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In this issue

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In this issue

I am pleased to introduce the second issue of the *Journal of Radiotherapy in Practice* for Volume 19 published in June 2020. In this issue, there are 13 original articles on a range of topics and a literature review on the patient preparation strategies to manage internal organ motion during radiotherapy to the pelvis. In addition, there are two technical notes presented in this issue: one is on the subject of a dosimetric comparison of volumetric modulated arc therapy (VMAT) and intensity-modulated radiation therapy (IMRT) for anal cancer and the other one is on hypo-fractioned radiotherapy versus conventional radiotherapy for the treatment of multiform glioblastoma in adults over 70 years old. The case study in this issue is of the case of a patient presenting with cancer of the tonsils and treated with radiotherapy during pregnancy.

In the first paper, Sarwar, Papastavrou, English and Thompson study the impact of brachial plexus (BP) movement during radical radiotherapy for head and neck cancers and consider the case for a larger planning organ at risk volume margin. Treatment volumes for radical radiotherapy to head and neck cancers commonly extend into the lower neck, the territory of the BP. There is a risk of radiation-induced brachial plexopathy, a non-reversible late toxicity experienced by a small number of patients. The BP was anatomically divided into superior and inferior divisions and analysed to establish if segmental inter-fractional BP movement should be considered when planning radiotherapy in this high-dose region.

A retrospective single-centre analysis of 15 patients with head and neck cancers treated with radical bilateral neck irradiation was conducted. The extent of BP movement relative to the planning scan was assessed using weekly cone-beam computed tomography (CBCT) scans. The BP was contoured on the planning scan and the subsequent 6-weekly CBCTs; this was used to calculate the Jaccard Conformity Index for the left, right, superior and inferior divisions of the BP.

The study concludes that inter-fractional BP movement occurs; the greatest movement is seen at the inferior division. These data suggest the need for reevaluation of current BP margins and consideration of a larger inferior BP planning organ at risk volume margin.

In the next study, O'Connor and Barker aimed to assess the clinical feasibility of employing an automatic match during CBCT imaging using prostatic calcifications within the 95% isodose set as the region of interest.

CBCT images were analysed on the 5th fraction in 34 patients evaluating the difference between standard manual soft tissue anatomy matching versus auto calcification matching. An assessment of the clinical feasibility of using prostatic calcifications during matching alongside considering the effect of a more automated matching process has been conducted on inter-observer variability.

The standard deviation values of the difference between the soft tissue match (baseline) versus automatic calcification matches fluctuated around 1 mm in all 3 axes for all of the matches carried out. The inter-observer variability observed between the 2 radiographers was 0.055, 0.065 and 0.045 cm in the vertical, longitudinal and lateral axes, respectively.

The clarity of the calcifications on the CBCT images might explain the low inter-observer variability displayed by the two matching radiographers. A calcification provides a clear starting point for image matching before commencing a check of volumetric coverage; if the matching process begins in the same place it can allow for a standardisation of matching technique between radiographers.

In the next paper, Farrugia and Mattes look into the subject of radiation-associated hypertension (RAH) in patients undergoing treatment for prostate cancer. Patients undergoing prostate radiation therapy were observed to have elevated blood pressure (BP) in clinic, and the authors sought to further characterise this phenomenon.

The charts of 76 patients who received radiotherapy for prostate cancer between 2014 and 2017 were examined. Blood pressure readings were obtained at initial consultation, on treatment visits and subsequent follow-up appointments. To describe this effect, we defined RAH as an increase of $\geq$ 15 mmHg systolic BP, 10 mmHg diastolic BP or 5 mmHg mean arterial pressure.

The authors conclude that a significant number of patients undergoing prostate radiotherapy developed RAH, necessitating additional medication in some.

In the next paper, Lynn Cuthbertson presents a methodological reflection on the use of interpretive phenomenological analysis (IPA) utilised in the context of a qualitative research project that explored perceptions and experiences of the journey to radiographer advanced practice.

A two-phase study explored the perceptions and experiences. Phase 1 reviewed reflective diaries (n = 12) kept during the educational phase of the practitioner journeys. Phase 2 included one-one, semi-structured interviews (n = 6) which were recorded, transcribed verbatim and reviewed using the IPA six-stage thematic analysis for practitioners embedded in the advanced practice role.

Key themes arising from reflective diary analysis informed the interview content and following interview transcription, data immersion and IPA, 12 emergent subthemes generated three

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super-ordinate themes. Theoretical perspectives and application of the methodology are discussed. The phenomenological and interpretative qualities of IPA have the potential to provide unique and valuable insights into lived experiences of individuals. It is hoped that these researchers' reflections are transferrable for those interested in employing a qualitative methodology for radiotherapy and oncology research.

