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In this issue

The first two papers in this issue are concerned with skin care advice for patients who are receiving radiotherapy. In the first paper, authors Morley, Tse, Cashell, Sperduti, McQuestion and Chow present their paper on the dosimetric impacts on skin toxicity for patients using topical agents and dressings during radiotherapy. It is acknowledged that skin care practices for radiotherapy patients are complicated by dosimetric concerns. This study measures the effect on skin dose of various topical agents and dressings. Superficial doses were measured under 17 topical agents and dressings and three clinical materials for reference. Dose was measured using a metal oxide semiconductor field effect transistor detector under a 1-mm polymethyl methacrylate slab, with 6 MV photon beams at 100 cm source to surface distance.

The results found that relative skin dose under reference materials was 128% (thermoplastic mask), 158% (5 mm bolus) and 171% (10 mm bolus). Under a realistic application of topical agent (0·5 mm), relative skin doses were 106–111%. All dry dressings yielded relative dose of ≤111%, two wet dressings yielded higher relative doses (133 and 141%).

The authors conclude that under clinically relevant conditions no topical agents or dry dressings increased the skin dose beyond that seen with a thermoplastic mask. Dressings soaked with water produced less skin dose than 5 mm bolus. This may be unacceptable if wet dressings are in place for the majority of the course of treatment. These results suggest that skin care practices should not be limited by dosimetric concerns when using a 6 MV photon beam.

In the second paper on the topic of skin care, Rudge presents a feasibility study on the use of colloidal oatmeal emollient as an alternative skin care approach in radiotherapy. This study aimed to assess the feasibility of a randomised-controlled trial on patients receiving radical radiotherapy for carcinoma of the anus, in order to compare the present skin care advice at the time of the study with an alternative product, Aveeno, used primarily for dermatological and chemotherapeutic-induced skin conditions.

Standardised Radiation Therapy Oncology Group (RTOG) grading and skin care assessments were used primarily to inform on physical reactions within a randomised-controlled trial. A pre-existing morbidity/quality of life instrument 'The Head and Neck Radiotherapy Questionnaire', which was validated for use with radiotherapy patients in preceding studies, was adapted for patients having anal cancer and formed the secondary basis for data collection. In all, 24 participants undergoing radical radiotherapy for anal cancer were randomised into two arms, Aveeno cream versus Aqueous cream BP, and reviewed weekly to collect data and perform analysis using Mann–Whitney *U* non-parametric statistical tests.

This study is the first to recognise colloidal oatmeal as a skin care approach in the radiotherapy setting and recognises the potential benefits of Aveeno in radiation-induced skin reactions. The study determined the RTOG grading system to be a robust method of evaluation of skin reactions and the questionnaires deemed the quality of life assessment to be a necessity in order to address patients' psychological needs in addition to the physical needs.

In the next paper, Rogers, Gujral and Welgemoed ask the question Does body mass index or subcutaneous adipose tissue thickness affect interfraction prostate motion in patients receiving radical prostate radiotherapy? It is

unclear whether body mass index (BMI) is a useful measurement for examining prostate motion. Patient's subcutaneous adipose tissue thickness (SAT) and weight has been shown to correlate to prostate shifts in the left/right direction. Authors sought to analyse the relationship between BMI and interfraction prostate movement in order to determine planning target volume (PTV) margins based on patient BMI.

In all, 38 prostate cancer patients with three implanted gold fiducial markers in their prostate were recruited. Height, mass and SAT was measured, and the extent of interfraction prostate movement in the left/right, superior/inferior and anterior/posterior directions was recorded during each daily fiducial marker-based image-guided radiotherapy treatment. Mean corrective shift in each direction for each patient, along with BMI values, were calculated.

The findings of this study are as follows: BMI is not a useful parameter for determining individualised PTV margins. Gold fiducial marker insertion should be used as standard to improve treatment accuracy.

In the next paper, Cengiz, Colak, Yıldız, Dogan, Ozyigit, Yıldız and Gürkaynak present their study to evaluate the impact of leg position on the dose distribution during intracavitary brachytherapy for cervical cancer. This prospective study was performed on 11 women with cervical cancer who underwent intracavitary brachytherapy. After insertion of the brachytherapy applicator, two sets of computerised tomographic (CT) slices were taken including pelvis, one with straight leg and one with leg flexion position with knee support. The dose (7 Gy) was prescribed to point A. The radiotherapy plan was run on the Plato Planning Software System V14.1 (Nucletron Inc., Veenendaal, The Netherlands) to get the dose distributions. In addition, rectum and bladder doses were measured for both leg positions during the treatment. The doses and volumes of organs were compared using Wilcoxon's signed-rank test by using Statistical Package for the Social Sciences 11.5 statistical software.

