



Estimation of dose length product (DLP) using MSCT for CT Abdomen-pelvis based on sex and body weight in north India

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Abstract

Objective: (A). To investigate the significance of sex and body weight (BW) in dose length products (DLP) based on monitoring of the radiation dose. (B). To estimate patient doses in the abdomen-pelvis examination using computed tomography, and calculate organ dose.

Material and Method: Three hundred (300) single-phase (plain or unenhanced) computed tomography examinations of the Abdomen-Pelvis, performed from 15 March 2022 to 30 September 2022, on 10 different scanners and were analysed.

Result: The mean DLP of a total of 300 participants was 893.13 ± 419.45 mGy X cm with a maximum of 1948 and minimum of 203 mGy X cm. The effective dose was calculated from the DLP of each examination using the conversion factors given by the European Commission with a mean value of 13.36 ± 6.27 mSv with a maximum of 29.22 and minimum of 3.045 mSv.

Conclusion: In conclusion, estimating the DLP for CT abdomen-pelvis scans based on patient characteristics such as sex and body weight is an important step in reducing patient radiation exposure during CT scans in North India. Healthcare providers should be aware of these factors and take steps to minimize patient radiation exposure whenever possible.

Keywords: DLP, EC, CT Abdomen-Pelvis, DRL

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Introduction

Introduced in the early 1970s, CT has since been a crucial part of medical practice. It has evolved into a powerful and versatile diagnostic tool and has already supplanted several radiologic procedures^{1,2}. Along with development of helical and multiple slice configuration, CT applications have advanced³. However, the potential for cancer development is a worry because of the relatively high radiation exposures associated with CT scans^{4,5}. Modern CT scanners also use techniques that dramatically alter the radiation dose provided to the patient and provide a wide range of exposure variables⁶. When a

radiological examination is required due to a valid clinical indication^{7,8}, all necessary precautions must be taken to ensure the patient's and the staff's safety from ionizing radiation, as well as the security of the radiation source itself, following international basic safety standards. CT examinations for targeted therapeutic purposes necessitate recording high-quality images without subjecting patients to excessive radiation.

Computed Tomography (CT) is a widely used medical imaging technique that provides detailed images of the internal organs and tissues of the body. CT scans use X-rays to



produce multiple images that can be reconstructed into a 3D image. However, CT scans also expose patients to ionizing radiation, which can potentially increase the risk of cancer. Therefore, it is important to estimate the radiation dose that patients receive during CT scans⁹. The dose length product (DLP) is a measure of the total radiation dose received during a CT scan and is commonly used to estimate patient radiation exposure.

In recent years, there has been growing concern about the potential health risks associated with CT scans, particularly for patients who undergo multiple scans. This has led to increased efforts to reduce patient radiation exposure during CT scans. One way to do this is to estimate the DLP based on patient characteristics such as sex and body weight.

CT scans are commonly used to diagnose and monitor conditions of the abdomen and pelvis, such as tumours, infections, and inflammatory diseases. Therefore, estimating the DLP for CT abdomen-pelvis scans is of particular importance in this region.

Several factors can affect the DLP for CT scans, including the type of CT scanner used, the scanning protocol, and patient characteristics. In general, larger patients and male patients tend to receive higher radiation doses during CT scans.

to receive higher radiation doses during CT scans.

Objective

- To investigate the significance of sex and body weight (BW) in dose length products (DLP) based on monitoring of the radiation dose.
- To estimate patient doses in the abdomen-pelvis examination using computed tomography, and calculate organ dose.

Methodology

Subjects

From 15 March 2022 to 30 September 2022, 300 single-phase (plain or enhanced) CT scans of the Chest were done on 10 different scanners and analyzed. The following inclusion criteria were applied:

Study population

- All records with requests for an Abdomen-pelvis scan. The data has been collected from DICOM.

The inclusion criteria were:

- Adults aged 18-90 years
- Weight between 45-90 kg.
- Both genders.

Sample Adult DLP Data Collection at Different Centers

| | |
|--------|--------------------|
| Sr. No | Chest (DLP in mSv) |
| DLP | 30 Cases |

Exclusion criteria

The Exclusion Criteria were:

- Weight between > 90 kg
- Adults aged < 18 years

Instrument of data collection

Ten (10) CT scanners are used, and 30 examinations meeting the inclusion criteria will be selected consecutively for each sex and body weight for each of the ten scanners.

Statistical analysis

Range, mean, standard deviation (SD), median, frequencies (number of cases), and relative frequencies (percentages), where applicable, will be used to characterize the data. The statistical tool SPSS 21 version for Microsoft

Windows and XLSTAT 2022 was used for all statistical calculations.

Result

The mean age of a total of 300 participants (157 male and 143 female) was 49.28 ± 15.86 years, with a maximum age of 84 and a minimum of 19 years. The average bodyweight of the patient was 71.40 ± 8.94 with a maximum of 90.0 and a minimum of 49.0.

The mean DLP of a total of 300 participants was 893.13 ± 419.45 mGy X cm with a maximum of 1948 and minimum of 203 mGy X cm. The effective dose was calculated from the DLP of each examination using the conversion factors given by the European Commission with a mean



value of 13.36 ± 6.27 mSv with a maximum of 29.22 and minimum of 3.045 mSv.

Discussion

The research was conducted in North India including 10 (ten) CT scanners. The data was collected from DICOM and analyzed. A total number of three hundred (n=300) patients within the age range of 19-84 who were referred for a CT scan of the Abdomen-pelvis were included in this research. One hundred fifty-seven (157) were males while one eighty forty-three (143) were females as shown in tables 2 & 3.

