm)	Male	842.9	90.0
		Female	819.7	56.0
Thorax	CTDI (mGy)	Male	16.3	0.0
		Female	16.5	0.7
	DLP (mGy/cm)	Male	696.2	87.4
		Female	759.7	192.6

Graph.1 Correlations of CTDI and DLP with BMI in Abdomen CT

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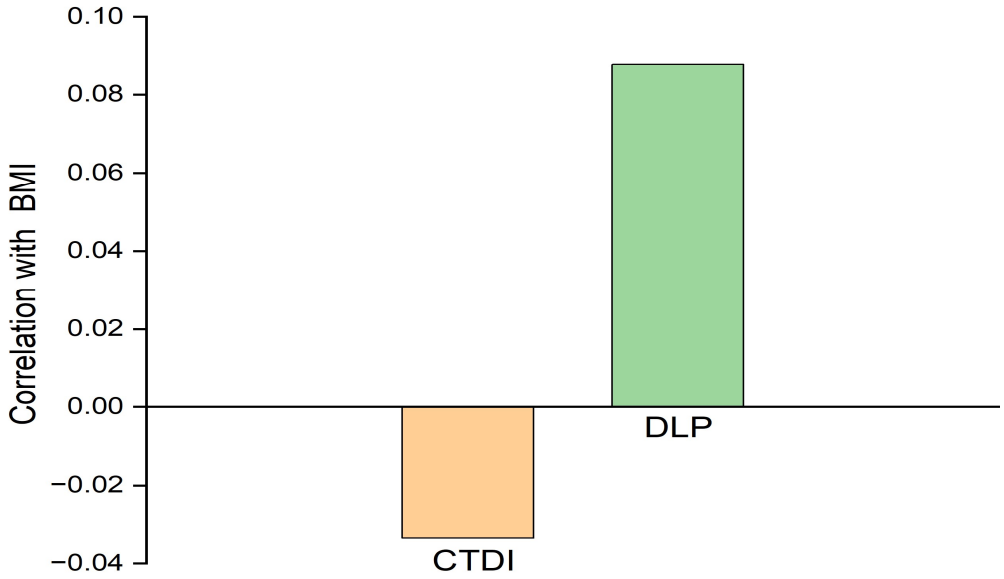

