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ABSTRACTS

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INVESTIGATION OF POTENTIAL SKIN TOXICITY FOR PATIENTS RECEIVING BREAST IORT USING EBT3 GAFCHROMIC® FILM [1]

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OBJECTIVES: To accurately calibrate EBT3 Gafchromic® film in the low kilo-voltage x-ray energy range and utilize it for dosimetry to estimate the dose to the skin of breast cancer patients receiving IORT.

DESIGN & METHOD: EBT3 Gafchromic® film calibration was performed by exposing sections of film to increasing dose levels using a Carl Zeiss INTRABEAM® 50 kV x-ray source in an INTRABEAM® water phantom. The absorbed dose to water could be determined using a PTW TN34013 soft x-ray ionization chamber and calculated with an algorithm specified by Zeiss. The irradiated film sections were scanned 42 hours later with an Epson V750 Pro transmission scanner in 48-bit RGB mode and analysis was done in the red colour channel using ImageJ. Once the calibration curve had been established, it was verified at various dose levels before implementation as a dosimeter during IORT cases.

During each breast IORT case, a lumpectomy is performed and one of the spherical treatment applicators (diameters ranging 1-5 cm) are placed into the cavity. The applicator is attached to the probe-like end of the x-ray source. A dose of 20 Gy is prescribed at 0 mm (at the surface of the applicator). During this study, a 1 x 1 cm² section of film was placed onto the outer skin surface of the breast at a region where the skin-to-applicator distance is minimal. The film was kept sterile by enclosing it with 3M™ Tegaderm™ transparent wound dressing before placement onto the patient. The influence of the Tegaderm™ on the film measurement was also evaluated.

RESULTS: For 22 patients that underwent the procedure, 7 received skin doses between 3-5 Gy which may result in low grade 1 skin reactions: erythema and epilation. The majority of the patients (12) received skin doses in the range of 5-10 Gy which could lead to high grade 1 reactions, resulting in dry desquamation. 2 patients measured in the 10-15 Gy dose range, which could lead to grade 2 reactions: dry or possibly moist desquamation, and 1 received a dose of 17.37 Gy which may result in blister formation (grade 3). The dose measured by the film could be verified within 3.3 % and the Tegaderm™ had negligible influence on the measurements. The collection of data for this study is ongoing.

CONCLUSION: EBT3 Gafchromic® film was found to be a suitable tool in determining the skin dose for breast IORT patients.

EVOLUTION IN BREAST CANCER KNOWLEDGE AND MANAGEMENT-THE LAST FOUR DECADES [2]

Coccia-Portugal MA

2650 BC – Breast Cancer was documented by Egyptian physicians. After more than 45 centuries the modern management of this disease was developed.

In the last 4 decades has been a dramatic change in the knowledge of breast cancer biology, together with improvements in surgery, radiotherapy and medical therapies. Thus impacting a change in its management.

Until the 1970's local therapy was the only treatment and breast cancer was then recognised primarily as a local-regional disease.

1970's – First clinical trials using adjuvant systemic therapy for positive axillary glands (L-PAM and CMF) post extensive surgery (mastectomy and axillary dissection).

Primary systemic therapy for inoperable disease was initiated.

Hormonal receptors were identified.

1980's – Adjuvant systemic therapy for negative axillary glands. The first target therapy (tamoxifen), anthracyclins, platinum and others medical therapies were further developed. On going trials using breast conservative therapy/mastectomy, sentinel node biopsy, and different systemic combination therapies for early disease.

1987 – Breast cancer presents as a spectrum of diseases from “local” to systemic when first detected. The importance of local and systemic therapy was emphasised at diagnosis.

1990's – Taxanes, steroidal and non-steroidal aromatase inhibitors targeting hormonal receptor +ve tumours and Trastuzumab for HER2Neu+ tumours used then only in metastatic disease.

1994- BRCA1 identification

1998 – Review of all on going phase III clinical trials for >20 years comparing mastectomy vs conservative surgery. Conclusion: mastectomy is no longer the standard of care. The intensity of local treatment does not change patient survival. NSABP: Primary surgery vs Primary chemotherapy showed no survival difference after 16 years follow-up.

2000's – Gene expression patterns of breast cancer distinguishing tumour sub - types with clinical implications (Luminal A, Luminal B, Her2+, Triple Neg) thus diminishing the use of TNM anatomical classification.

The use of HER2 target therapy for early breast cancer and development of intraoperative radiotherapy.

Concluding that treatment must be tailored to patient characteristics, tumour stage and molecular profile.

2010's – The use of Primary Systemic Therapy to evaluate tumour response at diagnosis, and the use of pathological response as a prognostic factor. PCR is associated with a prediction of long-term disease outcomes.

Conclusion for 2020's – Goal of improving the quantity and quality of life of breast cancer patients in developing countries. Breast cancer centres should be established in the Private and Government/Academic centers where patient therapy can be individualised by a multidisciplinary team (radiology, pathology, medical oncology, surgery and radiotherapy) at diagnosis.

HUMAN CYTOLYTIC FUSION PROTEINS TARGETING CSPG4 FOR THE TREATMENT OF TRIPLE-NEGATIVE BREAST CANCER [3]

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OBJECTIVES: Conventional chemotherapeutic approaches face obstacles such as off-target toxicity and therapy-resistance in certain cancers. Human cytolytic fusion proteins (hCFPs) are targeted therapeutic agents composed of a disease-specific humanized antibody-based ligand recombinantly fused with a conditionally apoptosis-inducing human oligopeptide. They exhibit low off-target toxicity and can overcome tumor resistance depending on the biomarker selected. We generated hCFPs targeting chondroitin-sulphate proteoglycan (CSPG4), a biomarker of aggressive and treatment-resistant cancers, for the treatment of triple-negative breast cancer (TNBC). These hCFPs are designed to bind to CSPG4-positive TNBC cells and deliver cytotoxic proteins intracellularly, where they induce tumor cell death by disrupting biosynthesis (angiogenin) or mitosis (microtubule-associated protein *tau* or MAP *tau*) in a compartment-dependent manner.

DESIGN & METHOD: We designed recombinant hCFPs based on angiogenin and MAP *tau* as lead agents, as well as a CSPG4-targeting SNAP-tag fusion protein (as a fluorescent mimic for binding). All fusion proteins were expressed in a transient secretory mammalian expression system and purified from the cell culture supernatant by ion metal affinity chromatography. Binding of CSPG4(scFv)-SNAP to CSPG4-positive and -negative TNBC cell lines was validated both quantitatively (by flow cytometry) and qualitatively (by confocal microscopy).

RESULTS: Preliminary proof-of-concept data demonstrate that the CSPG4-targeting, fluorescently-labeled CSPG4(scFv)-SNAP binds effectively to CSPG4-positive TNBC cells.

CONCLUSION: The combination of hCFPs with a robust companion diagnostic tool such as SNAP-tag technology represents the first step towards the effective management of African TNBC.

LINAC-BASED STEREOTACTIC RADIOSURGERY: PLAN OPTIMIZATION HOLDS THE KEY TO QUALITY [4]

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OBJECTIVES: This planning study compares 5 different linear accelerators in terms of their ability to perform highly conformal Linac-based Stereotactic Radiosurgery (LBSRS) for small, medium and large sized brain lesions. Resultant dose distributions following rigorous plan optimization are compared to GammaKnife (GK) dose distributions.

DESIGN & METHOD: LBSRS is a well established therapy for the treatment of arteriovenous malformations (AVM) and vestibular schwannomas (VS). Although the GK system has long been deemed the standard of care for Cranial Stereotactic irradiation, frameless image guided radiosurgery allows more treatment plan optimization flexibility and is offered on many linac platforms. LBSRS treatment plans were produced with ultra-modern volumetric modulated arc therapy techniques for small (VS and AVM), medium (AVM) and large (AVM) brain lesions on the Hyperion treatment planning system. Lesions ranged from 0.5cc to 14.6cc in volume. Treatment plans were developed using beam models of 5 different linear accelerators: Varian TrueBeam with a Millennium and High-Definition collimating system; Elekta Synergy with an Agility and Apex collimating system, as well as an Elekta Beam Modulator, each with their unique collimating characteristics. A comparison was made between the final optimized dose distributions for the 5 linacs and compared to GK planned dose distributions.

RESULTS: Treatment plans for each of the linear accelerators in the study produced dose distributions that were acceptable for treatment. These included conformity and heterogeneity indices. Differences between the collimating systems and their resultant dose distributions were negligible for all target lesion volumes, except the 0.5cc lesion that had slightly more favourable target volume conformity and OAR sparing with higher resolution collimation. However, higher resolution collimators performed only slightly better than those with coarser collimation in this case. As could be expected, GK distributions resulted in slightly better normal brain sparing at the cost of worse target dose uniformity and very long treatment times. Results indicate that any of these systems can deliver highly conformal treatments with little difference in dose distributions. Optimization parameters, such as segment smoothing options, had a much larger impact on the final dose distributions than the differences in collimating systems.

CONCLUSION: Treatment plans for linear accelerators with modern collimation devices compare favourably with GammaKnife SRS treatment plans. Differences between linac collimation systems only become observable when target volumes are very small; typically < 0.5cc. Planner experience and optimization tools have a much bigger dosimetric impact on the treatment plan quality than the collimation systems.

CARBOPLATIN-BASED CHEMOTHERAPY DELIVERS SUPERIOR RESULTS IN CHILDREN AND ADOLESCENTS WITH EXTRACRANIAL GERM CELL TUMOURS: FIRST REPORT BY THE SOUTH AFRICAN CHILDREN'S CANCER STUDY GROUP, 1990-2015

[5]

Hendricks M¹, Cois A^{2,14}, Geel J³, du Plessis J⁴, Bassingthwaighte M⁵, Naidu G⁵, Rowe B⁵, Buchner A⁶, Omar F⁶, Thomas K⁷, Uys R⁸, van Zyl A⁸, van Heerden J^{9,13}, Mahlachana N⁵, Vermeulen J, Davidson A¹, Frazier L¹¹, Donald K¹² & Kruger M⁶

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OBJECTIVES: Malignant extracranial germ cell tumours (MEGCTs) require a comprehensive multidisciplinary team approach to achieve good survival rates and good quality of survival. In preparation for harmonised national treatment protocol development, a national retrospective analysis was performed to evaluate treatment outcomes of children and adolescents with MEGCTs.

METHODS: Retrospective data from 9 South African paediatric oncology units was analysed to determine 5 year overall survival (OS) and prognostic factors. JEB (carboplatin, etoposide, bleomycin) and BEP (bleomycin, etoposide, carboplatin) were most frequently used and long term toxicities are described.

RESULTS: Between January 2000 and December 2015, 217 children and adolescents were diagnosed with MEGCTs, 64 males (median 25.67 months) and 153 females (median 98.33 months). Stage significantly affected 5 year OS: Stage 1 (95.9%), stage 2 (94.3%), Stage 3, (75.2%) and Stage 4 (59.8%) ($p=0.00002$, CI 95%). Protocol use also impacted outcome: JEB 87.6%, BEP 80.5%, PEB 66.5% and other 49.6% ($p=0.002$).

Only 6/82 (7.3%) patients who received cisplatin-based chemotherapy had a documented glomerular filtration rate (GFR) at diagnosis and only 10/82 (12.2%) an audiogram. Thirteen patients receiving cisplatin-based chemotherapy developed hearing deficits, 4 were severe. Causes of death in 36 patients included disease progression (30), infection (3), pulmonary fibrosis (1), secondary acute myeloid leukaemia (1) and surgical complications (1).

CONCLUSIONS: In the largest cohort of MEGCTs from sub-Saharan Africa, we demonstrate a five year OS of 80.3% with Stage 4 patients having only achieved a 59.9% OS. Protocol use impacted survival, with JEB showing clear superiority. Of concern, GFR and audiogram assessment pre-chemotherapy was performed in a minority of patients. Development and implementation of a standardised national protocol is intended to improve survival, especially for those with advanced disease, and will standardise the management of patients with long-term sequelae.

THE MANAGEMENT OF NEUROBLASTOMA IN SOUTH AFRICA BETWEEN 2000 AND 2014 [6]

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OBJECTIVES: Neuroblastoma (NB) in low- and middle-income countries (LMIC) has a poor outcome compared to high-income countries (HIC). A multi-institutional retrospective study across South Africa (SA) was done to determine outcomes.

METHODS: Patients treated between January 2000 and December 2014 in nine POUs were included. Demographic data, disease stage, treatment protocol and outcome were collected after custodian consent and individual consent waivers. Risk stratification was redetermined. Kaplan-Meier curves and Cox regression models were used in data analysis, metastatic post-induction remission and 2-year OS.

RESULTS: Data from 390 patients with neuroblastoma were included. The prevalence was 3.1/1000000 for 2014, representing 6.3% of all reported childhood malignancies. The median age was 39.9 months (SD 36.8, range 0-201 months). The majority presented with stage 4 disease (70%). The main chemotherapy regimens were OPEC/OJEC (44.8%), St Jude NB84 protocol (28.96%) and Rapid COJEC (22.17%). Only 44.4% received surgical interventions across all risk groups,

while 16.5% of high-risk (HR) patients received radiotherapy. The 2-year OS was 94.1% for very low risk, 81.6% low risk, 66.7% intermediate risk versus 27.6% for HR groups ($p < 0.001$, 95% CI). The 2-year OS of the NB84 was 41.0% in comparison to OPEC/OJEC with 32.5% and Rapid COJEC with 24.8% ($p = 0.039$, 95% CI). OPEC/OJEC had the least treatment related deaths (2.0%) followed by NB84 (6.2%) and Rapid COJEC (6.3%) ($p = 0.037$, 95% CI). Median survival time for the whole group was 13.0 months (mean 41.9 months, range 0.1 -209 months). On Multi-variate analysis stage ($p < 0.0001$, 65% CI), LDH > 750 U/L ($p < 0.0001$, 95% CI), ferritin > 210 g/dl ($p < 0.02$, 95% CI), MYCN amplification ($p = 0.01$, 95% CI), risk classification ($p < 0.0001$, 95% CI), chemotherapy regimens ($p < 0.04$, 95% CI) and surgical resection ($p < 0.01$, 95% CI) were identified as significant prognostic factors.

CONCLUSION: Limited disease had comparable OS to HIC. Poor OS was related to advanced disease. SA should investigate reasons for advanced disease and harmonise treatment by implementing a standard national treatment protocol.

FAVOURABLE OUTCOMES FOR SOUTH AFRICAN CHILDREN AND ADOLESCENTS WITH MATURE AND IMMATURE TERATOMAS (1990 -2015): FIRST REPORT BY THE SOUTH AFRICAN CHILDREN CANCER STUDY GROUP [7]

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- &
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BACKGROUND & OBJECTIVES: Outcomes of rare paediatric teratomas have not previously been reported, and treatment regimens have not yet been standardised in the middle income setting. We sought to evaluate treatment outcomes of children and adolescents with biopsy-proven mature and immature teratomas in preparation for harmonisation of management approaches.

METHODS: Retrospective data by folder review was collated from nine South African paediatric oncology units Kaplan-Meier analysis with Cox regression was performed to determine 5 year overall survival (OS) and prognostic factors.

RESULTS: From January 1990 to December 2015, 64 patients were diagnosed with mature teratomas, 15 males (median 3.47 months) and 47 females (median 10.83 months). Eighty four patients were diagnosed with immature teratomas, 20 males (median 0.85 months) and 64 females (median 30.02 months).

Definitive primary resection was performed in 58/62 patients with mature teratomas. In patients with immature teratomas, 62/84 had primary surgery which was definitive in 53.3% (33/62).

The five year OS for patients with mature teratomas was 92.5% and 80% for those with immature teratomas. For the combined group outcome was significantly influenced by stage: Stage 1 (97.3%), Stage 2 (100%); Stage 3 (64.4%) and Stage 4 (55.5%) ($p=0.00001$).

Five patients with mature teratomas died: 2 from post-operative complications, 1 from disease, 1 from infection and 1 unrelated. Fourteen patients with immature teratomas died, 11 from disease progression, 2 unrelated and 1 from infection.

Loss-to-follow-up was reported in 21/62 (38%) of patients with mature teratomas and 11/8 (13.1%) with immature teratomas All had stage 1 disease and underwent surgery alone.

CONCLUSIONS: Five year OS for the entire group was 84.7%, with poor outcomes for Stage 4 disease. This is the largest cohort of its kind reported in sub-Saharan Africa. Harmonisation of a national protocol will assist in standardising surgical approaches, indications for chemotherapy and follow-up guidelines and is intended to improve prognosis.

**FAVOURABLE OUTCOMES IN CHILDREN AND ADOLESCENTS
WITH SEX CORD STROMAL TUMOURS (1990-2015): FIRST
REPORT BY THE SOUTH AFRICAN CHILDREN'S
CANCER STUDY GROUP [8]**

Hendricks M¹, Cois A^{2,14}, du Plessis J³, Bassingthwaighte M⁴, Naidu G⁴, van Zyl A⁵, van Heerden J^{6,13}, Uys R⁵, Buchner A⁷, Rowe B⁴, Omar F⁷, Geel J⁸, Mahlachana N⁴, Thomas K⁹, Vermeulen J¹⁰, Davidson A¹, Frazier AL¹¹, Donald K¹² & Kruger M⁵

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OBJECTIVES: Paediatric sex cord stromal tumours are extremely rare and there is no data on outcomes reported from Africa. We sought to evaluate outcomes of children and adolescents with biopsy-proven SCSTs in preparation for the introduction of a national protocol.

METHODS: Retrospective data was collated from 9 South African paediatric oncology units. Kaplan-Meier analysis with Cox regression was performed to determine 5 year overall survival (OS).

RESULTS: From January 1990 to December 2015, 24 patients were diagnosed with SCSTs, 4 males (median age 100.52 months) and 20 females (median age 78,18 months). Histologies included: 1 thecoma, 12 Sertoli-Leydig cell tumours and 11 juvenile granulosa cell tumours. Only stage impacted overall survival (OS): Stage 1, 100%; Stage 2, 0%, Stage 3, 80% and Stage 4, 50%. Twenty one patients underwent primary surgery and the remaining 3 following neo-adjuvant chemotherapy. Patients assigned FIGO stage 1C disease and above received chemotherapy, except 1 with FIGO stage 3A disease who is a survivor. One patient with FIGO stage 1A disease received chemotherapy for rising markers and survived. Twelve patients received chemotherapy: 6 JEB (carboplatin, etoposide, bleomycin), 4 BEP (bleomycin, etoposide, cisplatin) and 2 others. One patient who received JEB was changed to PEB (cisplatin, etoposide, bleomycin) after 2 courses. Two patients developed hearing impairment: 1 received BEP and the other PEB. Only 3 patients had audiograms and only 2 glomerular filtration rate (GFR) testing prior to chemotherapy. Three patients died of disease. There were no treatment-related deaths.

CONCLUSIONS: Although the numbers in this cohort are small, this study represents a relatively large cohort and the OS of 82.6% is encouraging. It is essential that the management of rare tumours such as SCSTs be standardised to ensure the best possible OS and to limit long-term sequelae. Based on these results, a standardised management protocol has been designed.

PAEDIATRIC SOLID TUMOURS IN LOW TO MIDDLE INCOME COUNTRIES: A DECADE OF EXPERIENCE FROM A SOUTH AFRICAN HOSPITAL [9]

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BODY: There are few modifiable risk factors for solid tumours in children, except in the presence of a predisposing condition or syndrome, therefore early diagnosis and treatment are important in improving survival. Reporting the incidence, demographic data, presentation and outcomes of these solid tumours may improve awareness, and allocation of resources for their management. There is paucity of literature on the incidence, prevalence, demographics, treatment of paediatric solid tumours in Low to Middle Income Countries (LMICs) including South Africa.

OBJECTIVES: The aim of this study was to present, describe and interpret the disease burden, demographics, and stages at presentation of paediatric solid tumours at Chris Hani Baragwanath Academic Hospital (CHBAH).

DESIGN AND METHODS: A retrospective review of medical records of children below 16 years with solid tumours treated at CHBAH from 1 January 2007 to 31 December 2016 was carried out. Central nervous system, eye, bone, and medically managed tumours were excluded. Data on the total number of all paediatric cancers seen each year at the oncology department was obtained for comparison.