The average age of the 300 patients was 49.28 ± 15.86 years, with a maximum age of 84 and a minimum age of 19.0 years. The patients' average weight was 71.37 ± 8.86 Kg, with a maximum of 90 and a minimum of 49.0. The

effective dose was calculated from the DLP of each examination using the European Commission's conversion factors and ranged from 29.22 mSv to 3.045 mSv, with a mean value of 13.36 ± 6.27 mSv.

The data were collected and analyzed in both men and women separately. The mean age of male participants was 50.52 ± 15.98 with a minimum of 19 and a maximum of 84 years. The average body weight of participants was 72.99 ± 8.20 with a minimum of 53 and a maximum of 90 kgs as shown in table 1.

The mean age of female participants was 47.9 ± 15.68 with a minimum of 19 and a maximum of 77 years. The average body weight of participants was 69.59 ± 9.24 with a minimum of 49 and a maximum of 90 kgs as shown in table 3.

Table 1: Summary statistics

| Variable | Observations | Minimum | Maximum | Mean | Std. deviation |
|----------------|--------------|---------|----------|--------|----------------|
| DLP (mGy X cm) | 300 | 203.000 | 1948.000 | 893.13 | 419.45 |
| Body Wight | 300 | 49 | 90.000 | 71.40 | 8.94 |

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Table 2: Male statistics Summary

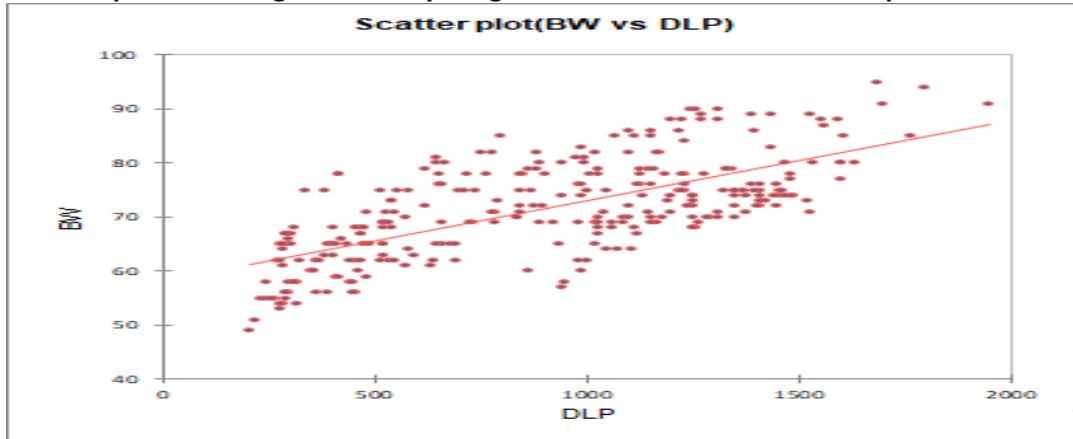
| Variable | Observations | Minimum | Maximum | Mean | Std. deviation |
|------------|--------------|---------|---------|---------|----------------|
| DLP | 157 | 0 | 157 | 244.000 | 1797.000 |
| Body Wight | 157 | 0 | 157 | 53.000 | 90.000 |

Table 3: Female statistics Summary

| Variable | Observations | Minimum | Maximum | Mean | Std. deviation |
|------------|--------------|---------|---------|---------|----------------|
| DLP | 143 | 0 | 143 | 203.000 | 1948.000 |
| Body Wight | 143 | 0 | 143 | 49.000 | 90.000 |



Graph 1: Showing DLP & Body weight distribution of all Abdomen-pelvis scans



Data collected from 10 different scanners showing the age and body weight of males and females with mean & SD separately are shown in table 7.

A positive correlation was found between DLP results and body weight across all scanners and both sexes, as shown in Table 5. The data taken from different scanners shows variation when compared to each other. This research also

shows that sex and body weight has a significant effect on radiation doses as shown in table 6. The Dose length product provided by the scanners was higher in men than that in women irrespective of the scanner table 8. The study suggests that men receive more radiation doses than women on CT Abdomen-pelvis examinations.

Table 4: Data collected from 10 scanners showing the age of males and females with mean & SD Abdomen-pelvis examination.

| S.no | Scanner | Age | | Mean ± SD | |
|------|-----------------------------|------|--------|---------------|---------------|
| | | Male | Female | Male | Female |
| 1 | 16 Slice GE Revolution | 16 | 14 | 36.69 ± 14.28 | 47.14 ± 14.87 |
| 2 | 16 Slice Siemens Emotion | 13 | 17 | 46.46 ± 19.05 | 56.65 ± 14.62 |
| 3 | 16 Slice Philips Brilliance | 19 | 11 | 52.58 ± 18.88 | 48.91 ± 15.48 |
| 4 | 32 Slice Siemens Scope | 18 | 12 | 44.25 ± 19.54 | 44.25 ± 19.54 |
| 5 | 08 Slice GE Revolution ACTs | 17 | 13 | 54.41 ± 10.17 | 48.31 ± 15.64 |
| 6 | 08 Slice Siemens Emotion | 14 | 16 | 56.79 ± 17.15 | 50.31 ± 63.88 |
| 7 | 64 Slice Siemens Somatom | 14 | 16 | 51.21 ± 15.99 | 48.25 ± 16.03 |
| 8 | 128 Slice Philips Ingenuity | 14 | 16 | 46.21 ± 12.91 | 44.25 ± 11.96 |
| 9 | 64 Slice Toshiba Aquilion | 16 | 14 | 46.63 ± 12.08 | 41.86 ± 10.76 |
| 10 | 64 Slice GE VCT | 16 | 14 | 59.06 ± 15.15 | 47.14 ± 16.96 |

Three hundred (300) participants underwent a CT scan of the chest on ten (10) different MSCT scanners with which each examination

consisting of thirty patients. The participants that were included were selected to correspond to the typical participant (weight 45-90 kg). The



DLP and effective dose were calculated in all participants. For the Abdomen-pelvis protocol, the mean DLP in a total of 300 participants was 893.13 ± 419.45 mGy X cm and ED was 13.36 ± 6.27 mSv as shown in table 1.

