



www.bioinformation.net
Volume 22(3)



Research Article

Received March 1, 2026; Revised March 31, 2026; Accepted March 31, 2026, Published March 31, 2026

DOI: 10.6026/973206300221712

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478

2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

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Citation: Gupta *et al.* Bioinformation 22(3): 1712-1716 (2026)

Comparison of DLP and CTDI in somatom Definition Flash and GE revolution computed tomography scanners at AIIMS, India

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Abstract:

The increasing radiation exposure from computed tomography (CT) scans raises concerns about patient safety, necessitating the comparison of radiation dose parameters across different CT scanners. This study compares the Dose Length Product (DLP) and Computed Tomography Dose Index (CTDI) values between the Somatom Definition Flash and GE Revolution CT scanners at AIIMS, New Delhi. Our findings reveal that the Somatom scanner consistently operates within international Diagnostic Reference Levels (DRLs), while the GE scanner shows significantly higher radiation doses, particularly for chest and abdomen scans. This research advances the understanding of CT dose optimization and highlights the need for scanner-specific protocols to ensure radiation safety.

Keywords: Computed tomography, dose length product, diagnostic reference levels, radiation dose, tomography dose Index

Background:

Computed Tomography (CT) has become an important diagnostic tool in modern medicine, offering rapid and high-resolution imaging capabilities [1]. However, the increasing use of Computed Tomography has increased significant concerns regarding patient radiation exposure, particularly given the associated risk of stochastic effects such as radiation-induced malignancies [2]. To avoid these risks and promote dose optimization, various international regulatory bodies and professional organizations have established Diagnostic Reference Levels (DRLs) as a means to guide appropriate radiation use [3]. The European Commission (EC) [4] and the United Kingdom (UK) [5] have developed well-known DRLs for commonly performed Computed Tomography examinations, including scans of the head, chest and abdomen [6]. These DRLs serve as benchmarks for institutions to assess and refine their imaging protocols. In India, however, such benchmarking is still evolving and there is a need to compare local dose metrics with internationally recommended standards to ensure patient safety and quality assurance. This study aims to evaluate and compare radiation dose parameters specifically the Dose Length Product (DLP) and Computed Tomography Dose Index (CTDIvol) between two advanced multi-detector Computed Tomography systems, the Somatom Definition Flash (Siemens) and the GE Revolution (GE Healthcare), both currently in use at the All India Institute of Medical Sciences (AIIMS), New Delhi [7]. Therefore, it is of interest to compare the radiation dose parameters, Dose Length Product and CTDIvol, between the Somatom Definition Flash and GE Revolution Computed Tomography scanners at AIIMS, New Delhi, against international Diagnostic Reference Levels (DRLs).

Methodology:

This study was done as a retrospective observation carried at the Department of Radiodiagnosis, All India Institute of Medical Sciences (AIIMS), New Delhi. Study was done with aim to assess radiation doses from routine Computed Tomography scans performed using two types of multi-detector Computed Tomography scanners which was the Somatom Definition Flash and the GE Revolution. Both non-contrast and contrast-enhanced studies of the head, chest and abdomen scans were included in the study. Data collection was done for six months,

from January to June 2025. We used records from the hospital's digital imaging and reporting systems to identify all Computed Tomography scans done during this time for the three body regions. Only adult patients (18 years and older) scanned for regular diagnostic reasons (not emergencies) were considered. Scans which have a complete dose report with both CTDIvol and Dose Length Product values were considered for the study. Any scans with missing or incomplete data, images with major motion problems or repeat scans, as well as those from children or involving multiple phases of contrast, were not considered in the study. For each anatomical region head, chest and abdomen at least 50 scans per scanner type were reviewed to make the results reliable. The radiation dose parameters, CTDIvol (measured in mGy) and Dose-Length Product (DLP, in mGy cm), were taken from auto-generated dose reports produced by the Computed Tomography scanners. Both scanners operated with standard hospital protocols designed for best image quality and diagnostic accuracy and the settings were matched as closely as possible. This included checking scan range, tube voltage, current control, pitch, rotation time and use of automatic exposure controls. After the data collection the recorded dose values were compared with safety standards set by both the European Commission (EC) and the UK National Diagnostic Reference Levels (NDRL) and other international DRL values. For analysis, the median values for each scanner and region were calculated. Differences between the scanners were tested using standard statistical methods considering p value <0.05 for statistical significance. The study followed all ethical requirements. Approval was granted by the Institutional Ethics Committee at AIIMS, with patient consent not required because the study used only previously recorded data.

