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Original Article

Abdominal DSCT Effectiveness of Contrast Media Dose on Basis of BMI

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ABSTRACT

Background: Dual-Source Computed Tomography (DSCT), which provides high-resolution imaging essential for precise diagnosis and treatment planning, is a mainstay in the diagnosis of abdominal diseases. In order to maximize image quality, contrast media are essential for highlighting vascular structures and lesions. However, patient-specific factors might affect the effectiveness of contrast media, and one important element to consider is body mass index (BMI). BMI, a measurement of body fat based on height and weight, is frequently associated with imaging difficulties because of changed contrast agent pharmacokinetics and increased tissue attenuation. **Methods:** The examinations were performed at SRMS IMS Bareilly with a 128 slice and 32 slice CT scan. An arterial phase was performed before the portal venous phase for all CT scans. The variables studied were as follows: Patients' characteristics: age, sex, weight, height, BMI, the patient Acquisition and iodinated contrast media protocols: kV, mA, concentration, volume, injection rate, duration of ICM injection, and contrast enhancement of the contrast of the liver parenchyma and organ of abdomen. **Results:** The age distribution of patients is shown in the table 1 and figure1. There are four age group divisions: 11–30, 31–50, 51–70, and above 71. Patient in the 51–70 age range creates the largest age group i.e. 38% of total patients included in this study. The Ages 31 to 50 creates the second largest age group i.e. 33% and Patients above 71 create the smallest age group i.e. 4% of total patients included in this study. The mean age of patients is 23.5 years, with a standard deviation of 14.1 years. This shows that the sample's average age is 23.5 years, with individual members' ages varied by about 14.1 years from this average. **Conclusion:** The study Abdominal DSCT Contrast enhance Computer tomography increasing the image quality of CT (cross-sectional image) and all digestive organ most frequency visualize insufficient, sufficient and satisfactory form, on the basis the BMI shows the image quality more as satisfactory 76% second is sufficient 22% and third is 2% is insufficient.

Keywords: NCCT, CECT, ROI, BMI, DLP, CTDI, CT, MDCT, HU, ED, TBW

INTRODUCTION

Dual-source CT (DSCT) offers fast, high-quality abdominal imaging(1), but consistent contrast enhancement can vary with patient size(2). Body mass index (BMI) significantly influences contrast distribution, potentially leading to suboptimal imaging in obese patients. This study explores the effectiveness of adjusting contrast media dose based on BMI, aiming to achieve uniform enhancement, reduce iodine usage, and improve diagnostic accuracy across varying body types in abdominal DSCT imaging(3) . Research investigates the effectiveness of adjusting iodinated contrast media doses in abdominal CT scans based on lean body weight instead of total body weight. Traditional dosing overlooks individual body composition, often leading to underdosing in muscular or lean individuals and overdosing in obese patients. By adopting a lean body weight-based approach, this study aims to enhance image quality, ensure diagnostic accuracy, and reduce unnecessary contrast exposure(4). Computed tomography (CT) is a popular imaging modality in medicine since it may detect several disorders. Contrast media whether intravenous, oral & rectal, enhance image quality of abdomen. Contrast enhancement may not always be necessary and can pose dangers. Contrast enhancement is usually acceptable for the presumed diagnosis. When the diagnosis is unknown, using contrast can be beneficial, but the dangers should be considered(5–10). All modern contrast agents contain iodine. Iodine

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produces enhanced absorption and scattering of incoming radiation, increasing the tissue or organ's attenuation or "brightness". Oral contrast can assist identify the bowels from other abdominal tissues(11). Oral contrast comes in two varieties: neutral and positive. Water or a dilute, low-attenuation fluid that resembles water make up neutral oral contrast. Positive oral contrast is an iodinated (e.g., Gastrografin) or barium-based solution with high attenuation that opacities the colon. The introduction of multidetector CT, which provides higher resolution, has made it simpler to distinguish abdominal structures without the use of pacification with positive oral contrast(3,12–16).