Data collected from ten different scanners were compared with each other, which shows patients who undergo an examination on 64 Slice Toshiba Aquilion slice (1326.66 mGy x cm) receive the highest dose length product (DPL) while those patients who undergo an examination under 16 Slice GE Revolution slice receive the lowest dose length product (DPL) as shown in table 5.

Our study also suggests that generally, men receive the highest dose length product (DPL) than females despite of given weight. DLP had a larger unadjusted variance among heavier subjects, suggesting that the highest risk of overdosing occurred in that population. DLP was the highest for the 64 Slice Toshiba Aquilion scanner, followed by the 128 Slice Philips Ingenuity scanner.

Table 6 presented standard effective dose values for each scanner for male and female participants separately. The effective dose was high in males than females except for 16-slice Philips Brilliance, and 64 Slice GE VCT scanners.

Table 5: Showing combined DLP received by patients on different scanners during CT Abdomen-Pelvis examination.

| S.no | Scanner | DLP | | P-Value |
|------|-----------------------------|---------|--------|---------|
| | | Mean | SD | |
| 1 | 16 Slice GE Revolution | 350.60 | 119.88 | <0.001 |
| 2 | 16 Slice Siemens Emotion | 538.30 | 216.92 | |
| 3 | 16 Slice Philips Brilliance | 1050.77 | 344.71 | |
| 4 | 32 Slice Siemens Scope | 972.90 | 377.43 | |
| 5 | 08 Slice GE Revolution ACTs | 627.57 | 166.34 | |
| 6 | 08 Slice Siemens Emotion | 464.33 | 173.44 | |
| 7 | 64 Slice Siemens Somatom | 1114.70 | 312.82 | |
| 8 | 128 Slice Philips Ingenuity | 1291.67 | 188.57 | |
| 9 | 64 Slice Toshiba Aquilion | 1326.66 | 174.02 | |
| 10 | 64 Slice GE VCT | 1193.77 | 191.37 | |

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Table 6: Showing means effective doses received by male and female patients during CT Abdomen-Pelvis examination from each scanner.

| S.no | Scanner | Effective Dose (mSv) | | | | ED (mSv) |
|------|-----------------------------|----------------------|------|--------|------|------------------|
| | | Male | | Female | | All |
| | | Mean | SD | Mean | SD | Mean \pm SD |
| 1 | 16 Slice GE Revolution | 5.90 | 2.03 | 4.52 | 1.16 | 5.026 \pm 1.80 |
| 2 | 16 Slice Siemens Emotion | 8.97 | 3.84 | 7.39 | 2.56 | 8.07 \pm 3.22 |
| 3 | 16 Slice Philips Brilliance | 15.30 | 5.74 | 16.56 | 4.15 | 15.76 \pm 5.17 |
| 4 | 32 Slice Siemens Scope | 16.85 | 5.16 | 11.21 | 4.74 | 14.60 \pm 5.66 |
| 5 | 08 Slice GE Revolution ACTs | 10.31 | 2.31 | 8.24 | 2.30 | 9.41 \pm 2.49 |



| | | | | | | |
|----|-----------------------------|-------|------|-------|------|--------------|
| 6 | 08 Slice Siemens Emotion | 7.90 | 2.96 | 6.09 | 1.99 | 6.94 ± 2.61 |
| 7 | 64 Slice Siemens Somatom | 17.27 | 2.72 | 16.27 | 5.98 | 16.73 ± 4.70 |
| 8 | 128 Slice Philips Ingenuity | 20.62 | 2.71 | 18.05 | 2.16 | 19.20 ± 2.71 |
| 9 | 64 Slice Toshiba Aquilion | 20.89 | 1.67 | 18.76 | 3.05 | 19.90 ± 2.61 |
| 10 | 64 Slice GE VCT | 17.49 | 2.14 | 18.38 | 3.55 | 17.91 ± 2.87 |

Table 7: Showing mean body weight of male and female patients involved in this study from each scanner.

| S.no | Scanner | Body Weight (kg) | | | |
|------|-----------------------------|------------------|------|--------|-------|
| | | Male | | Female | |
| | | Mean | SD | Mean | SD |
| 1 | 16 Slice GE Revolution | 67.44 | 7.64 | 63.14 | 8.65 |
| 2 | 16 Slice Siemens Emotion | 67.85 | 9.30 | 65.06 | 5.94 |
| 3 | 16 Slice Philips Brilliance | 73.47 | 9.38 | 75.45 | 7.62 |
| 4 | 32 Slice Siemens Scope | 77.89 | 8.90 | 69.25 | 12.17 |
| 5 | 08 Slice GE Revolution ACTs | 72.12 | 6.70 | 67.15 | 8.44 |
| 6 | 08 Slice Siemens Emotion | 69.79 | 9.65 | 63.88 | 7.14 |
| 7 | 64 Slice Siemens Somatom | 82.00 | 6.47 | 81.25 | 9.44 |
| 8 | 128 Slice Philips Ingenuity | 72.71 | 6.02 | 70.75 | 5.12 |
| 9 | 64 Slice Toshiba Aquilion | 73.63 | 2.25 | 69.50 | 5.32 |
| 10 | 64 Slice GE VCT | 72.69 | 5.31 | 71.50 | 6.42 |

