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In this issue

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In this issue

I am pleased to introduce the 'in this issue' for the first issue of the *Journal of Radiotherapy in Practice* for Volume 19. In this issue, there are 13 original articles on a range of radiotherapy-related topics, including one on the views of students on the support provided by placement supervisors. There is a literature review of the effects of tobacco smoking on cancer treatment outcomes and, to complete this issue, a technical note on the dosimetric comparison of TMR 10 and convoluted dose calculation algorithm in the gamma plan treatment planning system.

In the first article, Martin Sykes presents his study on the use of outcome measures that can be recorded in a radiotherapy IT system and how these can be used to extract mortality results for a group of patients receiving radical radiotherapy treatment for primary brain cancer.

In this study, treatment mortality outcomes were extracted from a radiotherapy database and were compared to the treatment technique used for each patient, between 1 January 2011 and 31 December 2017. The patients selected received one course of radiotherapy of 60 Gray in 30 treatments ($n = 270$). These patients received either Conformal Radiotherapy ($n = 127$) or Volumetric Modulated Arc Therapy (VMAT) ($n = 143$). The findings of this study demonstrate that not only can a radiotherapy database be used to extract treatment outcome measures but that it can be done to explore where a change in treatment delivery has been of benefit to the patients or not.

In the next article, Chow and Mohamed present their work on the development of a comprehensive computer database that was built to record and analyse the medical physics on-call data in emergency radiotherapy. The probability distributions of the on-call events varying with day and week were studied.

Variables of medical physics on-call events such as date and time of the event, number of events per day/week/month, treatment site of the event and the identity of the on-call physicist were input to a programmed EXCEL file. The EXCEL was linked to the MATLAB platform for data transfer and analysis. The total number of on-call events per day in a week and per month in a year was calculated based on the physics on-call data from 2010 to 2018. In addition, probability distributions of on-call events varying with days in a week (Monday–Sunday) and months (January–December) in a year were determined.

In this study, a database to record and analyse the medical physics on-call data was created. Different variables such as the number of events per week and per year could be plotted. This roster could consider the statistical results to prepare a schedule with better balance of workload compared to scheduling it randomly. Moreover, the emergency radiotherapy team could use the analysed results to enhance their budget/resource allocation and strategic planning.

In the article by Armstrong-James, Khine, Thorne, Tuckey and Bennett, the authors explore the experiences of radiotherapy students on clinical placement, specifically focusing on the provision of wellbeing support from clinical supervisors.

Twenty-five students from the University of the West of England and the City University of London completed an online evaluation survey relating to their experiences of placement, involving Likert scales and open-ended questions.

Students' experiences on placement differed greatly and appeared to relate to their specific interactions with different members of staff. It is suggested that additional training around providing wellbeing support to students may be of benefit to clinical supervisors.

In the article by Bairstow, Cain, Reynolds and Bridge, the authors evaluate the volume variability of seminal vesicle (SV) in patients receiving radiotherapy to the prostate. Prostate positional variability has been widely explored with SV variability only coming into the forefront in recent years. While planning target volumes (PTVs) margins and preparation protocols ameliorate the effects of bladder and rectum volume changes on prostate, studies on SV variation have looked at position only and not volume variability. The aim of this study was to investigate whether interfraction volume variability of the SV's can exist in patients receiving radiotherapy to the prostate.

The SV variability was investigated by comparing four on-treatment cone beam computer tomography scans to a planning computer tomography image for two patients receiving prostate radiotherapy. Variation in volumes (cm^3) was compared with intra-observer variation for each case.

This study identified potential for daily SV volume variability in patients receiving prostate radiotherapy. Future large-scale studies are warranted to identify the extent of this motion and potential clinical impact. Evidence-informed PTV margins and possible SV volume control protocols may need to be adopted.

