Radiation dose in pediatric cranial health and social care essay

Health & Medicine

In the past two decennaries, the figure of encephalon computed imaging scrutiny has increased quickly. This is in big portion due to progresss in multidetector CT engineering, which allows faster image acquisition and improved image quality. The increased usage in CT surveies has led to a significantly increased radiation dosage to the patient. However, about one tierce of CT encephalons scrutinies in the paediatric group are non pertinent to the diagnosing and direction. These show that it is non the best trial for the kids. Comparing with grownups, kids are more variety meats radiosensitive to radiation ; they will hold longer life clip hazard to confront cancerous alterations induced by radiation. In response to increasing concern for patient radiation protection, we should utilize the right proficient parametric quantities to protect the kids from inordinate and unneeded radiation dosage for these by CT scan. To cut down the radiation dosage, the doctors and radiotherapists should ever conscious to cut down CT scan radiation dosage for kids. Furthermore, we can develop some appropriate schemes to optimise scanning patterns based on the age, clinical indicants and organic structure size of the patients.

Undertaking aims and significance (Max. 1 page: State the intent of the proposed survey, place cardinal issues and jobs being addressed, province possible result in footings of its relevancy, significance and value)

The intent of this survey is to look into the consequence of dose decrease in different parametric quantity used in the Brain CT scan. In the visible radiation of addition the usage of encephalon CT scrutiny, dose decrease while maintain the CTdiagnosticvalue and image quality is a ambitious undertaking. Since a figure of issues are related to CT radiation, they have

become more outstanding as usage has increased. The issues concerns about the part of CT to a comparatively big radiation dosage to the populace. Furthermore, kids have more organ radiosensitive than grownups and they have a longer lifetime hazard radiation-induced malignant neoplastic disease. Therefore, we should do accommodation of paediatric CT parametric quantities based on the size or part of involvement to be scanned. On the other manus, the decrease of radiation dosage to cranial CT may depend on many factors such as replacing of CT usage, by utilizing other mode (MRI or ultrasound) which have less radiation dosage, lessening in the figure of CT surveies requested.

The aim of this survey is to find whether a lower radiation dosage technique could be used for paediatric cranial CT without impacting the diagnostic value and image quality in the scrutiny. Reviewing the literature and compare the approximative equivalent dosage to relevant organ (mSv) , I find that the protocol scenes in planing for kids and grownups are about the same. The radiation decrease can be about 50 % reduced by altering some parametric quantities. Therefore, the CT protocol scenes in cranial CT used for grownups should non be used for kids.

It is the clip we should alter the attitude and face the job how to cut down the radiation dosage in CT engineering for kids. The CT makers, doctors, radiotherapists and radiographer besides portion the duty to keep an appropriate balance between radiation dosage and diagnostic image quality.

Background (Max. 2 pages: A clear, comprehensive and up-to-date but concise reappraisal of the literature ; sum up and give cardinal mentions on related work, including old and alternate attacks to the jobs)

CT is a various diagnostic process and it can give high diagnostic output. However, CT scanning comprises about 15 % of the radiological scrutiny and represents the largest beginning (about 70 %) of radiation dosage to the patient. 1, 9 The usage of CT encephalon in kids is increasing in the past two decennaries. Indeed, CT induced radiation dosage is comparatively high compared with other imaging technique. The hazard for paediatric patients to develop long term biological effects following exposure to ionising radiation is higher than that for grownups because their cells, tissues and variety meats have a higher radiosentivity and they have a longer clip to live. 2, 11 The European Commission (EC) states that & amp ; acirc ; ˆ? radiation exposure in the first 10 old ages of life is estimated to hold a hazard about 4 times greater than exposure incurred at 30-40 old ages of age for some damaging effects & A ; acirc ; ˆ™. 3 Give the recent attending to radiation hazards, the radiation dosage of cranial CT in kids and the demand for accommodations in parametric quantities to the populace, we should understand more about existent pattern of cranial CT in paediatric patients.

Most CT Centre merely follows the recommended scenes of the makers, but these may non the best appropriate scenes for the patient. For paediatric cranial CT, there is no consensus about the optimal scene in different infirmaries.

To understand a patient receives how much of the radiation dosage in a peculiar scan, one must hold cognition of the methods of dose measuring. Radiation dosage is influenced by the radiation quality, the geometry of the scanner, the sensor type and the current transition of the tube. 10 Dose increases nonlinearly with an addition in tube electromotive force but will diminish the image noise. Typically, an addition in kVp from 120 to 140kVp will increase the dose by about 47 % . The incursion is improved and an about 70 % higher dosage reaches the sensor. But in some articles, informations suggest that kVp every bit low as 80 kVp can besides supply acceptable image quality in neonates. 4

Milliamperes (ma) and gantry rotary motion rhythm clip (in seconds) are combined to supply a step of radiation normally known as the tubing current (ma) . A additive relationship exists between tubing current and the radiation dosage. By cutting down the ma half, the patient exposure can be reduced by 50 % while maintaining the same noise degree and image quality. Cohnen et Al besides studied CT dosage in paediatric cranial CT and concluded that a 40 % decrease was possible. 7 Chan et Al performed CT in kids aged 1-12 old ages with several different milliampere 2nd valleies and he found that a 40 % decrease in milliampere seconds could be used in paediatric cranial CT. 2, 8

Section thickness and table velocity besides affect dosage. The faster table velocity and thicker piece should be selected based on the scan indicant. In general, most paediatric CT scan can be performed at a pitch of 1. 5. 5, 6, 12

Adjustment in piece thickness and pitch demand to be balanced against the possible loss in spacial declaration from the increased image noise.