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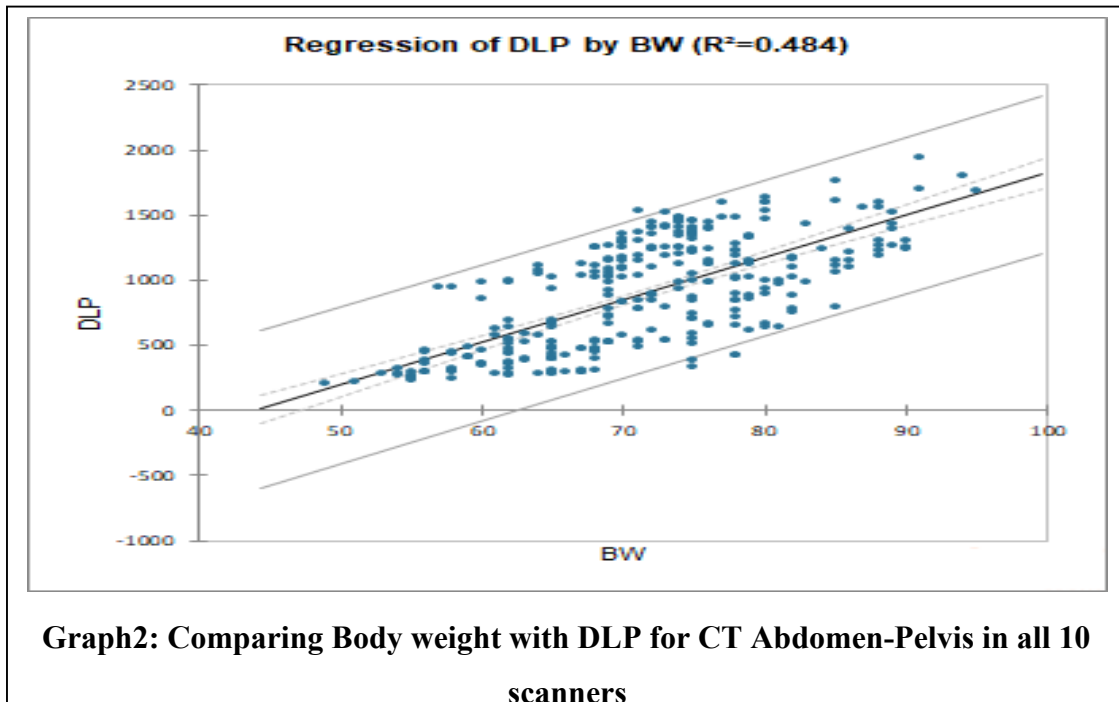
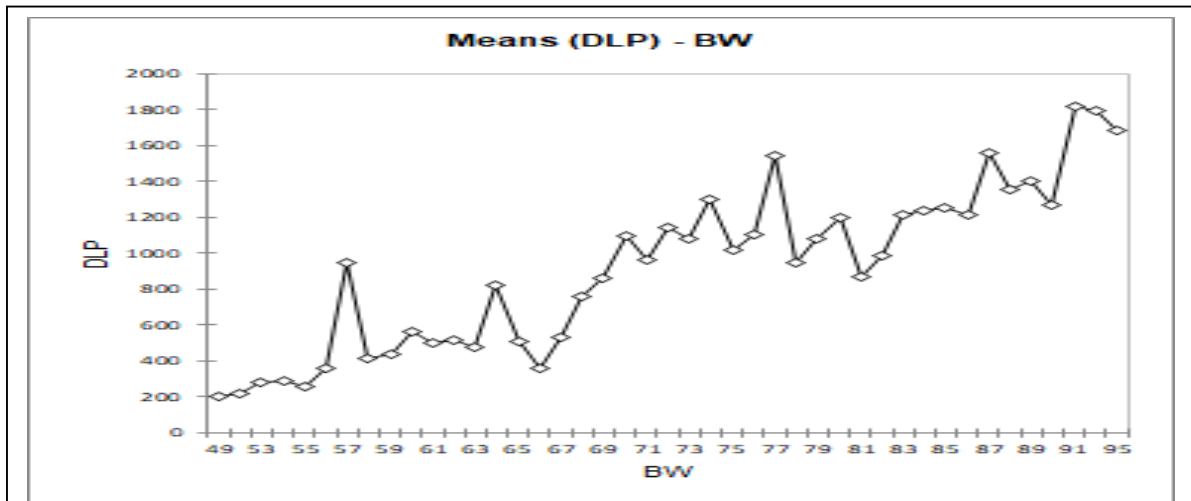
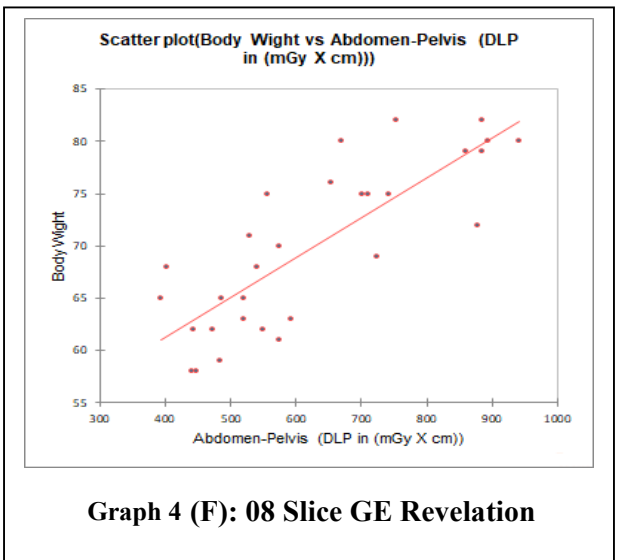
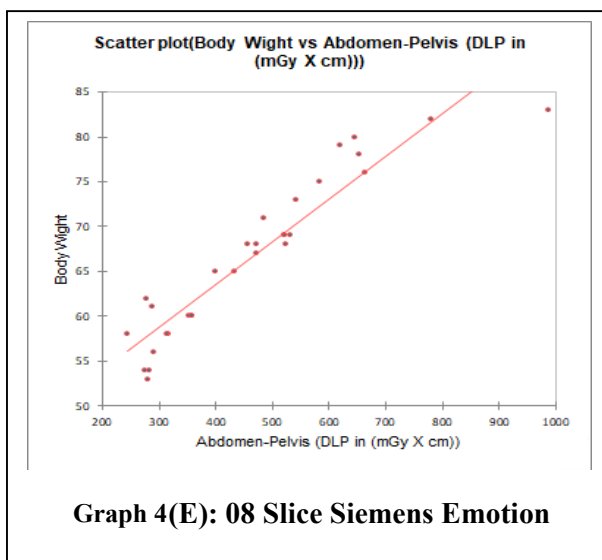
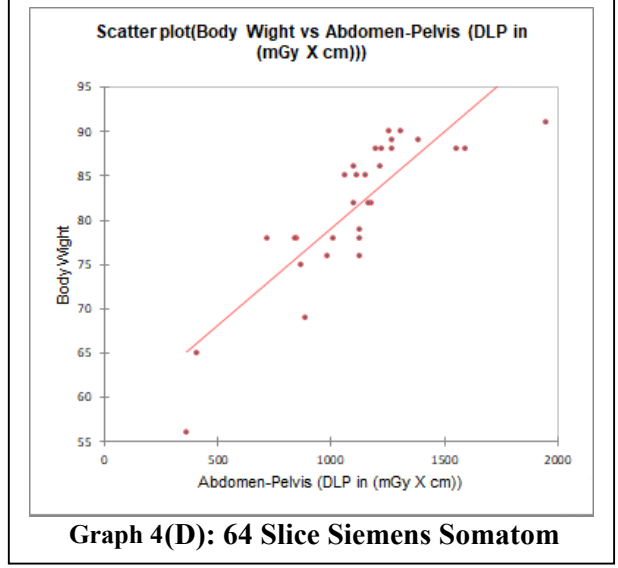
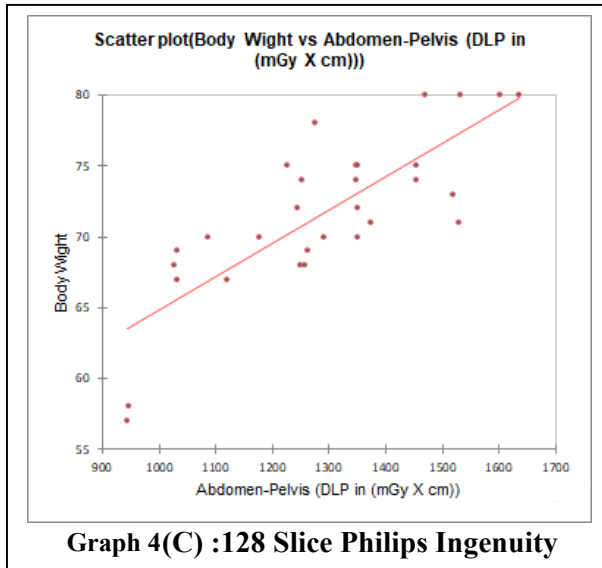
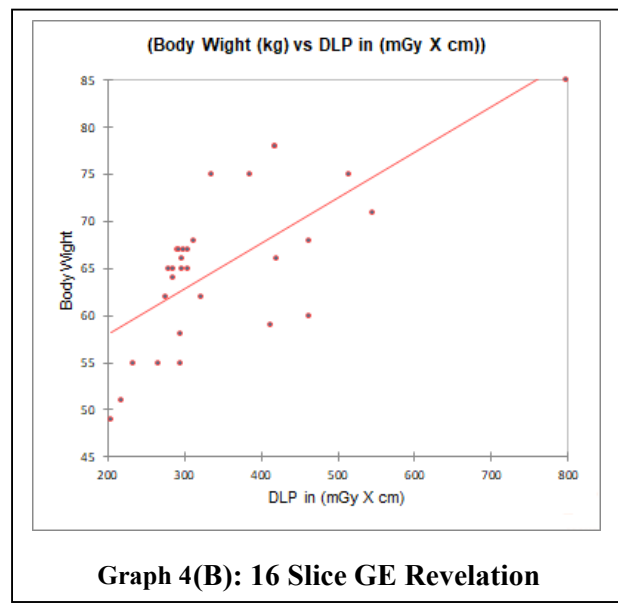
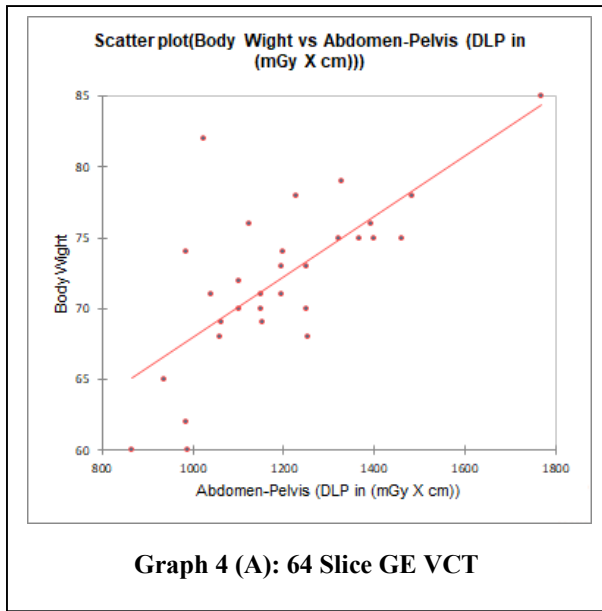


