Student Oral Presentation (competitive)

Date: 23rd August 2015 Venue: Room 324 Time: 10.45am to 12.00pm

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Title: A study of the effects of RF pulse shape on image quality in the biomedical use of MRI -The effects of encoding frequency on signal intensity-

Authors: *Akari KAYUKAWA*, & Kojiro YAMAGUCHI

Presenter: Akari KAYUKAWA

Background:

The MRI scanner for biomedical use in the university produces less signal intensity than expected to construct sufficient images when imaging a small area of interest with a thin slice is required. We examine the influence of the change in RF pulse shape to signal intensity with different number of encodings to resolve the issue.

Method:

The Bloch equation that allows us to digitize the physical phenomenon of MR is used in the examination to see if it is possible to evaluate the slice profile shape forming signal intensity when the RF pulse shape is changed with varying encoding frequencies. Object substances for the analysis are: FAT that has short T1 and T2 value, CSF that has long T1 and T2 value, and White Matter (WM) and Grey Matter (GM) that has no difference in T1 and T2 value respectively.

Results:

This examination indicates that the evaluation of the slice profile shape forming signal intensity is possible when RF pulse shape is changed with varying encoding frequencies. Having said that, it also shows that slice profile is more susceptible to the change in the encoding frequencies on T1W images than T2W images.

Conclusion:

It is indicated that the change of RF pulse shapes can improve image quality in the biomedical use MRI.

Title: A Phantom Study on Factors Influencing Exposure Indicator (EI)

Authors: *Chai Chang Hui*, Khadijah Ramli & Chan Lai Kuan

Presenter: Chai Chang Hui

Aim:

To study factors influencing EI in Digital Radiography: Samsung XGEO GC80 and Carestream DRX Evolution.

Method:

A retrospective study was conducted to gather informations on the range of exposure factors commonly used for a 1 year old chest X-ray. A one year old tissue equivalent phantom was exposed with the selected exposures with three optically stimulated luminescent dosimeters (OSLD) placed at the centring point for an anteroposterior (AP) chest. The changes in the entrance skin dose (ESD), exposure index (EIx) and deviation index (DI) were recorded. A further study on the selection of area, patient size, source image distance (SID), collimation size, table top/under and grid/non grid examinations was also performed using the same exposure factors.

Result:

There was no significant change in the EIx and DI when area of examination was changed. The DI decrease 35.71% when an adult size was selected in Samsung with no change in Carestream. As the SID was increased the EIx and DI were decreased. A decrease of 15.8% EIx in Samsung and 10.45% EIx in Carestream were noted when the SID was increased from 100 to 110 cm. The EIx increased with increased of exposure field size with 60.3% in Samsung and 12.71% in Carestream. The use of grid caused a decreased of 78.8% EIx in Samsung and 80.07% EIx in Carestream. The recommended exposure for a chest X-ray on a one year old is 55kVp, 1.4mAs, 320 mA, 100 cm SID and 17 cm X 17 cm collimation size.

Conclusion:

EIx and DI can be a guide to indicate correct technique for a radiographic examination. The study was limited by the default target EIx.

Title: Dosimetric implication, on skin and at depth, of placing insulating materials over treatment area during Radiation Therapy

Authors: *Goh Poh Ling Althea*, Claricia Chan Mei Xuan, Ho Si Qi Evangeline, Low Gee Keng, Muhammad Tarmizi Bin Pawi, Narthis Nishah Binte Maideen Ghani, Natalie Tan Siew Ping & Sofia Sadimin

Presenter: Natalie Tan Siew Ping

Aim:

This two-part pilot study aims to investigate the dosimetric implication, on skin and at depth, of placing insulating materials over treatment area during radiation therapy. In doing so, the project also aims to find the least attenuating material suitable to keep the patients warm during radiation therapy treatment.

Method:

The dosimetric pilot study was conducted in National University Hospital Radiotherapy Centre. The insulating materials tested were Cotton (hospital blanket), Polyester, Acrylic, Tyvek and Aerogel. Each material was placed over the treatment area. Thereafter, quantitative measurements of the dose on skin (D0) and at depth of 10cm (D10) were obtained using an ionisation chamber. A follow up of the dosimetric pilot study, thermal comfort pilot study, was conducted. The three least attenuating materials from the dosimetric pilot study were shortlisted and used to conduct a qualitative thermal comfort pilot study. The thermal comfort of the shortlisted material was compared against the current material, Cotton, used in hospitals. Volunteers were placed under an environment similar to radiotherapy patients and were asked to rate the effectiveness of the each material in keeping them warm.