The author concludes that therapeutic radiographers work within rapidly changing environments from technological, treatment and care perspectives. With continued development and change, the impact of research utilising an IPA methodology may allow exploration of perceptions and experiences from a range of key stakeholders with potential to increase the research base.

In the next paper by Yuen Yan Chan, Ki Man Ku, Yin Ping Ng et al., authors describe the development of an in-house self-held respiration monitoring device (SHRMD) for providing deep inspiration breath-hold (DIBH) radiotherapy. The use of SHRMD is evaluated in terms of reproducibility, stability and heart dose reduction.

Sixteen patients receiving radiotherapy to left breast cancer were planned for treatment with both a free breathing (FB) and a DIBH scan. Plans with FB and DIBH were generated for comparison of the heart, left anterior descending (LAD) artery and lung dose. All patients received their treatments with DIBH using SHRMD. Megavoltage cine images were acquired during treatments for evaluating the reproducibility and stability of treatment position using SHRMD.

Compared with FB plans, the maximum dose to the heart by DIBH technique with SHRMD was reduced by 29.9% with SD of 15.6%, and the maximum dose of the LAD artery was reduced by 41.6% with SD of 18.3%. The inter-fractional overall mean error was 0.01 cm, and the intra-fractional overall mean error was 0.04 cm.

The authors conclude that this study demonstrated the potential benefits of using the SHRMD for DIBH to reduce the heart and LAD dose. The patients were able to perform stable and reproducible DIBHs.

In the paper by Smith, Ashruf, Mylander, Geraghty, Hassan, Burke and Dad, the authors sought to retrospectively report their clinical outcomes using post-operative stereotactic radiosurgery (SRS)/stereotactic radiotherapy (SRT) in place of whole brain radiation therapy following resection of brain metastases from their hospital-based community practice.

A retrospective review of 23 patients who underwent postoperative SRS at their institution from 2013 to 2017 was undertaken. Patient records, treatment plans and diagnostic images were reviewed. Local failure, distant intracranial failure and overall survival (OS) were studied. Categorical variables were analysed using Fisher's exact tests. Continuous variables were analysed using Mann–Whitney tests. The Kaplan–Meier method was used to estimate survival times.

Their findings indicate single-fraction frameless SRS proved to be an effective modality with excellent local control rates. However, the 5-fraction SRT course was associated with an increased rate of local recurrence. Dural/pial involvement may portend a high risk for distant intracranial disease; therefore, it may be prudent to consider alternative approaches in these cases.

In the next paper, Saad, Radwan and Hadi study the treatment of locally advanced head and neck cancer (LA-HNC). Treated with radiotherapy, both dose escalation and hypofractionation can improve tumour control rates with an uncertain role of the addition of concurrent chemotherapy. The authors aimed at developing a new radiotherapy protocol for patients not eligible to receive the standard concurrent chemoradiation therapy (CCRT) with the aim to reduce the toxicity profile.

Sixty-three LA-HNC patients were randomised to receive either 70 Gy in 35fx in 7 weeks concurrently with cisplatin 100 mg/m^2 every 3 weeks for 3 doses (Arm A) or 74 Gy in 33fx in 6.5 weeks (Arm B). VMAT plans were created for both treatment arms. Authors compared the local control, progression-free survival, OS and acute and late toxicity between the two arms.

Conclusions drawn are that a slightly dose-escalated hypofractionated regimen is safe and feasible and has comparable efficacy and less acute and late side effects than conventional dose CCRT with avoidance of chemotherapy-related toxicities in LA-HNC patients.

In the paper by Zulkafal, Khalid, Minhas, Zafar, Khan and Iqbal, the main objective of this study was to assure the quality of cervical cancer treatment plans by using an electronic portal imaging device (EPID) in RapidArc techniques.

Fifteen cases of cervical cancer patients undergoing a RapidArc technique were selected to evaluate the quality assurance of their treatment. The CT scan of each patient was obtained with 3-mm slice thickness and transferred to the Eclipse treatment planning system. The prescribed dose (PD) of 50.4 Gy with 1.8 Gy per fraction to planning target volume (PTV) was used for each patient. The treatment planning aim was to achieve 95% of PD to cover 97%, and dose to the PTV should not receive 105% of the PD. All RapidArc plans were created using the AAA algorithm and treated on Varian DHX using 6 MV photon beam, with two full arcs. Gamma analysis was used to evaluate the quality of the treatment plans with accepting criteria of 95% at 3%/3 mm.

On the basis of their results, authors summarise that the EPID is a useful tool for quality assurance in standardising and evaluating RapidArc treatment plans of cervical cancer in routine clinical practice.