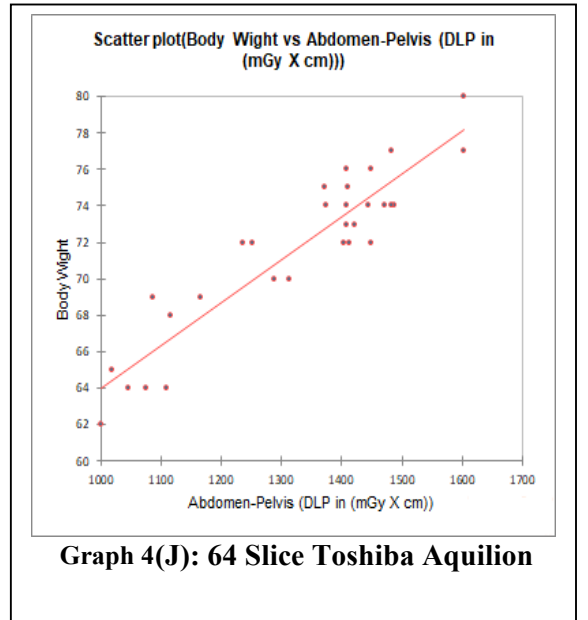
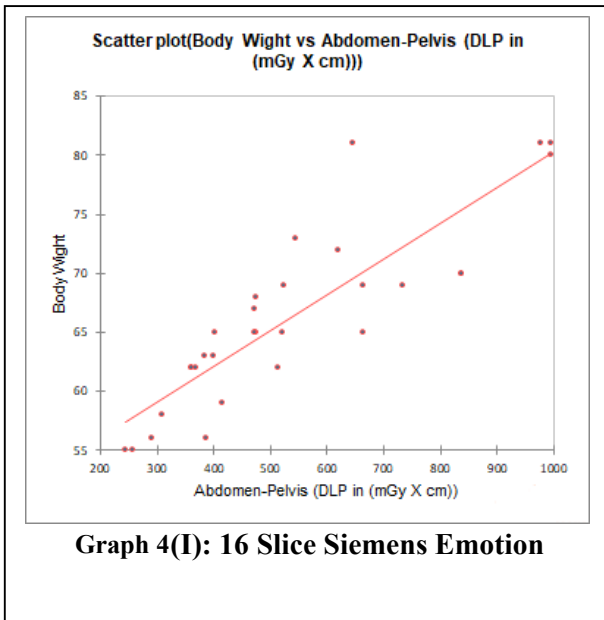
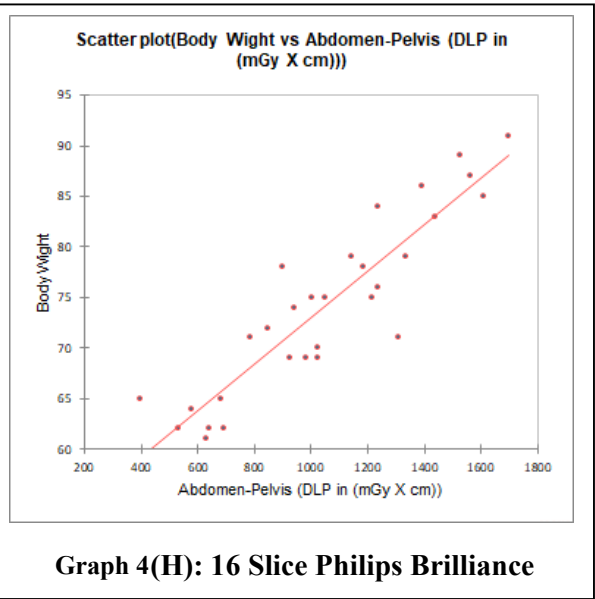
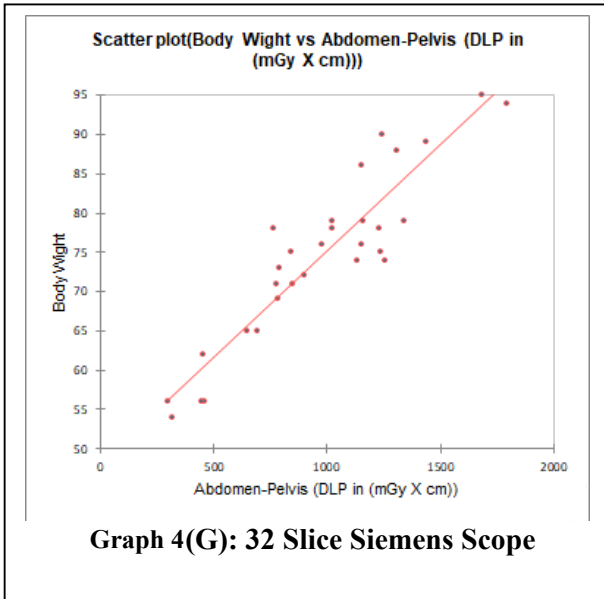
Table 8: Showing DLP received by male and female patients during CT Abdomen-Pelvis examination.