In the next article, Thongsuk, Chitapanarux, Wanwilairat and Nobnop evaluate changes of accumulated doses from an initial plan in each fraction by deformable image registration (DIR)

with daily megavoltage computed tomography (MVCT) images from helical tomotherapy for prostate cancer patients.

The MVCT images of five prostate cancer patients were acquired by using a helical tomotherapy unit before the daily treatment fraction began. All images data were exported to DIR procedures by MIM software, in which the planned kilovoltage computed tomography (CT) images were acting as the source images with the daily MVCT acquired as the target images for registration. The automatic deformed structure was used to access the volume variation and daily dose accumulation to each structure. All dose-volume parameters were compared to the initial planned dose.

Findings are the daily actual dose differs from the initial planned dose. The accumulated dose of target tends to be lower than the initial plan but tends to be higher than the initial plan for the organs at risk (OARs). Therefore, inter-fractional anatomic changes should be considered by the DIR methods, which would be useful as clinically informative and beneficial for adaptive treatment strategies.

In the article by Bisht, Natanasabapathi and Kale, they estimate technical treatment accuracy in fractionated stereotactic radiosurgery (fSRS) using the Extend^{TM} frame system (ES) of Gamma Knife (GK).

The fSRS with GK relies on a re-locatable ES where the reference treatment position is estimated using a repositioning check tool (RCT). A patient surveillance unit monitors the head and neck movement of the patient during treatment and imaging. The quality assurance test of RCT was performed to evaluate a standard error (SE) associated with a measurement tool called a digital probe. A '4 mm collimator shot' dose plan for a head-neck phantom was investigated using EBT3 films. Computer tomography and magnetic resonance image distortion measurement studies were combined to evaluate SE imaging. The combined uncertainty from all measurements was evaluated using statistical methods, and the resultant treatment accuracy was investigated for the ES.

Results found the combined result of the positional shift and expanded uncertainty showed close agreement with film investigations.

In the next article, Sahin, Şahiner, Göksel and Meriç undertake a comprehensive evaluation of electron radiation dose using beryllium oxide dosimeters during breast radiotherapy. In this study, the differences between calculated and measured dose values were then analysed to assess the performance, in terms of accuracy, of the tested Treatment Planning System algorithms applied to calculate electron beam dose targeted and non-targeted the breast region.

The beryllium oxide (BeO) dosimeters placed on the female RANDO phantom were irradiated using 12 MeV electron energy from a medical linear accelerator and repeatedly read in the Riso TL/OSL system via an optically stimulated luminescence (OSL) method at least three times.

The results of this study showed that BeO dosimeters can be used with the OSL method in radiotherapy applications and it is a very important tool for the determination of targeted/non-targeted absorbed dose.

In the article by Saad, Elshahat and Metwally, the aim was to compare dosimetrically between intensity modulated radiotherapy (IMRT) and VMAT in sparing of hippocampus and OARs and PTV coverage. Sixteen patients presenting with more than one brain metastases were previously treated and then retrospectively planned using VMAT and IMRT techniques. For each patient, a dual Arc VMAT and another IMRT (five beams) plans were created. For both techniques, 30 Gy in 10 fractions was prescribed to the whole brain (WB) minus the hippocampi and 45 Gy in 10 fractions to the tumour with 0·5 cm margin. Dose volume histograms, conformity index and homogeneity index of PTV, hippocampus mean and maximum dose and other OARs for both techniques were calculated and compared.

Conclusions indicate that using whole brain radiotherapy and a simulated integrated boost (WBRT-SIB) technique, VMAT showed better PTV coverage with less mean and maximum doses to the hippocampus than IMRT. Clinical randomised studies are needed to confirm safety and clinical benefit of WBRT-SIB.

The next article authors Biswas, Lahiri, Roy, Maji, Bhadra, Ray, Das, De and Mohanta present their study to measure the translational set-up errors using KV-CBCT in patients undergoing IMRT in head and neck cancers and also to optimise clinical target volume (CTV) to PTV margin using the NAL protocol.