Results:

In this study, two major radiation dose metrics Dose-Length Product (DLP) and Computed Tomography Dose Index Volume (CTDIvol) were evaluated for routine adult CT scans performed on Somatom and GE scanners at AIIMS. The Somatom scanner produced DLP values well below both EC and UK DRLs for all anatomical regions, showing optimized scanning protocols. The GE scanner, in contrast, generated significantly higher DLPs for all regions, particularly in the chest (1020 mGy cm) and abdomen (1150 mGy cm), exceeding EC and UK reference levels.

The excess dose reported for GE scans highlights the need for protocol review and dose optimization. Somatom values for CTDIvol stayed consistently below or near both UK and EC limits, confirming adequate dose management. GE values, however, showed elevated CTDIvol across all three regions, with the head (73 mGy) and chest (19 mGy) values higher than EC and UK limits. Abdomen CTDIvol (20 mGy) was within the broader EC range but remained above UK DRLs (10 mGy). These results emphasize the need for dose optimization protocols on GE systems, particularly for head and chest imaging, to minimize patient radiation exposure. **Table 1**

Table 1: Comparison of Dose Length Product median values (in mGy cm) recorded for Somatom and GE scanners with EC and UK Dose Length Product reference levels.

Region	Somatom Median DLP	GE Median DLP	EC DRL (mGy) [7]	UK NDRL (mGy)[5]	Somatom vs DRL	GE vs DRL
Head	780	1,470	1,050	960	Low	High
Chest	217	1,020	650	560	Low	High
Abdomen	306	1,150	780–900	700	Low	High

Table 2: Comparison of median CTDIvol values with UK NDRLs and EC guidelines.

Region	Somatom CTDIvol	GE CTDIvol	EC DRL (mGy) [7]	UK NDRL (mGy) [5]	Assessment
Head	45	73	60	47	Somatom: compliant; GE: exceeds both
Chest	6	19	12	8.5	Somatom: compliant; GE: exceeds both
Abdomen	7	20	15	10	Somatom: compliant; GE: exceeds UK, near EC

Table 3: Other state/ International Computed Tomography Dose Index Values (mGy)

Country/Region	Abdomen	Chest *	Chest **	Head
South India [11]	12	10	-	47
Puducherry, India [12]	16	12	-	32
Kerala, India [13]	9	5	-	27
IAEA CRPR [14]	10.9	9.5	-	47
Jordan [15]	17.9	-	-	-
EC [16]	13–35	10	10	60
USA [17]	-	12	13	56
Singapore [18]	11	9	-	41
Japan [19]	-	15	15	85
Canada [20]	-	14	14	82
UK [17]	14	12	12	60
Australia [17]	-	15	15	60
Korea [21]	10.58	-	7.3	63.7
Ireland [22]	13	9	9	58
Syria [23]	24.1	22	30.5	60.7
Turkey [23]	13.3	11.6	11.3	66.4
Our Study (Somatom)	7	6	-	45
Our Study (GE)	20	19	-	73

Chest * = non-contrast Scan, Chest ** = Contrast Scan.

Table 4: Other state/ International Dose Length Product Values (mGy cm)

Country/Region	Abdomen	Chest *	Chest **	Head
South India [11]	550	445	-	1041
Puducherry, India [12]	482	456	-	925
Kerala, India [13]	319	164	-	620
IAEA CRPR [14]	696	447	-	527
Jordan [15]	929	-	-	-
EC [16]	460–1200	400	400	1000
USA [17]	-	443	469	962
Singapore [18]	437	226	-	718
Japan [19]	-	550	550	1350
Canada [20]	-	521	521	1302
UK [17]	910	610	610	970
Australia [17]	-	450	450	1000
Korea [21]	1511.41	-	297.05	1119.4
Ireland [22]	1120	390	390	940
Syria [23]	721	520	133	793
Turkey [23]	204	289	283	810
Our Study (Somatom)	306	217	-	780
Our Study (GE)	1150	1020	-	1470

Chest * = non-contrast Scan, Chest ** = Contrast Scan.

presents a comparison of Dose Length Product median values (in mGy cm) recorded for Somatom and GE scanners with the European Commission (EC) and UK Dose Length Product reference levels. **Table 2** compares the median CTDIvol values with UK NDRLs and EC guidelines for both scanners. **Table 3** outlines the other state and international Computed Tomography Dose Index values (in mGy) across various countries and regions. Finally, **Table 4** provides a comparison of other state and international Dose Length Product values (in mGy cm) for different anatomical regions and scanners.