RESULTS: There were 387 solid tumours, accounting for 33% of all paediatric oncology cases. Eighty-five percent were malignant and only 3% of these tumours occurred in children with a predisposing condition. Nephroblastoma was the commonest tumour, accounting for 28%, followed by rhabdomyosarcoma at 15.5%, neuroblastoma at 12.5%, germ cell tumours at 12%, and hepatoblastoma at 4%. Peaks in occurrence were seen in nephroblastoma, rhabdomyosarcoma and neuroblastoma within the 1 to 5 years age group, with 48% of all the tumours studied occurring within this age group. Late presentation was common with 52% presenting with advanced disease. Over the 10-year period, 296 oncological surgeries were performed, averaging 30 operations per year, including surgeries performed for lung metastases.

CONCLUSION: The solid tumours studied accounted for a third of all oncology cases encountered in children at CHBAH with over 50% of the malignant tumours presenting late with advanced disease. Programmes put in place to create awareness on signs and symptoms of paediatric solid tumours, encourage early presentation, early referral and prompt management will improve survival in paediatric solid tumours at CHBAH. These programmes may be targeted towards the 1 to 5 years age group, within which half of these solid tumours occur.

SETTING UP A NEW RADIOTHERAPY FACILITY IN KENYA: THE ELDORET EXPERIENCE [10]

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INTRODUCTION: According to the ministry of health, Kenya, cancer is the 3rd leading cause of death after infectious and cardiovascular diseases. Literature of the time estimated that in 2012 there was an estimated 37000 new cancer cases and 28000 cancer-related deaths in Kenya. Approximately 15% of the global cancer burden is attributable to infectious agents with higher percentages in developing countries.

In Kenya, as in many other African countries, cancer patients have to travel from across the country, some as far as 600km away, to access treatment. There were only one public facility and five private facilities, all based in Nairobi being the capital city, when Equra Health Kenya decided to broaden easier access to cancer care services in other parts of Kenya. Eldoret, one of the new growing cities in the country, is located 500km West from Nairobi.

Access to especially radiotherapy services in Kenya remains a challenge. The situation in the public sector is even more challenging but also in the private sector many patients, when commencing radiation therapy, is at advanced stage of their disease.

DESIGN & METHOD: The cancer centre in Eldoret was planned, constructed and operationalized as a total new facility and this required the project to be tackled in various phases

- **initial stages** (Business feasibility studies, identifying local clinical partners, site identification, tendering for construction, and construction of the facility),

- **equipping and staffing** (equipment identification and ordering, delivery and installation, acceptance, commissioning and the recruitment of staff) and
- **operationalizing of the facility** (staff orientation, protocols and policies implementation, safe work procedures and accreditation of the facility).

RESULTS: Various **challenges** which we had to face and overcome occurred along the journey. These related to for example the initial and ongoing importation process of equipment, parts and radioactive sources, different construction methods, unreliable electricity supply, staff availability and centre accreditation challenges), Despite the challenges, **the impact** of opening a cancer treatment facility outside Nairobi has been significant. Radiotherapy and brachytherapy patient volumes have increased dramatically over the course of 24 months, resulting in reduced travelling costs and improved cancer support closer to where people live and work

CONCLUSION: With the successful launch of the modern chemotherapy and radiotherapy facility in Eldoret town, cancer patients no longer have to experience the burden of traveling more than 600 km to access similar facilities in the capital city Nairobi. Due to local access to necessary cancer treatment options, the waiting time from diagnosis to treatment has greatly reduced for a large number of patients.

DEMONSTRATION OF A 3D GRAPHICS, INTERACTIVE RADIOTHERAPY SIMULATOR FOR TRAINING AND TEACHING [11]

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Groote Schuur Hospital**

OBJECTIVES: Familiarity and confidence are important aspects in ensuring that equipment are used properly, with care and to the full ability of the equipment. It is ideal to have a treatment unit available on which staff can learn and practice, but due to the high cost of treatment machines and the need to use the treatment units optimally for patient treatments, it is not possible or feasible to have treatment units idle for staff training. To overcome this problem an interactive, computer simulation can fill the need. This project involves the development of a computer simulator for Radiotherapy. This simulator aims to address all aspects of Radiotherapy, from basic equipment use, to patient setup, as well as image production.

DESIGN & METHOD: The first step was to determine what aspects were required to be simulated in terms of detail and complexity. The next step was to design 3D models of the selected treatment unit objects. These models were then created using 3D modelling software. These 3D models are then combined and a computer program written to manipulate and control these models to achieve the desired outcomes and realism, as well as to make them interactive.

RESULTS: The radiotherapy simulator is being developed and it will involve multiple phases in order to achieve its full potential. Currently a generic treatment unit simulation is being used in order to test the functionality.

CONCLUSION: The computer, graphics simulator has the potential to serve as an independent training aid for a department, not just for learning how to use the equipment, but also as an aid in demonstrating to patients what their treatment will involve in terms of patient setup and machine movements. The simulator also has the potential to be expanded to include other divisions in radiation medicine.

OPTIMAL SKIN MARKINGS FOR POSITIONING IN RADIOTHERAPY: ARE TATTOOS THE ONLY OPTION? [12]

Botha R

**Planning Radiotherapist, WITS University Donald Gordon Medical
Centre**

OBJECTIVES: Reproducibility of setup is one of the most important aspects of good radiotherapy treatment. Skin markings are made at the initial simulation to facilitate this. Permanent black tattoo skin markings are the standard of care for skin marking in radiotherapy positioning, however, this practice is being called into question. The exclusive practice of placing permanent skin markings for radiotherapy does not consider the psychological impact to the patient, religious beliefs or other social impacts. There is now greater emphasis on patient autonomy and there is a growing number of patients wanting an alternative to permanent tattoos, for various reasons. The objective of this review is to compare the available options for skin markings used for radiotherapy set up.

DESIGN & METHOD: The advantages and disadvantages of various skin marking methods will be compared, including temporary markers, such as temporary marker pens, paint markers and temporary henna tattoo skin markings, surface guided radiotherapy, UV ink tattoos and permanent black India ink tattoos. I will be comparing durability of marking, repetition of marking session, skin reactions to markings, patient comfort and radiographer satisfaction.

RESULTS: Temporary markings can be used, however, they are not as durable as permanent tattoos and remarking periodically can lead to setup variances. When using henna there is a time impact when remarking and therefore is not ideal in departments with high workloads.

Surface guided radiotherapy provides an alternative to permanent tattoos, however, this is still relatively new technology and not readily available. The cost of these upgrades in units is often prohibitive and will likely limit availability in the future.

UV ink is good alternative to India ink as you have the advantage of permanent marking but the markings are not as obtrusive.

CONCLUSION: With current resources in most departments permanent tattoos remain the recommended standard of care, however, UV ink may be considered instead of India ink. For patients who are very strongly opposed to tattoos, temporary markings such as henna markings, paint- and pen markers may be considered provided the patient is adequately counselled regarding the advantages and disadvantages of different skin markings.

IMAGE GUIDED RADIOTHERAPY (IGRT) A LIFE HILTON PRIVATE HOSPITAL: RADIOTHERAPY UNIT EXPERIENCE [13]

Clarke N, Bux M, Coyne R, Govender N & Haynes J
Life Hilton Private Hospital

OBJECTIVES: IGRT is the use of imaging before and/or during radiation therapy. With the development and implementation of advanced techniques such as VMAT (volumetric arc therapy), IMRT (intensity modulated radiation therapy) and SRS (stereotactic radiosurgery), IGRT has become an essential pre-requisite for delivering high precision radiotherapy. It is essential however that imaging protocols are carefully developed and implemented and all staff are trained adequately.

DESIGN & METHOD: A literature review covering the importance of pre-treatment patient preparation, immobilisation and set-up as well as the different imaging modalities available and their utilisation will be covered. The roles and the responsibilities of the different team members will be discussed. A more practical approach will be explored as to what we currently within our own unit, here, at Life Hilton Radiotherapy Unit have adopted, and helpful tips, protocols and troubleshooting ideas that we have used in our workplace will be shared.

RESULTS: Daily imaging, if implemented correctly, ensures more accurate delivery of treatment. It also allows for the reduction of PTV margins. When limiting these margins it is critical that correct image matching is performed to limit the possibility of target miss.

CONCLUSION: Implementing daily IGRT correctly is necessary to ensure accurate delivery of radiation treatment, especially when modulated techniques are implemented, dose escalation is performed and PTV margins are reduced. Well-developed imaging protocols need to be in place as well as sufficient training for staff needs to be performed to ensure treatment is delivered as intended.

THE EVALUATION OF AN ALGORITHMIC MODEL, CREATED FOR THE IMAGE GUIDED RADIOTHERAPY TREATMENT COUCH FOR INTEGRATION INTO THE PINNACLE TREATMENT PLANNING SYSTEM [14]

Botha JJ
Medical Physics, Groote Schuur Hospital

INTRODUCTION: This study was done as part of the MSc degree in Radiography. During treatment planning the Linac couch must be added as a structure on the plan, so that its density is taken into account for dose calculations. Scripting is a programming language that supports the writing of programs for a software environment that automate the execution of tasks, which could alternatively be executed one-by-one by a human operator. Scripting the couch top on the Pinnacle Treatment Planning System (TPS) replaces manual contouring of the couch as a structure, thus streamlining the planning process. The Varian IGRT couch is not regular in shape and the aim was to model the full couch accurately in terms of shape, dimensions, and attenuation characteristics.

DESIGN AND METHODS: The actual transmission of the 6 MV and 18 MV Linac beams through the Varian IGRT couch top was measured at different gantry angles for three different field sizes on different parts of the treatment couch. These attenuation properties

were then used to create a model of the treatment couch which can then be inserted into the treatment plans by the script.

Because the shape of the couch is not regular from superior to inferior, as well as anterior to posterior, the modelling of this shape proved quite challenging and a slice-by-slice approach was used.

The user specifies on the TPS where the top of the couch must be and then clicks the button to run the script. The script then determines on which part of the couch each slice is and then draws the relevant couch contour, taking into account any longitudinal and lateral offsets that the user specified.

RESULTS: The couch transmission was measured at gantry angles ranging from 120° - 240° through 180°. The couch transmission as determined by the TPS at the same gantry angles after the script was implemented was within ± 0.56 % of the measured transmission for the 6 MV beam and within ± 0.61 % for the 18 MV beam.

CONCLUSION: Scripting the Varian IGRT couch top on Pinnacle was achievable and the script runs fast and reliably. The script is currently being tested clinically and will then be made available to departments running the Pinnacle treatment planning system.

HDR BRACHYTHERAPY: THINKING OUT OF THE BOX! [15]

Heetun A

Equra Health West Rand Oncology Centre

OBJECTIVE: Presentation reviewing interesting HDR Brachytherapy cases done at the West Rand Oncology Center and Arcadia Oncology Center for gynaecological cancer.

DESIGN & METHOD: Data was collected retrospectively on patients that underwent HDR brachytherapy at the West Rand Oncology Center. Information was gathered from EMR (electronic medical recording system), the Radiation Oncologist and the treating Radiotherapist. Data will be presented on patients that received a modified Sorbo (Cylinder) brachytherapy treatment post EBRT.

RESULTS: Cases are presented with pictures and displayed in a Powerpoint presentation.

CONCLUSION: To present interesting out of the ordinary HDR cases that took place at this facility. This will include the preparation of the treatment, the planning of the treatment and the delivery of the treatment.

NETCARE PRE-TREATMENT PATIENT SPECIFIC QA FOR IMRT & VMAT [16]

Fourie H^a & Venter D^a

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OBJECTIVES: The South African Standards for Quality Assurance in Radiotherapy require verification measurements for each patient undergoing IMRT or VMAT. These measurements are to confirm the relative and absolute dose distributions as calculated by the TPS before the patient starts treatment. At least 95% of the evaluated points must pass the dose difference (DD) criteria by < 3-4% and the distance-to-agreement (DTA) criteria by < 2-3mm. The ideal measurement equipment and procedures have to be established to produce all the required information but still be time and cost effective.

METHOD: The Sun Nuclear DoseCHECK™, an independent Monitor Unit check software, was introduced as a surrogate for the absolute dose reproduction check. This software uses the patient CT information and “Golden Beam” linac data to compare its own calculated dose distribution to that of the TPS. The Varian Portal Dosimetry (PD) was used for the relative dose distribution reproduction check. The IMRT / VMAT plan is delivered on the linac and measured using the EPID. The software compares the measured fluence to the predicted fluence and also produces a composite of the individual fields. The PTW Octavius 4D phantom and 1500 array were used for absolute dose distribution measurements. All of the above equipment are capable of producing a DD and DTA analysis.

RESULTS: The DoseCHECK™ software is based on a centralized server, hence multiple radiotherapy sites can make use of the software. The dose comparisons rarely fail and if required a machine specific model may be developed to more accurately represent the configuration of the linac. The Varian PD is not an absolute dose measurement, therefore an MU check program or an additional absolute dose measurement is required. The PD measurement however is very quick and no additional equipment is required. The PTW Octavius 4D can produce an absolute 3D dose distribution measurement and also do a DD and DTA analysis in 3D. It is however time consuming to perform a complete set of measurements (30 – 60 min) and it requires large and heavy equipment.

CONCLUSIONS: We have concluded that the DoseCHECK™ and Portal Dosimetry are the optimal combination of solutions regarding QA, time and cost effectiveness. The PTW Octavius 4D remains the “gold standard” since it can produce absolute dose distributions in 3D and can be used on any linac.

MPOWERING CHOC PSYCHOSOCIAL SUPPORT STAFF WITH KNOWLEDGE AND SKILLS TO SUPPORT CHILDREN AND TEENAGERS BEFORE AND DURING MEDICAL TREATMENT PROCEDURES IN ORDER TO PREVENT TRAUMA [17]

Bence JA

OBJECTIVES: The CHOC psychosocial support staff based in Paediatric Haematology and Oncology units across South Africa witness, on a daily basis, the debilitating, traumatic impact of invasive medical treatment procedures on the children and teenagers undergoing treatment for childhood cancer or life threatening blood disorders. These treatments can result in a vast array of feelings such as fear, anxiety, anger and despair and this is often expressed as obstructive behaviour and resistance to cooperating with treatment procedures.

DESIGN/METHOD: Realising this, the CHOC psychosocial support team engaged the services of a qualified Child Life Specialist to empower them with the necessary knowledge and skills to address this problem. Each team member was provided with a “Preparation Toolkit” to use in their work with the children and teenagers before, during and after treatment procedures. The training methods used, both theoretical and practical in nature, included the following: distraction, sharing of information, play and other therapeutic techniques. The importance of familiarising the children and teenagers with the medical equipment and treatment facilities was also attended to.

RESULTS: The psychosocial team observed that the children and teenagers experienced a greater sense of control over their situation and this in turn, released stress and anxiety and generally assisted them to cope better. Preparing the children before procedures has proven to contribute to better physical recovery and an informal observation has also shown that since “preparation” has become part of psychosocial service delivery, there has been a decline in families abandoning treatment.

CONCLUSION: Introducing “preparation” as part of psychosocial service delivery in CHOC is providing formal research opportunities.

BUILDING A PSYCHOSOCIAL AND SPIRITUAL CARE SERVICE FOR CHILDREN WITH CANCER AND THEIR FAMILIES [18]

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OBJECTIVES: Comprehensive, coordinated psychosocial, supportive and spiritual care is an essential component of the holistic care of childhood cancer sufferers and their families. The authors detail the development and value of a multidisciplinary psychosocial care team as an essential adjunct to care of childhood cancer sufferers.

DESIGN & METHODS: A historic preamble details a period during which psychosocial and supportive care was the sole province of the paediatric oncologists and social workers and describes that the process of creating a multidisciplinary psychosocial and spiritual care team has enhanced medical care.

RESULTS: Each member of the psychosocial group describes their care philosophy and role in the clinical setting. We also describe the critical role of the meeting as a teaching vehicle for oncology fellows.

CONCLUSION: This reproducible partnership between public and private sector practitioners, designed in a resource-constrained setting, affords a diverse and highly skilled group of professionals the opportunity to meet the medical, psychological, social and spiritual needs of patients and families as they transition through the care journey.

DEVELOPING AN IN-FACILITY INTERVENTION TO MANAGE COMPASSION FATIGUE IN ONCOLOGY NURSES, DURBAN, SOUTH AFRICA [19]

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INTRODUCTION: Oncology nurses are at high risk for developing compassion fatigue and it is therefore essential to develop strategies that may assist them.

AIM: To develop an in-facility intervention to manage compassion fatigue among oncology nurses in Durban, South Africa.

METHOD: The Self-Care Intervention for Oncology Nurses was developed using action research with a mixed methods sequential explanatory design. The study was conducted with oncology nurses at three settings (a state hospital, private hospital and an NGO hospice). The study comprised of an integrative review, a quantitative component using a questionnaire that measured compassion fatigue, burnout and compassion satisfaction (ProQOL v5) and in-depth interviews. The oncology nurses played an active part in developing the intervention, which was then verified by experts.

RESULTS: The intervention was developed from the findings and included psychoeducation, remembrance and support structures. An intervention booklet was designed providing psychoeducation by highlighting compassion fatigue and normalisation thereof. A remembrance tree and follow-up family phone call assisted symbolic remembrance of patients. The support group enabled oncology nurses to discuss their fears and concerns and reflect on their experiences and the effect these may have had on them.

CONCLUSION: Preliminary findings immediately post implementation of the Self-Care intervention for Oncology nurses indicated that the intervention prompted oncology nurses to become more aware of the risks of compassion fatigue, and to engage in improved self-care practices.

**THE PREVALENCE AND GENOTYPES OF HUMAN PAPILLOMA
VIRUS IN OCULAR SURFACE SQUAMOUS NEOPLASIA AT
DR GEORGE MUKHARI ACADEMIC HOSPITAL,
GAUTENG, SOUTH AFRICA [20]**

**Mhlongo LN & Nkosi CM
Sefako Makgatho Health Sciences University**

OBJECTIVES: The purpose of the study was to determine the prevalence of Human Papilloma Virus (HPV) in different Ocular Surface squamous Neoplasia (OSSN) lesions, to detect the HPV genotypes in OSSN lesions and to correlate HPV and P16^{INK4a} expression in OSSN lesions at Dr George Mukhari (DGM) Academic Hospital.

DESIGN AND METHOD: The study was a retrospective cross-sectional observational study using archival OSSN tissue samples. A total of 58 OSSN formalin fixed paraffin-embedded (FFPE) tissue samples classified as CIN I (5), CIN II (8), CIN III (33) and CIS (11) were randomly selected for the study by two panel of pathologist blinded. The prevalence of HPV was determined using HPV immunohistochemistry (IHC), Chromogenic-In-Situ-Hybridisation (CISH) and polymerase chain reaction (PCR) targeting the L1 region using the MY09/MY11 and GP5+/GP6+ primers with Human β -Globin (PCO3(F) and GH20(R) primers) used as an internal control. The P16^{INK4a} expression was detected using immunohistochemistry.

RESULTS: HPV was detected in 18% (12/58) of samples using IHC, CISH for viral antigen was negative in all samples (0/58), 19% (11/58) samples were positive using PCR at DGM and 15.5% (9/58) were positive using PCR at Belgium. Multiple HPV genotypes were detected in 8.6% (5/58) cases [5/11(45.5%) positive cases]. The HPV genotypes detected includes HPV 16 (8), HPV 11&16 (5), HPV 11 (2), HPV 6 (2), HPV 81 (1), HPV 55 (1), HPV 31 (1) and HPV 67 (1). P16^{INK4a} was positive in 22.4% (13/58) of the OSSN cases, of these positive cases, 61.5% (8/13) were HPV positive on PCR and IHC, of this HPV positive cases, the genotypes detected were HPV 6 (2) AND HPV 16 (4) and HPV 11 (2).

CONCLUSION: HPV was positive in less than 20% of the OSSN cases, this suggest that HPV is not the cause but a cofactor in the cause of OSSN. P16^{INK4a} was positive in more than 50% of the HPV positive OSSN cases; this might imply P16^{INK4a} can be used as a surrogate marker for HPV, especially the high-risk HPV types, additional confirmatory test is essential to eliminate the risk of missing some HPV-Positive tumours as HPV-Negative.

WHAT TO DO WHEN A COMPETENT PATIENT REFUSES TREATMENT [21]

Brummer A

The Mary Potter Oncology Centre

OBJECTIVE: As a nurse we are taught to take every step possible to save a life. We are also trained to respect the patients' wishes. Sometimes these two conflict. How do we proceed?

DESIGN AND METHOD: A 20-25 minute slide-based presentation discussing the ethical and legal boundaries of this topic. We work around evidence-based medicine that incorporates guidelines, protocols and audit.