Graph.2 Correlations of CTDI and DLP with BMI in Thorax CT

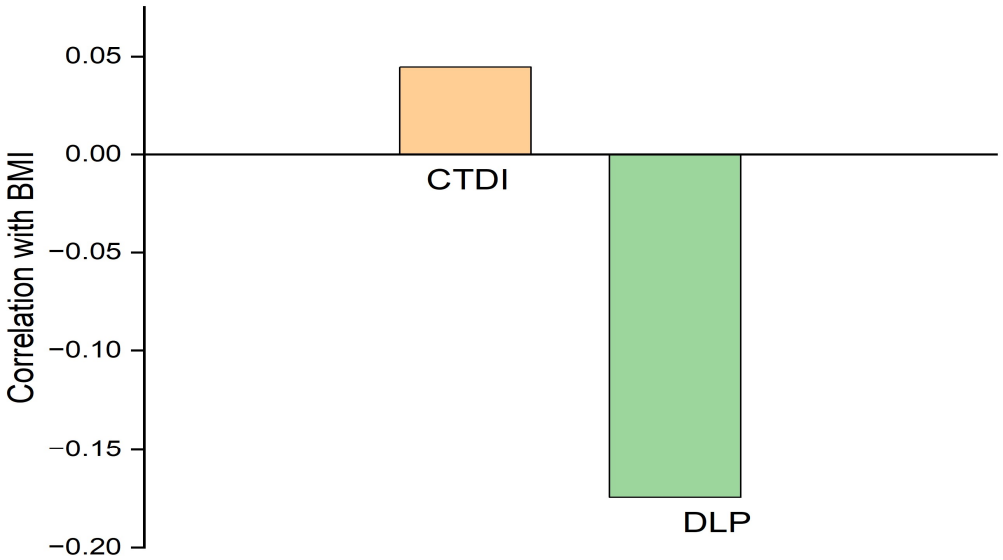

Figure 1. Shows the dose information of thorax

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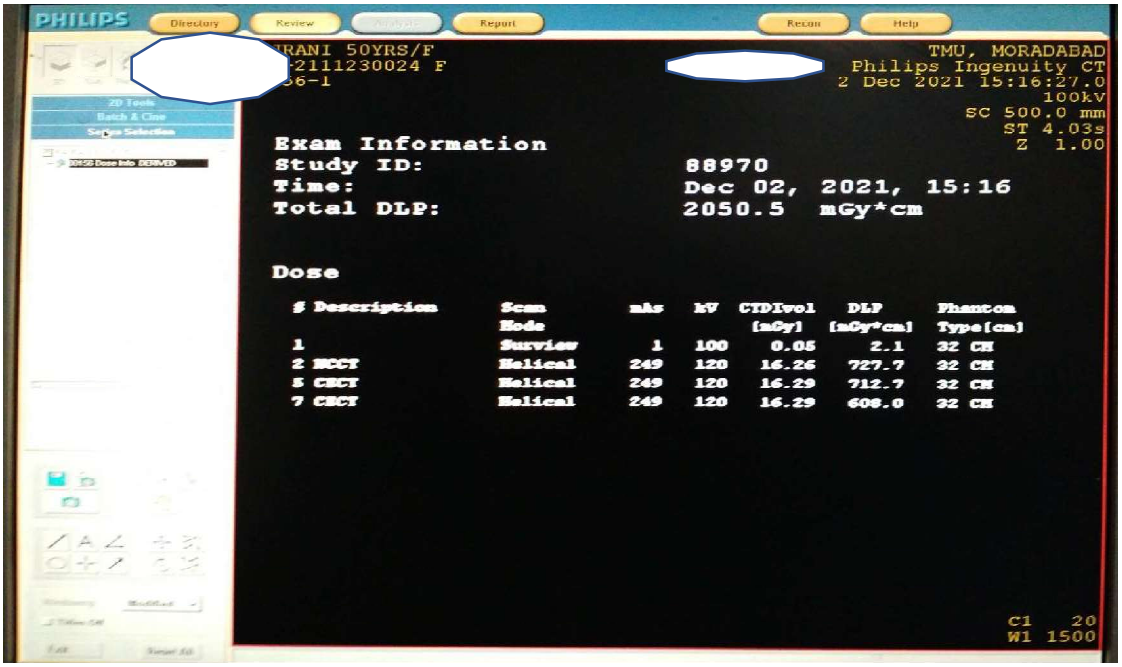

igure 2. Shows the dose information of thorax

Discussion

In this prospective cross-sectional study, which was conducted in the Radiology Department. We take

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160 patients of NCCT abdomen (100) & NCCT thorax (60) according to inclusion & exclusion criteria. Our study was clinical based study to measure the radiation dose (CTDI & DLP) in NCCT abdomen and thorax according to BMI & gender.

Jae-Yeon Hwang et. Al. (sept. 19,2020)- They compare their study with other universities & hospitals to analyse the dose for paediatric patient (age from 1month to 18years) & they found that doses of their study (in Korea) were lower than other universities and hospitals (of other countries) but the doses significantly increase with weight groups (<5, 5-15, 15-30, 30,50, & 50-80) in both the abdominopelvic(weight from <5kg to <80kg with CTDI 1.4mGy to 4.7mGy & DLP 30 to 233mGy/cm) and chest examinations (same weight groups with $CTDI_{vol}$ 1.2mGy to5.8mGy & DLP 21.5 to 184.4mGy/cm.

Dan E. Ware et Al- They gathered information from three groups of patients who had their abdomen CT scans at random. 32 young adults between ages of 11 & 18, 31 youngsters between ages of 10 & 18, & 36 individuals over the age of 18 were included. The corresponding patient effective dose mean values were 6.1 mSv 6 1.4 for 3.9 mSv 6 1.1 for adults, 4.4 mSv 6 1.0 for children, and 4.4 mSv 6 1.0 for young adults. They discovered that the average quantity of CT slices for minors went from 22.0 to 31.5 for adults, and the average radiation quality in MA increased from 220 to 290 for adults. They eventually found that adult dosages were three times larger than child doses, while kid doses were 50 percent higher than adult doses (according to age group).

In our study we perform clinical based study to measure the radiation dose (CTDI & DLP) in NCCT abdomen and thorax according to BMI & gender. There was a negative correlation of BMI with CTDIvol, which means as BMI increases, $CTDI_{vol}$ of the abdomen decreases, while a positive correlation with DLP means as BMI increases, DLP increases. There was a positive correlation of BMI with $CTDI_{vol}$ of thorax, meaning as BMI increases, $CTDI_{vol}$ of thorax increases, while a negative correlation with DLP means as BMI increases, DLP decreases. There was no difference in CT radiation doses ($CTDI_{vol}$ and DLP) in the abdomen and thorax according to gender

Conclusion

Processed tomography is related to moderately high radiation dosages. The exact estimation of radiation introduction is, in this way, a significant need within the clinical material science network. As the CT scanner gear, the significant concern was to diminish the radiation portion, and it ought to be as low as sensibly feasible. The $CTDI_{vol}$ portion file is an omnipresent portion amount utilized in CT. $CTDI_{vol}$ has become a standard portion amount in CT. After summing up the entire discussion, It is concluded that there was a significant difference between CTDI and DLP of the abdomen and thorax. There was no difference in CT radiation doses ($CTDI_{vol}$ and DLP) in the abdomen and thorax according to gender,but there was significant difference between $CTDI_{vol}$ and DLP of abdomen and thorax. There was a negative correlation of BMI with CTDIvol, which means as BMI increases, $CTDI_{vol}$ of the abdomen decreases, while a positive correlation with DLP means as BMI increases, DLP increases. There was a positive correlation of BMI with $CTDI_{vol}$ of thorax, meaning as BMI increases, $CTDI_{vol}$ of thorax increases, while a negative correlation with DLP means as BMI increases, DLP decreases.

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