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Comparative Analysis of Absorption Doses between Exposed and Unexposed Area on Major Organs During CT Scan

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INTRODUTION

Since the first generation CT unit was developed by EMI in 1972, CT has been widely used on diagnosis, treatment, and operation plan in the medical field. Until now, the fifth generation CT unit was developed. CT scan consists of two kinds of techniques such as conventional and spiral mode. The spiral technique is universally used for human body except brain. Continuous rotation of x-ray tube using slip-ring and brush makes it possible to perform fast scans within one second per slice. Also, the spiral technique makes it possible to scan a fast study during one-breath-hold (20-40 seconds), multiplanar 2- and 3-dimensional reconstruction of images, and accentuation of contrast enhancement. However, the risk of radiation is increased due to detail and repeated scans. The limitation of radiation per one exposure is 100mSv (Modern, 1989). The limitation dosages are 0.3-1mGy and 1-6mGy on chest and abdominal radiographs . ICRP recommends limitation dosages that are 0.15Gy on temporary sterility, 3.5-6Gy on permanent sterility for man and 0.65-1.5Gy, 2.5-6Gy for woman. However, the limitation of dosages is not fully specified on CT, yet. Therefore, the purpose of the present study is to define the limitation x-ray dosage on CT.

METHOD

The CT unit was Somatom plus 4 (Siemens, Erlangen, Germany). Rando female phantom (Model RAN-110, chuchin Associate LTD. USA), thermo-luminescent dosimeter(TLD-100), and Reader (Model 5500, Harshaw chemical) were used. TLD chip calibrated with LINAC 6MV was inserted into the target organ of phantom. For adequate insertion of TLD chip, the measurement of distances (±2mm) from the midline of vertebral body to 10 sites of target organ was performed on 40 cases (20-40 years old females). The condition of exposure was exactly identical to conventional study. The chips were distributed in target organs according to sizes and absorption dosages. Also, the absorption dosages of surface were measured on 4 sites such as orbit, thyroid, breast and uterus.

RESULTS

1) On the scan for brain, the absorption dosage of exposed area was 73.93±5.846mGy. The dosages of unexposed trachea and upper lobe of lung were 6.945±2.142mGy and 2.066±0.094mGy. The dosages of bladder and uterus was negligible.

2) On the scan for chest, the absorption dosages of exposed area were 15.226±0.987mGy. The dosage of unexposed hepatic dome was somewhat high while that of uterus was 0.258±0.095mGy.

3) On the scan of abdomen, the absorption dosages of exposed area on liver, kidney, spleen, stomach, bowel, and uterus were 16.252±1.399mGy, 16.426±0.72mGy, 15.575±1.037mGy, 16.363±1.249mGy, 16.871±1.656mGy, and 11.575±0.685mGy, respectively.

4) The absorption dosages of surface differed between phantom and patient. On the special study of PNS, temporal bone, facial bone, and orbits, the absorption dosage of surface of lens was approximately in the range of 100-142mGy.

DISCUSSION

The size, location, and shape of organs were variable according to body volume, age, and sex, The absorption dosage was variable according to type of study, number of slice, width, and

operation in brain study by conventional CT techniques. But in chest, abdomen, and pelvis study by spiral CT techniques, the absorption dosage was variable according to type of study, number of slice, number of slice, operation, and pitch.

CONCLUSIONS

The present study showed that the absorption dosage of brain scan was higher than that of other organs such as chest, abdomen etc. On the scan of brain, the reproductive organs were not affected. But, the chest scan affected reproductive organs. Thus, for the scan below chest, radiation shielding would be necessary for reproductive aged women. On the scan of abdomen, unnecessary scan would be controlled for the abuse radiation dosages. On the special study, the lens and thyroid were some affected.