Objectives-

To evaluate the BMI of the patient preferred for CECT. Assessment of contrast dose with the help of BMI, to assess the image quality of CECT abdomen.

METHODS

Study Type

This was a **cross-sectional observational study**, aimed at evaluating the effectiveness of contrast media dose in abdominal DSCT based on patients' body mass index (BMI).

Study Design

The study was designed prospectively, applying a uniform imaging protocol to all enrolled patients undergoing elective contrast-enhanced CT (CECT) of the abdomen.

Study Area

The research was conducted at the **Department of Radio-Diagnosis and Imaging**, **SRMS Institute of Medical Sciences, Bareilly, Uttar Pradesh**.

Study Duration

Data collection spanned a total of **6 months**, including a broad range of clinically indicated abdominal imaging cases.

Study Population

All patients referred for CECT abdomen during the study period were considered for inclusion, excluding those undergoing emergency scans. Final eligibility was determined based on clinical indications and exclusion criteria.

Method of Data Collection

CT imaging was performed using both 128-slice and 32-slice dual-source scanners. Each patient underwent arterial and portal venous phase imaging. Demographic and scan-related data such as age, sex, weight, height, BMI, tube voltage (kV), current (mA), contrast volume, concentration, injection rate, and duration were documented. BMI was categorized using WHO criteria. Contrast enhancement was measured by calculating the difference in Hounsfield Units (HU) in liver segment IV between non-contrast and portal venous images. Aortic enhancement of ≥211 HU during the arterial phase was considered diagnostically adequate. Regions of interest (ROIs) were consistently placed, measuring approximately 1–2 cm²(17).

Setting and Resources

The study used the existing imaging infrastructure at SRMS IMS. Patient anthropometric measurements were recorded using **calibrated devices**. Imaging analysis was conducted via the institutional PACS system by qualified radiology staff.

Statistical Analysis

The final sample size was set at **94 participants**. Data analysis included descriptive and comparative statistics across BMI groups, with a significance level of **$p < 0.05$**.

Ethical Considerations

The study protocol received approval from the Institutional Ethical Committee (IEC) of SRMS, IPS/IMS, Bareilly. Ethical Clearance Certificate Reference No-SRMS/IPS/ECC/2022/029.

RESULTS

The age distribution of patients is shown in the table 1 and figure1. There are four age group divisions: 11–30, 31–50, 51–70, and above 71. Patient in the 51–70 age range creates the largest age group i.e. 38% of total patients included in this study. The Ages 31 to 50 creates the second largest age group i.e. 33% and Patients above 71 create the smallest age group i.e. 4% of total patients included in this study. The mean age of patients is 23.5 years, with a standard deviation of 14.1 years. This shows that the sample's average age is 23.5 years, with individual members' ages varied by about 14.1 years from this average.

Table 1: -Distribution of patients according to their age group

Age group	Frequency	%
11-30	23	24%
31-50	31	33%
51-70	36	38%
above 71	4	4%
Total	**94**	**100%**
Mean±SD	**23.5±14.1**	

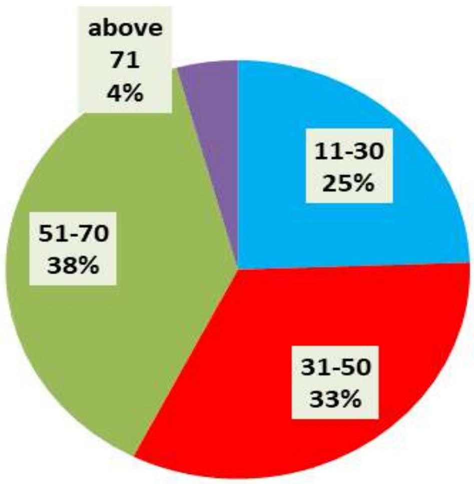

Figure 1: - Distribution of patients according to their age group

Data on the distribution of genders within a patient, including frequencies and percentages for each sex, are shown in the table and Figure2.The percentages show how many people in each sex there are in relation to the 94 overall sample size. At 61% of the patients as male and three-nine percent of patients are female.