The authors conclude that a difference in leg position caused only a small change in rectum dose distribution and did not cause any other change in either dose distributions or in vivo measured doses of both target and critical organs during cervical brachytherapy.

Straight leg position appears better with regard to rectum dose.

In the paper by Silva, Mateus, Vieira, Eiras and Greco, authors pose the question Radiotherapy couches: is kevlar an obstacle? Treatment tabletops are usually made of carbon fibre due to its high mechanical strength and rigidity, low specific density, extremely light and regularly considered radiotranslucent. Their centre acquired a Calypso 4D Localization System where electromagnetic (EM) frequencies are used to detect implanted transponders in the patient. Carbon fibre is an electrical conductive material which interferes with EM frequencies. Therefore, in order to be able to use the Calypso System the carbon fibre tabletop in the treatment room must be replaced. The aim of their study was to determine the attenuation of the new, non-carbon fibre tabletop in treatment delivery.

Measurements were performed using an ionisation chamber inserted in a slab phantom positioned at the isocentre for 6, 10, 6 flattening filter-free (FFF) and 10FFF MV photon beams. These measurements were performed with and without tabletop for 0, 30 and 60° beam angle for a True Beam STx linac, for 5×5 and $10 \times 10\ cm^2$ field size beams. The attenuation was calculated for each measurement for each tabletop.

The authors found that the attenuation outputs were definitely higher for the Varian Exact IGRT Couch when compared with the kVue tabletops. The attenuation measurements for the kVue tabletops were closer to each other. Nevertheless, kVueTM Calypso® Varian tabletop showed smaller mean attenuation of the beams than kVueTM Universal Tip Insert for all measurements. There was no loss in treatment quality administration due to beam attenuation in the tabletop when tabletops were exchanged because of Calypso system integration. There is no need to change between kVue tabletops whenever there is a regular treatment or a Calypso System-guided treatment.

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In the next paper, Alwers, Gonzalez, Torres, Arbelaez, Gaitan and Cendales undertake a study to determine if a patient's breast size accurately correlates with the breast volume measured in the CT scan, and to determine which sizes correspond to a volume >750 cc, in order to predict which patients will benefit from breast irradiation in the prone position.

Breast size was calculated as the difference between the thoracic (band) and breast (bust) circumferences. Breast volume was contoured by a radiation oncologist and measured on the simulation CT scan. Pearson's coefficient was used to evaluate the correlation between both variables. A receiver operating characteristic (ROC) analysis was performed to determine the optimal cut-off point to predict which differences between band and bust would be associated to a volume ≥750 cc.

A total of 59 patients were included in the study. Mean breast volume was 851·8 cc and mean size difference was 4·7 inches. Pearson's correlation coefficient was 0·61 ($p < 0·001$). The ROC analysis found that a difference of 5 inches between the band and bust circumferences was the optimal cut-off point to determine a breast volume of 750 cc.

Authors concluded that a significant correlation between breast size as measured in the clinical practice and breast volume measured in the CT scan was found. Among other characteristics, a 5-inch difference between breast band and bust will be the cut-off point to decide if a patient will be treated prone at their institution.

In the next paper, Krishna, Varghese, Gopurathingal, Pilaka and Backianathan present their study to evaluate the clinical significance of pulmonary nodules incidentally detected in patients undergoing locoregional radiotherapy for breast cancer and present a retrospective analysis of the natural progression of such nodules.

A retrospective review of CT scans of breast cancer patients, who underwent radiotherapy over a period of 3 years, to screen out patients with indeterminate lung nodules was undertaken. This was correlated with the patient and tumour characteristics and the status of the disease at last follow-up.

Of the 132 patients reviewed 28 had indeterminate lung nodules. Four patients out of the 28 had progressive lung nodules on follow-up. Subgroup analyses did not show any significant correlation.

Authors conclude that one-fifth of patients may present with incidentally detected lung nodules. Multiple nodules, oestrogen receptor negative status and locally advanced breast cancer may point to a higher risk of these nodules progressing to metastatic cancer. There is no indication to stop locoregional therapy in the presence of indeterminate nodules, but close follow-up of high-risk group is recommended.

In the next paper, Khadsiri, Chawapun, Tharavichitkul and Saekho develop a software program to convert physical dose distribution into biologically effective dose (BED).

The MATLAB-based BED distribution software program was designed to import the radiotherapy treatment plan from the computer treatment planning system and to convert the physical dose distribution into the BED distribution. The BED calculation was based on the linear-quadratic-linear model. Besides radiobiological parameters, other specific data could be fed in through the panel. The accuracy of the program was verified by comparing the BED distribution to manual calculation.

The authors conclude that it is feasible and practical to use this in-house BED distribution software program in clinical practices and research work. However, it should be used with caution as the validity of the program depends on the accuracy of the published biological parameters.

