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Comparison of Radiation Dose in Brain Imaging Between 64 Slice And 16 Slice Ct

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ABSTRACT

Aim:Comparison of radiation dose in brain imaging between 16 and 64 slice CT. Materials and Methods:Sampling was done by convenience sampling method considering inclusion and exclusion criteria and a sample of 80 was included. 40 were scanned in 64 slice CT and 40 were scanned in 16 slice CT. Effective dose was computed from DLP using the equation; E=k x DLPk=0.0021 (According to European guidelines). Statistical analysis was done using Mann-Whitney U test.Result:The 16 slice CT machine is delivering more radiation dose compared to 64 slice CT for brain imaging with statistically significant difference.Conclusion:In the context of brain CT imaging using the same software from the same manufacturer, 64CT examinations provide gives a lower ED when compared with 16CT examinations

Introduction

Computerized Tomography (CT) is a significant advancement in radiology. It is a non- invasive technique and it is becoming increasingly available and replacing gradually the conventional radiographs. The basic principle of CT states that the internal structure of an object can be reconstructed from its multiple projections. Therefore, images of the human body can be reconstructed by using a large number of projections from different location (1).One of the main drawbacks of CT is the high dose delivered to the patient during a scan. The challenge is to keep the doses as low as possible with optimum image quality. Optimization is a radiation protection principle that is intended to ensure that dose delivered to the patient are kept As Low As Reasonably Achievable (ALARA).Nowadays CT manufacturers display the dose information delivered to patients in the CT monitors. These are called the CT dose descriptors. CT dose descriptors includes CT dose index (CTDI) and dose length product (DLP

The DLP is noted down from the monitor and the effective dose will be computed from DLP. Since high radiation dose delivering to the patient during CT scan is a growing concern among radiology departments, it is important to know whether the increase in number of detectors causes any changes in radiation dose. CT scan of brain is a common practice in hospitals. There is only limited study done comparing the radiation dose in brain imaging between 16 and 64 slice CT.

Objectives

To compare radiation dose for brain imaging in 16 slice and 64 slice CT.

Materials and Methods

By using convenient sampling method a total of 80 subjects were selected. The sample size was then categorized into two sets of data. A set of 40 patients was planned to scan on 64 slice CT and another set of 40 patients on 16 slice CT.

CT brain was performed using standard brain protocol. After the scan a folder appeared named "Dose Info" . By opening that folder we can see the dose related information such as CTDIvol and dose length product (DLP). DLP will be noted down from the monitor and effective dose will be computed from this data by using the the equation E=k x DLP.According to new ICRP recommendations, (2)k=0.0021.

Results

Since the data distribution is highly skewed, median was used for analysis. The statistical analysis shows that the median radiation dose in 64 slice CT is 2.029 mSv. The statistical analysis of dose information of 40 patients in 16 slices CT showing that the median of effective dose is 2.12 mSv.

Mann-Whitney U test was performed to compare the average effective dose between two groups.

The result showed that there is a statistically significant difference in the average effective dose between the two groups ($p<0.001$). The 16 slice CT machine is delivering more radiation dose compared to 64 slice CT for brain imaging.

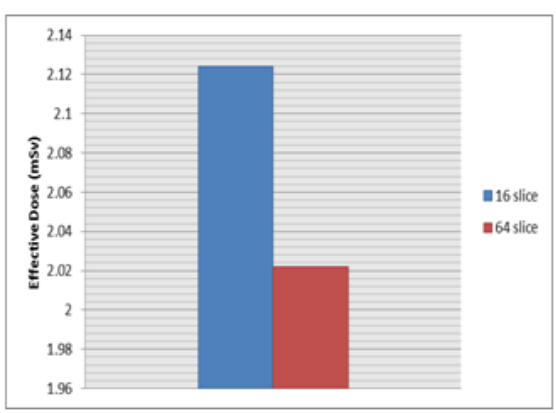

Fig.1: Comparison of radiation dose between 64 slice and 16 slice

Discussion

Compared to other diagnostic imaging modalities CT scanning has been considered as high radiation dose modality. It is generally believed that introduction of multi-slice CT will lead to higher patient doses (3). There are limited published studies comparing radiation doses between 64 and 16 slice MDCT scanners. However there is lack of articles comparing radiation dose in brain imaging between 16 and 64 slice MDCT scanners.

O J Arthurs et al performed a cross-sectional study on evaluation

of radiation dose between 64 and 16 slice MDCT for adolescent thoracic imaging(4). Author compared radiation dose received in thoracic imaging using data from 15 subjects scanned in each scanner. The statistical analysis was done using mean and paired student's t-test. Authors concluded that 16 slice MDCT scanner deliver more radiation dose than 64 slice CT.

Tracy A.Jaffe et al conducted a study on a commercially available anthropomorphic phantom to estimate the absorbed foetal radiation doses of 16 slice MDCT and 64 slice MDCT(5). Because accurate dose comparison of the two systems for any protocol can be achieved only if same subject is scanned in two scanners but scanning the same patient on two scanners would be prohibitive because of unnecessary radiation dose to the patient(5). The CT equipment used were from same vendor. Authors stated that the absorbed dose is associated with the CTDIvol and they found that16 slice MDCT causes more dose compared to 64 slice MDCT.

Atif Khan et al (6) performed a cross-sectional study to compare the radiation dose between 64 slice MDCT and 320 slice MDCT for coronary angiography. Prospective gated coronary angiogram was performed in 95 patients in 64 slice MDCT and 174 patients in 320 slice MDCT. 64 slice MDCT needed around eight heart beats to scan the whole heart whereas 320 slice CT required only one heartbeat, this is because of the increased number of detectors in 320 slice MDCT. The calculation of radiation dose received by the patient was done by using CTDIvol data. DLP was calculated by multiplying this CTDIvol data with respective scan length. A conversion factor of k=0.014 mSv/mGy*cm was used to convert dose-length product (DLP) to effective dose (ED). The statistical analysis was done using median of radiation dose and Kruskal-Wallis rank test. Authors found that the median ED was 6.2 mSv in 64 slice MDCT, which is significantly higher compared to that of 320 slice MDCT which is 4.4 mSv. Authors concluded that overall radiation dose decreases when there is an increase in number of slices acquiring in one rotation, thus 320 slice MDCT gives lower radiation dose compared to that of 64 slice MDCT(6).

Conclusion

The study concluding that the radiation dose is lower with wide area detector MDCT compared to protocols that use lesser detector configuration. In brain CT imaging using scanners of same manufacturer, 64 slice CT examinations give a lower effective dose when compared with 16 slice CT examinations. It is debatable whether these results can be generalized to other manufacturers. This lowered radiation dose makes 64 slice MDCT as a better option for brain imaging.

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