Table 2: - Distribution of patients according to their gender group

Gender	Frequency	%
Male	57	61%
Female	37	39%
Total	**94**	**100%**

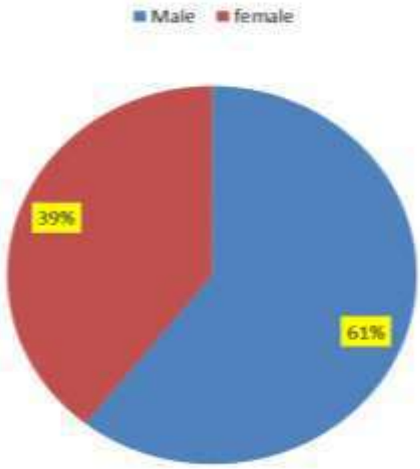

Figure 2: - Distribution of patients according to their gender group

The Table and Figure 3 show frequencies and percentages for each weight category and offer information on the weights distributed between a patients. The 61–80 is the weight group with the largest frequency, making up 49% of the all. The weight range of 41–60, comprise 41% and the weight categories 40 and >81 are 4% and 5%. The mean weight is 63.07 units, with a 12.58-unit standard deviation.

Table 3: - Distribution of patients according to their weight group.

Weight	Frequency	%
<40	4	4%
41-60	39	41%
61-80	46	49%
>81	5	5%
Total	**94**	**100%**
Mean ± Sd	**63.07±12.58**	

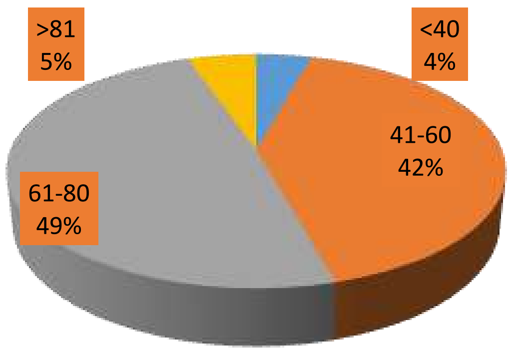

Figure 3: - Distribution of patients according to their weight group.

Patient's distribution of Body Mass Index (BMI) categories, together with their frequencies and percentages, are shown in the data that is provided. Underweight with a BMI of less than 18.5, 7% of the patients is considered underweight. Normal Weight with BMIs ranging from 18.5 to 25, the majority of the patients 69% the normal weight group. Overweight with BMIs ranging from 25 to 30, 20% of the sample is classified as overweight. Obese of the sample, just 4% have a BMI of 30 or more, making them obese with a standard deviation of 4.23, and mean BMI is 23.24.

Table 4: - Distribution of patients according to their BMI group.

BMI	Frequency	%
Underweight referred to BMI	6	7%
Normal weight referred to BMI	65	69%
Overweight referred to BMI	19	20%
Obese referred to BMI	4	4%
Total	**94**	**100%**
Mean ± Sd	**23.24±4.23**	

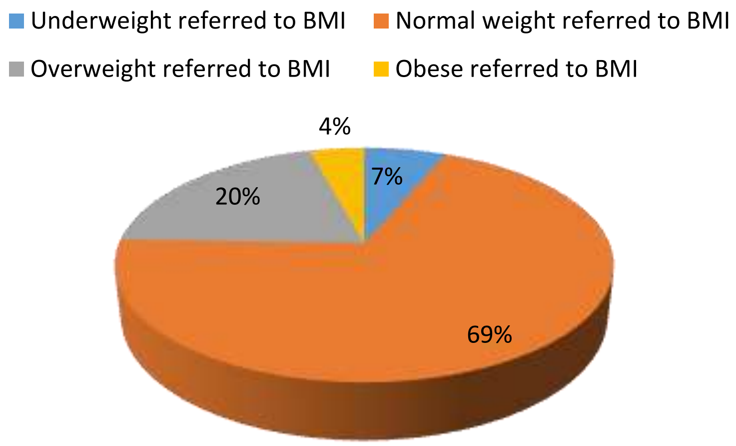

Figure 4: - Distribution of patients according to their BMI group.