Somatom scanner consistently showed lower Dose Length Product values, showing better radiation dose optimization and safety. In contrast, the GE scanner demonstrated significantly higher Dose Length Product values across all regions, especially for Chest and Head CTs, showing a need for protocol review and optimization. When compared with the European Commission (EC) and IAEA reference levels, Somatom values were well within acceptable limits, whereas GE values often exceeded international diagnostic reference levels (DRLs), raising concerns regarding radiation exposure.

Discussion:

This study aimed to evaluate radiation dose levels delivered during routine adult Computed Tomography scans at a tertiary care institution, using two different multidetector Computed Tomography scanners (Siemens Somatom and GE systems). Dose metrics, including Dose Length Product (DLP) and Computed Tomography Dose Index Volume (CTDIvol), were assessed for head, chest and abdomen Computed Tomography protocols. The Computed Tomography Dose Index (CTDI) values observed in our study using two different scanners Somatom and GE were compared with available data from other Indian states and international references. In head examinations, the Siemens Somatom scanner recorded a median Dose Length Product of 780 mGy cm, which is below both the EC DRL (1050 mGy cm) and the UK NDRL (960 mGy cm), demonstrating appropriate dose optimization consistent with international standards. In contrast, the GE system showed a median head Dose Length Product of 1470 mGy cm, exceeding both EC and UK thresholds, showing the possibility of unnecessary radiation exposure in routine protocols. Computed Tomography Dose Index vol values show a similar pattern. The Somatom measured 45 mGy, similar to the UK DRL (47 mGy) and EC DRL (60 mGy), whereas the GE system showed 73 mGy, exceeding both

reference levels. Higher GE head values may be attributed to fixed high tube current, limited modulation controls, or non-optimized helical parameters. Comparable findings have been seen in international study by Atli *et al.* (2022), who showed head CTDI_{vol} medians of 61.1 mGy on standard protocols in Turkey showing the need for optimization when scanners exceed DRLs [8]. In head CT, the Somatom scanner reported 45 mGy, which is comparable to values from South India (47 mGy) and IAEA CRPR (47 mGy) and lower than those from the UK (60 mGy), Ireland (58 mGy) and Canada (82 mGy). The GE scanner, however, showed a head Computed Tomography Dose Index of 73 mGy, which is notably higher than most regional and global references except Japan (85 mGy) and Canada (82 mGy). For head scans, the Somatom scanner had a Dose Length Product of 780 mGy cm, which is below average, comparable to Turkey (810) and Syria (793) and lower than South India (1041), USA (962) and Canada (1302). The GE scanner recorded a very high Dose Length Product of 1470 mGy cm, exceeding almost all reported values, including Japan (1350), Canada (1302) and Korea (1119.4). The performance gap is most pronounced in chest CT. The Somatom scanner achieved a very low median chest Dose Length Product of 217 mGy cm, well beneath the EC (650 mGy cm) and UK (560 mGy cm) DRLs. Its CTDI_{vol} value (6 mGy) is also below both guidelines (UK: 8.5 mGy; EC: 12 mGy), reflecting effective protocol optimization through techniques like automated exposure control and low-kVp imaging. However, the GE scanner yielded substantially elevated doses: CTDI_{vol} of 19 mGy and Dose Length Product of 1020 mGy cm, both nearly twofold above international reference levels. This mirrors trends reported in some multicenter European studies, where chest Computed Tomography DLPs ranged from 700–1100 mGy cm depending on scanner calibration and user-dependent factors. These findings show that dose modulation and acquisition parameters in the GE system require immediate review to meet international safety standards. For chest CT, our Somatom scanner showed a Computed Tomography Dose Index of 6 mGy, which is lower than nearly all regional and international values, including Kerala (5 mGy), South India (10 mGy) and IAEA CRPR (9.5 mGy). The GE scanner showed a Computed Tomography Dose Index of 19 mGy, which is among the highest reported, surpassing those from Syria (22 mGy), Japan (15 mGy) and Canada (14 mGy). The Somatom scanner recorded a Dose Length Product of 217 mGy cm, which is among the lowest values, even lower than Kerala (164) and Turkey (289). It shows effective dose optimization. The GE scanner, however, produced a very high Dose Length Product of 1020 mGy cm, which is significantly higher than all national and international benchmarks, including UK (610), Japan (550) and EC (400). Similar trends were observed in abdominal Computed Tomography scans.

