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TO INVESTIGATE EFFECTIVENESS OF PERSONALISED I.V CONTRAST MEDIUM DOSE FOR CECT ABDOMEN BASED ON BMI

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Abstract: *The radiation exposure to the patient associated with computed tomography (CT) imaging utilizing an iodinated contrast liquid may need to be reduced depending on the BMI Included articles from various journals which conducted studies on CM administration on basis of BMI or LBW or BSA of patients undergoing CT abdomen. In most studies, four groups were formed and the mean level of improvement in each group was compared. They found consistent improvements, especially in overweight individuals. The results were not significant for underweight individuals, suggesting that instead of administering a fixed dose based on LBW or TBW, CM dosing could be used without compromising image quality. was found to be adjustable CM dosing for abdominal CT adjusted for BMI or LBW or BSA reduces the amount of CM injected and improves both image quality and parenchymal enhancement.*

Introduction

A narrow x-ray beam is quickly spin around a patient's body during a procedure known as "computed tomography," or CT. This produces signals that are then analysed by the machine's computer to create cross-sectional images, or "slices," of the patient's body. These sections, which are known as tomographic pictures, can provide a clinician with more specific information than traditional x-rays [(1)]. It enables medical professionals to examine organs and aids in the diagnosis of diseases like cancer or injuries like fractures[(2)]. It is a non-invasive imaging that was revolutionised by the development of computed tomography (CT), particularly in the field of imaging the central nervous system. Over the past 20 years, further developments in CT technology have made it possible to more elegantly visualise a variety of body systems, such as vascular anatomy and organ perfusion physiology [(3)]. CT scanners can have one or many slices. Per gantry rotation, single slice CT devices can capture one image (the gantry is the ring the patient is placed in). A scanner with more slices enables faster acquisition, and multi-slice would facilitate examination of difficult-to-control toddlers or frail elderly patients who cannot remain still for an extended period of time [(4)].

An increasingly frequent test that aids in the diagnosis of a wide variety of illnesses is the CT abdomen. The simplest kind of a CT abdomen is a scan from the diaphragm to the symphysis pubis that is carried out 60 seconds following an iodinated contrast pump injection into a peripheral vein [(5)]. The digestive, urinary, endocrine, and reproductive systems organs are found in the abdomen. When another type of examination, such as X-rays or a physical examination, is inconclusive, a CT scan of the abdomen may be performed to examine the abdomen and its organs for tumours and other lesions, injuries, intra-abdominal bleeding, infections, unexplained abdominal pain, obstructions, or other conditions [(6)].

Patients may be requested to take a particular contrast agent for a variety of computed tomography exams (orally, rectally or via injection). Pharmaceutical substances (liquids) used as intravenous, oral, and rectal CT contrast are commonly referred to as "dye." CT contrast is utilised to make specific organs, blood vessels and/or tissue types highlighted with increased image contrast to better show the presence of disease or injury [7]. The amount of iodine in the organs is correlated with the radiation absorption in CT, which is increased by contrast medium. An average 30% increase in the dosage to absorbed organs can result from the enhanced radiation absorption brought on the contrast media [8].

Body Mass Index (BMI) is calculated by dividing a person's weight in kilogrammes (or pounds) by their height in metres squared (or feet). High body fatness may be indicated by a high BMI. BMI does not make a body fat or health diagnosis for a person, but it does screen for weight categories that may cause health issues [9]. Potentially, large amounts of CM higher than 100 mL could cause contrast-induced nephropathy (CIN). CIN, which accounts for 11% of all instances of acute renal failure acquired in hospitals and results in a longer hospital stay and higher medical expenses, is the third most common cause of this condition [10]. The contrast media administration may be personalised or modified according to BMI of the patient which will result in low contrast media dose and low radiation dose.

MATERIAL AND METHOD

A literature search in which studies examining the use of BMI or LBW or BSA to administer personalised contrast medium dose in abdominal CT to reduce CM dose and Radiation dose. The full texts of all articles as well as their supplemental material, when available were used to gather all the information.

Articles from PubMed, Research gate, Elsevier, Springer has been used to collect information. Titles and abstract and articles with both prospective and retrospective and other studies were used.

Inclusion criteria

• Studies on patients who underwent Abdominal CT.

• Include use of personalized contrast medium

dose.

Exclusion criteria

• The publication written in any language that is other than English

• Studies conducted on Single slice CT.

RESULT

Results indicate that hepatic enhancement was consistent throughout the whole investigation. Results indicate an average increase of 54 HU in hepatic density as compared to hepatic enhancement prior to CM treatment. After CM treatment, there was a variance of 25.50 HU between the highest and lowest values, compared to a variation of 27 HU in liver density before to CM administration. Following sample analysis, they confirm that 96.05% of the results represent a good improvement. They compared the volume of the same patients calculated using the most popular approach (TBW) and this calculation method (LBW) to better comprehend the genuine difference in CM volume. Based on the hypothesis of 1.5 mL CM/kg of TBW, they utilised the amount of CM used with LBW to calculate the volume of CM we would need if we used TBW as the foundation for calculation. They stratified the sample into different classes of body mass index in order to determine whether this strategy prevents low dosages in slim patients and overdoses in obese individuals (BMI). In the majority of research, four groups were established, and the average levels of improvement in each group were compared. They discovered a consistent improvement, especially in individuals who are overweight. The findings are not significant for individuals who are underweight, and it was discovered that CM administration may be tailored rather than administered at a fixed dose based on LBW or TBW without compromising image quality.