RESULT: Adult competent patients are entitled to accept or reject a treatment option. The reasons do not have to be sound or rational and in fact the patients do not have to give any reason at all. Patients may even favour a treatment that is untested or even clearly detrimental to the patients' health. When a competent adult patient refuses treatment recommended by guidelines we are bound to respect it. If we do not we could be faced by disciplinary action by a governing council and even possible civil or criminal proceeding in battery.

Informed refusal, just like informed consent, comprises three elements:

- The patient must be competent
- He or she must have sufficient information to make a decision
- The decision must be made voluntarily

This involves:

- Communication. The patient has to be well informed of choices, challenges, benefits and costs. They need to understand the impact of accepting treatment versus the impact of declining treatment as well as the consequences.
- Patient preferences and goals need to be discussed and their healthcare professional needs to understand their thought processes.
- An acceptable solution needs to be understood by both parties and the decision needs to be documented
- The patient at any time may change their mind and withdraw consent or refusal but future healthcare decisions might be impacted by a change in their healthcare state

CONCLUSION: Understanding ethical and legal parameters that healthcare professionals might face on a daily basis in an oncology setting. A few case scenarios will be used as examples to support the talk.

A COHORT STUDY OF TREATMENT OUTCOMES AFTER RADIOTHERAPY IN VULVAR CARCINOMA PATIENTS [22]

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Stellenbosch University

OBJECTIVES: Carcinoma of the vulva is a rare tumour, representing about 4% of gynaecological malignancies. For locally advanced vulvar cancer, surgery often involves exenteration with colostomy or urinary diversion causing significant physical and psychological morbidity. Neoadjuvant or primary chemoradiation is an acceptable treatment option for these patients to reduce the tumour size and minimize the extent of surgery. The purpose of the study was to determine the socio-demographic features and treatment outcomes in patients with vulvar carcinoma in a single institution.

METHODS: A quantitative retrospective cohort study was done of all women diagnosed with vulvar cancer referred for radiotherapy from 1 January 2015- 31 December 2017. Demographic and clinical data, treatment time, and radiotherapy fractionation were noted. The primary end point was local control (LC) and overall survival (OS), defined as date of start of RT to date of relapse, secondary primary or death related to cancer (which ever came first).

RESULTS: 33 women were eligible for inclusion in the study. There were 22 patients who received curative treatment: definitive CRT/RT (N=17), adjuvant RT (N=5). Of the 22 patients, 11 were in remission, 3 with documented local recurrence and 8 died due to unknown cause. Twelve patients received palliative treatment. The overall survival at twelve months showed that dual modality treatment resulted in a 100% survival outcome for the patients who received primary surgery followed by adjuvant radiotherapy. There was however, no significant difference between the survival for the definitive CRT/RT (57%) and high dose palliative RT (52%). The dose of radiotherapy was significant; women who received a total dose greater than 60Gy had better local control compared to those who received a total dose of less than 45Gy.

CONCLUSION: Dual modality treatment had superior overall survival outcome over definitive chemoradiation or radiotherapy alone in this small cohort.

A RETROSPECTIVE REVIEW OF PATIENTS WITH STAGE 3 CERVICAL CANCER TREATED WITH RADICAL RADIOTHERAPY AT UNIVERSITAS HOSPITAL ANNEX FROM 2001 TO 2010 [23]

**Rothman M & Napo H
University of the Free State¹**

OBJECTIVE: To determine the disease-free survival and the overall survival in patients with stage 3 cervical cancer treated with concurrent chemoradiation.

DESIGN & METHOD: A retrospective analytical cohort study was conducted. We reviewed the files of 393 patients with stage 3 cervix cancer who was treated at the Universitas Hospital Annex between 2001 and 2010. Data collected included total dose of external beam radiation and brachytherapy, the total number of concurrent chemotherapy cycles, the performance status, the HIV status and CD4 counts.

RESULTS: The 5-year survival was 86,4% and the 5-year disease free survival was 66,3%. The total radiation dose (EQD₂) did not make a significant difference to the overall survival (p=0.48; HR 0.98) or the disease-free survival (p=0.19; HR 0.98). Concurrent chemotherapy did not affect the overall survival (p=0.99) but did have a significant impact on the disease-free survival (p=0.03). The number of chemo cycles also impacted the disease-free survival (p=0.03; HR 0.73). The age of the patients was significantly associated with disease-free survival (p<0.01, HR 0.97) but not with overall survival (p=0.84, HR 1.00).

CONCLUSION: Whether the patients received chemotherapy and the number of chemotherapy cycles had a statistically significant impact on the disease-free survival but not on the overall survival. The total dose of radiotherapy (EQD₂) did not have a significant impact on either disease-free or overall survival.

SEXUAL QUALITY OF LIFE IN LOCALLY ADVANCED CERVICAL CANCER PATIENTS TREATED WITH DEFINITIVE CONCURRENT CHEMORADIATION [24]

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University of Witwatersrand^a & Wits Donald Gordon Medical Centre^b

OBJECTIVES: Research of radiation toxicity has primarily focused on symptoms related to nearby organs such as the bladder, bowel and rectum; however the vagina is both the target and an organ at risk. The purpose of this study was to describe the sexual quality of life (QoL) of patients treated with chemoradiation for locally advanced cervical cancer.

DESIGN & METHOD: This is a retrospective analysis of prospectively collected data from a phase-III randomised controlled trial investigating the benefits of the addition of hyperthermia to chemoradiation from January 2014 to June 2017. 76 participants from the control arm with a median follow-up of 12 months were included in this analysis. QoL was prospectively assessed using EORTC QLQ-CX24 Quality of Life (QoL) questionnaires at baseline, then every 3 months post-treatment during the first year, and every 6 months in the second.

Results: Sexual worry (i.e. that sex would be painful), and poor body image, were present in 60% of participants at baseline and remained constant for the first year post-treatment but decreased in those who survived beyond a year to 35-40%. 11% of participants (n=8) reported being sexually active at baseline but this doubled by six months post-treatment (n=17) and plateaued to 30% of participants after 9 months post-treatment. 21% of women under 30 years, 22% of those 31-50 years and 10% of participants over 50 years of age reported having sex in the last four weeks. Out of the 72 reports of sexual activity, pain during intercourse was reported in 65% of participants while 77% found intercourse enjoyable. 51% of the participants found it both enjoyable and painful, 26% enjoyed sex without pain and 14% who did not enjoy intercourse reported pain. The main vaginal symptom was discharge that was almost two times more prevalent than vaginal discomfort throughout the first two years post-treatment (71% vs. 43% at baseline; 40% vs. 27% at 6 months; 23% vs. 14% at 18 months). However there is a clear and noteworthy improvement over time.

Conclusion: The sexual QoL of participants were greatly impaired before treatment and their concerns persisted throughout the first year with an improvement in the subsequent year. Providing care on a daily basis without the in-depth understanding of what is most meaningful to our patients only widens the gap in our care. These findings can help health professionals to shape expectations by paying attention to concerns, and to reassure patients that there are improvements over time.

RETROSPECTIVE STUDY OF THE TREATMENT OUTCOMES OF CERVICAL CANCER IN YOUNG WOMEN TREATED AT A SINGLE INSTITUTION [25]

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Stellenbosch University

INTRODUCTION: Cervical cancer affects mostly young women from poor countries and disadvantaged populations. There is limited information available to specifically outline the presenting features and treatment outcomes of young patients treated for cervical cancer.

OBJECTIVES: The aim of the study was to evaluate demographics and treatment outcome in young women under the age of 40 years with cervical cancer treated at a single institution in South Africa.

DESIGN AND METHODS: Retrospective study that reviewed medical records of patients younger than 40 years with cervical cancer referred for radiation from January 2015 to December 2018. The MOSAIQ® patient management system was used as the source of patient names. Data collected included patient demographics; HIV status; stage; treatment and survival outcome.

RESULTS: In the study time period 96 patients under the age of 40 years were referred for radiotherapy. The median age was 33 years (24-38 years); 15.6% (n=15) were under the age of 30. Overall, 36.5% were HIV-positive.

Disease characteristics included 91.7% squamous cell carcinoma on histology; 65.6% (n=63) were Stage IIIB and above. The very young (under 30 years) had a high proportion presenting with advanced stage disease, 73.3% (n=11).

Seventy-one patients (74%) received radical CCRT, RT or adjuvant CRT – 77 patients (80.2%) received >40Gy. HIV-negative patients were significantly more likely to be prescribed curative therapy (82% vs 60%; p=0.018).

Of the 71 patients who received radical therapy, 17 (23.9%) had a recorded date of death by study end, with no significant difference by HIV-status.

CONCLUSION: The young women presenting with cervical carcinoma at our institution had a high prevalence of HIV and advanced stage. Though HIV status impacted treatment intent, more than 80% of the cohort received a high dose of radiation.

GESTATIONAL TROPHOBLASTIC NEOPLASM: A RETROSPECTIVE REVIEW IN A SOUTH AFRICAN POPULATION [26]

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BODY: Gestational trophoblastic diseases comprise partial and complete hydatidiform mole, persistent or invasive mole, choriocarcinoma and placental trophoblastic tumours. Partial and complete hydatidiform mole are considered premalignant forms of the disease whereas persistent or invasive mole, choriocarcinoma and placental site trophoblastic tumors are malignant and therefore termed gestational trophoblastic neoplasms. Gestational trophoblastic diseases have an estimated incidence of 1-3:100 pregnancies for complete Hydatidiform Mole, 3:1000 pregnancies for partial hydatidiform Mole, 1:50,000 deliveries for choriocarcinoma and placental site trophoblastic tumours in the United Kingdom. However, it is most common in Asian populations. It is not known, the epidemiological factors, treatment strategies and outcomes in the South African population. This study serves to identify and examine a South African cohort of patients who were treated for gestational trophoblastic neoplasms at the Groote Schuur Hospital, Cape Town, South Africa between 2010-2017. The epidemiological factors and presenting symptoms, investigational modalities, risk stratification, treatment and outcomes will be assessed. The data will then be analysed to identify any correlation between presentation/treatment and outcome. In addition, comparisons will be made with pre-existing information on gestational trophoblastic neoplasms both locally and internationally.

OBJECTIVES: To identify the epidemiological factors, presenting symptoms, management strategies and outcomes of patients treated for gestational trophoblastic neoplasms between 2010 to 2017 at the Groote Schuur Hospital.

DESIGN & METHOD: The retrospective review will be conducted on a study population of 50 female patients who presented with and were treated for gestational trophoblastic disease, based on serum beta human beta chorionic gonadotropin levels and histological diagnosis, at the Groote Schuur Hospital between 01/01/2010 to 01/01/2017. Data will be obtained from the Department of Radiation Oncology, Groote Schuur Hospital Cancer Registry.

RESULTS: Results will include the identification of incidence rates, significant epidemiological factors, presenting symptoms and outcomes identified by the number of consolidation cycles and remission rates. Variables will be assessed using correlation analysis and data will be compared to previous data using parametric testing.

CONCLUSION: At the end of the study, a better understanding of the epidemiology, management and outcomes of gestational trophoblastic disease in a South African population will be attained. This will be influential as it would outline the differences from and similarities to international presentations, protocols of management and prognoses.

TRAINING RAD ONCS FOR LMIC COUNTRIES: HAVE WE MADE ANY IMPACT? A 20 YEAR STUDY AT UNIVERSITY OF CAPE TOWN

[27]

Parkes J & Mohamed Z
University of Cape Town and Groote Schuur Hospital^a

OBJECTIVES: In 1999, the Radiation Oncology department at the University of Cape Town(UCT) embarked on a policy of implementing training of international Radiation Oncologists. The purpose of this study was to evaluate the success of the program implemented with respect to the origin of the professionals trained, how successful they were at completing the program, and their current positions.

DESIGN & METHOD: All international doctors and supernumerary registrars registered in the Department of Radiation Oncology at UCT from 1999 until 2019 were included in the study. Evaluation was done according to countries of origin, short period or full training, whether the full training registrars stayed for the intended duration of study, whether they were able to pass the Part 2 South African examinations in Radiation Oncology by the end of their training time, and whether they returned to their country of origin after completion of training and are still working there.

RESULTS: A total of 39 supernumerary doctors were registered between 1999 and 2019. 31 of these were international doctors and 8 were registrars from other sites in South Africa. Of the 31 international registrars, 28 were registered for full training and 3 for short visits of 6 months. Of the 28 registered for full training, 10 are currently still in the program, 16 have completed the program and 2 did not complete the program. The trainees were from 13 different countries. Only one registrar did not pass the Part 2 CMSA examinations by the end of training. Of the 16 who completed the program, 7 are currently heads of department in their home countries, 6 doctors are working in their own countries, 1 has emigrated, 1 is working in another country in Africa, 1 is not currently working but plans to return to his country of origin and work. Of the 8 local registrars who attended the department for part of their training, 5 passed Part 2 CMSA examinations at completion of training and 3 have never passed. Of the 5 who are specialists, 4 work in their province of origin, but 2 in private practice. 1 relocated to another province.

CONCLUSION: The international training program at UCT has successfully trained Radiation Oncologists for many countries in Africa and beyond. Few international registrars do not successfully complete the program. Most international registrars are still in practice in their countries of origin and a high number are Heads of Department. Of the local registrars who complete part of their training in the department, the pass rates are slightly lower, but many stay in the state sector working in Oncology. Overall, the program shows a high impact.

THE ROLE OF SURGERY AND RADIOTHERAPY IN THE MANAGEMENT OF NEUROBLASTOMA IN SOUTH AFRICA [28]

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OBJECTIVES: Local therapies are essential in the management of Neuroblastoma (NB) regardless of risk classification. A multi-institutional retrospective study across South Africa was done to evaluate the impact of surgery and radiotherapy on outcomes in NB patients.

METHODS: Patients treated between January 2000 and December 2014 in nine POUs were included. Demographic data, disease stage, risk stratification, degree of surgery, the administration of radiotherapy and outcome were collected after custodian consent and individual consent waivers. Kaplan-Meier curves, Cox regression models and Fischer's Exact test were used in data analysis and calculating 2-year OS.

RESULTS: Data from 390 patients were included. The median age was 39.9 months (SD 36.8, range 0-201 months). The majority presented with high-risk (HR) disease (75.6%). Only 42.8% received treatment related surgical interventions across all risk groups. Of patients with very low-risk (VLR) disease 88.2% were operated, 76.9% of low-risk disease (LR), 70% of IR and 35.6% of HR. Radiotherapy was administered to 16.7% of intermediate-risk (IR) and 16.3% of high-risk (HR) patients. HR achieved 25.4% post-induction complete metastatic remission (MR), while 82.6% (n = 62) were operated. Incomplete MR was achieved in 71.5%, but only 18.5% (n = 39) were operated. In HR disease (n=295), completely resected (CR) tumours had a 2-year OS of 46.4%, incomplete resected (ICR) tumours 51.4% and unoperated tumours (UT) 16.2 % (p<0.001, 95% CI). In IR disease (n=30), CR had a 2-year OS of 83.3%, ICR 70.1% and UT 42.9 % (p<0.001, 95% CI). In LR disease (n=26), CR had a 2-year OS of 84.4%, ICR 100% and UT 42.8 % (p<0.001, 95% CI). In LR disease, CR and ICR had a 2-year OS of 100%, but UT 50 % (p<0.001, 95% CI). Only 2 patients (1.2%) died from surgical complications. In HR disease, who received tumour bed radiotherapy, the 2-year OS was 42.3% versus 24.1% with no radiotherapy. IR disease, who received tumour bed radiotherapy, had a 2-year OS of 75% versus no radiotherapy 63.4% (p<0.001, 95% CI). Even HR disease, who received radiotherapy without surgical interventions had an improved 2-year OS of 25.8% as opposed to 17.3% in patients that did not receive local therapies (p<0.001, CI 95%). On multi-variate analysis stage (p<0.0001, 65% CI), risk classification (p<0.0001, 95% CI), post-induction complete remission rate (p<0.001, 95%CI), degree of surgical resection (p<0.01, 95% CI) and radiotherapy administration (p<0.001, 95% CI) were identified as significant prognostic factors.

CONCLUSION:Complete and incomplete surgery provide a survival advantage to neuroblastoma patients, who achieved mCR. Monotherapy radiotherapy benefited local control. Both treatment modalities should be implemented in settings without access to autologous transplant or targeted therapy.

COMPLICATIONS IN THE PLACEMENT OF CENTRAL LINES FOR PAEDIATRIC ONCOLOGY PATIENTS AT UNIVERSITAS ACADEMIC HOSPITAL, FROM 1992 TO MARCH 2018 [29]

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INTRODUCTION / BACKGROUND: Central venous access devices (CVADs) such as External tunneled cuffed catheters (Hickman Lines) are notoriously associated with complications such as central line associated infections and more severely, systemic sepsis

AIM: To determine the complications of central lines for chemotherapy in paediatric oncology patients treated by the Paediatric, Haematology and Oncology Unit at Universitas Academic Hospital in Bloemfontein from 1992 to March 2018.

DESIGN & METHOD: This was a retrospective descriptive study. The study population was paediatric oncology patients, 16 years and younger that received CVAD's and treated by Paediatric Haematology and Oncology Unit at Universitas Academic Hospital in Bloemfontein. Information was collected from their database.

RESULTS: There were 293 lines that were inserted with a median age was 64.7 months. There were no in-situ local complications in 183(62.5%) of the lines while 39(13.3 %) showed sepsis, the rest of the lines had scientifically insignificant complications. Of the 39 that had line sepsis, 23% had no systemic sepsis and 61.5% were neutropenic and septic. 190 patients had symptoms of systemic symptoms of sepsis and accompanying neutropenia. Of these 190 lines, 128(67.4%) did not develop in-situ line complications. 85(44.7%) lines were removed because it was the end of treatment and only 31(16.3%) lines were removed as a result of line sepsis

CONCLUSION: Despite the study population having characteristics that make them more prone to infections, there was a significantly low incidence of line sepsis complications (13.3%). The special care taken intra-operatively and the meticulous aseptic handling and maintenance post-operatively can be the reason for the low infective complication values.

POOR PROGNOSTIC FEATURES OF CHILDREN DIAGNOSED WITH OSTEOSARCOMA OVER A 20 YEAR PERIOD IN A HOSPITAL IN JOHANNESBURG [30]

Ngcana T

Chris Hani Baragwanath Hospital

BACKGROUND: Survival rates of South African children with osteosarcoma (OS) are known to be poor but prognostic factors have not been elucidated in an African setting.

AIM AND SETTING: To determine the overall survival rate and prognostic factors in children with OS at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH).

METHODS: A retrospective review was conducted of children with OS from 1990 to 2010. Descriptive statistics, Kaplan-Meier survival analysis and Cox logistic regression were performed.

RESULTS: 55 files were available for analysis. The median symptom duration was 90 days. The median age was 12.1 years. The majority had poor prognostic features: 47 (85%) had masses larger than 8cm diameter, all patients had high alkaline phosphatase and 46 (83.6%) had elevated lactate dehydrogenase (LDH). Histology included osteoblastic (37/55) and chondroblastic OS (9/55). Forty-three (78.2%) patients had low BMI at presentation. Forty-one patients were treated with ifosfamide, doxorubicin, methotrexate and cisplatin and one patient was on a hybrid protocol. Thirteen (25%) did not receive chemotherapy and four patients declined surgery. The five-year survival rate of those treated with curative intent was 42%. Causes of death included progression of disease (22/42) and treatment complications (5/42). On univariate analysis site of primary tumour ($p = 0.044$), LDH ($p = 0.011$) and stage ($p = 0.0001$) impacted on survival, while on multivariate analysis confirmed only stage ($p=0.0001$) and unknown LDH level ($p= 0.011$) as significant.

CONCLUSION: Advanced disease at presentation, which is a modifiable factor, was common and impacted negatively on overall survival.

PAEDIATRIC PULMONARY LEIOMYOSARCOMA [31]

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BACKGROUND: This Central hospital services the entire Province of KwaZulu Natal which has a large burden of Paediatric HIV infections. Leiomyosarcomas is rare and we have not seen the increase in the paediatric AIDS defining leiomyosarcomas described in developed countries. With wider HAART coverage HIV related cancers would drop.

OBJECTIVE & METHOD: Case presentation of primary pulmonary leiomyosarcoma which is extremely rare and has poor outcome if not completely resected.

This 8 year old female presented with a non-productive cough for 6 months and constitutional symptoms. Examination revealed severe respiratory distress with features of dense consolidation on the right chest. She was commenced on anti-TB treatment. Gene expert returned negative. CXR showed large opacification right side of chest. She developed severe upper airway obstruction requiring intubation and supportive ventilation on transfer.