| Scanner | DPL (mGy x cm) | | | | |
|-----------------------------|----------------|--------|---------|--------|------------------|
| | Male | | Female | | All |
| | Mean | SD | Mean | SD | Mean ±SD |
| 16 Slice GE Revolution | 393.63 | 135.59 | 301.43 | 77.20 | 350.60 ± 119.88 |
| 16 Slice Siemens Emotion | 598.62 | 260.60 | 492.18 | 170.67 | 538.30 ± 216.92 |
| 16 Slice Philips Brilliance | 1020.11 | 382.44 | 1103.73 | 276.51 | 1050.77 ± 344.71 |
| 32 Slice Siemens Scope | 1123.61 | 343.91 | 746.83 | 315.99 | 972.90 ± 377.43 |
| 08 Slice GE Revolution ACTs | 687.41 | 153.77 | 549.31 | 153.71 | 687.41 ± 153.77 |
| 08 Slice Siemens Emotion | 526.86 | 197.25 | 409.63 | 132.64 | 464.33 ± 173.33 |
| 64 Slice Siemens Somatom | 1149.21 | 179.64 | 1084.50 | 398.92 | 1114.70 ± 312.82 |
| 128 Slice Philips Ingenuity | 1149.21 | 179.64 | 1084.50 | 398.92 | 1114.70 ± 212.82 |
| 64 Slice Toshiba Aquilion | 1391.79 | 187.54 | 1204.06 | 143.95 | 1291.67 ± 188.57 |
| 64 Slice GE VCT | 1166.19 | 142.96 | 1225.29 | 236.88 | 1193.77 ± 191.37 |