DISCUSSION

The use of contrast agents (CA) is essential for medical imaging, as lesions and tissues become opaque. 50–60% of all interventions CT alone use iodine CA, it is used to ensure considerable diagnostic quality. Extensive literature on safety in clinical trials has been published. Certification bodies, and it is widely recognized that the following guidelines ensure safe and effective use [11]. BMI, which is calculated as the weight in kilogrammes divided by the square of the height in metres, is a factor related to contrast enhancement. BMI is a tool to measure adiposity; it is not an indicator of body size and should not be used in isolation when determining CM volume. For instance, a little infant with a high BMI would need less CM volume than an adult who is lean and has a low BMI. The other body size indices, such as lean body weight and body surface area, should be combined with this one. It has increased awareness of the demand for CM administration that is optimised. As per International classification of body mass index, Underweight patients were those whose BMI was less than 18.5 kg/m2, normal weight patients were those whose BMI was between 18.5 kg/m2 and 25 kg/m2, overweight patients were those whose BMI was between 25 kg/m2 and 30 kg/m2, and obese patients were those whose BMI was greater than 30 kg/m2[12].

In computed tomography, iodinated contrast media enhances the visibility of interior body structures. However, it may result in consequences such as acute renal damage or worsening chronic kidney disease, ranging from modest symptoms like itching and rashes to severe life-threatening reactions like anaphylaxis. In most healthcare facilities, administering a fixed volume (FV) of contrast agent is considered to be normal procedure. However, because patient body habits vary widely, that strategy results in varying degrees of contrast enhancement. It exposes individuals with low body weight to the hazards of contrast media and its unnecessary high dosages [13].

Nakayama et al in their early research, they examined the CT values after scanning test tubes with various iodine solution concentrations as a phantom at 120 kV and 90 kV. This enables the obtaining of the proper CT numbers for the phantom's tubes. Additionally, subjects had their CT numbers recorded after undergoing 90 kV and 120 kV abdomen scans. According to these preliminary tests, lowering the tube voltage had a higher impact on the number of CT regions that were enhanced with iodinated contrast material than it did on the number of CT regions that weren't enhanced. The radiation dosage provided to the phantom's central and periphery cavities was reduced by 56.8% and 46.2%, respectively, according to the results of their investigation in the phantom, which demonstrated that radiation exposure may be significantly reduced by lowering tube voltage from 120 kV to 90 kV. We used the weighted average CT dose index value instead of radiation exposure readings since it is challenging to get dose data from patients. Preliminary measurements of the weighted average CT dose index indicated that the radiation dose at the 300 mA setting was 13.2 m Gy at 120 kV and 5.7 m Gy at 90 kV. The dose reduction estimated using the weighted average CT dose index was close to the dose measurements in the phantom study. Iodine-based contrast agents improve contrast with age because the relative atomic number of iodine (Z 53) increases when exposed to decreased X-ray energy, resulting in increased X-ray attenuation. Therefore, decreasing tube voltage with increasing photoelectric effect and decreasing Compton scattering increases the attenuation of calcified structures and iodinated contrast agents. They found that lowering the tube voltage from 120 kV to 90kVreduced the amount of contrast agent by at least 20% without compromising image quality [14].

Moreno Zanardo et al observed a deviation from proportionality between TBW and injected CA dose and explained when asked how the CA dose was set. This was especially noticeable in obese patients who received lower doses of CA than the theoretical value based on TBW. In fact, a high negative correlation was found between the patient's her TBW and CA dosage. That is, the higher the TBW, the lower the CA dosage. All CT scans were considered diagnostic and no patients underwent rescans. This allows us to hypothesize that there is room for dose reduction, especially in underweight patients who received significantly higher doses in gI/kg than obese patients. The doses of CA injected at their institution for multiphase CT of the abdomen varied widely, with obese patients receiving much lower doses than underweight patients, as a radiographic 'compensatory' effect. Diagnostic abdominal CT obtained at 0.63gI/kg LBW with room for dose reduction[12].

CONCLUSION

In summary, the results of these randomized, multi centre studies demonstrate that instead of administering a fixed CM dose, administering CM according to patient BMI or LBW or body surface area (BSA) adversely affects imaging. It shows that the amount of injected CM can be significantly reduced without Enhancing quality and substance. To reduce costs and minimize the risk of acute renal adverse reactions due to contrast agents, implementation of LBW, BMI, or BSA-adjusted protocols should be considered in cancer patients.

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