CT Chest revealed large heterogeneously enhancing solid mass with areas of breakdown measuring 13cmx10cmx10 cm, extending from the base of the neck into the right thoracic cavity. The mass abutted and encased vessels. A percutaneous tru-cut biopsy revealed a muscle tumour with features of a leiomyosarcoma (positive for Desmin and SMA).

Cardiothoracic team was unable to consider resection in view of major vessel encasement. Radiation of the tumour was not considered to be a practical alternative. She was given chemotherapy (2 cycles of Adriamycin, Bleomycin, Vinblastine and Dacarbazine). With poor response the patient was given 1 cycle of Ifosfamide and etoposide.

Patient failed extubation multiple times due to functional obstruction of the mass. Repeat imaging revealed poor response to chemotherapy. Multi-disciplinary team decision was to palliate and stop further chemotherapy. Mum was extensively counselled. She was then transferred to base hospital with an advanced care plan and a ventilation weaning protocol. Demised at base hospital while weaning 3 months after diagnosis.

DISCUSSION: Primary pulmonary leiomyosarcoma occurs in <0.5% of all pulmonary tumours with a reported 5 year survival of 60% if completely resected. Surgery is the definitive mode of management. If early complete resection is achieved, the 5 year survival is 50%. Adjuvant radiotherapy and chemotherapy is recommended in incomplete resection or unresectable tumours. Early referral will decrease mortality in this rare malignancy.

DEVELOPING A NATIONAL NUTRITIONAL STUDY IN PAEDIATRIC ONCOLOGY UNITS IN SOUTH AFRICA [32]

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& University of BC^c**

BACKGROUND: Globally more than 160,000 children and adolescents are diagnosed with cancer each year. The majority, 80% -85%, live in low- or middle-income countries (LMICs) and up to 50% of these children are malnourished.

OBJECTIVES: To investigate the incidence and severity of malnutrition, food security and poverty in children diagnosed with cancer over a 3 year period in South Africa. The association of these variables with underlying cancer, 2-year overall survival (OS) and event free survival (EFS) will be investigated.

DESIGN & METHODS: This will be a prospective cohort study in state-funded paediatric oncology units (POUs) in South Africa for the period of 3 years. All newly diagnosed children with cancer will be enrolled in the study within 72h after diagnosis and consent obtained. Nutritional assessment will be done at diagnosis and monthly during treatment: anthropometry-, biochemistry- and clinical assessment. This will be repeated 3-monthly after treatment till end point. In person interviews will be conducted with parents to complete the hunger scale questionnaire and Poverty Assessment tool to determine socio-economic circumstances at home.

RESULTS: To date 52 patients were enrolled in the study. The preliminary results show 57.7 (30/52) boys and 42.3 (22/52) girls with age range 8 to 177 months. Interesting fact that 18% (9/52) was premature babies. Majority of patients are African (67.3%; (35/52), 26.9% (14/52) coloured and 5.8% (3/52) Caucasian. Most of the children live in Western Cape (42.3%; (22/52)) and Mpumalanga (41, 4%; (21/52) while 15.4% were from Gauteng and 1.9% (1/52) North West.

CONCLUSION: This is the first study in sub-Saharan Africa that will systematically investigate nutritional status at diagnosis, food insecurity and risk for poverty in children with cancer and the association with OS and EFS. The findings will assist in creating a comprehensive supportive care plan for children with cancer in future.

VOLUMETRIC MODULATED ARC THERAPY (VMAT): A CLINICAL AND PATIENT-ORIENTATED EXPERIENTIAL REVIEW [33]

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BODY: The novel radiation technique, VMAT (Volumetric Modulated Arc Therapy), can offer improved sparing of normal tissues and target volume coverage, whilst achieving highly conformal dose distributions when compared with conventional radiotherapy techniques. The clinical worldwide use of VMAT is significantly increasing with additional advantages including reduced treatment delivery time, when compared with IMRT (Intensity Modulated Radiation Therapy).

OBJECTIVES: To provide feedback from clinical oncologists, radiation therapists and retrospective patients with regards to experience related to the VMAT treatment modality.

DESIGN & METHOD: Reviews were obtained from radiation oncologists regarding planning experience, including the draw of tumor volumes, duration of planning, plan reviews and the treatment of related side-effects. Patients that received previous intensity modulated radiation therapy (IMRT) and was re-treated with volumetric modulated arc therapy (VMAT) within the past 5 years, was interviewed. Feedback was obtained from personal experience including daily treatment time, the comfort of treatment duration and devices, as well as management of side effects during and after treatment. Radiation therapists were questioned to obtain opinions on the use of VMAT as a treatment modality with regards to scheduled daily time slots, imaging and daily radiation setup.

RESULTS: The result of combined feedback tended to be in favour of the VMAT modality.

CONCLUSION: The VMAT modality remains relatively novel, with published data focused on dosimetric planning studies with limited clinical outcomes. Although the VMAT modality holds various distinct advantages, it cannot be considered as a universal solution in all clinical cases.

A RETROSPECTIVE REPORT ON THE USE OF CONE BEAM CT FOR ADAPTIVE RADIOTHERAPY FOR LUNG CANCER [34]

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BACKGROUND: Kilovoltage cone beam computed tomography (CBCT) in room imaging is used to provide superior soft tissue information. CBCT for lung imaging has become a fast growing as we move from standard to complex delivery techniques, treatment verification and inter-fraction adaption, it has become essential especially when treating Lung cancer. The objectives of this study aim at providing us with the necessary information needed to recognize and implement changes in departments equipped with this imaging modality. Adequacy of the PTV margin is important particularly in lung cancer cases due to radiation induced tumour changes as well as geometric uncertainties considering the low stability of the treatment area. CBCT thus provides us with information ensuring tumour coverage is achieved daily.

DESIGN & METHOD: A quantitative retrospective study will be done on patients presenting at a Radiotherapy department. A convenience sample size of 15 patients over the past two years will be looked at. Patients 18 years or older with previously untreated Small lung cell cancer or non-small cell adenocarcinoma of the lung will be considered. A total prescribed dose of 60Gy in 30 fractions. Three aspects involving these cases will be looked at. Firstly, we will look at clinical cases involving volume expansion and how the treatment plan was adapted. Secondly, we will go over cases that could have been adapted during the treatment. In the case of PTV adjustments following a re-plan the difference of the PTV from the original plan to the adapted plan will be measured. Lastly, we will look at volumes that required no re-plan but had to be monitored for geometric uncertainties.

RESULTS: 15 patients' CBCT had been looked at retrospectively, from the 15 patients, 9 (60%) patients had a tumour response and could have been re-planned. 3 (20%) patients showed no change to the tumour throughout the treatment but had to be monitored for geometric uncertainties and 3 (20%) of the 15 patients had been re-planned due to their rapid tumour growth not being included in the PTV. Radiation changes and growth of the tumour had been noticed in majority of the cases, however adequate PTV margins had been used to ensure that the volume is still covered.

CONCLUSION: In radical RT for lung cancer daily CBCT allows us to make use of IGRT to support adaptive radiotherapy and has the potential to reduce PTV margins which would result in improved outcomes for lung cancer patients. Furthermore, it provides us with useful information to prevent geometric uncertainty and ensure adequate tumour coverage especially.

OPTIMISING PROSTATE CONFORMAL RADIOTHERAPY PLANNING WITH A PRIORITISED LIST OF PARAMETERS [35]

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INTRODUCTION: Treatment planning is aimed at delivering sufficient radiation dose to the tumour, while sparing the surrounding, uninvolved tissue. The planning of prostate conformal radiotherapy (CRT) is widely standardised. Evaluation, however, varies considerably across planning centres. This study aims to determine a prioritised list of physical and dosimetric (biological) parameters for evaluation, and thus improvement, of CRT treatment plan quality.

MATERIALS AND METHODS: Details of one patient requiring prostate radiotherapy were sent to nineteen XiO treatment planning systems and CRT planning was done by nineteen planners. Four physical parameters (number of beams, opposing fields, field size and wedge) and eight biological parameters (heterogeneity, conformity, maximum, minimum and mean dose, V_{50} , and V_{65} for the rectum and V_5 for the bilateral femora) were extracted from each plan. Verification of the dose-delivery was performed with Gafchromic film within a Rando phantom. Using principal component analysis (PCA), a list of evaluation parameters was obtained. Several plans were used to verify the application of this list.

RESULTS: The PCA indicated that the biological parameters best predicting treatment plan quality are: heterogeneity index, minimum dose and rectal V_{65} . Dose-verification with film showed >90% agreement. No alteration to the biological parameters was required. Using the proposed parameters showed 22% improvement in the indices, 5.6% improvement of the ICRU dose limits, and a decrease in small bowel dose of 8%. A 3.5% increase in the dose to the rectum, bilateral femora and bladder was observed.

CONCLUSION: The number of beams and field size should be used to improve the biological parameters. A verified protocol for planning evaluation was developed and implemented using the identified parameters. This study is being expanded and extended to include more plans.

EFFICIENCY INDEX: REPORTING METHOD FOR STEREOTACTIC TREATMENT PLANS [36]

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BODY: Stereotactic radiotherapy is defined as an external radiation beam, which is precisely aimed at a tumour. A very high and intense dose is delivered, making a steep dose fall-off essential to minimize normal tissue toxicity. Dose sparing has been highlighted again in the ICRU 91ⁱ report, which focused on stereotactic treatments. End of 2018 Dimitriadis et al. has published a novel metric; the efficiency index ($\eta_{50\%}$), which is used to determine the dose sparing and dose fall-off. It focusses on the relation of useful energy over input energy. Useful energy is referred to as the energy which is needed to treat the tumour. Thus, obtaining a higher efficiency index, indicates more energy (dose) is deposited into the tumour and less is wasted. At Panorama Oncology Unit we have started to use the efficiency index as a reporting method on our neuro stereotactic radiotherapy patients.

OBJECTIVES: Efficiency index is been implemented in our unit as a reporting method on neuro stereotactic patients.

DESIGN & METHOD: Currently our dose prescription for our neuro stereotactic patients are done at 80%, 6MV. Meaning that the prescribed dose should fall onto the 80% isodose level, covering the planning tumour volume. Internationally this prescription dose level varies to obtain a steep dose fall-off. Firstly, the efficiency index value, expressed as a percentage was calculated retrospectively for 8 of our treatment plans, comparing to the internationally published values. Secondly the prescription dose level was changed from 80% to 50%, using the same 8 treatment plans. Lastly 3 treatment plans were reoptimized for 10MV.

RESULTS: Internationally the efficiency index value varies between 30 to 45%. Our calculated efficiency index values do fall between 20 and 48%. It seems that the 50% dose prescription level results into a steeper dose fall-off, however increasing the hotspot. Reoptimizing with a different energy did not lead to a significant difference in the efficiency index percentage.

CONCLUSION: The efficiency index is a useful and easy tool to compare treatment plans. This index is sensitive to conformity and dose fall-off. It can be used and implemented with any treatment planning system. However, any index cannot replace a clinical decision and evaluation.

A NOVEL TREATMENT PLANNING MODEL FOR TOTAL SKIN ELECTRON IRRADIATION [37]

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OBJECTIVES: Total skin electron irradiation (TSEI) is a standard treatment technique for Mycosis Fungoides. No clinical treatment planning systems exist for treatment planning at large source-to-skin distances (SSD) without the use of electron applicators. We have developed an electron beam characterization model for an Elekta[®] Precise linear accelerator using the EGSnrc/DOSXYZnrc Monte Carlo (MC) code to perform treatment planning and dosimetrically verified the model on an anthropomorphic phantom.

DESIGN & METHOD: A dual point-source DOSXYZnrc beam characterization model was constructed for a 4-, 6- and 8 MeV electron beam, collimated to a 40 x 40 cm² field at isocentre. Electron and photon beam characteristics were extracted from simulated phase space files. Fluence spectra for each energy were modelled independently using mathematical functions to dosimetrically match measured off-axis ratios (OARs) at multiple SSDs in water. In addition, abutted 2-D array measurements at isocentre in water were compared with simulated 2-D dose distributions. Output factors (OFs), central axis (CAX) and off-axis (OAX) percentage depth dose (PDD) curves were also verified for SSDs between 100 and 200 cm. An in-house full-body anthropomorphic phantom was made and CT scanned, requiring two half-body scans to be joined together in a single whole-body CT set. A discrete beam arc with various arc increments was simulated with the phantom at 180 cm SSD, covering the entire phantom using an energy-dependent optimal separation distance between 4 planes each with individual beam central axes levels from head-to-toe. Dose evaluation was performed on ProSomaCore after converting MC 3D dose data to DICOM format, and compared to in-vivo measurements.

RESULTS: The beam characterization models produced CAX and OAX PDD curves, OARs and OFs to within 2% of measured data, whereas 2D dose distributions complied with a 2%/2mm dose/distance-to-agreement criterion in both water and the phantom. Improved dose uniformity at the depth of maximum dose in the anthropomorphic phantom was observed when the number of beam angles were increased. Due to the variation in phantom contours (hence SSD variations), hot-and-cold spot formation across the phantom was identified and consequently beam weighting could be optimized to improve dose uniformity along treatment planes from head-to-toe.

CONCLUSION: The MC beam model compared to within 2% of measured data. Increasing the number of beam angles for TSEI improves dose uniformity, especially in large-diameter treatment regions. Dose visualization and analysis allowed beam weight optimization for a beam model that can be used for patient specific treatment planning.

TREATING CHAOS THE LION AND OTHER CATS: A ROARING EXPERIENCE! [38]

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OBJECTIVE: This wonderful story made news worldwide! Chaos the Lion was referred to Arcadia Oncology Centre. This private unit often treats animals, especially pets, but treating a lion was a first. With this presentation we would like to share the amazing and overwhelming experience of treating the king of the jungle! On this unit's animal treating CV is also a leopard and a cheetah. These case studies will also be shared during the presentation.

DESIGN & METHOD: Information from these case studies will be presented as an oral presentation. The animal treatment technique, prescription and challenges will be discussed.

RESULTS: Pictures of the animals' treatment will be shared during the presentation, as well as the outcome of their treatment on follow up.

CONCLUSION: To share this once-in-a-lifetime story of Chaos the Lion and other cats with the Oncology community. All these case studies have been memorable experiences for all the staff involved.

THE CAPE TOWN ACCESS TO CARE COURSE: WHAT WE HAVE LEARNED AND WHAT THE FUTURE HOLDS [39]

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BACKGROUND: Increased access to radiotherapy treatment units, treatment planning systems and appropriate dosimetry equipment coupled with a need for the implementation of 3D conformal radiotherapy (3DCRT) protocols and the appropriate skills training for staff, is an ongoing challenge throughout Africa. The Groote Schuur Hospital Access to Care (A2C) course focuses on moving from 2D to 3DCRT. The A2C centre is a technology-based teaching platform for the radiation oncology treatment team. It is a joint collaborative training initiative between Varian Medical Systems, UCT and CPUT.

METHODS: Four teams attended each course and were asked to complete surveys before, during and after the integrated three week course. Consent was given to use this information. The surveys of the six courses spanning 2015 to 2019 (72 participants) will be analysed and discussed in terms of pre- and post-course knowledge and experience.

RESULTS:

- All participants agreed that the course added value to their application of radiotherapy treatment technique knowledge. Certain valuable learning points

identified, included: planning of specific sites, practical application of planning and contouring, the importance of ethical multi-disciplinary teamwork, protocols and quality assurance.

- Before attending the course, 36% of respondents felt hampered by limited dedicated time for planning and contouring in their own departments. Each course provided 35 dedicated hours of practical contouring and planning with assistance, which resulted in 16% improvement in the need for practicing these skills.
- Topics identified for the future included: VMAT, IMRT, planning for electrons, cranio-spinal planning, ARIA administration and paediatrics.

CONCLUSION: Participants reported that infrastructure, budget and human resources would be the greatest challenges in implementing course knowledge in their own departments. The need for ongoing mentorship and skills development was identified

Development of an advanced techniques course will commence in 2019, as well as shorter courses for the learning needs of South African teams.

AGGRESSIVE END-OF-LIFE CARE VS PALLIATIVE CARE INTERVENTIONS IN PATIENTS WITH HAEMATOLOGICAL MALIGNANCIES: A SOCIAL WORK PERSPECTIVE [40]

De Beer A

The aim of this presentation is to provide attending social workers with an understanding of the difference between aggressive end-of-life care and palliative care interventions, including hospice referrals, in patients with haematological malignancies. The benefits and disadvantages of each approach will be explored. Particular attention will be paid to the ethical considerations of each approach. The patient's preferences as well as communication with the patient and their family regarding end-of-life care and withdrawing of treatment will be discussed.

THE OUTCOME OF PATIENTS WITH SQUAMOUS CELL CARCINOMA OF THE OROPHARYNX TREATED WITH CHEMORADIOTHERAPY AT GROOTE SCHUUR HOSPITAL OVER AN EIGHT YEAR PERIOD [41]

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OBJECTIVES: Definitive chemoradiotherapy is a standard treatment for SCC of the oropharynx – however it is a regimen with many potential side-effects – both acute and long-term. Even when patients have access to the best medical care they frequently do not complete treatment as prescribed and/or are left with reduced function (swallowing etc) post-treatment. In theory this rigorous regimen may be even less well tolerated in a socio-economic setting where patients have poorer baseline nutrition and more limited access to health care. These patients may present with more advanced disease and/or struggle to comply with scheduled treatments. It has been established in previous studies that deviations from the chemoradiation protocol for head and neck SCC's compromises outcome. The aims of this study are threefold: to determine the disease-free survival of patients with SCC of the oropharynx treated with definitive chemoradiotherapy in our hospital (a tertiary Government hospital serving a large geographical area), to quantify the extent of protocol deviations within our system and to document the incidence of medium and long-term side-effects of this regimen in our patient population. These findings will guide us in deciding whether our treatment approach (in terms of patient selection, treatment prescribed etc) should be altered or may remain unchanged.

DESIGN AND METHOD: This is a retrospective study in the form of a folder review of patients with SCC of the oropharynx treated at Groote Schuur Hospital between 2011 and 2018. All patients treated with definitive chemoradiotherapy (as opposed to surgery +/- adjuvant radiotherapy) are included. In almost all cases chemoradiotherapy was preceded by neoadjuvant chemotherapy – mainly because of waiting times for radiotherapy. Staging was done as per AJCC version 7. Histological (biopsy) findings (HPV status, presence/absence of perineural invasion, grade of tumour etc) will be documented. The primary end-point of the study is the overall survival of patients with SCC of the oropharynx treated with definitive chemoradiotherapy. Secondary end-points of the study include documenting the incidence of treatment protocol deviations as well as the incidence of medium and long-term side-effects of treatment.

RESULTS: The folders of approximately 92 to 98 patients are in the process of being reviewed. This process is incomplete at this point. The documentation is complex as the information being collected is detailed and highly variable. An update of the results will follow as soon as all folders have been reviewed.

CONCLUSION: No final conclusions can be drawn at this time. The conclusions will follow once all results have been analysed. It is hoped that the study will give us a reasonable overview of how successful/unsuccessful our treatment of oropharyngeal SCC is in a limited resource setting. If the topic is accepted for presentation, a final update of this abstract will be forwarded to the organising committee prior to the congress.

DESCRIPTIVE EPIDEMIOLOGICAL STUDY OF HEAD AND NECK CANCERS AT A SINGLE INSTITUTION IN SOUTHERN AFRICA [42]

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OBJECTIVES: To describe the epidemiology of head and neck malignancies at Tygerberg Hospital (TBH) from the period 1st January 2015 to 31st December 2017. We evaluated patient demographics, risk factors, tumour characteristics, prognostic factors, disease stage, treatment intent and treatment modality.

METHODS: Records of all HNC patients that presented to Tygerberg Hospital oncology department between 1 January 2015 and 31 December 2017 were reviewed. The following variables were described: patient demographics, which include age, sex, HIV status, and socio-economic status as well as tumour characteristics, risk factors, treatment intent and treatment modalities.

RESULTS: Data was collected from 854 patients seen between 2015 and 2017. There were 603 (71%) male and 251 (29%) female patients. The male to female ratio was 2.4:1. The age range was 10-89 years (median age 58 years). Smoking was a risk factor in 737 (86.3%) and alcohol in 634 (74.2%) patients. Eleven patients (2.22%) were HPV positive, of these 73.68% were in the oropharynx. The most common site was the oral cavity (n=320) and the most common sub-site was the anterior tongue (n=137). Eleven patients had two separate primaries at the time of diagnosis. In total, 466 patients (53.87%) presented with locally advanced, stage IVA disease.

