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In this issue

In the fourth issue of Volume 16, there are 12 original papers on a range of subjects, including compassion in healthcare, fatigue management in therapy radiographers, an international audit of the virtual learning environment in radiotherapy and several studies on dosimetry and on the evaluation of different radiotherapy techniques and practice. There is a technical note on the dosimetric characteristics of a commercially optically stimulated luminescence system and two Letters to the Editor.

In the first paper, Taylor, Hodgson, Gee and Collins, undertake a concept analysis on the topic of compassion in healthcare. Compassion and compassionate care are central to radiographers' professional policy and practice and are congruent with the core values of the National Health Service Constitution. The authors state that the term compassion is often over-used, ambiguous and vague. This work sought to explore and provide contextual understanding to the term- compassion in healthcare.

The Walker and Avant's Eight-step model was used as the framework for the concept analysis for this study. Data collection utilised a number of resources including online databases: Medline, CINAHL complete, Scopus, PubMed, PsycINFO, Science Direct, Cochrane and DARE; dictionaries, social media, internet sources, books and doctoral theses. 296 resources were included in the review.

The author's findings identify the complexity of the term compassion and the subjective nature in which it is displayed and in turn perceived. The concept analysis forms the basis of further research aiming to develop a healthcare explicit definition of compassion within healthcare, specifically cancer care and radiography practices. Lucidity will enhance understanding; facilitating active engagement and implementation into practice.

In the second paper, Tolson and Jessop, present their study to establish whether fatigue management education impacts on radiographers' perceived competence and confidence in supporting patients undergoing radiotherapy.

A single-centre mixed method study was conducted. Participants completed a questionnaire determining baseline fatigue support practice, undertook an education package, then repeated the questionnaire to determine any change in their competence and confidence. Semi-structured interviews were used to gain insight into practice and perceived barriers.

The authors conclude that fatigue management education impacts on radiographers' perceived competence and confidence in supporting patients during their radiotherapy. Interviews highlighted knowledge of cancer-related fatigue is built up through day-to-day practice. Although there's greater awareness and support of fatigue, barriers exist, including patient compliance, lack of practical training, provision to monitor patients and unclear referral pathways.

In the next paper, Bridge, Giles, Williams, Boejen, Appleyard and Kirby, undertake an international audit of the use of the Virtual Environment for Radiotherapy Training (VERT) in academic practice. This high fidelity simulation hardware and software resource replicates the expensive and high pressure clinical environment of a radiotherapy treatment machine. The simulation allows students to gain confidence with clinical techniques in a safe and unpressured

academic environment prior to clinical placement. The aim of this study was to establish the current and future role of VERT and explore the potential for collaborative resource development and research.

An anonymous online survey was made available to all users of the software internationally. A mixture of fixed and open response questions gathered usage data and user feedback. This audit demonstrated high levels of engagement and enthusiasm for collaborative resource development and ongoing research among the radiotherapy simulation community. Adoption of an international Academic Community of Practice for collaborative simulation resource deployment and support may be of significant value and is worthy of further discussion and consideration.

In the next paper, Khadsiri, Tharavichitkul, Saekho and Chawapun, present their study to develop a software program to convert physical dose distribution into Biological 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. Authors found 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.

Authors, Tsang, Collins, Wong and Chiu, present their study to dosimetrically compare TomoDirect, TomoHelical, and Linac-based 3D-conformal radiotherapy (3DCRT) for craniospinal irradiation (CSI) in the treatment of medulloblastoma. Five CSI patients were replanned using Linac-3DCRT, TomoHelical, TomoDirect-3DCRT, and TomoDirect-intensity-modulated radiotherapy (IMRT). Dose of 36 Gy in 20 fractions was prescribed to the planning target volume (PTV). Homogeneity index, non-target integral dose (NTID), dose-volume histograms, organs-at-risk (OAR) Dmax, Dmean, and treatment times were compared. The findings of this study indicate that TomoDirect has the potential to lower NTID and shorten treatment times compared with TomoHelical. It reduces PTV inhomogeneity and better spares OARs compared with Linac-3DCRT. Therefore, TomoDirect may be a CSI treatment alternative to TomoHelical and in place of Linac-3DCRT.

In the next paper, Samanta, Balukrishna, Rafic, Peace, Singh and Pavamani, present their study to introduce a method to generate a 'DVH band' for plan evaluation of photon therapy and explore its various potentials. Intensity modulated radiotherapy (IMRT) plans for head and neck cancer patients were analyzed retrospectively for set up errors noted during treatment. From the maximum observed random errors, absolute displacement was calculated using Euclidian formula. The original plan with same beam parameters and leaf sequence were used to generate 6 plans with shifts applied in 3 axes in 6 directions. The dose volume istogram (DVH) curves from these 6 plans were superimposed to form the DVH band. Plans were reviewed with set tolerance criteria.