Group1: This group consists of five patients. Their CM (assuming contrast media dose) is less than or equal to 50, and their BMI (body mass index) is within the range of less than or equal to 18.5kg/m². Group 2: This group consists of a single patient. Their CM dosage is between 50 and 60, and their BMI is between 18.5 and 25 kg/m². Group 3: This group consists of 84 patient. Their CM dosage is between 70 and 80, and their BMI is between 25 and 30 kg/m². Group 4: This group consists of 4 patients. Their CM dosage is more than or equal to 81, and their BMI is more than or equal to 30 kg/m². Total: There are ninety-four patient in all the groupings. It appears that this table classifies people according to their BMI and the amount of contrast media (CM) they are prescribed

Table 5 Showing range of CM dose given in different Groups

Group	Frequency	BMI (kg/m²)	CM dose
1	5	<=18.5	<=50
2	1	18.5- 25	50-60
3	84	25- 30	70-80
4	4	>=30	>=81
Total	94		

The height distribution among the 94 patients revealed that the **majority (91.49%)** measured **151 cm or more**, while **7.45%** fell in the **121–150 cm** range. Only **1.06%** of patients had a height of **120 cm or less**. The **mean height** was calculated as **162.98 cm**, with a **standard deviation of ±20.36 cm**, indicating moderate variability within the study group.

Table 6: - Distribution of patients according to their height group.

Height categories	Frequency	%
<=120	1	1.06%
121-150	7	7.45%
>=151	86	91.49%
Total	94	100%
Mean± Sd	162.98 ± 20.36	

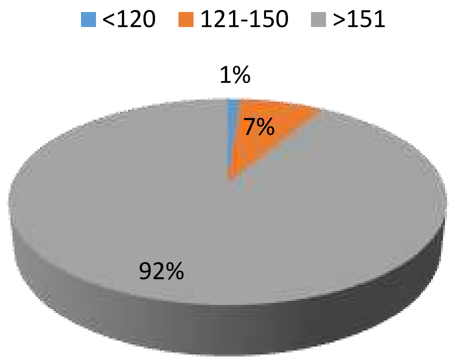

Figure 6: - Distribution of patients according to their height group

Out of the 94 patients evaluated, the majority (**76%**) demonstrated **satisfactory image quality** across all BMI categories. Notably, **underweight patients (n=5)** consistently showed satisfactory image quality. Among **normal-weight individuals**, most images (48 out of 62) were satisfactory, while a smaller portion had **sufficient (12)** or **insufficient (2)** quality. In the **overweight group**, 16 had satisfactory, and 7 had sufficient image quality, with no cases of insufficient quality. For **obese patients**, image quality was either satisfactory (2) or sufficient (2), indicating some limitation in achieving optimal imaging at higher BMI levels. Overall, only **2% of scans** were deemed **insufficient**, emphasizing generally effective image acquisition across BMI groups.

Table 7 distribution of patients according to their BMI and image quality

Image quality	BMI					
	Underweight referred to BMI	Normal weight referred to BMI	Overweight referred to BMI	Obese referred to BMI	Total	%
Insufficient	0	2	0	0	2	2%
Sufficient	0	12	7	2	21	22%
Satisfactory	5	48	16	2	71	76%
TOTAL	5	62	23	4	94	100%