On the first 5 days of RT, patient's position was verified by KV-CBCT and then weekly during the course of treatment. The comparison between the reference and KVCBCT images was performed and the shifts measured and recorded. The mean error from the initial five consecutive fractions was corrected on the sixth daily fraction. Displacements in all the directions were measured. The population systematic and random errors were determined and used to estimate PTV margins according to van Herk's formula.

The authors conclude that a simple offline NAL protocol can correct the set-up errors without daily online imaging in patients undergoing IMRT and hence acting as a resource sparing alternative. A 5 mm margin to CTVs was adequate and safe to overcome the problem of set-up errors in head and neck IMRT.

In the study by Rangineni, Lahiri, Misra, Maji, Roy, Ray, Banerjee, Das and Pallath, the authors analysed the tumour response and the toxicity profiles in patients with locally advanced oropharyngeal cancers receiving hypofractionated intensity modulated radiation therapy (IMRT) and concurrent chemotherapy with Cisplatin. They investigated the feasibility and radiobiological efficacy of the regimen and its use as a resource-sparing alternative for a high-volume centre.

The records of 41 eligible patients with locally advanced squamous cell carcinoma of oropharynx, registered from September 2015 to April 2017, treated with hypofractionated IMRT with concurrent Cisplatin were analysed from the hospital database. Patients received concurrent chemoradiation with 2 cycles of 3-weekly cisplatin on day 1 and 22 along with hypofractionated IMRT, 55 Gy delivered in 20 fractions over 4 weeks. Patients were observed for any radiation reaction or chemotherapy toxicity at least once a week during the course of radiation therapy.

The authors conclude that this hypofractionated regimen is feasible and is associated with tolerable acute and late morbidity and satisfactory loco-regional response. Larger prospective, multi-institutional studies examining similar schedules may be undertaken to establish this as a standard practice, particularly for a high-volume centre.

In the article by Ooi and Mustafa, the authors present a phantom study to evaluate the dosimetry effects of using virtual bolus (VB) in the TomoTherapy Treatment Planning System (TPS) optimisation for superficial PTV that extends to the body surface. Without VB, the inverse-planning TPS will continuously boost the photon fluence at the surface of the superficial PTV due to lack of build-up region. VB is used during TPS optimisation only and will not be present in actual treatment delivery.

In this study, a dummy planning target was contoured on a cylindrical phantom which extends to the phantom surface and

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VB of various combinations of thickness and density was used in treatment planning optimisation with TomoTherapy TPS. The plans were then delivered with the treatment modality TomoTherapy. Radiochromic films (Gafchromic EBT3) were calibrated and used for dose profile measurements. TomoTherapy Planned-Adaptive software was used to analyse the delivered dose volume histograms (DVHs).

Findings are VB with the combination of 4 mm thickness and 1·0 g/cc density provides the most robust solution for the TomoTherapy TPS optimisation of superficial PTV.

In the next article, Abdulhadi Almuammar presents his study with the aim to identify and explore the factors that contribute to late-stage presentation of common cancers in Saudi Arabia. The main objective of the study is to understand the help-seeking journey taken by patients with cancer from the time they discovered or felt their symptoms until the time they have their treatment initiated.

Qualitative interviewing was used to collect data from 20 patients and 15 health professionals. The interviews were transcribed and then were subjected to the thematic analysis using a framework approach.

This research identified several factors that need to be investigated in the future using quantitative methods. There is a need to investigate the extent of using alternative medicine and its possible association with late presentation of cancer.

In the article by Dagli, Yurt and Yegin, they aimed to investigate the accuracy of dose distributions calculated by the BrachyDose Monte Carlo (MC) code in heterogeneous media for high-dose-rate (HDR) brachytherapy and to evaluate its usability in clinical brachytherapy treatment planning systems.