The authors concluded that the DVH band in photon therapy can help the clinician visualize the impact of setup errors at planning and may help select the plan with lesser influence of setup errors over another.

In the next paper, Giri and Pradhan, present their study on the assessment of in-built systematic and random errors in the ExacTrac imaging system due to the software of Brainlab, and on that basis; recommending a new quality control program for ExacTrac imaging system. A program was developed to compare the image data set of real time anthropomorphic pelvic phantom using ExacTrac with the reference image data set from computed tomography. Images were acquired 20 times in a day, on single sitting for 20 conjugative days. On the basic of these translational and rotational shifts, systematic and random errors were calculated that had arisen

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due to multiple time image acquisition and image registration between acquired and reference image data set of the phantom. This study concluded that there was inherent error in the ExacTrac system which can be quantified and used as a quality assurance tool for the ExacTrac system.

In the next paper, Almatani, Hugtenburg, Lewis, Barley and Edwards, present their study on the dosimetric feasibility of MR-based dose calculation of prostate radiotherapy using multilevel threshold algorithm. Owing to the high soft tissue contrast, the development of magnetic resonance (MR) imaging systems has been extended for the entire radiotherapy process. However, MR images provide voxel values that are not directly related to electron densities (ED), thus MR images cannot be used directly for radiotherapy dose calculation. The aim of this study is to enable dose calculations to be performed on MR images and evaluate the necessity of re-planning. A prostate cancer patient was imaged using both MR and CT. The multilevel threshold algorithm (MLT) was used categorise to voxel values in the MR images in into segments of homogeneous Hounsfield units (HU). The MLT algorithm was applied in MR images to segment and convert voxel values into air, water and bone. Bone contours were drawn on the MR image to enable accurate bone representation, and to isolate bone tissue from the surrounding adipose and water tissues. An intensity modulated radiation therapy (IMRT) plan was generated from CT images of the patient. The plan was then copied to the segmented MR data sets with identical settings and the doses were recalculated and compared using pencil beam, and collapsed cone (CC) algorithms and Monte Carlo (MC) modelling. Authors concluded that the segmentation and conversion of MR images into HUs/EDs data using the MLT algorithm, used in this feasibility study, can be used for dose calculation. Compared with the pCT plan, the segmented MR provided accurate dose calculation with differences of less than 2%. As a result, this method can be used as a dosimetric assessment tool and can be easily implemented into the clinic. With the simplicity of this approach, it can be used as a fast decision-making tool regarding on-treatment patient shape changes on an MRI-Linac and whether a new CT is required, as an alternative to obtaining a new planning CT and re-outlining the structures.

In the next paper, Kannan, Ashutosh, Saravanan and Reddy, assessed the acute toxicities in patients having carcinomas of oropharynx, larynx, and hypopharynx treated with concomitant boost radiation therapy by volumetric arc therapy (VMAT).

In this study, 30 patients of stage II to IVA disease were treated with concomitant boost radiation therapy using VMAT and those with stage III and IV also received concurrent chemotherapy with cisplatin 100 mg/m2 3 weekly for two cycles. The total dose was 68·4 Gy/40 fractions/5½ weeks [1·8 Gy/fraction/day to the large field for 28 fractions + 1·5 Gy/fraction/day to boost field for the last 12 days of treatment]. Radiation therapy oncology group (RTOG) acute radiation morbidity scoring criteria was used to grade acute effects.

Authors conclude that VMAT based concomitant boost radiation therapy allows for dose escalation with good patient tolerance by limiting acute toxicities.

In the next paper, Nantavithya, Saksornchai, Oonsiri and Shotelersuk, present their dosimetric study of 3-dimensional conformal radiotherapy, electronic compensator technique, intensity modulated radiation therapy, and volumetric arc therapy in whole breast irradiation. Whole breast irradiation is an essential treatment after breast conserving surgery. However, there are some adverse effects from inhomogeneity and dose to adjacent normal tissues. The aim of this study was to compare dosimetry among standard technique, three-dimensional Conformal Radiotherapy (3D-CRT), and advanced techniques, Electronic Compensator (ECOMP), inverse Intensity Modulated Radiation Therapy (IMRT) and Volumetric Arc Therapy (VMAT).

Whole breast irradiation treatment plans of patients who had underwent Breast Conserving Surgery (BCS) and whole breast irradiation were re-planned with all four techniques. Clinical Target Volume (CTV) was contoured according to the

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Radiation therapy oncology group (RTOG) atlas for breast only in patients who had negative node or ductal carcinoma in situ (DCIS) and breast with chest wall for patients with positive node. Planning Target Volume (PTV) was non-uniformly expanded. Dose prescription was 50 Gy in 25 fractions with 6 mega voltage (MV) photon energy.