Somatom's CTDI_{vol} of 7 mGy and Dose Length Product of 306 mGy cm were again well below both EC (CTDI_{vol}: 15 mGy; DLP: 780–900 mGy cm) and UK limits (CTDI_{vol}: 10 mGy; DLP: 700 mGy cm). These are reflective of optimized scanning protocols and rational exposure justification. Conversely, the GE

system had the highest abdomen Dose Length Product at 1150 mGy cm and CTDI_{vol} at 20 mGy. While the CTDI_{vol} is within the broader EC range (often reported between 15–25 mGy), it still substantially exceeds UK standards, which dictate a CTDI_{vol} of 10 mGy. Comparable values were noted by Sabiniewicz-Ziajka *et al.* where adult abdominal CTDI_{vol}s across multiple centers ranged from 12–20 mGy, identifying large variability attributable to scanner settings and user practices [9]. Similarly to our study, Sulieman *et al.* [10] found the mean and range of 28.2 (3.0–13.0) CTDI_{vol} (in mGy) for the abdomen. For abdominal Computed Tomography scans, the Somatom scanner in our study reported the lowest Computed Tomography Dose Index of 7 mGy, which is significantly below the values reported from South India (12 mGy), Puducherry (16 mGy) and Kerala (9 mGy). Even when compared to international benchmarks such as the IAEA CRPR (10.9 mGy), Korea (10.58 mGy) and the UK (14 mGy), our Somatom Computed Tomography Dose Index remains lower. In contrast, the GE scanner recorded a higher abdominal Computed Tomography Dose Index of 20 mGy, which exceeds values from most regions except Syria (24.1 mGy) and falls within the range reported by the European Commission (13–35 mGy). The Somatom scanner in our study showed a relatively low Dose Length Product of 306 mGy cm, which is lower than values reported from South India (550), Puducherry (482) and IAEA CRPR (696). It is also below international benchmarks such as the UK (910), Ireland (1120) and Korea (1511.41). In contrast, the GE scanner recorded a much higher Dose Length Product of 1150 mGy cm, which is among the highest values, comparable to Ireland (1120) and slightly lower than Korea (1511.41), but higher than the EC's upper limit (1200). Furthermore, Gupta *et al.* (2025) [11] further reinforce the present findings by showing, through a comparative assessment of routine CT dose indices across two tertiary care hospitals in Delhi NCR, that inter-institutional variation in DLP and CTDI persists in clinical practice, highlighting the importance of ongoing protocol review, dose monitoring, and optimization to improve radiation safety without compromising diagnostic utility.

Conclusion:

Radiation doses from two Computed Tomography scanners show that the Siemens Somatom scanner consistently delivers lower CTDI_{vol} and Dose Length Product values, staying within or below diagnostic reference levels (DRLs). However, the GE scanner produces high doses, particularly in chest and head CTs, often exceeding DRLs. These findings emphasize the need for protocol optimization, scanner-specific calibration and periodic dose audits to ensure patient safety and adherence to ALARA principles.

References:

- [1] Hussain S *et al.* *Biomed Res Int.* 2022 **2022**:5164970. [PMID: 35707373].
- [2] Chen J *et al.* *Front Public Health.* 2025 **13**:1626906. [PMID: 40756407]
- [3] Abe K *et al.* *Ann Nucl Med.* 2025 **39**:1027. [PMID: 40900285]

- [4] <https://www.scirp.org/reference/referencespapers?referenceid=3023821>
- [5] <https://www.gov.uk/government/publications/diagnostic-radiology-national-diagnostic-reference-levels-ndrls/ndrl>
- [6] Malik MMUD *et al. Diagnostics*. 2024 **14**:1585. [PMID: 39125460]
- [7] Union PO of the E. *European guidelines on quality criteria for computed tomography*, 2000.
- [8] [\[https://www.dr.dk/guidelines/ct/quality/htmlindex.htm\]](https://www.dr.dk/guidelines/ct/quality/htmlindex.htm)
- [9] Athi E *et al. Diagnostic and Interventional Radiology*. 2021 **27**:147. [PMID: 33475510].
- [10] Sabiniewicz-Ziajka D *et al. Biomedicines*. 2024 **12**:600. [PMID: 38540213]
- [11] Sulieman A *et al. Radiation Physics and Chemistry*. 2020 **174**:108963. [DOI: 10.1016/j.radphyschem.2020.108963]
- [12] Gupta *et al. Bioinformation*. 2025 **21**: 4991. [DOI: DOI: 10.6026/973206300214991]

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