CONCLUSIONS: The median age of diagnosis, the most predominate primary site; histological subtype and stage at presentation were consistent with that reported in the literature. The incidence of p16 positive oropharyngeal lesions differs greatly from the changing worldwide etiological trends of SCC of the oropharynx.

CARE, ETHICS & SOCIETY: SUPPORTIVE GOVERNANCE [43]

Abratt RP

Medical Specialist Holdings and the University of Cape Town

OBJECTIVES: To review the role of Institutional Clinical Governance Committees (CGC) as well as Social and Ethics Committees (SEC).

The aims of these committees are to support professional performance, ethical behaviour and a cohesive society as well as to manage possible conflicts of interest and discrimination.

DESIGN & METHOD: The structures functioning, and legal background of a CGC (established in 2015) and a SEC (established 2018) were reviewed.

RESULTS: The CGC aims at high standards of care and quality improvement programs. It is opportunity orientated. It functions in 5 Domains - Clinical Excellence, Health Personnel, evidence Based Medicine, Environment (including facility accreditation) and risk management for both chemotherapy and radiotherapy. Objectives with measurable results are set on an annual basis for each of these domains. Peer reviewed publications have resulted within all these domains since the inception of the CGC. In particular, an audit of user experience of the accreditation process showed it was welcomed as being helpful in maintaining standards.

The SEC aims to include societal interests and ethics in all decisions and actions. It sets a balanced framework for decisions and actions. It is regulated by the Company Act of 2008. These specify 5 domains of activity - Social and Economic Development, Good Corporate Citizenship, Environmental, Health and Safety, Consumer Relations and Labour and Employment.

OBJECTIVES with measurable results have been set in each of these domains and will be reviewed.

CONCLUSION: The CGC is about performance in clinical care. The SEC is about a balanced framework for all decisions and actions. When successful, they will synergize high quality clinical care and institutional and societal well-being.

TUBERCULOSIS IN CHILDREN WITH CANCER: EXPERIENCE FROM A SOUTH-AFRICAN CENTER [44]

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BACKGROUND: Tuberculosis (TB) has been reported in children undergoing chemotherapy. The objective of this study is to

- (i) describe the incidence of latent TB-infection and TB-disease in children with cancer,
- (ii) (ii) to compare the Tuberculin Skin Test(TST) with the Interferon Gamma Release Assay(IGRA-T-SPOT.TB) for diagnosing latent TB-infection and
- (iii) (iii) to describe the characteristics and outcome of children with TB-disease and cancer .

METHODS: A prospective cohort study was conducted at a tertiary center in South Africa from 1 April 2010 to 31 March 2012 and patients followed until March 2015. Newly diagnosed children with cancer were enrolled and screened for latent TB-infection with a TST and T-SPOT.TB test. Where TB-disease was suspected during chemotherapy sputum was sent for culture.

RESULTS: A total of 169 patients were enrolled. Latent TB-infection was documented in 5 patients (2.9%). The T-SPOT.TB assay yielded negative results. Twenty-four (14.2%) patients were diagnosed with TB-disease during chemotherapy. The incidence of TB-disease was 4.7 per 100 child years .Those that developed TB-disease during chemotherapy had a higher number of high-dose corticosteroid courses (397.4 per 100 child years) compared to those who did not develop TB (40.7 per 100 child years; $p < 0.001$). Children who developed TB-disease had more septic episodes associated with profound neutropenia (319.5 vs 46.6; $p < 0.001$), profound lymphopenia (264.9 vs 41; $p < 0.001$) and profound monocytopenia (389.6 vs 63.7; $p < 0.001$). Children who developed TB had more septic episodes with prolonged neutropenia (350.6 vs 51.1; $p < 0.001$), prolonged lymphopenia (335.1 vs 59.2; $p < 0.001$) and prolonged monocytopenia (444.2 vs 70.7; $p < 0.001$). There were 4/24(16.7%) deaths.

DISCUSSION: The incidence of latent TB-infection in children with cancer was low. The TST and T-SPOT.TB tests have limited value in diagnosing TB-infection in immunocompromised patients. Risk factors for developing active TB-disease in patients with hematological malignancies are the use of numerous courses of high-dose corticosteroids and profound, prolonged neutropenia, lymphopenia and monocytopenia. Mortality in patients with TB and cancer are due to complex factors.

RESPIRATORY VIRUS-INFECTIONS IN CHILDREN WITH FEBRILE NEUTROPENIA: EXPERIENCE FROM A SOUTH AFRICAN CENTER [45]

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OBJECTIVE: The role of respiratory viruses (RV) as infecting or co-infecting pathogens in patients with febrile neutropenia (FN) has not been extensively characterized. The aim was to

- (i) document the incidence of RV-infections in children with hematologic malignancies and solid tumours, and to assess whether there was a difference between these groups,
- (ii) to identify the most common RV's occurring in children with FN, and
- (iii) document the incidence of RV-infections in those children that died.

METHODS: All children diagnosed with cancer between 01 April 2010 and 31 March 2012 and followed up until March 2015, at a paediatric oncology unit at a tertiary center in South Africa were enrolled in a prospective cohort study. A suspected septic episode (SSE) was defined according to the standard definition of FN. During a SSE, blood investigations and nasopharyngeal aspirates were done and various parameters recorded.

RESULTS: There were 169 patients, 82/169(48.5%) with hematologic malignancies and 87/169(51.5%) with solid tumours. A total of 528 SSE's occurred. The number of SSE's associated with RV were 147/330(44.5%) in hematologic malignancies and 64/198(32.3%) in solid tumours ($p=0.007$). The number of SSE's with bacterial-viral co-infections were 112/330(33.9%) in hematologic malignancies vs 45/198(22.7%; $p=0.01$). The overall incidence per 100 child years of RV-associated SSE's was 61.2 with 92.4 in hematologic malignancies vs 35.1 in solid tumours ($p<0.001$). Human rhinovirus (HRV) was identified in 96/368(26.1%). Viral-viral co-infections occurred in 17.5% and RV-bacterial co-infection in 35%. Twelve children (7.1%) died due to sepsis. Eighteen RV's were isolated in the 12 deceased patients; Human Coronavirus in 44.4% and HRV in 27.8%.

DISCUSSION: RV-infections and bacterial-viral co-infections in SSE's were more common among children with hematologic malignancies compared to those with solid tumours. The most common RV identified was HRV. Viral-viral co-infections were lower than bacterial-viral co-infections. The patients who died had bacterial and fungal co-infections in addition to the identified RV's. The presence of RV-infection and its clinical significance and relationship with outcome remains uncertain.

IMMUNE RECONSTITUTION VIRAL DISEASE MIMICKING RELAPSE WITH HAEMATOLOGICAL MALIGNANCY [46]

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BACKGROUND: Immune reconstitution inflammatory syndrome (IRIS) has been well documented in HIV infected patients after anti-viral treatment has commenced. A similar phenomenon may occur in some patients with severe malnutrition when nutrition improves and in patients receiving chemotherapy with lymphocyte recovery.

OBJECTIVE & METHOD: To document IRIS viral reticulo-endothelial hyperplasia in a series of HIV negative patients suspected to have relapsed of malignancy..

RESULTS: Three HIV negative patients are described -2 with CMV and 1 with EBV..

Patient 1: A 3yr old White male with Burkitt lymphoma presented with extensive disease (orbital, abdominal, CNS and bone marrow involvement). He was treated with chemotherapy including intra-thecal Rx and cranial radiotherapy. Mild tumour lysis occurred with treatment initiation. He achieved a complete remission and treatment was given over 9 months. .Three months after treatment was stopped he was noted to have splenomegaly and lymphadenopathy (PET positive). Biopsy of an inguinal node showed CMV lymphadenitis. This resolved without further treatment. :

Patient 2: A 3year 8month Indian male with B-precursor ALL presented with a white cell count of $34 \times 10^9/l$, hepatosplenomegaly and CNS disease. He achieved complete remission with induction therapy and was given high intensity blocks of chemotherapy. Maintenance chemotherapy (lower intensity Rx) commenced 11 months after presentation. After 2 months relapse was suspected because of splenomegaly and small lymph nodes. Investigations for relapsed disease were negative. CMV viral load was 527828/ul (log 5.7). Improvement occurred after treatment with valganciclovir and continuation of maintenance chemotherapy.

Patient 3: A 4 year old African male patient had empiric treatment for tuberculosis. Lymph node biopsy initially showed an EBV lympho-proliferative disorder. Six months later he developed increasing cervical adenopathy and dysphagia. Repeat biopsy showed a high grade B cell lymphoma. He received aggressive chemotherapy and went into clinical remission. After chemotherapy was stopped increasing cervical nodes were noted and relapse suspected. Biopsy revealed a reactive lymph node with no malignant disease. This was possibly related to EBV and became smaller without specific treatment..

CONCLUSION: The patients described above all demonstrated clinical features mimicking relapse of their original disease which were due to viral infections which became apparent when chemotherapy was less intense or stopped.

THE SIGNIFICANCE OF DELAYS IN RADIOTHERAPY [47]

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OBJECTIVES: The intention of the study was to review the evidence concerning the effect of radiotherapy treatment delays on tumour outcomes in a variety of common tumours.

DESIGN & METHOD: A review of recent literature was undertaken to identify articles that provided evidence concerning the effects of overall treatment time and time till treatment initiation in a selection of common tumour types. Where available, kick-off times and effective radiation doses lost due to inferred proliferation are reported.

RESULTS: The effect of changes in overall treatment times and times to the initiation of radiotherapy have significant effects in certain tumour types, but results are highly variable. Introduction of modern therapies and combinations may influence the effect of treatment delays.

CONCLUSION: The results may provide guidance for radiobiological analysis and recommendations for handling of treatment delays. Heterogeneity of tumours and the development of modern therapies may influence the assumptions that should be used when attempting to estimate the effects of repopulation in a clinical setting.

CBCT IMAGES USED FOR DOSE CALCULATION IN ADAPTIVE RADIOTHERAPY AT NETCARE OLIVEDALE HOSPITAL [48]

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Cone-Beam Computed Tomography (CBCT) is the imaging device used for patient positioning and target localization in real-time. The use of daily CBCT allows the monitoring of patient weight loss, set-up errors and tumour shrinkage during the course of radiotherapy treatment. One of the biggest challenges in radiotherapy is motion management. The patient target position variations arise from the set-up error, online matching errors, changes in tumour position due to organ motion and by organ filling and changes in tumour sizes resulting in treating tumour or surrounding tissue inaccurately.

CBCT images are used for dose calculation to determine the dosimetric deviation due to set-up error, organ motion, tumour shrinkage and matching errors. These images are not used for patient treatment planning purposes.

OBJECTIVES: To estimate the dosimetric deviation by using CBCT images for adaptive radiotherapy when the patient geometry changes and set-up errors. And To determine feasibility, limitation concerns and usefulness of this method.

DESIGN & METHOD: The commissioning of the treatment planning system includes the CT calibration curve to convert the Hounsfield Units (HU) of different materials to electron density (ED) for accurate dose calculations. The calibration curve of the CT scanner is done using the electron density phantom. The calibration of the HU to ED

for CBCT images is done using Catphan 604 and electron density phantom. The calibration curves for planning CT and CBCT obtained using electron density curve and CBCT obtained using Catphan 604 are compared. To validate CBCT dose distribution, a treatment plan using 6 MV photon beam with a field size 10 X 10 cm² on pelvic phantom is generated for both CBCT and treatment planning CT images. The Dose Volume Histogram (DVH) from both plans is compared.

When the patient tumour shrinks during the course of the treatment, the CBCT images is used to calculate the dosimetric deviation between the original plan and the current plan with the change of tumour size. The DVH of both plans are evaluated and the deviation is calculated. And in case of incorrect setup this method is used to assess the actual treatment given.

RESULTS AND CONCLUSION: The calibration curves for planning CT and CBCT were comparable. For tumour shrinkage patients with deviation greater than 3%, re-scan using the planning CT will be done. Re-scanning and re-planning reduces the dose to the critical organs and gives adequate dose to the tumour.

PLANNING AND TREATMENT OF A TOTAL SKIN ELECTRON IRRADIATION PATIENT: A CASE STUDY [49]

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ICON

OBJECTIVES: A 33-year-old male patient was diagnosed with Mycosis Fungoides. The patient was treated using a total skin electron irradiation (TSEI) technique and utilizing the high dose rate electrons that are available on the treatment unit. The aim of this case study was to give feedback on the planning and treatment of a TSEI treatment technique in order to aid in the treatment of Mycosis Fungoides patients in future.

DESIGN & METHOD: The patient was prescribed a dose of 36 Gy in 18 fractions. Before to the commencement of treatment, a virtual simulation was performed on the patient in order to obtain the patients diameter, length and the source-to-surface distance of the patient to the treatment unit. Using this information, the monitor units required to obtain the prescription was calculated as well as the separation required between fields in order to facilitate a uniform dose distribution on the skin of the patient. During treatment the patient was placed on a trolley below the treatment unit for easy and accurate setup of the patient for the different fields required for total body irradiation in a horizontal position. A 3 mm slab of perspex was placed over the patient in order to meet the clinical requirements by attenuating the 6 MeV beam to have a penetration equivalent to that of 4-5 MeV mean electron energy. Diode measurements were performed in the first week of treatment. The patient's eyes, nails and genitals were shielded during the treatment using a combination of wax and lead. Before each treatment daily dose output checks were performed on the high dose rate energy to ensure accurate treatment.

RESULTS: Using the TSEI technique the patient could be treated in the horizontal position with relative ease. The treatment time was significantly reduced by using the high-dose rate electrons. The diode measurements that were performed in the first week of treatment showed good correlation to the dose that was planned. The daily output checks that were performed stayed well within the 2% tolerance limit as

recommended by SASQART which provided confidence that the patient was treated accurately for each fraction.

CONCLUSION: This case demonstrates that the TSEI technique can be successfully implemented using high dose rate electrons for treatment of patients with Mycosis Fungoides.

DEVELOPMENT, VALIDATION AND FIRST RESULTS OF A NEW COMPREHENSIVE TOOL FOR DIGITALLY TESTING ACCURACY OF MULTI-LEAF COLLIMATORS ON MEGAVOLTAGE UNITS [50]

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OBJECTIVES: Due to the steep dose gradients and proximity of the organs at risk (OAR) to the target in Radiotherapy, multi leaf collimator (MLC) positional accuracy becomes an increasingly important feature for intensity modulated radiotherapy (IMRT) type techniques. Previous studies have shown that systematic errors of as small as 0.5 mm can have significant dosimetric effects on the outcome of IMRT treatment delivery. In this study, the accuracy and versatility of a new digital MLC quality assurance tool was assessed.

DESIGN AND METHOD: A new platform for testing MLC accuracy was developed employing a picket fence test, using images from the online portal imaging device and in house created software. Validation and acceptance testing for this method was performed and the method was implemented as routine quality assurance to evaluate the accuracy of the MLC on Elekta and Siemens units within the company.

RESULTS: EPID imaging could be used to measure a picket fence digitally. Software could be created to analyse the positional error with an average accuracy of 0.1 mm + 0.1 mm and the width error with an accuracy 0.1 mm +0.1 mm in the clinically applicable range. Additional testing could be performed to evaluate MLC accuracy at various gantry angles and during an arc delivery.

CONCLUSION: This quality assurance tool proved to be versatile enough to be used on multiple platforms, yet sensitive enough to MLC errors and was implemented as a new in-house quality assurance tool on a national level within Equra Health.

MEASURED AND CALCULATED DOSES IN THE “CLAWS” [51]

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INTRODUCTION: The “Claws” is a gold applicator loaded with I-125 seeds, used as a temporary implant to treat retinoblastoma. Under general anaesthesia, a pericorneal ring is attached to the four extra-ocular muscles, and four appendages, each loaded with I-125 seeds, are inserted beneath the conjunctiva in-between each pair of muscles and attached anteriorly to the ring. The applicator has an inside diameter of 22 mm. A typical treatment prescription is 40 Gy given over four days to the centre of the eye. General anaesthesia is also required for the removal of the applicator.

METHOD AND MATERIALS: Solid water eye phantoms were manufactured to allow for dose measurements in the “Claws”. Dose measurements were done with thermoluminescent dosimeters (TLDs) and gafchromic film. The four legs of the “Claws” were each loaded with four seeds of the same activity and the phantom was irradiated.

RESULTS: Dose points were added on the gafchromic film during image analysis to coincide with the dimensions and positions of the TLDs during irradiation. Normalized dose distributions agreed remarkably well to within one standard deviation.

CONCLUSION: Normalized calculated doses showed discrepancies of more than 20 % in certain areas of the “Claws”, with measured doses being lower than calculated doses. It is thus evident that the gold shielding of the applicator material is not taken into account adequately in the treatment planning system.

CONFORMAL RADIATION THERAPY FOR BREAST CANCER [52]

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OBJECTIVE: To document the Radiation doses to lung and heart (organs at risk) in addition to breast tumour volumes and to correlate with treatment related toxicities. Methods : A total of 115 patients of cancer of breast underwent CT scans and planning procedure after decision at the multidisciplinary management meeting during 2016-17. Both right and left breast were almost equally affected (Right – 62 patients (54%) and left -53patients (46%)). All patients had MUGA scans before RT planning. Forty- three patients (37%) had conservative breast surgery and 72 had mastectomies. Seventy- four patients (64%) received 50Gy in 25 fractions and 39(34%) patients had 40.05Gy in 15 fractions. The Radiation therapy was delivered using 6Mv photos with different fields. The patients with conservative surgery received a boost to the tumour bed following tangential field. The patients with locally advanced disease and nodal involvement received radiation to chest wall as well lymph drainage areas. Forty – eight percent (56 patients) had radiation to chest wall and lymph drainage areas; 30 patients (26%) had tangential field and tumour bed boost.

RESULTS: The lung constraints used were $V_{20} \leq 30\text{Gy}$, $V_8 = 35-40\%$ and mean lung dose = $<15\text{Gy}$. One hundred and six patients (92%) achieved the lung constraints. The heart constraints used were $V_{25\text{Gy}} = <10\%$ and mean heart dose = $<26\text{Gy}$. The heart constraints could be achieved in all except 1 patient in respect of both V_{25} as well as mean heart dose.

CONCLUSION: Conformal radiation was able to achieve the aim of study and constraint were maintained in over 90 percent patients. There is no toxicity reported up till now on follow up.

LOW GRADE GLIOMAS TREATED AT THE UNIVERSITY OF CAPE TOWN ACADEMIC HOSPITAL COMPLEX: 2001-2017 [53]

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OBJECTIVES: The majority of central nervous system tumours in children are low grade gliomas (LGG). Long-term survival rates are high with a slow, progressive course. Children with LGG have a good overall prognosis, although tumour location and extent of resection affect outcome. Although complete tumour resection is the goal in the management of these tumours, this is not always possible. Adjuvant therapy thus has an important role. This study evaluated the characteristics of LGG in our setting, the role of adjuvant therapy including more targeted, novel biologic therapy such as BRAF/MEK inhibitors, and the outcome of children with LGG in our institution.

DESIGN & METHOD: A retrospective analysis was performed on all children diagnosed with LGG at Red Cross War Memorial Children's Hospital (RCWMCH) between 2001 and 2017. Data were collected from patient hospital folders, as well as Paediatric Oncology records and Groote Schuur Hospital Radiotherapy records.

RESULTS: Eighty-five children (40 boys and 45 girls) aged 0.10-13.76 years (median 4.74 years) were diagnosed with LGG between 2001 and 2017 at RCWMCH. Sixty-five patients (76%) were WHO Grade I, 18 patients were WHO Grade II (21%), and 2 patients' histology were indeterminate. Six patients had metastatic disease at presentation. The most common sites were the cerebellum (27%), followed by the hypothalamus (17%), optic nerves and cerebrum (11% each). Forty-three patients had surgery upfront (51%), of which 21 patients had a complete resection, and 22 patients had debulking surgery. Thirty patients had a biopsy only (35%), where definitive surgery was not feasible. Twenty-three patients (27%) received chemotherapy. All but two patients were treated with Vincristine/Carboplatin upfront. The most common second line agent was Vinblastine. Twenty-two patients received radiotherapy (26%), of which 3 patients progressed thereafter. The estimated 5-year Overall Survival (OS) was 86.8% and the estimated 5-year Progression Free Survival (PFS) was 42.8%. BRAF status was determined in 3 patients, all of which were negative.

CONCLUSION: Our outcomes are similar to those achieved in developed countries. Chemotherapy and radiotherapy are valuable adjuncts to treatment. BRAF status should be tested where possible to determine whether biologic therapies can be used.