Graph3: Showing Means (DLP in (mGy X cm)) - Body Weight in all abdomen-pelvis scans





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Graph 4 (A) to (J): Comparing Dose length product with body weight in scatter plots in all 10 scanners separately.

Table 9: Scan parameters and dose estimates for all scanners in Abdomen-Pelvis Examination

| Scanner | N | kVp (n) | mAs [median (range)] | Pitch [median (range)] | Slice Thickness (mm) | FOV (cm) | DLP [(mGy X cm) Mean] | ED [(mSv) Mean] | |
|--------------------------|----|----------|----------------------|------------------------|----------------------|----------|-----------------------|-----------------|--------|
| | | | | | | | | Male | Female |
| 16 Slice GE Revolution | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 350.60 | 5.90 | 4.52 |
| 16 Slice Siemens Emotion | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 538.30 | 8.97 | 7.39 |



| | | | | | | | | | |
|-----------------------------|----|----------|---------|----------------|---|----|---------|-------|-------|
| 16 Slice Philips Brilliance | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 1050.77 | 15.30 | 16.56 |
| 32 Slice Siemens Scope | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 972.90 | 16.85 | 11.21 |
| 08 Slice GE Revolution ACTs | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 627.57 | 10.31 | 8.24 |
| 08 Slice Siemens Emotion | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 464.33 | 7.90 | 6.09 |
| 64 Slice Siemens Somatom | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 1114.70 | 17.27 | 16.27 |
| 128 Slice Philips Ingenuity | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 1291.67 | 20.62 | 18.05 |
| 64 Slice Toshiba Aquilion | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 1326.66 | 20.89 | 18.76 |
| 64 Slice GE VCT | 30 | 120, 180 | 180-450 | 1.00 (0.9-2.0) | 5 | 40 | 1193.77 | 17.49 | 18.38 |

The DLP is typically used to calculate overall radiation exposure for a certain CT scan. Ten scanners were utilized in the current study to investigate the role of gender and body weight in DLP-based radiation dose monitoring. Image quality was not compared between scanners, and imaging settings for each scanner were selected empirically. It should be emphasized that the DLP values that are produced rely on the parameters and do not represent how well the scanner performed. When using different imaging procedures and scanners, the dependence on sex, weight, and DLP levels varied. Plots showing how DLP and body weight are related.

300 patients underwent CT scans of abdomen-pelvis examination for different 10 MSCT scanners, each MSCT Scanner examination consisting of 30 patients. The patients that were included were selected to correspond to the typical patient (weight 45-90 kg). The DLP and effective dose were calculated in the patient. For abdomen-pelvis protocol, the mean, DLP after a scan and ED were 350.60 ± 119.88 mGy-cm and 5.026 ± 1.80 mSv for 16 Slice GE Revolution, 538.30 ± 216.92 and 8.07 ± 3.22 for

16 Slice Siemens Emotion, 1050.77 ± 344.71 and 15.76 ± 5.17 for 16 Slice Philips Brilliance, 972.90 ± 377.43 and 14.60 ± 5.66 for 32 Slice Siemens Scope, 627.57 ± 166.34 and 9.41 ± 2.49 for 08 Slice GE Revolution ACTs, 464.33 ± 173.44 and 46.94 ± 2.61 for 08 Slice Siemens Emotion, 1114.70 ± 312.82 and 16.73 ± 4.70 for 64 Slice Siemens Somatom, 1291.67 ± 188.57 and 19.20 ± 2.71 for 128 Slice Philips Ingenuity, 1326.66 ± 174.02 and 19.90 ± 2.61 for 64 Slice Toshiba Aquilion, 1193.77 ± 191.37 and 17.91 ± 2.87 for 64 Slice GE VCT as shown in table 5 and 6.