Results:

The dosimetric study has revealed that the least attenuating material was Tyvek with 9.3% dosimetric difference while the most attenuating material was Aerogel at 71.4% at D0. The dosimetric implication at D10 was found to be clinically insignificant. The shortlisted materials for the thermal comfort study were Polyester, Acrylic and Tyvek with Cotton used as the reference. An analysis of the survey has revealed that Polyester has provided the best thermal comfort.

Conclusion:

The results suggest that protocols for covering patient during treatment should be re-evaluated because of the potential for an increase in the skin dose and associated risk of skin toxicity. However, to seek a balance between good patient care and treatment accuracy, we suggest the use of Polyester blankets for its superior thermal comfort and lower dosimetric impact than Cotton.

Title: The relationship between artherosclerosis risk factors and coronary artery calcification in Taiwanese population

Authors: *Ho-Huu Hung*, Chiung-Wen Kuo & Shang-Yun Ho

Presenter: Ho-Huu Hung

Purpose:

To assess the effect of atherosclerosis risk factors on coronary artery calcium score (CACS).

Materials and Methods:

A total of 556 patients (403 males and 153 females), aged 23-93 years (57.6 ± 11.4 years) were enrolled in this research. CACS and bone mineral density (BMD) of spine and both femoral neck were measured by dual source computed tomography and dual-energy X-ray absorptiometry, respectively. CACS was calculated by Agatston method and were categorized into four levels (score 0: non-identified, score 1 – 100: mild, score 101 – 400: moderate, score > 400: high). Laboratory parameters including glucose, low-density lipoprotein, high-density lipoprotein, cholesterol and triglyceride were collected.

Results:

There were 229 (41.2%) of patients classifying with no CACS, 194 patients (34.9%) with mild, 88 patients (15.8%) with moderate, and 45 patients (8.1%) with high level of CACS. The CACS was positively correlated with age ($r = 0.252$, $p < 0.001$) whereas CACS was negatively correlated with the low-density lipoprotein (LDL) and cholesterol ($r = -0.248$, $p < 0.001$, $r = -0.252$, $p < 0.001$, respectively).

Conclusion:

Age, LDL, and cholesterol played a vital role that affected on coronary artery calcification.

Title: The role of magnetic resonance spectroscopy in medical imaging of recurrent brain lesions.

Author: Aung Nyein Chan Oo

Presenter: Aung Nyein Chan Oo

Background:

A brain lesion detected after radiosurgery in patients could be the tumour recurring or necrosis. It is a radiologic dilemma for clinicians to differentiate the malignant from the benign under such circumstances with conventional imaging. Magnetic Resonance Spectroscopy (MRS) is an application used to distinguish recurrent brain tumour from radiation necrosis.

Purpose:

The aim of this literature review is to develop an understanding of MRS and to evaluate its role in medical imaging of recurrent brain lesions.

Findings:

The major role of MRS is to noninvasively differentiate between recurrent tumour and necrosis of a post-treatment lesion that cannot be discerned with conventional medical imaging.

MRS has been found to have high effectiveness in studying the metabolites related to brain lesion pathologies. The metabolic ratios of Choline, Creatine and N-acetylaspertate have been established as reliable markers of malignancy. There is however a possibility that this differentiation is only reliable in pure tumour or pure necrosis conditions, but not a mixture of both. More research is needed in this field.

In the current clinical application of MRS, there are technical limitations namely with spectrum reproducibility, subject motion, shimming and the need for higher field strength scanners.

Conclusion:

Magnetic Resonance Spectroscopy is an application that helps to alleviate confusion at discerning recurrent brain tumours from radiation necrosis where conventional imaging strategies are limited. Its integration in clinical routine however, has not been fully optimized and widely used due to a lack of knowledge of its full effectiveness, technical limitations, as well as challenges posed by clinical conditions.