

[Room/Salle : Albert]

Chair: D.E. Wilkins, Ottawa Regional Cancer Centre

TU-P1-1 13h15

Parameter Correlation for a Fully Heterogeneous Tumour Control Model, **Marco Carlone**, David Wilkins, Balazs Nyiri and G. Peter Raaphorst, *Ottawa Regional Cancer Centre* — There has been considerable interest lately in using clinically measured tumour control data to estimate radiobiological parameters for the linear quadratic model. It is likely that this practice will become more important in the future since there is increasing interest in biologically based treatment planning for radiotherapy. In a previous publication (Carlone et al, *Med. Phys.* **30**, pp. 2832-2848), we introduced a scaling theory to simplify a tumour control model that includes a heterogeneous distribution of radiosensitivity. This scaling theory is further developed in this work. The enhanced theory forms the basis of a procedure that can be used to estimate radiobiological parameters using a heterogeneous tumour control model without construction of a fit statistic, or the subsequent minimization of a statistical function. This procedure yields equivalent parameter estimates as other, statistically based methods, but with a computational efficiency several orders of magnitude faster than the statistically based method. This improved theory also shows that when modeling clinical data with a population tumour control model, the slope of the correlated parameters, a and $\ln(k)$, is an estimate of the reciprocal of the dose of 50% tumour control. This result shows that a bias in estimates of radiobiological parameters will be introduced depending on the mean survival level of the clinical data. It is also shown how the same form of parameter scaling can be applied when the tumour control model is expanded to the general case, which includes inter-patient heterogeneity in clonogen number and tumour growth rate.

TU-P1-2 13h30

Radiation Energy Deposition Calculations using Monte Carlo Simulations in K-shell X-ray Fluorescence Bone Lead Measurements*, **Naseer Ahmed**¹, David E.B. Fleming¹ and Joanne M. O'Meara², ¹ Mount Allison University and ² University of Guelph — Recent applications of K-shell x-ray fluorescence (KXRF) bone lead measurement have used a shorter source-to-sample (S-S) distance than the traditionally used standard value of 20mm, in order to improve measurement precision and decrease minimum detectable limit. This alteration to the standard S-S distance has been made without consideration of the impact on the subject dose. Therefore, Monte Carlo simulation has been used to calculate the energy deposition in a soft-tissue/bone model, simulating the lower part of the leg during KXRF bone lead measurements. The simulations were run for models representing both young and adult subjects, assuming lead concentrations of 10 $\mu\text{g/g}$ in bone and tracing 500 million photons in each simulation. Trials were performed over a wide range of 5–40 mm source to sample (S-S) distances. The energy deposition due to the Compton and the photoelectric (for both x-ray and non x-ray events) processes occurring in the bone and the soft tissue are presented. The ratios of the energies deposited in the bone and in the soft tissue with respect to the total energy deposited in the sample are calculated. Potential implications for the choice of an appropriate source-sample distance in KXRF bone lead analysis are discussed.

* This work is being supported by NSERC.

TU-P1-3 13h45

Monitoring the Response of Mycosis Fungoides to Total Skin Electron Irradiation with Optical Coherence Tomography, **Joseph E. Hayward**¹, Pawel P. Malysz¹, Glenn W. Jones¹, Maggie L. Gordon², Victor X.D. Yang¹, I. Alex Vitkin^{2,3}, ¹ *Juravinski Cancer Centre*, ² University of Toronto and ³ University Health Network — Optical coherence tomography (OCT) is a novel imaging technique that is like ultrasound imaging with light waves, as opposed to sound waves. OCT can acquire subsurface images of tissues with microscopic resolution (~ 15 μm). Microstructural information can be obtained up to ~ 2 mm in depth in tissues like skin. Imaging is completely non-destructive and can be done without touching the tissue surface. Mycosis fungoides (MF) is a cutaneous T-cell lymphoma that is commonly treated with total skin electron irradiation (TSEI). The subsurface margin of the disease beyond the superficial lesion edge is unknown, and its regression dynamics during and following TSEI are poorly understood. The purpose of this study was to determine whether OCT is capable of MF lesion characterization and radiation treatment response monitoring in a selected group of patients undergoing TSEI. Several patients were imaged with OCT before, during, and after TSEI. Similar to histological analysis, it was observed that OCT images of MF lesions usually appeared less structured than MF images of normal, healthy skin. In one patient, OCT images of normal-looking skin had the disordered characteristics of MF lesions. Weeks later, the previously normal-looking area had become part of a large MF lesion, suggesting that OCT may be useful for predicting the subsurface spread of MF.

ORAL SESSION ABSTRACTS

TU-P1-4

14h00

Identification of Breast Specimens via Low-Angle X-Ray Scatter Measurements with a Digital Imaging System*, **Robert LeClair**, *Laurentian University* — The information carried by the x rays diffracted from breast specimens could be useful for diagnosing breast cancers. Our research program is focused on determining whether we can identify breast biopsy specimens (e.g. malignant tumor, benign tumor, normal breast tissue) via the use of a pencil beam delivery/low angle x-ray scatter digital imaging system. Suppose we wish to measure the scatter profiles of 5 mm thick samples of carcinoma and fibro-glandular tissue with a 2 in by 2 in charged coupled device (CCD) camera using a 30 kV beam. Each sample is sequentially placed at 2 in above the center of the CCD and interrogated by a 1 mm diameter pencil beam. For an entrance exposure of 120 mR, the signals simulated with scatter between 13 and 15 degrees give a false negative probability of 1.7×10^{-11} and a false positive one of 2.3×10^{-10} . These small values encourage us to quantify the potential applications of the scatter technique. Experimental data obtained for plastics with our digital specimen radiography system indicate that the dark current is too high to acquire diffraction signals. Therefore work is under way to cool our detector. The predicted probabilities quoted above are based upon using preliminary diffraction data from the literature. In our lab, we are in the process of measuring the x-ray diffraction signals of all breast tissue types via energy dispersive x-ray diffraction measurements.

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14h15 Session Ends / Fin de la session