CHAPTER II

REVIEW OF RELATED LITERATURE

It is well known that the radiation dose associated with CT scanning is relatively high[1]. Recent studies in the USA and Europe state[2] that CT scans compromise only 3-5% of all radiological exams, but they contribute 35-45% of total radiation dose to the patient population. It is also true that the radiation dose associated with head and neck CT scans is considerably less than that associated with abdominal or chest CT examination[3,4]. However, as head CT scans are more common, their contribution to the total collective radiation dose to the population is significant.

The head and neck CT scanning protocols routinely used at different scanning facilities depend on choices made by the operator or radiologist[5]. They controlled variables (parameters) include the number of scan series performed, exposure technique, pitch and slice thickness. Such choices will affect the dose delivered to the patient. In addition, certain inherent characteristics of the CT scanner design may also affect to a patient dose, which include the detector type, geometric efficiency of the detector array, size of the gantry aperture, and so on[6,7].

There have been many reports on the radiation dose from CT, based on CT-dose measurement applying the computed tomography dose index (CTDI)[8,9], which was established in 1981. The dose values should be printed on all CT-images allowing an evaluation of the individualized patient dose. However, these radiation dose values are based on the results of older survey data from the late 1980s[10,11,12]. Nowadays, radiologists aim at the lowest maximal diagnostic acceptable signal to noise ratio. The technical improvements in CT, in particular use of the multiple detector-row CT (MDCT), have offered new possibilities in both diagnostics and radiation dose reduction [13,14]. To decrease radiation dose, low kV and mA, but a high pitch should be used[15]. Newly developed CT-dose-reduction soft-wares and filters should be installed in all CT machines[2,14]. The results of older surveys that were based on investigations of radiation dose for conventional and single detector-row CT[15] may not be representative data at the present situation.

The radiation dose in patients who underwent head CT examination[16] were reported. Mean section doses were 44.4±11.1 mGy for infants and 44.2±1.5 mGy for adults, with protocol parameters of 120 kVp, 271±73 and 340±0 mAs for infants and adults respectively.

There was a result of comparison between MDCT and single-row detector CT (SDCT) on a standard pelvic imaging protocol and parameters[17]. Protocol parameters for SDCT were 210 mA, 140 kVp, pitch of 1.0, 5-mm slice thickness and 0.8-second gantry rotation speed. MDCT protocol parameters were 130 mA, 140 kVp, pitch of 0.75, 5-mm slice thickness, 15-mm table feed and 0.8-second gantry rotation speed. With noise constant MDCT resulted in a dose profile approximately 27% higher than that from SDCT in the plane of imaging(8.0 vs 6.3 mGy) and 69% higher at adjacent level of the imaging plane (6.8 vs 4.0 mGy). The individual doses to the various organs (e.g. uterus, ovaries) were 92-180% higher with MDCT than with SDCT. This difference should be taken into the design of MDCT protocols.

Look at diagnostic quality of CT image, we need good image quality for medical diagnosis (i.e, thin section and low artifact). MDCT could reduce image degradation induced by organ motion, data could be carried out within a single breath-hold. Image quality was evaluated on the basis of section-sensitivity profile (SSP), image noise, and artifact ratings, slice thickness, pitch, kV, mAs, CT image reconstruction algorithm, *z*-interpolation and operation matrix size also affect image noise [18,19,20]. Modern MDCT scanners have the potential to offer adequate image quality with moderate radiation dose for the majority of clinical protocols.

For estimating the necessary radiation exposure of patients, it is essential to measure simultaneously dose and obtain images for quality assessment according to the clinical protocols actually used at the scanners concerned.

In this study, we will present the results of average radiation dose and image quality, in terms of image noise, for routine head and neck (excluding the brain and location is from superior aspect of hyoid bone to supraorbitomeatal baseline) protocol parameters comparing two multiple detector-row CT scanners (Siemens Sensation 4 and Siemens Sensation 16) at King Chulalongkorn Memorial Hospital in Bangkok, Thailand.