During this study body, the weight of all patients was recorded separately for each scanner for both gender patients as shown in table 7. In this study, the Body weight was compared with DLP for CT Abdomen-pelvis examinations in all 10 scanners as shown in graph 1.

DLP values were found to be sensitive to the subject's sex and weight in varying ways, with the degree of sensitivity varying among imaging techniques and scanner types. The characteristics of an imaging procedure in terms of radiation dose can be recognized with the help of the plots exhibiting the relationship of DLP with sex and weight, as illustrated in Graph



4 (A-J). It is suggested that every facility evaluate its imaging protocols using these graphs. Radiation exposures from 160 CT scans were studied by Elameen et al. in 2010 across three hospitals in Sudan¹⁰. Mean DLP values for adult patients ranged from 272-460 mGy-cm (head), 195-995 mGy-cm (chest), and 270-459 mGy-cm (body) based on a CT survey (abdomen). Each examination's effective dosage was calculated using CT dose indices, exposure-related data, and CTDI to effective dose conversion factors. Both the CT air kerma index and the dose length product fell below the criterion for acceptable radiation exposure established at the international level. Mean effective doses were 0.82 mSv for the brain, 3.7 mSv for the chest, and 5.4 mSv for the belly. When compared to other countries, Sudan had a lower effective dose per examination. Differences were found in CTDI, DLP, and ED.

Our study shows mean DLP values ranged 203-1948 mGy X cm for abdomen-pelvis examination. Each examination's effective dose was calculated, the mean effective dose was 3.04-29.22 mSv for an abdomen-pelvis examination. When compared to other countries, Sudan had a lower effective dose per examination.

The optimal dosage was calculated and put to use in medicine by Oberg et al., 2007. Their objective was to calculate the ED¹¹. Exposure doses for routine CT tests of the head, chest, and abdomen are promised by these statistics, which might be included in standard practice.

The CTDI_{VOL}, DLP, and effective dosage for the routine head, cervical spine, abdominal, and chest inspections were determined by Mastora et al. (2009) and compared to the EC¹². A CT study found that the average DLP for the abdomen in adult patients was 9.49/15.22 mSv¹². Researchers found that while results were higher for head and chest checks, they were lower for abdomen checks.

Doses given to patients getting CT scans have been the subject of multiple investigations. Research on the implementation of European Commission reference dose limits in Crete was given by Tsapaki et al.¹³. To aid in the establishment of diagnostic reference levels in

CT, studies were conducted and published by Papadimitriou et al.¹² and Hatzioannou et al.¹³, respectively, who surveyed 14 CT scanners in Greece and 32 scanners in Italy. And there were also extensive polls in the UK, Taiwan, Iran, Italy, and Tanzania. Various countries' CTDI, DLP, and effective dose measurements are compared in Table 1.

A total of 426 CT scans on adults and 26 on children were measured for Computed Tomography Dose Index (CTDI) in the air by Abdullah et al., 2009 at Malaysian hospitals. Studies performed for European guidelines, the UK, and Taiwan showed a similar range of effective dosages for routine head, routine chest, and pelvic inspections. The effective doses for routine abdominal inspection were comparable to those found in studies based on European guidelines and Taiwan, but 55.1% greater than the value from the study performed in the UK. Third-quartile values of effective doses for all CT examinations collected were provided by the study to aid in the definition of the dosage reference level for CT examinations in Malaysia¹⁴. Results showed higher CTDI and DLP for CT scans of the brain, chest, and abdomen compared to the UK.

The effective dose was quantified by Oberg et al., 2007 and used in medical practice. Specifically, they wanted to figure out the ED¹⁵. The results of this research have the potential to be utilized as the basis for standardized protocols relating to the exposure doses required for routine CT exams of the head, chest, and abdomen.

Mastora et al. (2009) computed the CTDI_{VOL}, DLP, and effective dose and compared those results with the EC¹⁶ for numerous body locations (regular head, cervical spine, belly, and chest inspections). A CT survey found that the average DLP values for adults ranged from (923.2-1394.6) mGy-cm for the brain, (854.7-1517.8) mGy-cm for the neck, and (301.0-1029.1) mGy-cm for the chest (abdomen). The average effective doses for the abdomen were 15.22 mSv. The values for the head, chest and abdomen checks were greater than in this study. Our study also shows mean DLP values ranged from 203-1948 mGy X cm for abdomen-pelvis

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examination. Each examination's effective dose was calculated, and the mean effective dose was 3.04-29.22 mSv for an abdomen-pelvis examination.

CONCLUSIONS

In conclusion, estimating the DLP for CT abdomen-pelvis scans based on patient characteristics such as sex and body weight is an important step in reducing patient radiation exposure during CT scans in North India. Healthcare providers should be aware of these factors and take steps to minimize patient radiation exposure whenever possible.

It was found that the DLP and ED for the normal Abdomen-pelvis procedure were far lower than the recommendations of the European Commission (EC). Despite the DLP and effective dose of the Chest examination being less than the EC, the diagnostic image quality was not compromised.

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Conflict of interest

The authors of this work have disclosed no potential conflicts of interest.

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