DISCUSSION

Grande P .et .al A total of 218 patients were enrolled in this study. The female sex represented 124 patients (56.88%), and the male sex represented 94 patients (43.12%) with a sex ratio of 1.3. The mean age was 50.92 ± 15.78 with extremes of 6 and 85 years. The mean weight of the patients was 70.46 ± 15.23 kg, and the mean height was 1.67 ± 0.08 m. The mean BMI was 24.91 ± 5.32 kg/m2. Most of the patients had normal weight (n =114; 52.29%). Bae. T. K. et.al, The study's objective was to assess the impact of obesity, body mass index (BMI), height, body weight, and body surface area (BSA) on aorta contrast enhancement in MDCT .in this study, 73 patients undergo cardiac CT angiography on the 64 MDCT scanner A significant negative association was observed between body weight and aortic attenuation (r = – 0.73, ρ = –0.74, $p < 0.001$), suggesting that patients who weigh more had less aortic attenuation. The aorta attenuation of 355 H can be obtained by administering 1.0 mL/kg (i.e., 75 mL for a patient weighing 75 kg) of 350 mg I/mL of contrast medium, according to the regression formula (aortic attenuation [H] = 520 – 2.2 weight [kg]). A significant inverse relationship was seen between height and aortic attenuation (r = –0.47, $p < 0.001$), suggesting that taller patients have less aortic attenuation. According to the regression calculation (aortic attenuation [H] = 882 – 3.3 height [cm] ($p < 0.001$), there appears to be a drop in enhancement of 33 H in the aortic attenuation for every 10 cm rise in height. Aortic attenuation and BMI have a rather high inverse connection (r = –0.63, ρ = –0.64, $p < 0.001$). This suggests that patients with higher BMI had less aortic attenuation. Aortic attenuation (H) = 529 – 6.8 BMI ($p < 0.001$) was the regression formula. Zanardo.m.et.al This study the total body weight (TBW) of the patient is usually used to calculate the contrast agent (CA) dose for abdominal computed tomography (CT), neglecting the distribution of adipose tissue. Our experience with dosing based on lean body weight (LBW) is reported. retrospectively assessed 219 consecutive patients after receiving approval from the ethics committee; 18 of them were omitted because they did not meet the inclusion criteria. Based on a contrast-enhanced abdominal CT scan with iopamidol (370 mgI/mL) or iomeprol (400 mgI/mL), 201 patients (106 males) were analyzed. LBW was calculated with the use of proven formulas. The enhancement of liver contrast (CEL) was quantified. The information was presented as mean ± standard deviation. Utilized were the Levene test, ANOVA, and Pearson correlation coefficient. Mean age was 66±13 years, TBW 72±15 kg, LBW 53±11 kg, and LBW/TBW ratio 74±8%; body mass index was 26±5 kg/m2, with 9 underweight patients (4%), 82 normal weight (41%), 76 overweight (38%), and 34 obese (17%). The administered CA dose was 0.46±0.06 gI/kg of TBW, corresponding to 0.63±0.09 gI/kg of LBW. A negative correlation was found between TBW and CA dose (r=-0.683, p< 0.001). A low but significant positive correlation was found between CEL and CA dose in gI per TBW (r=0.371, p<0.001). Due to a "compensation effect" induced by radiologists, the injected dose of CA varied greatly, with obese patients receiving a lower dose than underweight patients. It is possible to achieve diagnostic abdomen CT examinations with 0.63 gI/kg of LBW. My study 94 patients involve the male patient 61% and female patient 39% shows in the figure and table 2, the table and figure 1 shows the age distribution, first age group have the 23 patients 24% and second group is having the 31 patients 33%. Third group have large number patients, 36 patients ,38%, forth group have the small number of patients 4, 4%.the mean age shows 23.5 and standard deviation 14.1. According to figure and table 3 presented data shows the distribution of patient's basis on weight group, as well as frequencies and percentages. Weight <40: 4 patients' percentage in 4%. Weight 41-60: 39 patients, percentage 41%. Weight 61-80: 46 patients' percentage 49%. Weight >81: 5 patients' percentage 5%. The data indicates that the bulk of patients lie within the weight range of 41-80, with fewer in the extreme weight groups (40 and >81). The mean weight of 63.07 with a standard deviation of 12.58. Overall, this data obtains to understand the patients ' weight and can be used for a variety of analyses or interpretations, in the CT scan According to figure and table 4 presented data shows the distribution of patients by Body Mass Index (BMI) group, as well as frequencies and percentages. Underweight (BMI): 6 patients, 7%. Normal weight (BMI): 65 patients, 69%. Overweight (BMI): 19 patients, 20%. Obese (BMI): 4 patients, 4%. The mean BMI obtained from these data is 23.24, with a standard deviation of 4.23. This data