For dose comparisons, three different dose calculation algorithms were used in this study, namely, BrachyDose Monte Carlo code, Eclipse TG-43 dose calculation tool and Acuros®BV model-based dose calculation algorithm. Dose distributions were obtained by using any of the above codes in various scenarios, including 'homogenous water medium scenario', an 'extreme case heterogeneous media scenario' and clinically important 'a patient with a cervical cancer scenario'. In the 'extreme case, heterogeneous media scenario', geometry is a rare combination of unusually high-density and low-density materials and it is chosen in order to provide a test environment for the propagation of photons in the interface of two materials with different absorption and scattering properties. GammaMed ^{192}Ir Model 12i Source is used as the HDR brachytherapy source in this study. Dose calculations were performed for the cases where there is either a single source or five sources planted into the phantom geometry in all homogeneous water phantom and extreme case heterogeneous media scenarios. For the scenario a patient with a cervical cancer, dose calculation was performed in a voxelised rectilinear phantom constructed from a series of CT slices of a patient, which are obtained from a CT device.

In this study, the accurate dose calculation capabilities of the BrachyDose programme in HDR brachytherapy were investigated on various scenarios and, as a Monte Carlo dose calculation tool, its effectiveness in HDR brachytherapy was demonstrated by comparative dose analysis.

In the literature review, Kassim, Osei and Cronin review the effects of tobacco smoking on cancer treatment outcomes. The adverse health effects associated with smoking tobacco have been well investigated, and its detrimental effects on cancer treatment outcomes, efficacy and quality of life for cancer patients have also been well documented. Tobacco smoke contains many thousands of chemicals including a plethora of carcinogens, and the exposure of human cells to these carcinogens and their metabolic activation are the main mechanism by which smoking-related cancer is initiated.

This paper reports on a narrative review of recent studies in the field of the effects of tobacco smoking on cancer treatment, including the effects of the carcinogens in tobacco smoke on carcinogenesis, cell mutations and the immune system. The health effects of smokeless tobacco and effects of tobacco smoking on cancer treatment including its impact on surgery, radiation therapy and chemotherapy are reported. The potential risks of second primary cancers or recurrence from tobacco use, the effects of second hand smoking and cancer treatment, the impact of smoking on quality of life after cancer treatment and the need to integrate smoking cessation programmes into the cancer care continuum are also reported.

The authors conclude that tobacco use has a direct impact on cellular function by inhibiting apoptosis, stimulating proliferation and decreasing the efficacy of cancer treatment; therefore, quitting its use has the potential to improve treatment response rates and survival, as well as lower the risk of developing second cancers and potentially improved quality of life after treatment. Smoking cessation is one of the most important interventions to prevent cancer and is also essential after the diagnosis of cancer to improve clinical outcomes. Due to the numerous benefits of smoking cessation, it should become a critical component of the cancer care continuum in all oncology programmes from the prevention of cancer through diagnosis, treatment, survivorship and palliative care. Evidence-based smoking cessation intervention should be sustainably integrated into any comprehensive cancer programme, and the information should be targeted to the specific benefits of cessation in cancer patients.

To complete this issue is a technical note by authors Kendall, Algan, Chen and Ahmad, with the aim of comparing the tissue maximum ratio (TMR10) and convolution dose calculation algorithm in GammaPlan used in stereotactic radiosurgery (SRS) treatments with Gamma Knife and to assess if the algorithms produce clinically significant differences.

Treatment plans were analysed from 10 patients who have undergone Gamma Knife stereotactic radio surgery treatments. Patient plans were retrospectively recalculated using Lesksell GammaPlan 10 treatment software utilising the TMR10 and Convolution dose calculation algorithms in order to create a paired dataset for comparison. Evaluation was based on the DVH parameters of minimum, mean, maximum and integral doses.

Although doses calculated with the Convolution algorithm resulted in slightly higher mean integral doses for the brainstem and skull critical structures when compared to that of TMR10 doses, these result were not statistically or clinically significant. Thus, they continue to use the TMR10 algorithm at their clinic.

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