Twenty-five patients underwent whole breast irradiation with computer tomography (CT) simulation from November 2013 to November 2014 were included.

Authors concluded that the HI of ECOMP and IMRT were significantly higher than 3D-CRT technique. All advanced techniques showed statistically better in CI. Lung V20, MILD, heart V25 and heart V30 of advanced techniques were lower than 3D-CRT. However, only ECOMP showed decreased MLD, MHD, MCLD and MCBD when compared to 3D-CRT.

In the paper by Qurat-ul-ain Shamsi, the author undertakes a dosimetric comparison of photon beam profile characteristics for different treatment parameters.

The main objective of this study was to investigate the 6 MV and 15 MV photon beam profile characteristics to improve the accuracy of radiation treatment plans. Methods In this exploration, treatment parameters like depth, field size and beam energy were varied to observe their effect on dosimetric characteristics of beam profiles in a water phantom, generated by linear accelerator Varian Clinac.

The author concluded that all the characteristics of photon beam dosimetry were analyzed and the characteristics like homogeneity and symmetry measured by an ion chamber in a water phantom came within clinically acceptable level of 3% and 103% respectively, thus fulfilled the requirements of standard linear accelerator specifications. This exploration can be extended to the determination of beam profile characteristics of electron and photon beams of other energies at various depths and field sizes for designing optimum treatment plans.

In the next paper Sadik, Romero, van Linge, Dallenga, Pauw and Wolbers, study the long-term beneficial outcome of fractionated stereotactic radiotherapy for smaller and larger vestibular Schwannomas. Fractionated stereotactic radiotherapy (FSRT) is an alternative treatment for large vestibular schwannomas (VS), if patients are not fit for or refuse surgery. In this study, we compared long-term clinical and radiological outcome in both small-medium sized and larger tumours.

A retrospective study was performed of 50 patients with sporadic VS who underwent primarily conventional FSRT. Fifty consecutive patients were divided in two groups by volume. Clinical and volumetric parameters were analysed. Authors concluded that FSRT is a treatment in his own right since highly effective in both smaller and larger VS without causing permanent disabling complications. The outcome is beneficial also in larger tumours that affect the 4th ventricle.

The final paper in this issue is a technical note presented by Jain, Chougule, Ananth and Akula on their study of the dosimetric characteristics of a commercial optically stimulated luminescence system. Optically stimulated luminescence dosimeters (OSLD) have a number of advantages in radiation dosimetry making them an excellent dosimeter for in vivo dosimetry. This study aimed to study the dosimetric characteristics of a commercial optically stimulated luminescence system by Landauer Inc., before using it for routine clinical practice for in-vivo dosimetry in radiotherapy. Further, this study also aimed to investigate the cause of variability found in the literature in a few dosimetric parameters of carbon-doped aluminum oxide (Al_2O_3:C). The commercial OSLD system uses Al_2O_3:C nanoDotTM as an active radiation detector and InLightTM microStar® as a readout assembly. Inter detector response, energy, dose rate, field size and depth dependency of the detector response were evaluated for all available clinical range of photon beam energies in radiotherapy.

Authors conclude that the cause of variability found in the literature for some dosimetric characteristics of Al_2O_3:C is due to the difference in general geometry, construction of dosimeter, geometric condition of irradiation, phantom material and geometry, beam energy. In addition,

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the irradiation history of detector used and difference in readout methodologies had varying degree of uncertainties in measurements. However, the large surface area of the detector placed in the phantom with sufficient build up and backscatter irradiated perpendicularly to incident radiation in Co60 beam is a good method of choice for the calibration of a dosimeter. Understanding the OSLD response with all dosimetric parameters may help us in estimation of accurate dose delivered to patient during radiotherapy treatment.

To complete this issue, there are two letters to the Editor, the first is related to the introduction of new technology, written by Shahabi, Salehi, Panahi and Halimi on he subject:

Circulating microRNAs: Are they indicators for the prediction of radiotherapy induced normal tissue injury?

The second is a letter to the Editor in regard to a previously published paper in the Journal:

Ahmad M, Ahmad H, Khattak MR, et al. Postoperative single versus multiple fractions high-dose rate iridium-192 surface mould brachytherapy for keloid treatment: a comparative study. J Radiother Pract. 2017;16 478.

The letter is entitled : Caution in comparing keloid treatment regimens through linear quadratic model, and written by Iftikhar Ahmad and Muhammad Rauf Khattak.

Professor Angela Duxbury

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