In the next paper, Elcim, Dirican and Yavas present their study on the dosimetric verification and comparative analysis of two different treatment planning systems using collapsed cone convolution (CCC) and pencil beam (PB)

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algorithms for treatment sites of head and neck, chest wall–supraclavicular region, lung and prostate.

Target volumes and critical organs for treatment sites mentioned above were delineated according to relevant RTOG protocols. Treatment plans were generated using 6 MV photon energy with medical linear accelerator and Thermoluminescent Dosimeter-100 dosimeters were used to perform dosimetric verification which were placed in appropriate locations in the Alderson rando phantom.

Comparative analysis of CCC and PB algorithms for treatment sites revealed that point dose measurement values were higher with the PB algorithm compared with CCC algorithm, in both head and neck and chest wall–supraclavicular region plans. The most significant difference between the two algorithms was found at the supraclavicular region which includes the lung point dose within the treatment field and 7–12 mm depth from the skin, respectively. Unlike the head and neck and chest wall–supraclavicular region plans, CCC and PB algorithms show overall comparable results in lung and prostate plans in terms of point dose measurement values; however, the most prominent difference was found in 7 mm and 6 cm depth from skin, respectively. The CCC algorithm values were higher.

This study confirms that the PB algorithm calculates less absorbed dose than CCC algorithm in medium transitions, skin entrance and irregular treatment regions and is the underestimation of lateral equilibrium's contribution to the total absorbed dose.

In the final original paper, authors Yekta, Mahdavi, Baghani, Robatjazi, Mostaar, Mirzaie, Sardari, Akbari and Nafisi undertake a study to check the dose delivered to the patients during intraoperative electron beam radiation therapy (IOERT) in the conservative treatment of breast cancer, by means of reference dose measurement using radiochromic (EBT2) films.

In all, 22 patients with early-stage breast cancer underwent exclusive IOERT to the tumour bed using an LIAC accelerator (Sordina SPA, Italy). Absolute dose measurements were done with film pieces. After irradiation, the pixel values of the films were obtained via MATLAB and ImageJ softwares. Calibration curve was also used for calculating net optical density. Expected dose was compared with the patient-delivered dose. The findings of this study are as follows: EBT2 film response is independent from dose per pulse and it can be robustly used during breast IOERT for dosimetric and also positioning verifications.

The next paper is an educational note, in which Bridge, Warren and Pagett evaluate the use of planning metrics software for automated feedback to radiotherapy students in the University.

Pre-registration teaching of radiotherapy planning in a non-clinical setting should allow students the opportunity to develop clinical decisionmaking skills. Students frequently struggle with their ability to prioritise and optimise multiple objectives when producing a clinically acceptable plan. Emerging software applications providing quantitative assessment of plan quality are designed for clinical use but may have value for teaching these skills. This project aimed to evaluate the potential value of automated feedback to second-year BSc (Hons) Radiotherapy students.

All 26 students studying a pre-registration radiotherapy planning module were provided with automated prediction of relative feasibility for left lung tumour planning targets by the PlanIQ software (Sun Nuclear Corporation, Melbourne, FL, USA). Students were also provided with interim quantitative reports during the development of their plan. Student perceptions of the software were gathered using an anonymous questionnaire. Independent blinded marking of plans was performed after module completion and analysed for correlation with software-assigned marks.

Authors conclude that automated software is capable of providing useful feedback to students as a teaching aid, in particular with regard to relative feasibility of goals. The strong correlation between human and computer marks suggests a

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role in benchmarking or moderation; however, the narrow scope of assessment parameters suggests value as an adjunct and not a replacement to human marking.

The technical note is on the subject of unflattened photon beams shaped by multileaf collimator (MLC) using BEAMnrc code. Authors Kajaria, Sharma, Sharma, Pradhan, Mandal and Aggarwal present their study on the basic dosimetric properties of an FFF 6 MV photon beam shaped by MLC and examined using the Monte Carlo method.

The BEAMnrc code was used to make a Monte Carlo simulation model for 6 MV photon beam based on Varian Clinic 600 unique performance linac, operated with and without a flattening filter in beam line. Dosimetric features including central axis depth dose, beam profiles, photon and electron spectra were calculated and compared for flattened and unflattened cases.

This study demonstrated that improved accelerator characteristics can be achieved by removing flattening filter from beam line.

This issue is completed by two interesting case studies. In the first case study, Ampil, Nanda, Gonzalez-Toledo and Vora report a case of the long-term outcome after gamma knife radiosurgery of a patient presenting with an advanced jugulotympanic glomus tumour.

In the second case study, Syed, Ma and Gomez Suescun report the case of a patient presenting with unilateral vocal cord paralysis in squamous cell lung cancer treated with stereotactic body radiation therapy.

Angela Duxbury

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