ANAPLASTIC EPENDYMOMA IN EARLY CHILDHOOD [54]

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The incidence of paediatric intracranial ependymomas peak in early childhood with a median age at diagnosis of five years and 30-40% of patients less than two years old. Traditionally anaplastic ependymomas are histologically classified as grade III tumours, however no association between grade and biologic aggressiveness has been established. Molecular subtyping has revealed distinct groups of tumours which differ in anatomical location, response to treatment and prognostic outcomes. Location is considered a strong prognostic indicator with a significant subset of supratentorial ependymomas containing a *RELA* fusion chromosomal rearrangement (ST-EPN-RELA) which potentiates oncogenic NF-κB signalling and confer poorer outcomes. In addition, a subgroup of these tumours is YAP-fusion positive, especially in infants, and is associated with improved survival outcomes. In contrast, infratentorial anaplastic ependymomas are sub-divided into posterior fossa group A (PF-EPN-A) and B (PF-EPN-B) tumours depending on genetic and methylation profiling. Multiple retrospective studies have now confirmed that gain of 1q is a predictive marker for increased local and distant disease progression. Loss of histone protein H3K27M due to aberrant methylation occur in a significant subset of PF-EPN-A tumours and is of diagnostic relevance. PF-EPN-A tumours mostly occur in infants and young children, exhibit higher levels of genomic methylation, are more invasive with greater metastatic potential and carry worse prognosis. PF-EPN-B tumours generally occur in older children and young adults and may carry a more favourable prognosis than PF-EPN-A. It is now generally accepted that molecular subgrouping is the strongest predictor of progression-free and overall survival. As a means of clinical application, two case studies will be described. The first is of a 3-year her-old boy with ST-EPN-RELA⁺ who underwent debulking surgery, followed by chemotherapy and craniospinal external beam radiotherapy (36.00Gy/1.8Gy x 20# to the craniospinal PTV using 3DCRT plus an 18.00Gy/1.8Gy x 10# boost to the tumour bed PTV using VMAT). The second case is that of a 2-year-old girl with a H3K27M negative / 1q EXO1 gain negative PF-EPN-A who underwent subtotal resection, followed by external beam radiotherapy (54.00Gy / 1.8Gy x 30# to the PTV and 5.4Gy/1.8Gy x 3# boost to the tumour bed using VMAT). The clinical pictures, respective management and short-term outcomes will be discussed.

**WOMEN'S SEXUALITY POST GYNAECOLOGICAL CANCER
TREATMENT AT GROOTE SCHUUR HOSPITAL: A QUALITATIVE,
DESCRIPTIVE STUDY USING A COMPREHENSIVE FRAMEWORK**

[55]

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OBJECTIVES: This study aimed to investigate women's experiences of their sexuality post gynaecological cancer treatment by using a comprehensive framework of sexuality, and, to understand how their sexual health needs can best be addressed as part of cancer care.

DESIGN AND METHOD: The study made use of a qualitative descriptive design. Participants were recruited through purposive sampling at follow-up clinics within Groote Schuur Hospital's Gynae-Oncology Unit. The final sample consisted of 35 women aged 29-35. All women had been diagnosed with one or more gynaecological cancer and treated with either surgery, chemotherapy, radiation or a combination of these. Data was collected using semi-structured, in-depth individual interviews in participants' home language. Pile sorting was used within the interviews to facilitate discussion about difficult topics. The data was analysed using thematic analysis.

RESULTS: The results are expected to provide thorough insight into women's sexual functioning and psycho-sexual well-being post treatment and how this affects their lives and relationships.

CONCLUSION: Such information can help develop support programs to improve patients' quality of life post treatment. Furthermore, this research expands the qualitative literature relating to gynaecological cancers in South Africa.

GROIN LYMPH NODE STATUS IN OPERABLE VULVA CARCINOMA AMONG HIV NEGATIVE VERSUS HIV POSITIVE PATIENTS [56]

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OBJECTIVES: Vulvar cancer is 5.8 times higher in HIV/AIDS women compared with the general population. Positive metastatic groin lymph nodes represent advanced disease with increased surgical morbidity with a more guarded prognosis and the requirement for post-operative adjuvant therapy. Not all metastatic lymph nodes are clinically palpable and not all clinically palpable lymph nodes are metastatic. Our objective was to describe groin lymph node (GLN) and tumor characteristics at initial presentation and on final histology post- surgery in HIV negative (HivN) and positive (HivP) patients with operable vulva carcinoma.

DESIGN & METHODS: This was a retrospective clinical audit of patients with newly diagnosed operable vulva carcinoma, treated from 1 Jan 1999 to 31 Dec 2016 at Steve Biko Academic Hospital, University of Pretoria. Exclusions were patients with incomplete records, histology results indicative of benign disease and patients with other known gynaecologic cancers.

RESULTS: Ninety-six patients were included of which 46 were HivP; 88% were on ARV's and 92% had CD4 counts above 200 cells/mm³. There were no major differences in the two groups for pre- and post-treatment tumour characteristics and histology, and clinical GLN findings with 81% being non-palpable bilaterally. HivP patients however, had increased GLN metastasis (HivP= 51% vs. HivN=23%; p=0.009).

Non-palpable GLN's were more likely to be normal or reactive (83%), with only 17% being metastatic. HivP patients had significantly more reactive GLN's (HivP=55% vs. HivN=12%; p<0.001) and a non-significant trend toward more clinically occult metastases within this clinical finding (HivP=23% vs. HivN=12%). The majority of clinically palpable GLN's were metastatic (77%) while 23% were either normal or reactive on final histology. The majority of normal and reactive GLN's on final histology were actually non-palpable clinically (91% vs. 89%). Extra-capsular metastatic GLN's were palpable or suspicious clinically in 86%. No difference was found for all these findings within the two groups. Metastatic GLN's were non-palpable in 42% with however, a non-significant trend toward more clinically occult metastasis in HivP patients (HivP=45% vs HivN= 38%; p=0.435).

CONCLUSION: The HivP and HivN groups did not differ in clinical and histologic tumour features and clinical status of GLN's. HIV positive patients had higher rates of GLN metastasis and a non-significant trend toward clinically occult metastasis.

PET-CT IN THE STAGING AND PLANNING OF HIV-POSITIVE CERVICAL CANCER PATIENTS [57]

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INTRODUCTION: PET-CT imaging is commonly used as a staging tool to identify nodal involvement in locally advanced cervical carcinoma (LACC), especially in developed countries with a low burden of disease. The value of PET-CT for staging HIV-infected patients with locally advanced CC has not been described. In South Africa, the age-standardized incidence rate of CC is 43.5/100,000 females, and the prevalence of HIV in the general population is 18.9%. We analyzed PET-CT findings in a cohort of patients with LACC in Cape Town, SA.

METHODS: Participants had LACC FIGO Stage IIb or IIIB, and were referred, on the basis of stage and the availability of bookings, for PET-CT/radiotherapy planning CT from January 2015 to December 2018. All patients with HIV were prescribed cART. A team of expert nuclear medicine physicians and radiologists reported the PET-CT examinations; these were then coded for nodal station involvement and distant disease. Descriptive statistics and chi-squared tests were used to compare patients with and without HIV.

RESULTS: Of 1089 patients referred for radiotherapy (curative, adjuvant, or palliative), 286 underwent PET-CT. Eighty-nine patients (31.2%) were HIV-positive; their median CD4 cell count was 482 cells/ μ L (IQR 295-608).

PET-CT imaging found pelvic nodal involvement in 205 patients (72.4%), including 77.3% of those who had HIV and 70.3% of those who did not ($p=0.22$); para-aortic nodal disease in 114 patients (42.7% of HIV+ vs 38.8% HIV-, $p=0.53$); and distant disease in 55 patients (23.6% of HIV+ vs 17.3% HIV-; $p=0.22$).

In total, 223 patients (79.3%), including 81.8% of patients without and 75.0% of patients with HIV ($p=0.31$), were prescribed standard fractionation EBRT. Twenty-two patients (7.8%) were prescribed hypofractionated EBRT, and 36 patients (12.8%) palliative therapy. Five patients (1.7%) did not return.

CONCLUSIONS: PET-CT imaging found no differences between LACC patients, with and without HIV, in nodal involvement or occult metastases and did not lead to, or justify, treatment differences.

EVALUATING PALLIATIVE CARE TRAINING IN THE ONCOLOGY REGISTRAR PROGRAMME [58]

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OBJECTIVES: In 2016 the University of Cape Town together with South African College of Radiation Oncology identified the need to integrate palliative care in the oncology curriculum at an intermediate level. In collaboration with CANSA, a 12 module curriculum was introduced at five teaching hospitals. The overall aim of this research was to evaluate the impact of such a 1-year Palliative Care(PC) course within the oncology registrar program in South Africa. This was a prospective evaluation of an intervention using a mixed mode approach.

DESIGN AND METHOD: Blended learning was developed to train and support students and facilitators across 5 universities. Evaluations forms were electronically collected to determine students' reactions to course materials. Pre and post-MCQ's were used to review knowledge. Focus group discussions were used to explore reactions, change in knowledge and skills and integration of PC. Case studies from Oncology Portfolios will be evaluated to determine the application and integration of skills in their oncology practise.

RESULTS: The first objective of this research was to determine the reaction of oncology registrars and their supervisors to a PC course. There was an overwhelmingly positive reaction towards the course. Concerns about feasibility and appropriateness of the course were found unsubstantiated.

The second objective was to determine change in knowledge and skills in PC. The MCQ demonstrated change in knowledge and skills in module 7 and 8 (symptom management). The poor MCQ results are ascribed to poor question sequencing and variable response rates. The focus group discussions demonstrated change in knowledge and skills, especially communication skills and pain and symptom management. The focus groups indicated a change in approach to PC as an essential component of oncology.

The third objective was to determine the application of knowledge and skills of PC in oncology practise. This was subjectively evaluated. Most registrars felt the course addressed topics that formed part of their daily work. Students were able to integrate the learnt principles of PC.

CONCLUSION: PC forms part of daily practise of oncologists and a structured curriculum enables clinicians to use an evidence based approach. Supervisors of the oncology training program and registrars are confident that the training of 12 modules across one year in early registrar time is feasible and appropriate. Teaching in communication skills and pain and symptom management were found to be the most valuable modules. All registrars felt that the skills learnt were applicable to daily oncology practice. In conclusion this research demonstrated that PC training is an essential component of Oncology Training in the South African setting.

RETROSPECTIVE ANALYSIS OF THE THERAPEUTIC UTILITY OF CAPECITABINE PLUS OXALIPLATIN IN PATIENTS WITH COLORECTAL CANCER AT TYGERBERG HOSPITAL [59]

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OBJECTIVE: To retrospectively explore the efficacy and safety of capecitabine plus oxaliplatin in patients with colorectal cancer at Tygerberg hospital between 2012 and 2017

METHODS: A review of medical records of adult patients with histological diagnosis of colorectal cancer at Tygerberg hospital between June 2012 and June 2017 was conducted. Patients received oxaliplatin at a dose of 130mg/m² as an infusion over 2 hours on day 1 and capecitabine was administered orally in two divided doses recommended at 12 hours interval at a dose of 2000mg/m² on days 1-14 of every cycle; repeated every 3 weeks. For most patients, a computer-tomography scan of the chest, abdomen and pelvis was requested after the third or fourth cycle of chemotherapy to assess response. Objective response rates are reported and the rates of progression-free survival (PFS) at 12 and 24 months were estimated using the Kaplan-Meier methods and compared by the log rank test using Stata version 13. A p-value of less than 0.05 was regarded as significant.

RESULTS: 63 participants were treated with capecitabine plus oxaliplatin (XELOX) regimen over the study period. The median age was 53 years, and 46% were female, with 60.3% having colon as primary site, and 95% had stage IV disease at time of treatment with XELOX. Patients received an average of 6 cycles of chemotherapy. In 57.1% of participants, the intent of treatment was palliative. In the curative intent group, equal numbers of patients received XELOX as either neoadjuvant or adjuvant, and liver resection was performed in 20 patients (31.8%) 95% CI (0.21-0.45). Overall, disease control rate was 88.9% 95% CI (0.78-0.95) with 13 patients attaining complete remission after initial treatment with XELOX. Approximately a third of patients developed disease progression (30.4%) and the 1 year PFS was 44.5% 95% CI (0.31-0.57) while the 2 year PFS was 25.1% 95% CI (0.14-0.38). Regarding safety, Thrombocytopenia was the most frequent adverse event (18.3%) and overall 15.1% patients experienced grade 3 and 4 toxicity.

CONCLUSIONS: Our findings confirm a good objective response rate with XELOX regimen and tolerable side effect profile regardless of the intent of treatment.

DELAYS IN THE REFERRAL AND PRIMARY MANAGEMENT OF CUTANEOUS MALIGNANT MELANOMA AT TYGERBERG HOSPITAL [60]

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Cutaneous malignant melanoma (CMM) is a major cause of skin cancer-related mortality. The time between diagnostic biopsy and surgical excision, or surgical interval (SI) is a modifiable factor that may impact melanoma outcomes. Delays in the SI are attributable to many factors unique to the population and the resource available. Although delays may evoke psychological stress in patients, the impact on morbidity and mortality is controversial and few guidelines exist which outline an optimal SI.

OBJECTIVE: To determine the surgical interval in patients with resectable CMM.

DESIGN AND METHODS: A retrospective chart review was done of patients referred to the Tygerberg Academic Hospital (TAH) multidisciplinary melanoma clinic with histologically confirmed CMM between January 2015 and December 2017. Males and females >18yrs with resectable melanoma (T1b-T4b N0-3 M0-1a) who went on to receive definitive surgery were included.

RESULTS: The cohort of 40 patients comprised mostly of Caucasians referred from the Cape metro area, with a median age at diagnosis of 69.5yrs. Most diagnostic biopsies (67.5%) were performed by primary care clinicians in public and private health settings. 72.5% of patients had T3 or T4 lesions and half underwent SLNB which led to upstaging in 40% of cases. The median length of the SI was 13.6 weeks. Twenty-two patients (55%) underwent excision within the recommended 12 weeks from diagnostic biopsy. Median time from diagnostic biopsy to multidisciplinary team meeting MDT was 4.8 weeks and from MDT to surgery 7.3 weeks. Statistical associations between patient, provider and tumour variables and the surgical interval will be reported.

CONCLUSION: Surgical interval guidelines for cutaneous melanoma are poorly defined. Limited evidence suggests that definitive treatment should be offered timeously but does not need to be immediate. Quality indicators for the treatment of melanoma were developed in a number of countries and some aimed to include a surgical interval. We have used 12 weeks as an extrapolation of international SI guidelines and even though this target was not met, the study is proposed to be of value in guiding future protocols and ultimately allowing TBH to provide an improved, timely service to patients with an already devastating disease.

**PATTERNS OF PRACTICE OF BREAST CANCER IRRADIATION IN
THE DEPARTMENT OF RADIATION ONCOLOGY, CHARLOTTE
MAXEKE JOHANNESBURG ACADEMIC HOSPITAL 2010-2012 [61]**

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BODY: Conducting survival analysis is important for a radiation oncology department to facilitate distribution of resources to conditions that benefit most from intervention. It also aids the institution in identifying potential areas for improvement.

OBJECTIVES: Comparative determination of local control, overall survival and type of disease progression relative to local, regional and international findings. To ascertain factors that affect overall survival of the local population.

DESIGN & METHOD: A retrospective review of patient records from January 2010 to December 2012 with 5 year follow up. Ethical approvals were obtained. A proforma was used to collect data from patient files. 95 patient files were identified and randomly selected for inclusion into study. Data entered into SPSS and analysed using descriptive statistics, Kaplan-Meier Survival and Cox Regression for bivariate analysis.

RESULTS: Local recurrence rate was 4.2%, 22.1% had distant metastases while 50.5% of Study Population had no progression. 5-year overall disease free survival was 41.1%, loss-to-follow-up rate was 23.2%. Death rate was 30.5% over 5 year follow up. Median survival for progressed patients was 28 months. Factors found to be significant on univariate analysis were: Stage grouping ($p=0.047$) Radiation dose ($p=0.03$), Perinodal Spread ($p=0.034$) and Number of Involved nodes in women aged ≥ 50 years ($p=0.021$). Bivariate analysis with Radiation dose and Staging was also significant ($p=0.023$). 72% of those that received hypofractionated irradiation were still alive at 60 months follow up. 35.8% of the study population received radiotherapy within 8 weeks from previous intervention. Consideration to best-case and worst-case scenarios was conducted to account for loss-to-follow-up rates.

CONCLUSION: Hypofractionated radiotherapy has favourable outcomes in our setting. The loss-to-follow-up rate makes analysis reliable in descriptive statistics but not reliable in survival analysis. Establishing a departmental database and regularly collecting information on patient outcomes to facilitate timely data analysis is recommended. Provision of incentive to patients for attending follow-up clinics to reduce loss-to-follow-up. Careful selection of patients to receive radiotherapy will aid in improving outcomes. Identifying patients needing radiotherapy at Multidisciplinary Team Meetings to plan scheduling ahead of time.

CLINICIAN AND PATIENT REPORTED OUTCOMES FOR SEVERE LATE BLADDER AND GASTROINTESTINAL TOXICITY IN LOCALLY ADVANCED CERVICAL CANCER PATIENTS TREATED WITH CHEMORADIATION [62]

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OBJECTIVE: The purpose of this study is to determine the incidence of severe late (\geq Grade 3 and >90 days after treatment completion) bladder (BC) and gastrointestinal (GIC) complications, and to describe the quality of life of these patients.

DESIGN & METHOD: This is a retrospective analysis of the control arm of a prospective phase-III RCT investigating addition of hyperthermia to chemoradiation from January 2014 to June 2017. 76 participants (FIGO stage IIB-IIIB) were included. The Kaplan Meier time to event analysis was used to determine actuarial probability of complications. Clinician reported morbidity using RTOG criteria and patient reported outcomes (PRO) using EORTC QLQ-CX24 Quality of Life (QoL) questionnaires were assessed at baseline, every 3 months post-treatment during the first year, and 6-monthly in the second.

RESULTS: The mean age was 50 years ± 10.6 . 50% were HIV positive and the median CD4 count was 518 (374-626). All participants completed the entire course of 50Gy in 25 fractions of external beam radiation, three 8Gy brachytherapy fractions and 1-2 doses of concurrent cisplatin within 56 days. BC are predominantly fistulas, highest in the first year and half as likely in those with no evidence of disease (NED). GIC were largely obstructive, predominantly in the second year with a similar risk irrespective of disease presence. In those with NED: 5.3% developed \geq Grade 3 BC (Gr 5 fatality=1) with an actuarial probability of 3.3% and 12.5% at 1 and 2 years respectively; 3.5% developed \geq Grade 3 GIC (Gr 5 fatality=2) with 0% at 1 year and 23.1% actuarial risk at two years. The probability of being alive with or without complications was not statistically different (Chi-Square 0.788 $p=0.375$ Log Rank: Mantel-Cox). However those without complications lived longer and the median survival was not yet reached. Patients with complications reported more severe symptoms (bladder 20% vs. 5% and GIT 21% vs. 8%) and these tend to be complication specific symptoms e.g. incontinence in fistulas or related obstructive symptoms. There was a discordancy between clinician graded and PRO (bladder 9.2% vs. 7% and GIT 7.9% vs. 10%). Clinicians grading using the worst toxicity underestimated the time and quality of life that participants endure with Grade 3/4 symptoms before a Grade 5 fatality.

CONCLUSION: There is a high risk of developing severe complications in patients who survive the first year; and their QoL outlook is significantly worse than those without complications. Patterns of tell-tale symptoms and their intensity reported by patients are our best early-warning system to detect severe late complications.

USING A TWO PHASE ELECTRON RADIOTHERAPY TECHNIQUE TO MANAGE EARLY STAGE DUPUYTREN'S DISEASE: OUTCOMES OF A CASE SERIES [63]

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OBJECTIVES: Prophylactic irradiation, orthovoltage and electron therapy, has shown benefit in early stage Dupuytren's disease (DD). Much of the data however is derived from retrospective clinical trials with variable patient, treatment and disease parameters making it difficult to draw definitive conclusions. In a prospective randomised controlled trial (RCT) comparing low and medium dose radiotherapy (RT) to observation, long term results demonstrated that RT reduced progression and the need for hand surgery more than 5 years post-treatment, with acceptable acute and late effects. We present the outcomes of 5 cases with early stage disease treated with medium dose electron therapy protocol in our institution.