In the paper by Gondhowiardjo, Aman, Setyawan, Handoko and Ramli, the authors consider metastatic brain disease and prognostic factors. Metastatic brain disease is still a major contributor to cancer treatment failure. Various treatments have improved in recent decades, which allow for better control of brain metastatic lesions. Various prognostic scoring tools have been developed and used worldwide to stratify patients with brain metastases to determine who will benefit most from aggressive treatment. The three most commonly used prognostic scoring tools are Recursive Partitioning Analysis (RPA), Basic Score for Brain Metastases (BSBM) and Graded Prognostic Assessment (GPA). The aim of this study is to validate these scoring tools using an Indonesian cancer patient population.

A retrospective analysis of all patients presenting with brain metastases from January 2012 until December 2014, through using hospital medical records, was conducted. All patients receiving whole brain radiotherapy during this period were included in this study. A follow-up with a telephone call was carried out to determine the patient's health and survival status. Incontestable patients were excluded from the analysis. Survival analysis was carried out by stratifying patients based on the three prognostic scoring systems.

A total of 80 patients were eligible to be included in the study, with 18 excluded due to being incontestable. The remaining 62 patients' data were analysed and stratified with all three scoring systems. The RPA was found to confer better stratification than BSBM and GPA in this study population.

Findings suggest that the GPA was non-prognostic in this study population, and BSBM was less prognostic, especially in the middle group, class 1 and class 2. Those BSBM class 1 and class 2 did not

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provide good prognostic stratification in our study population. Whereas, RPA was proven to be the best in stratifying patients' prognosis with brain metastases.

The next paper is an evaluation of setup errors and determination of setup margin in pelvic radiation therapy using electronic portal imaging device (EPID), by Noghreiyan, Nasseri, Anvari, Naji and Momennezhad. This study aimed to evaluate random and systematic errors occurring in interfraction setups during pelvic radiotherapy using the EPID and to propose the optimum clinical target volume (CTV) to PTV margin in pelvic cancer patients.

This study examined 22 pelvic cancer patients treatment, and a total of 182 portal images were studied. Population random (σ) and systematic (Σ) errors were determined based on the portal images in three directions (X, Y and Z). Setup margin for the CTV to PTV was calculated by published margin recipes of ICRU report No. 62 recommendation and formulas presented by Stroom and Heijmen and Van Herk et al.

Findings suggest that systematic errors for pelvic cancer patients ranged between 2.36 and 4.99 mm and random errors ranged between 1.51 and 2.74 mm. The margin required to cover the target volume for pelvic cancer treatment calculated based on ICRU 62, Stroom and Heijmen and Van Herk et al. formulas were obtained in the range of 2.8–5.7, 5.7–11.9 and 6.9–14.4 mm, respectively.

In the next paper, Aysun İnal presents a dosimetric evaluation of two phases on respiratory movement using a lung-equivalent material for radiotherapy treatment planning. Radiation dosimetry requires special phantoms which are comparable with organs and tissues of a human body. The lung is one of the organs with a low density; therefore, it is important to create and use lung-equivalent phantoms in dosimetric controls. The aim of this study was to investigate the importance of using lung-equivalent phantoms for different respiratory phases during measurements with both CT and the linear accelerator.

The maximum lung inhalation phantom (LIP) and lung exhalation phantom (LEP) were created for two respiratory phases. The Hounsfield unit (HU) values based on the selected slice thickness and CT tube voltages were investigated, as well as the difference between energy and algorithms used in the treatment planning system.

The author concludes that the LIP and LEP phantoms, prepared in accordance with respiratory phases, can be a simple and inexpensive method to investigate any difference in dosimetry during respiratory phases. Also, measured and calculated dose values are in the best agreement when a thinner CT slice thickness was chosen.

In the next paper, Osei, Kassim, Cronin and Maier present their evaluation of their initial evaluation of their tobacco cessation intervention program. Tobacco is a known addictive consumer product, and its use has been reported to be associated with several health problems as well as the leading cause of premature, preventable mortality worldwide. For patients undergoing cancer treatment, tobacco smoking can potentially compromise treatment effectiveness; however, there is sufficient evidence suggesting numerous health benefits of smoking cessation interventions for cancer patients.

The Grand River Regional Cancer Centre (GRRCC) smoking cessation program began in October 2013 to provide evidence-based intensive tobacco intervention to patients. All new patients are screened for tobacco use and those identified as active smokers are advised of the benefits of cessation and offered referral to the program where a cessation nurse offers counselling. Patients' disease site, initial cessation goal, quit date, number of quit attempts and mode of contact are collected by the cessation nurse. This study reports on the initial evaluation of the smoking cessation program activities at GRRCC.