reveals that the majority of participants have normal weight, with fewer classed as underweight, overweight, or obese. This data our understanding of the patients, on basis of BMI injected the contrast dose to the patients. According to table 5 presented shows the distribution of patients into distinct groups based on their Body Mass Index (BMI), as well as the relevant medication frequencies and dosages (CM dose). Group 1 had 5 patients with a BMI of <=18.5 who received a CM dose of <=50.Group 2: One patient with a BMI between 18.5 and 25 received a CM dose of 50 to 60. Group 3 included 84 patients with a BMI of 25 to 30 who received a CM dose of 70 to 80. Group 4 included four patients with a BMI of 30 or above who received a CM dose of at least 81. This distribution shows that the majority of patients are in Group 3, which corresponds to overweight persons getting a moderate CM dose. Individuals with lower BMIs are divided into two groups: Group 1 (underweight) and Group 2 (normal weight), both of which get lesser doses of the contrast media. Group 4 included obese subjects who received a greater CM dose. contrast doses can be tailored depending on BMI to improve image quality outcomes while reducing potential side effects or inefficiencies associated with under or overdose. According to figure 5 and table 6 presented shows the distribution of patients by height, as well as frequencies and percentages. One patients (1.06% of the total) had a height of less than 120 cm. Height 121-150 cm: 7, 7.45% .86 patients with a height of more than 151 cm, 91.49%. The mean height calculated from this data is 162.98 cm, with a standard deviation of 20.36 cm. This distribution indicates the bulk of individuals are taller than 151 cm, with only a small fraction being shorter. The mean height of 162.98 cm with a standard deviation of 20.36 cm indicates a modest amount of height diversity among the participants, with the standard deviation representing the spread of heights around the mean. According to table 7 presented data shows the distribution of participants depending on their Body Mass Index (BMI) categories and the related assessment of image quality, which is classified as insufficient, sufficient, or satisfactory. Underweight was defined as having a BMI of insufficient (0), sufficient (0), satisfactory (5), total (5), or percentage (5.32%). Normal weight according to BMI: insufficient (2), sufficient (12), satisfactory (48), total (62), and percentage (65.96%) Overweight was defined as BMI: insufficient (0), sufficient (7), satisfactory (16), total (23), and percentage (24.47%). Obese refers to BMI: insufficient (0), sufficient (2), satisfactory (2), total (4), and percentage (4.26%). With variable proportions classified as sufficient or insufficient, the overall distribution shows that most individuals across all BMI groups obtained a good assessment of image quality. Compared to participants who are classed as underweight or normal weight, individuals who are overweight or obese have a larger patient of satisfactory image quality. This could imply that body composition or structural changes linked to various BMI categories could have an impact on the evaluation of image quality. Comprehending the correlation between BMI classifications and evaluations of picture quality can be pivotal in many domains, specifically in medical imaging where the precision and clarity of images significantly influence the accuracy of diagnosis. The identification of potential determinants of picture quality assessments, such as BMI, might guide the development of image processing approaches customized to particular patient features or the optimization of imaging protocols.

CONCLUSION:

This study highlights the impact of Body Mass Index (BMI) on contrast media (CM) dosing and image quality in CT imaging. Among 94 patients, most had normal (69%) or overweight (20%) BMI, with the CM dose appropriately adjusted based on body composition. Image quality was rated satisfactory in 76% of cases, sufficient in 22%, and insufficient in only 2%, demonstrating effective imaging protocols. Notably, underweight and normal-weight individuals showed consistently good image quality, while slight variability was observed in obese patients, possibly due to anatomical and physiological differences. The mean values for height, weight, and BMI indicate a moderately diverse population, yet the protocol maintained diagnostic accuracy across groups. These findings support the importance of BMI-based CM dosing to achieve optimal imaging outcomes. Tailoring contrast doses can enhance image quality, minimize exposure, and improve diagnostic precision, especially in patients with higher or lower BMI. Personalized imaging approaches are thus recommended

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