DESIGN & METHOD: This study was designed as a retrospective case series of patients referred to Groote Schuur Hospital (GSH) for RT to prevent disease progression. After clinical assessment, patients were staged according to a modified classification of Tubiana et al. and only patients with early stage disease (N and N/I) were considered eligible for the study. 5 patients (9 hands) were included in the final analysis. Once informed consent was obtained, patients were irradiated with 4 meV electrons between February 2013 and April 2018 according to a protocol developed in Heidelberg, Germany. Treatment was administered in two phases of 15 Gy each to a total of 30 Gy, delivered as 5 fractions of 3 Gy each on 5 consecutive days followed by a 6 to 12 week break before delivery of the second phase of treatment. Pre and post-treatment parameters, both subjective (symptoms and patient satisfaction) and objective (numbers and sizes of nodules & cords and comparative pictures), were compared to assess treatment response. Patients were also asked to report all acute and late side effects of treatment.

RESULTS: Final results pending

CONCLUSION: At the time of abstract submission some patient responses and images were still outstanding. It is expected that these will be received within the coming weeks. Once received, results will be analysed and the abstract finalised for final submission to the South African Congress of Oncology (SACO) abstract committee for consideration.

**CYTOGENETICS IN B-LINEAGE ACUTE LYMPHOBLASTIC
LEUKEMIA (ALL); TRANSLOCATION t(1;19) (q23;p13.3) E2A-PBX1
IS A POOR PROGNOSTIC CRITERION IN CHILDREN OF
AFRICAN DESCENT [64]**

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BACKGROUND: Cytogenetics is used to stratify B-lineage ALL into prognostic risk groups. Hyperdiploidy and translocation t(12;21) indicate a favorable prognosis, whereas translocation t(9;22) and MLL gene rearrangements indicate an unfavorable prognosis. Translocation t(1;19) E2A-PBX1 has not been used in the major clinical trials in High Income Countries (HIC) as an unfavorable prognostic factor, and the literature is not conclusive.

METHODS: A retrospective chart review was performed on all ALL patients treated at the Charlotte Maxeke Johannesburg Academic Hospital, and Wits Donald Gordon Medical Centre, Johannesburg, South Africa from 2002 to 2018. Initial bone marrow examination included immunophenotyping by flow cytometry, cytogenetics, ploidy by flow cytometry and Fluorescent In-Situ Hybridization (FISH) for the ALL quadruple FISH.

RESULTS: A total of 322 patients were diagnosed with ALL. Of these 241 (74.7%) were diagnosed with B-lineage ALL. There were 224 with early Pre-B/CALL, 11 with pro-B/Null ALL, and 5 patients who also had mature B antigen expression with surface membrane immunoglobulin and CD20. Thirty-six patients (16%) tested positive for t(1;19). All 5 patients with mature B elements were t(1;19) positive. The patients with t(1;19) had a mean age of 7.18 years, a male to female ratio of 0.6 to 1, and a mean white cell count of $97.8 \times 10^9/l$. Thirty patients (83%) were of black African descent. Cytogenetics of this group showed a complex karyotype in 17 of the 36 patients (47%) in addition to the translocation t(1;19). The EFS of the t(1;19) group was 55%, as opposed to 90% in the t(12;21) group, and 80% in the patients with no particular FISH abnormality.

CONCLUSION: Patients with translocation t(1;19) present in the older child, have a higher white cell count at diagnosis and occur in patients of African descent. The inferior survival rate suggests a poorer prognosis, and that t(1;19) should be used in the risk stratification of B-lineage ALL.

PAEDIATRIC ANAPLASTIC LARGE CELL LYMPHOMA: A SINGLE UNIT EXPERIENCE IN KWA-ZULU NATAL, SOUTH AFRICA [65]

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BACKGROUND / OBJECTIVES: Anaplastic large cell lymphoma (ALCL) accounts for 10% of paediatric lymphoma. In areas with a high tuberculosis (TB) burden, lymphoma is often misdiagnosed as TB and diagnosis is delayed. We sought to describe patient characteristics, treatment response and survival of patients diagnosed with ALCL, at a single centre from January 2003 – December 2017.

DESIGN / METHODS: A retrospective review of patients (aged 12 and under) diagnosed with ALCL from January 2003 – December 2017 presenting to the paediatric unit at Inkosi Albert Luthuli Central Hospital.

RESULTS: Eighteen patients were diagnosed over a fifteen year period. The male: female distribution was 11:7. All eighteen patients were black. Patient's ages ranged between two and twelve years. Two patients were human immunodeficiency virus positive. There were two patients each with stage 2 and 3 disease, and 14/18 patients had stage 4 disease. Half of the patients with stage 2 and 3 disease are alive, and the other half have been lost to follow-up (LTFU). Patients were treated with the NHL – BFM 90 protocol. Of the fourteen patients with stage 4 disease, 3 are alive (survival 21m – 5yrs), 1 LTFU, 8 died from primary /progressive / early relapsed disease, and 2 were late deaths (1 relapse and 1 second malignancy). Of the 2 HIV positive patients, one was LTFU after 6m and the second died after developing acute biphenotypic leukaemia after 3 yrs. ALK / t2,5 status was positive in 8 patients (6 alive), negative in 5 patients (4 dead, 1 LTFU) and unknown in 5 patients (4 dead, 1 LTFU). Six patients with stage 4 disease were treated for TB for between 2 and 7 months prior to diagnosis, and in another 5 patients there were delays of between 1-10 months. Stage 4 disease presented with a wide range of signs including pleural effusions, tender lymphadenopathy, bone lesions, gibbus, ascites and significant abdominal adenopathy.

CONCLUSIONS: Most patients had stage 4 disease with poor outcomes due to delays in diagnosis and incorrectly being treated for TB. Intensive public awareness on early warning signs and further clinician education enabling earlier diagnosis is needed to improve survival.

SINGLE-CENTRE EXPERIENCE OF B-CELL LYMPHOMAS IN CHILDREN AT THE HEIGHT OF THE HIV EPIDEMIC IN SOUTH AFRICA [66]

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BACKGROUND: South Africa has seen an increase in B-cell lymphomas (BCL) associated with HIV/AIDS. Burkitt lymphoma (BL), the most common subtype, occurs mostly in the sporadic form in South Africa.

OBJECTIVES: The purpose of this study was to evaluate the outcome of children with BCL, with and without HIV infection, assess the most common histology, and to determine whether the HIV epidemic has increased the incidence of BCL.

DESIGN & METHOD: The study was a retrospective folder review of patients with BCL at Red Cross Children's Hospital, Cape Town, between January 2003 and December 2015.

RESULTS: Ninety-eight patients were diagnosed with BCL with a median age of 6.41 years. 69 patients were HIV-negative, and 29 patients were HIV-positive. The annual incidence of BCL in the HIV-negative group was 4.3 vs 5.3 cases per year for 1991-2002 and 2003-2015, respectively. In the latter period, 2.2 additional cases of BCL were diagnosed in HIV-positive children. In the HIV-positive group, 19 (66%) had BL, 7 (24%) had Diffuse Large B-cell Lymphoma (DLBCL), 3 (10%) had other subtypes of BCL. Twelve (41%) were on antiretroviral therapy at diagnosis. Seven HIV-positive patients were not treated with chemotherapy due to poor performance status, parent refusal or post-mortem diagnosis. In the HIV-positive group, one patient was in LMB risk Group A (3%), 19 patients in Group B (65%) and 8 patients in Group C (28%). One patient had a primary CNS lymphoma. In the HIV-negative group, 8 patients were in Group A (12%), 38 patients in Group B (55%), and 23 patients in Group C (33%). Overall 5-year event free survival was 81%; specifically, HIV-negative group: 84% (n=69) and HIV-positive group: 70% (n=22). Survival rates were not significantly different between the HIV-positive and negative groups for Group B and C (*p*-value 0.20 and 0.37 respectively).

CONCLUSION: The outcomes for HIV-positive children with BCL were not significantly worse than the survival of HIV-negative children in the same time period. Although BL was the most common subtype overall for both the HIV-positive and negative group, DLBCL was proportionally more common in the HIV-positive group. The HIV epidemic has produced a modest increase in the incidence of BCL.

RARE RELAPSED / SECOND NHL IN AN HIV INFECTED CHILD [67]

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BACKGROUND: HIV infection is associated with an increased risk of malignancy which is reduced with anti-retroviral treatment (ARVs). Children with HIV have a higher incidence of Non-Hodgkin lymphoma (NHL) and Kaposi sarcoma. .

OBJECTIVE & METHOD: To describe an ARV naïve child who presented with spinal NHL and who developed a second NHL involving the pericardium.

CASE PRESENTATION: A 3yr old African Male child presented with acute flaccid paralysis. Initial CSF showed no cells, normal glucose and protein of 5.46g/l. He was treated as a Guillain Barre syndrome with i.v. immunoglobulin with no effect. Radio-imaging showed axillary and abdominal lymphadenopathy and hypoechoic lesions in the spleen. HIV infection was confirmed with the initial viral load of 69243/ul and CD4 count of 890 (19.5%). ARVs were commenced. A lymph node biopsy showed changes consistent with HIV infection. A subsequent MRI of the spine showed an extra-dural mass within the spinal canal extending from C7 to T6/T7 displacing and compressing the spinal cord and extending into several neural foramina. Laminectomy and decompression of the spinal cord were performed 7 weeks after presentation and biopsy showed a high grade NHL with features of a Burkitt lymphoma (BCL6, CD10 and EBER positivity with a high Ki67 proliferation index and a C-MYC translocation t(8;14)). He completed treatment for Burkitt lymphoma over the following 8 months. Toward the end of treatment he showed some improvement in the paraparesis. This continued during the follow up period while he was off chemotherapy and on ARVs.

He remained well until he presented with recurrent pericardial effusions 53 months after stopping chemotherapy. His viral load was undetectable and the Cd4 count normal. Typing of the malignant cells showed B lymphocytes with Kappa restriction and CD19, CD20, CD79b and CD5 positivity. CD10 was negative and cytogenetic studies for t(8;14) were negative. The long period of remission and the phenotype strongly support a second NHL. He is currently receiving chemotherapy.

CONCLUSION: The initial presentation as acute flaccid paralysis and primary spinal NHL is rare. The second presentation with pericardial lymphoma on ARVs with viral suppression with a likely second high grade lymphoma has not been reported in HIV infected children.

A COST COMPARISON OF RASBURICASE VERSUS DIALYSIS IN THE MANAGEMENT OF CHILDREN WITH ACUTE LEUKAEMIA AND LYMPHOMA AT A SOUTH AFRICAN CENTRE [68]

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BACKGROUND: Tumour lysis syndrome (TLS) is a common complication of haematological malignancies and has historically been managed with hyperhydration, urine alkalinisation and allopurinol with renal dialysis reserved for patients in acute renal failure. Rasburicase has been shown to drastically reduce the need for dialysis, however its use is limited in developing countries due to its cost and availability.

OBJECTIVE: This retrospective analysis aimed to compare the cost to state per patient of rasburicase compared to dialysis in the management and prevention of tumour lysis syndrome in paediatric patients presenting with haematological malignancies admitted to Red Cross War Memorial Children's Hospital (RCWMCH).

DESIGN & METHOD: This study is a retrospective analysis of administrative data of paediatric patients with haematological malignancies who required dialysis or rasburicase in the management or prevention of TLS since the availability of rasburicase at RCWMCH in September 2014. Patients from two consecutive 35-month periods, before and after the availability of rasburicase at RCWMCH, were grouped according to treatment modality and the cumulative costs of hospitalisation, dialysis and drug administration were compared.

RESULTS: The groups were comparable in mean age and gender. The mean total length of hospital stay was 10.04 days shorter for the rasburicase group than the dialysis group with the average cost *per patient* in the rasburicase group being R40 989.64 lower than the dialysis group.

CONCLUSION: The use of rasburicase results in a significant per patient cost saving when compared to dialysis, which often requires intensive care admission and results in extended hospitalisation. The study supports the continued use of rasburicase as an essential adjunct in the management and prevention of tumour lysis syndrome, reaffirming its use as a cost effective and efficient drug.

PRE-OPERATIVE CA 125 LEVELS ACCURATELY PREDICTS LYMPHATIC METASTASES AMONG SOUTH AFRICAN ENDOMETRIUM CANCER PATIENTS AT HIGH RISK FOR LATE STAGE [69]

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OBJECTIVE: The purpose of our study was to evaluate the predictive value of serum CA 125 levels in the pre-operative assessment of endometrium carcinoma in a setting where late presentation is common.

DESIGN & METHOD: Data were collected retrospectively from patient files over the period January 2012 to January 2017 at the Gynaecological Oncology Unit, Steve Biko Academic Hospital. All patients with pathologically proven endometrial carcinoma, scheduled for surgery, who had pre-operative serum CA 125 test results were included in the study. The association of CA 125 with various histological factors were determined to evaluate sensitivity and specificity, using Spearman correlation and Receiver Operator Characteristic (ROC) curves.

RESULTS: A total of 58 endometrial cancer patients with complete records were included in the study. The mean age was 63 years (SD 8.80; range 41 – 84 years). Postmenopausal bleeding was reported in 94.6% of patients. All patients underwent surgical staging, total abdominal hysterectomy with bilateral salpingo-oophorectomy and pelvic and/or para-aortic lymph node dissection. The number of lymph nodes removed ranged between 1 – 46 (median: 10 nodes; SD 8.96), while preoperative CA-125 serum values ranged from 3 – 400 IU/ml (median: 21 IU/ml; SD 85.4). The FIGO stage distribution was 41.4%, 15.5%, 36.2% and 6.9% (FIGO stage I, II, III and IV respectively).

No significant correlation was found of CA 125 with histopathological type ($p = 0.257$), but there was a significant correlation with grade ($p < 0.05$), advanced FIGO stage ($p < 0.001$), depth of invasion ($p < 0.001$) as well as lymph nodes metastases ($p < 0.001$). In extra uterine metastasis, CA 125 values were found to be statistically significant different for lymph nodes metastasis ($p < 0.001$), cervical ($p < 0.05$) and ovarian involvement ($p < 0.05$).

The most appropriate cut-off point of CA 125, where an increase in sensitivity was not associated with a fall-off in specificity, was 20 IU/ml reaching a sensitivity of 90% and a specificity of 67% for detection of lymph node metastases.

CONCLUSION: In our cohort of endometrial cancer patients, the pre-operative serum CA 125 level was associated with lymph node metastases; we found a CA 125 of 20 IU/ml or more to be predictive. These findings suggest that among similar populations, CA 125 could be done pre-operatively and could be used to determine the need for node dissection. This finding should however be validated in a larger prospective study on early stage disease.

A SEAMLESS SOLUTION FOR IMAGE GUIDED ADAPTIVE RADIOTHERAPY VERIFICATION AND DOSE SUMMATION [70]

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OBJECTIVES: An online software application with real time component tracking and dose calculation in linear accelerator treatment was developed for total dose computation in the verification of image guided adaptive radiotherapy (IGART). The application can also be utilized for treatment verification and quality assurance.

DESIGN & METHOD: Intensity modulated radiotherapy techniques such as Volumetric Modulated Arc Therapy (VMAT) require significant investment in online and offline treatment verification devices. Dosimetric verification requires substantial measurement efforts, human resources, non-standard working hours and overtime efforts, as well as routine device setup and dismantling. In high-volume treatment centers, these requirements could limit the number of VMAT plans generated, let alone the option of plan adaptation for patients who may benefit from it. We have developed an online software application that automatically tracks each treatment fraction delivered by a linear accelerator, patient related details and create a log of linac component statuses during treatment. Upon treatment completion, a DICOM-RTplan is generated for re-calculation of the treatment dose based on the logged data. The application was extensively tested against several types of treatment interruptions, monitoring of components during beam on and –off, as well as several repeated treatment test cases. Dose recalculation was tested on the SciMoCa Monte Carlo dose engine.

RESULTS: The software application is easy to use and does not require any user interventions during operation. The application “fishes” for data continuously and automatically bins the data into logged data files with patient ID association. Application testing in this regard gave similar results on Elekta Synergy, Precise (South Africa) and Versa HD linacs (Germany and Austria respectively). Treatment logs and DICOM-RTplans were generated successfully for every treatment fraction. DICOM-RT files can be generated containing each logged entry or each planned control point. Negligible differences were found when comparing sequential treatment fractions in highly modulated VMAT beams, though any difference in linac component values are considered during dose calculation. Dose summation using biological indices allows tracking of the dose during adaptive treatment execution.

CONCLUSION: A novel software application was developed for linac component logging to generate full- or filtered treatment logs. Automatic DICOM conversion allows dose re-calculation serving as a high impact Quality Assurance module. The ease of use and speed of calculation permits extension to IGART dose tracking.

REVIEW ON HYPERTHERMIA TECHNIQUES USED FOR THE MANAGEMENT OF CERVICAL CANCER AND THE TREATMENT OUTCOMES [71]

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OBJECTIVES: Several hyperthermia (HT) techniques have been developed and investigated over the last two decades. We review the trials, including our local trial, and report on outcomes based on protocols and techniques used to treat cervical cancer.

DESIGN & METHOD: A literature search on Pubmed was conducted using the key words “hyperthermia”, “thermotherapy”, and “cervical cancer”. Trials were grouped according to treatment regimens: HT + radiotherapy (RTHT); HT + chemoradiotherapy (CRTHT); and HT + chemotherapy (CHT). The HT protocols, techniques and outcomes were tabulated.

RESULTS: Two heating techniques are used: capacitive coupling heating using either 8 MHz radio-frequency (RF) at 1200W or 13.56MHz RF at 150W, or radiative heating. Differences in protocols, technical specifications, and administration exist between various techniques. Radiative heating requires shielding and requires patients to be sedated. Phase III trials using each technique have demonstrated a local control benefit (capacitive heating: 80% versus 50% in the control arm, $p=0.048$; radiative heating: 83% versus 57% in the control arm, $p=0.003$) and survival benefit (capacitive heating: 80% versus 49% three year relapse free survival in the control group, $p=0.048$; radiative heating: 51% versus 27% three year survival in the control arm, $p=0.009$) with the addition of HT to radiotherapy. Phase I/II studies on CRTHT using both techniques showed acceptable toxicities. Two phase III trials on CRTHT (one on each technique) applied HT once per week and did not show any benefit. A third phase III trial is in progress in Johannesburg using 13.56MHz RF capacitive coupled heating (power 130W) applied twice per week. Local disease control at 6 months is significantly improved (46% versus 24%, $p=0.003$) and preliminary results on three year survival show significant improvement (58% versus 35%, $p=0.042$) with the addition of HT. Studies have shown safety and improved local control using CHT for the management of local recurrences or residual disease in previously irradiated cervical cancer patients (Phase II study on radiative heating: objective response=55%; randomised study on capacitive coupled 13.56MHz RF heating: overall response rate = 72% versus 35% in the control group, $p=0.0461$)

CONCLUSION: HT is an effective radiosensitiser for cervical cancer patients who cannot receive chemotherapy. When applied twice a week to CRT protocols using capacitive coupled 13.56MHz RF, HT improves local disease response and may improve three year disease free survival. CHT may improve local control in patients with recurrent / residual disease in a previously irradiated region where treatment options are limited.

USE OF PALLIATIVE CHEMOTHERAPY IN SOUTH AFRICA: NATIONAL SURVEY OF PAEDIATRIC ONCOLOGISTS [72]

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BACKGROUND: Palliative chemotherapy is cancer-directed therapy which aims at stopping or slowing down the progression of the malignancy even though it may not have any potential for remission or cure. There are different reasons why cancer in children may be advanced and even incurable at presentation to an oncology unit. In these situations palliative chemotherapy may be offered in an attempt to improve quality of life and prolong survival.

OBJECTIVES: This research study evaluated South African paediatric oncologists' perspectives and practices regarding the use of chemotherapy in patients with cancer with no realistic hope of cure.

DESIGN & METHOD: An online survey was conducted among paediatric oncologists in South Africa. The main aims of the questionnaire were to assess paediatric oncologists' considerations around the use of palliative chemotherapy, and then focus on the most recent patients treated with palliative chemotherapy. A total of 41 participants completed the survey, giving a response rate of 89%.

RESULTS: The majority of the paediatric oncologists were either neutral or agreed that palliative chemotherapy should be considered. The most important treatment aim was to improve quality of life of the patient (92.7% of respondents agreed that palliative chemotherapy should be given to maximise quality of life). The most important considerations when prescribing palliative chemotherapy was to minimise toxicity of the chemotherapy regimen (4.56 mean, SD=0.5 utilising a 5 point scale where 1=not important to 5=very important), and the effectiveness of the chemotherapy (4.37; SD=0.48). Parental preference was not reported to be one of the most important factors when deciding on palliative chemotherapy and only 19.5% of patients received treatment primarily because it was requested by parents. The most important treatment considerations were largely achieved as expected in the most recent patient treated with palliative chemotherapy. Individual opinions and preferences with regards to recommending palliative chemotherapy differ between paediatric oncologists.