Multiple dose descriptions have been used in the past. Presently, the Computed Tomography Dose Index (CTDI) , along with its discrepancies, and the Dose Length Product (DLP) are the standard parametric quantities used to depict CT associated radiation dosage. Radiation dose CTDI is measured in milligrays as displayed on the CT proctor every bit good as DLP which are calculated by the CT machine automatically. Increase the tube electromotive force from 120kVp to 140kVp additions the CT dosage index (CTDI) by a factor of 1. 4, but decrease the tubing electromotive force to 80kVp lowers the CTDI by a factor of about 2. 2. 13

We can measure the paediatric cranial CT protocol and happen the CT radiation dosage that is recommended to be every bit low as moderately accomplishable. Hence, we need to unite different attacks sing to CT dose decrease. In add-on, the refering parties including doctors, radiotherapists and radiographers must take the duty to keep an appropriate balance in scanning parametric quantities, diagnostic image quality and radiation dosage. Long term schemes is desperately set up that include encouraging development and acceptance of paediatric CT protocols, educating working staff through diary publications and conferences within and outside the radiology fortes, carry oning farther research to find the relationship between CT quality and dosage. We besides customize CT scanning for single kids to optimise exposure scenes and to measure the demand for CT in an single patient.

Methodology (soap. 2 pages: including research design, program, stuffs, methods and cardinal mentions)

The survey will be carried out in CT scan room at the Radiology Department of the Princess Margaret Hospital. A entire figure of 100 paediatric patients aged under 15 old ages for encephalon CT scan during January to June 2011 by indiscriminately selected as topics of this survey. Before informations aggregation, the survey will acquire the blessing from the Department Manager Mr. Fung and so explicate to all CT radiographers to acquire their full cooperation in the survey. Furthermore, the process will be explained to each patient and their parents in order to obtain their permission in the survey.

The patients will split into two groups, one is control group and the others are study group. Brain CT scan will be done by utilizing paediatric CT scan protocol in the control group. We can measure the radiation dosage by altering the exposure parametric quantities in the survey group. Brain CT scan was done utilizing 64-section CT scanner GE lightspeed VCT machine. Image obtained utilizing a multi-slice axial computed imaging system of 5mm piece thickness without automatic choice of effectual ma. Scaning parametric quantities that affect radiation dosage include peak kilovoltage, tubing current, pitch etc. Therefore, the survey group will be divided into 3 parts. The first portion is to compare the different kVp (80kVp, 100kVp and 120kVp) to the image quality while other puting kept at a changeless scene. The 2nd portion is to compare the different tubing current (100mAs and 120

ma) and the 3rd portion is to compare the different pitch (1 and 1. 5) . All CTDI and Dose-Length Product will be recorded after the scrutiny.

I will ask for two radiotherapists Dr. Yung and Dr. Lam to reexamine the movies in a double-blinded mode by utilizing 6 inquiries assessment strategy. Question 1-5 are refering about radiation dosage and image quality for visualising defined anatomical constructions. The anatomical construction chosen for reappraisal included: (Q1) border of the sidelong ventricles, (Q2) the basilar arteria in the prepontine cistern, (Q3) internal capsules, (Q4) ambient cistern, (Q5) gray-white distinction at the degree of 4th ventricles. The inquiry 6 will inquire the radiotherapists grade of assurance in doing a diagnosing.

A 5-point marking system will be used for rating. Indicate 5 means the anatomical construction can clearly be visualized and the assurance degree in making a diagnosing are about 90 % or above. Indicate 4 agencies visual image and assurance are about 70 % . Point 3, 4 and 5 are about 50 % , 30 % and less than 10 % severally. Consistency of marking will be assessed by giving 40 scans to the two radiotherapists. The average tonss given to these 6 inquiries during the first and 2nd reading will be compared.

Statistical analysis will set about utilizing assurance interval (CI) and hypothesis testing, as expressed by P values. The assurance interval can demo the deficiency of preciseness in the estimation of involvement and therefore conveyed more utile information than the P value which are merely a quantitative value. For each reader, 95 % CI and a two sample t-test will execute to compare the average value of the tonss for each inquiry between

the two groups. For inquiry 6, this assessed the radiotherapists & A ; acirc ; ˆ™ assurance degree, farther distribution of tonss between the two groups. Dependability trials to measure intra-reader understanding in hiting the movies were besides carried out by utilizing 95 % CI and paired t-test. Analysis was facilitated by the usage of commercially available computing machine statistics plan SPSS ver. 1. 7.