Most patients referred to the program indicated a readiness to quit smoking, affirming that if patients become aware of the various risks associated with continual smoking or if they are informed of the benefits associated with cessation with regard to their treatment, they will be more likely to decide to quit. Therefore, it is essential that patients, their partners and families are counselled on the health and treatment benefits of smoking cessation and sustainable programs should be available to support them to quit smoking. Evidence-based smoking cessation intervention should be sustainably integrated into the cancer care continuum in all oncology programs from prevention of cancer through diagnosis, treatment, survivorship and palliative care.

In the next paper, Zarifi, Ahangari, Jia, Tajik-Mansoury, Najafzadeh and Firouzjaei examine detail depth dose characteristics of ideal proton beams using the GATE Monte Carlo technique. In this study, in order to improve the simulation efficiency, authors use the pencil beam geometry instead of parallel broad field geometry. Depth dose distributions for beam energies from 5 to 250 MeV in a water phantom were obtained. This study used parameters named Rpeak, R90, R80, R73, R50, full width at half maximum (FWHM), width of 80–20% distal fall-off (W(80-20)) and peak-to-entrance ratio to represent Bragg peak characteristics. The obtained energy–range relationships were fitted into third-order polynomial formulae. The present study also used the GATE Monte Carlo Code to calculate the stopping power of proton pencil beams in a water cubic phantom and compares results with the NIST standard reference database data.

The authors conclude that detail depth dose characteristics for monoenergetic proton beams within therapeutic energy ranges were reported. These results can serve as a good reference for clinical practitioners in their daily practice.

In the next paper, Slevin, Beasley, Speight, Lilley, Murray and Henry undertake a literature on patient preparation strategies to manage internal organ motion during radiotherapy in the pelvis. Pelvic internal organs change in volume and position during radiotherapy. This may compromise the efficacy of treatment or worsen its toxicity. There may be limitations to fully correcting these changes using online image guidance; therefore, effective and consistent patient preparation and positioning remain important. This review aims to provide an overview of the extent of pelvic organ motion and strategies to manage this motion.

Given the breadth of this topic, a systematic review was not undertaken. Instead, existing systematic reviews and individual high-quality studies addressing strategies to manage pelvic organ motion have been discussed. Suggested levels of evidence and grades of recommendation for each strategy have been applied.

Various strategies to manage rectal changes have been investigated including diet and laxatives, enemas and rectal emptying tubes and rectal displacement with endorectal balloons and rectal spacers. Bladder filling protocols and bladder ultrasound have been used to try to standardise bladder volume. Positioning the patient supine, using a full bladder and positioning prone with or without a belly board, has been examined in an attempt to reduce the volume of irradiated small bowel. Some randomised trials have been performed, with evidence to support the use of endorectal balloons, rectal spacers, bladder filling protocols and the supine over prone position in prostate radiotherapy. However, there was a lack of consistent high-quality evidence that would be applicable to different disease sites within the pelvis. Many studies included small numbers of patients, were non-randomised, used less conformal

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radiotherapy techniques or did not report clinical outcomes such as toxicity.

There is uncertainty as to the clinical benefit of many of the commonly adopted interventions to minimise pelvic organ motion. Given this and the limitations in online image guidance compensation, further investigation of adaptive radiotherapy strategies is required.

In the first of two technical notes in this issue, authors Chiang, Hibbitts, Ortega, Herman and Ahmad present a dosimetric comparison of VMAT and IMRT for anal cancer. VMAT, an extension of IMRT, employs modifications in gantry rotation speed, machine dose rate and multi-leaf collimator motion to deliver a 3D dose distribution. This study compared VMAT to IMRT for patients with anal carcinoma.

Sixteen patients previously treated with IMRT were retrospectively selected. Each patient received a total dose of 57.6–63.0 Gy in 1.8 Gy fractions. A single or double isocenter multi-arc VMAT treatment plan was generated using Eclipse RapidArc system with same CT image sets and optimisation constraints used for IMRT. Dose–volume histograms for PTVs and organs at risk; monitor units (MU) and beam on times (BOT) were used for comparison.

Conclusions from the study indicate that fewer MU and shorter BOT for VMAT may decrease damage from secondary radiation and treatment delivery uncertainty due to intra-fraction tumour motion, lead to higher machine throughput and improve patient comfort with less treatment time.

In the second technical note, Cantero, Nogueda, Vazquez, Castillo de la Garza, Montes de Oca and Olmos present their study on the global survival and recurrence-free survival of adults over 70 years old with multiform glioblastoma treated with hypofractionated radiotherapy and standard regimen between 2013 and 2016.

The results of this study show that hypofractionated scheme could be comparable in OS and recurrence-free survival to conventional fractionation, but a longer study should be done.

The case study in this issue is presented by Pineda, Espinosa, Noguez, Solis and Olguin and is a report on a patient who presented with tonsil cancer and was treated with radiotherapy during pregnancy.

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