CONCLUSION: Although the overall attitude towards the use of palliative chemotherapy is positive, there is great inter-individual variation between oncologists in opinions and experience. The lack of empirical data to justify recommendations with regards to palliative chemotherapy remains a problem, and the researcher hopes that this study will spark productive discussion and planning towards more structured use of palliative chemotherapy in children with cancer in South Africa.

USE OF PALLIATIVE CHEMOTHERAPY IN SOUTH AFRICA: EXPERIENCE IN A SINGLE UNIT [73]

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BACKGROUND: Palliative chemotherapy is used to stop or slow down the progression of cancer that is deemed to be incurable. In South Africa delayed diagnosis of childhood cancer is a common problem for a variety of reasons including lack of health care facilities, transport, information about the disease and delayed presentation due to traditional healer visits or other cultural issues. In these patients who present with advanced cancer, or in patients with relapsed cancer without realistic hope of cure, palliative chemotherapy can be offered in an attempt to improve quality of life and prolong survival.

OBJECTIVES: This research study described the use of palliative chemotherapy in patients who received treatment at the Steve Biko Academic Hospital Paediatric oncology unit.

DESIGN & METHOD: A file review was done of deceased patients who died in the period from January 2012 to December 2018 and who had received palliative chemotherapy as part of their cancer management. We reviewed diagnoses, palliative chemotherapy regimens, timing of initiation and stopping palliative chemotherapy, and whether end of life decisions and discussions were documented.

RESULTS: Of the 305 patient deaths recorded in the study period, a total of 74 patients had received palliative chemotherapy and were included in the file review. The most common diagnoses were neuroblastoma (18.2%), retinoblastoma (15.6%) and osteosarcoma (14.3%). At the time of diagnosis the median age of the patients was 6.0 years (range 0.3 to 17.6 years). In 47 patients (63.5%) the disease was deemed incurable at first diagnosis and palliative chemotherapy given from the onset of treatment, while 27 patients (36.5%) were given palliative chemotherapy at relapse of disease. The median time from last palliative chemotherapy to time of death was 30 days (range 0-742 days). The main documented aim of palliative chemotherapy was to improve symptom control (97.3%) while parents' opinion played an important role in 32.9% of cases. About half of the patients (41 of 74, 55.4%) had documentation of symptomatic improvement.

CONCLUSION: This study provided a birds-eye view on the use of palliative chemotherapy in children, but also showed clearly that a lot of decisions around end of life care and decision making are better researched using a quantitative, prospective, interview-based approach. Repeated measurements of the child and family's quality of life and its associations with palliative chemotherapy should be a research priority in future, especially in our setting where many of the patients are from indigent communities and travel very far to reach oncology care.

LIFE-WORLD MEETS THE BIO-TECHNICAL WORLD: PATIENTS' EXPECTATIONS AND EXPERIENCES OF THE COMPUTED TOMOGRAPHY (CT) LOCALISATION EVENT [74]

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INTRODUCTION: The radiation therapy (RT) localization procedure is a transitional event between cancer diagnosis and radiation treatment, in the cancer care continuum. The Computerise tomography (CT) localization procedure is significant, from a RT health care team perspective, where the technical aspects for radiation dose planning and the treatment delivery are prepared, In order to inform a patient-centered approach for effective care during this event, it is important to establish how patients' expectations and experiences are shaped at this point in the cancer journey.

METHOD: Ten patients with diverse demographics and diagnosis were interviewed immediately prior to and after undergoing the CT localisation procedure. The study was conducted using a qualitative research methodology with a phenomenological hermeneutic strategy to interpret and analyze the patients' reported expectations and experiences.

FINDINGS: In this presentation, an interpretation of the themes, sub-themes and categories that emerged from the analysis of the interviews will be offered. Although the aim of the study was focussed on the expectations and experiences of the CT localisation event, other insights were gained. These were the experience of discovering the presence of the cancer and navigating the healthcare system to access treatment and the expectation for recovery, that were significant enough for the patients to share during the interviews.

CONCLUSION: Although this study set out to provide insights to inform a patient-centered care at this juncture of the patients' journey, it also provides insights for person-centered care.

POSTERS

IMPACT OF VARIOUS PARAMETERS ON ISODOSE COVERAGE IN HDR BRACHYTHERAPY FOR CERVIX CANCER [75]

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OBJECTIVE: Cancer cervix is the most common cancer in Kenya & HDR brachytherapy is an integral part of radiation treatment. This retrospective study was designed to find the optimum inter-ovoid distance for best isodose coverage in cervical cancer HDR brachytherapy. The findings will help in situations where image-guided brachytherapy was not available or not feasible.

DESIGN & METHODS: Retrospective analysis of 29 cases of uterine cervix randomly chosen in 12 months period, from March 2018 to February 2019. Various parameters like ovoid separation, dose to bladder and rectum points as specified in ICRU-38 were recorded.

RESULTS: All parameters recorded were co-related with the isodose coverage (AP & Lateral) and the most significant parameter affecting the point A isodose distribution was inter-ovoid distance. The Lateral isodose coverage increases with increase in ovoid separation up to approximate 30 mm, while the AP isodose coverage decreases significantly after 24 mm inter-ovoid distance.

CONCLUSION: Inter-ovoid distance of 20-24 mm could be optimal considering both AP & lateral isodose coverages. This also translates to lesser chances of vaginal injury.

COMBINING MARKERS OF HYPERMETHYLATION WITH CYTOLOGY OR HPV BASED CERVICAL CANCER SCREENING IN HIV-POSITIVE SOUTH AFRICAN WOMEN [76]

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OBJECTIVE: The aim of our study was to determine the role of molecular markers in cervical cancer screening strategies among South African women living with HIV (WLHIV).

DESIGN & Methods: Data were collected in a South African cohort of WLHIV who also underwent cervical screening and colposcopy-directed biopsy. Data included cytology and HPV prevalence, HPV 16/18 genotyping as well as histology results. Detection of FAM19A4/miR124-2 hypermethylation was performed on DNA isolated from cervical scrapes. Diagnostic performance was determined of cytology and HPV tests, as single test strategies and in combination with FAM19A4/miR124-2 hypermethylation triage tests.

RESULTS: A total of 285 women with valid results on all parameters were included in the analyses. Cytology provided the highest specificity (91.6%), but lowest sensitivity (59.3%), whereas a single HPV test provided the highest sensitivity

(83.1%), but lowest specificity (66.4%). Combining cytology with methylation did not improve the performance compared with cytology alone: a slight increase in sensitivity was seen (67.8% for cytology with methylation triage, and 62.7% for methylation with cytology triage), at the cost of a decrease in specificity (85.5% and 87.2%). Triage of HPV positive women with methylation, increased specificity compared with the use of a single HPV test (76.1%) or cytology, while maintaining an acceptable sensitivity (72.9%). Similar performance was observed for HPV16/18 with methylation triage (sensitivity 79.7%, specificity 74.8%). The number of women needed to refer to detect one CIN3+ case was lowest for cytology (1.5), but was only slightly higher for HPV with methylation triage or HPV16/18 with methylation triage (2.3 and 2.2, respectively).

CONCLUSION: Molecular screening strategies using HPV, with or without HPV16/18 genotyping, and FAM19A4/miR124-2 hypermethylation have higher sensitivity with an acceptable loss in specificity compared with current cytology screening practice. It can be feasible for detection of CIN3+ in South African WLHIV and further investigation is warranted.

PRELIMINARY STUDY ON THE DESIGN OF A NOVEL PELVIC PROSTHESIS SPIRAL PHANTOM FOR ADVANCED RADIOTHERAPY VERIFICATION [77]

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BODY: Accurate radiotherapy dose verification is of great importance to optimize the local tumour control while sparing the organs at risk (OARs) and healthy tissues. In the presence of a high-Z implanted material, knowledge of planning and dosimetric verification are essential due to perturbation effect caused by the metal-tissue interface.

OBJECTIVES: The purpose of this study is to present the design and construction of a novel pelvic prosthesis spiral phantom for radiotherapy quality assurance (QA).

DESIGN AND METHOD: The organ-specific pelvic prosthesis phantom consists of different removable inserts for ionization chamber and spiral film. Ion chamber insert is suitable for cavity volume of $\leq 0.8 \text{ cm}^3$, while film insert can accommodate a thin sheet and size of 3 cm and 20 X 43 cm² respectively. The 25 cm thick dosimetric phantom also contains organ substituted materials with densities of bladder, rectum, bony structure and prostate (cancer cell composition) embedded in water-equivalent nylon. 1 cm nylon is sandwiched between the titanium implant of 2.5 cm geometrical radius and the right hip bony structure for a tight grip. There will be a cylindrical hole crossing the prostate gland for placing the ionization chamber and a spiral slot to enclose the film.

RESULTS AND CONCLUSION: This is a quick assemble phantom that is more convenient than liquid phantoms. The spiral phantom will be useful and flexible for dosimetric verification. It can determine the OAR doses for comprehensive treatment planning. The spiral shape of this phantom makes it suitable for arc radiotherapy QA.

**THE IMPACT OF VENOUS THROMBOEMBOLISM ON THE
OUTCOMES OF PATIENTS WITH CERVICAL CARCINOMA:
A RETROSPECTIVE AUDIT FROM
JANUARY 2015 TO DECEMBER 2016 [78]**

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BACKGROUND: Venous thromboembolism (VTE) is a frequent cause of morbidity in patients with cervical cancer. The aim of this study was to investigate the outcomes of patients with cervical cancer and a deep vein thrombosis (DVT) in a South African population.

METHODS: We retrospectively reviewed the records of cervical cancer patients who were admitted to our institution over a 2 year period in 2015 and 2016. Data collected included the age, stage, Human Immunodeficiency Virus (HIV) status, proximity to radiotherapy and whether the course prescribed radiotherapy was completed. The survival of patients from diagnosis of VTE and the 2 year overall survival were evaluated using the method of Kaplan and Meier. A univariate analysis was performed for age, clinical stage, HIV status, whether patients successfully completed radiotherapy, and whether VTE was diagnosed before or after radiotherapy.

RESULTS: We identified 47 patients with cervical cancer who were admitted to hospital with venous thromboembolism. The majority of patients (62%) were stage IIIB. Sixty percent of patients were HIV positive and 40% of patients were HIV negative. The median survival of patients from the time of diagnosis of VTE was 2.7 months, (interquartile range (IQR): 0.97 – 6.93 months) and the 12 month survival from diagnosis of VTE for this cohort was 17%. Once a deep venous thrombosis was diagnosed the survival becomes poor irrespective of age, stage, HIV status or whether the prescribed course of radiation was completed. The 2 year overall survival of this cohort was 29.8%. The 2 year overall survival of patients who were diagnosed with a DVT before or during radiotherapy was significantly lower than that of patients who were diagnosed with DVT after radiotherapy, (12.5% versus. 38.7%), $p = 0.001$.

CONCLUSION: The diagnosis of venous thromboembolism in patients with cervical cancer is an independent poor prognostic indicator and is associated with extremely poor survival. It is possible that poor prognosis reflects more aggressive tumour behaviour.

STEREOTACTIC RADIOSURGERY FOR RECURRENT GLIOBLASTOMA MULTIFORME [79]

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BODY: The most common malignant brain tumour in adults and most aggressive of all cancers is Glioblastoma Multiforme (GBM). Initial management of GBM is a combination of surgical resection, followed by fractionated radiotherapy and chemotherapy to improve overall survival. However, GBM recurs in majority of patients which is fatal. The utilization of stereotactic radiosurgery (SRS) for the treatment of recurrent GBM's have been reported with variable success.

OBJECTIVE: To evaluate the efficacy of SRS as a treatment for recurrent GBM'S using a dose of 10Gy x 3 fractions.

DESIGN & METHOD: Rates of radiation necrosis and neurological complications were performed.

RESULTS: A dose of 10Gy x 3 fractions using SRS after initial fractionated radiotherapy to 59.4Gy.

CONCLUSION: Results show that SRS is a relatively safe treatment option for recurrent GBM.

THE USE OF HDR-ENDOBRONCHIAL BRACHYTHERAPY (EBB) IN RARE ADENOID CYSTIC CARCINOMA TRACHEAL RECURRENCE: A CASE PRESENTATION [80]

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BACKGROUND: Adenoid Cystic carcinoma is a rare tumour mostly occurring in the parotid gland, but can occur elsewhere in the aerodigestive and female genital tract¹. We present a case of such a tumour in the lower trachea and detail the approach to its management.

CASE DESCRIPTION: A 48-year-old Caucasian female presented in 2017 with lower tracheal obstruction due to a primary Adenoid Cystic Carcinoma. She underwent resection followed by high dose external beam radiotherapy using the VMAT technique due to positive margins at multiple sites. 18 months later, she had an obvious symptomatic local recurrence for which high endobronchial therapy was successfully administered with a single dose of 10Gy.

CONCLUSION: Endobronchial brachytherapy is feasible and safe in properly selected patients²; the high single dose is desirable in a slow growing tumour such as this one. Similar cases will be too rare to generalise on its palliative effect but observations on this patient should give some indication thereof; however, the extent of the tumour made complete inclusivity challenging.

**RADIOPHOTOLUMINESCENCE GLASS DOSIMETRY END TO END
AUDIT OF HIGH DOSE RATE GYNAECOLOGICAL
BRACHYTHERAPY AT CHARLOTTE MAXEKE
JOHANNESBURG ACADEMIC HOSPITAL [81]**

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OBJECTIVES: To develop and perform the end to end for high dose rate (HDR) brachytherapy for cervical cancer by comparing planned and delivered dose around a series of different gynaecological treatment applicators in water. This is done to improve the quality assurance in verifying the accuracy of the treatment system and to ensure that the brachytherapy software and hardware components are utilised properly and optimal for patient safety in brachytherapy treatments. One of the main objectives being to develop an HDR brachytherapy audit methodology.

DESIGN & METHOD: A phantom was designed using CAD software such that radiophotoluminescence glass (RPLG) dosimeters could be positioned accurately at point "A", which is 2cm parallel to the left and right side of the intra uterine (IU) tube and 2cm superior to the surface of an ovoid or the cover of a ring applicator. Additional RPLG dosimeters were placed parallel to the dosimeter at point A at 1cm intervals up to 7cm laterally. The phantom was designed in such a way that it accommodates all the applicators that were used in this study.

The designed water phantom was CT scanned with a 26 diameter ring and a 6cm long IU. The scanned images were exported to the brachytherapy treatment planning system (Gammamed). The applicators were reconstructed on the images and plans were created to deliver 8Gy to point A in water using the normal clinical protocol at CMJAH

RESULTS: The brachytherapy treatment planning system dose and the delivered dose differ by just more than 2%. The combined standard uncertainties for each glass rod dosimeter were evaluated in this study, including the uncertainties from glass dosimeter characterization.

CONCLUSION: The results show the possibility of establishing brachytherapy dosimetry audit using glass dosimeters. The audit will provide quality healthcare and Physicists will fulfil legal requirements and minimize risk errors.

THE ROLE OF HYPERTHERMIA IN RADIOTHERAPY [82]

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OBJECTIVE: To answer the following questions: (1) What is hyperthermia and how does it work? (2) Who stands to benefit from hyperthermia treatment? (3) What benefits does hyperthermia offer patients undergoing radiotherapy treatment?

DESIGN & METHOD: A Hyperthermia Unit was recently installed at the Wits Donald Gordon Medical Centre. We visited the unit and gained information from those directly involved in the treatment. Information was gathered from oncologists who refer their patients for hyperthermia treatment whilst receiving radiotherapy. We also collected information from studies done on the benefits of hyperthermia.

RESULTS: A greater knowledge of hyperthermia and a better understanding of the selection process for patients. A clearer view of the advantages and disadvantages of the treatment.

CONCLUSION: Hyperthermia is a valuable complimentary treatment to radiation and could benefit all radiotherapy units.

VOLUMETRIC MODULATED ARC THERAPY (VMAT) FOR RECURRENT MALIGNANT SYNOVIAL SARCOMA [83]

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BODY: Malignant Synovioma is a rare form of cancer. It makes up about 10% of all sarcomas and usually occurs in the joints. Synovial Sarcoma in the cardiac muscle is extremely uncommon. This case is about a 41 year old woman who presented with shortness of breath and was eventually diagnosed with a Synovial Sarcoma of the cardiac muscle. The patient received a heart transplant and pacemaker in 2015 and later recurred in 2019 in the mediastinal nodes and both lungs.

OBJECTIVE: To deliver 66Gy in 33 treatments to the mediastinal nodes whilst limiting the dose to the surrounding organs at risk (heart, liver, lungs and spinal cord) and pacemaker.

DESIGN & METHOD: The Eclipse™ Treatment Planning System was used to delineate the target volume, pacemaker and organs at risk (OAR). Both VMAT and a 3D plan were created. These plans were then compared to assess the dose distribution in the target volume and the relevant doses to the critical structures and pacemaker.

RESULTS: The VMAT plan was found to be more conformal with acceptable doses to the surrounding OAR as compared to the 3D plan.

CONCLUSION: Results show that VMAT produces a better outcome for the patient when treating to higher doses in the mediastinum.

CORRELATION BETWEEN PSA AND BONE SCAN FINDINGS IN PATIENTS WITH PROSTATE CANCER AT GREYS HOSPITAL, KWAZULU-NATAL: A RETROSPECTIVE CHART REVIEW [84]

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OBJECTIVES: To investigate the correlation between PSA and bone scan findings in patients with prostate cancer at Greys Hospital, Pietermaritzburg, KwaZulu-Natal, South Africa.

METHODS AND MATERIALS: In this retrospective, randomized chart review study, 84 patients with prostate cancer were selected from patient files collected over a three year period, between 1st of September 2015 and 30th of September 2018, at Grey's Hospital in Pietermaritzburg, KwaZulu-Natal. The study was approved by the Biomedical and Research Ethics Committee (BREC) of UKZN, with BREC Number BE295/18. Data was collected using Microsoft Excel. Data analysis was performed using IBM SPSS version 25 (Armonk, NY, USA) and SAS version 9.0 (SAS Institute, Cary, NC). Continuous variables such as patient age were summarized using mean \pm standard deviation (SD), and medians (interquartile ranges (IQR) for highly skewed data. Categorical variables such as age and race were summarized using proportions and percentages and compared using Pearson's Chi-square test or Fisher's exact test as deemed appropriate.

RESULTS: Thirty six (42.86%) of the patients had both image-confirmed bone metastasis and an elevated PSA level ($>8.6\text{ng/ml}$), with a mean PSA level of 304.81 ± 156 . Based on a Chi-squared test, an increase in PSA level was found to be positively associated with increased likelihood of positive bone scan findings ($P=0.012$). Twenty four (92.31%) out of 26 patients with a PSA value ≥ 100 had a positive bone scan. No patient with serum PSA levels between 0.0 to 4.0ng/mL , had a positive bone scan. Using a Fisher's exact test, no statistically significant association, between patient age and incidence of bone metastasis was observed, $P=0.10$. Bone metastasis had a statistically significant association with patients' race ($P=0.012$), with black African having highest number of positive bone scans (50.82%). The mean and median serum PSA concentration in patients with a positive bone scan were $560.54 \pm 890.93\text{ng/ml}$ and 196.50 (IQR56-802), whereas patients with a negative bone scan had a mean and median serum PSA level of $38.27 \pm 69.45\text{ng/ml}$ and 20 (IQR9-40.7) ng/ml respectively. Using an unpaired t-test, the difference in mean serum PSA levels between patients with a positive bone scan and those without was statistically significant, $P=0.0001$. Only one patient (1.19%) had a serum PSA value in the reference range (0.0 to 4.0 ng/ml). This patient's bone scan was reported to be normal.

CONCLUSION: Our study indicates that serum PSA levels have fairly high sensitivity (100%) and positive predictive value (43.37%) for bone metastasis. Out of 13 patients with PSA levels ≤ 10 , only 1 (7.7%) had a positive bone scan finding. However, at PSA level ≤ 8.5 ng/ml, 0 (0%) patient had a positive bone scan. The study also demonstrated at PSA levels ≤ 24 , only 1(3.7%) patient out of 31 had a positive bone scan finding. It can be concluded that at PSA levels ≤ 24 ng/ml, 96.3% of the patients had a negative bone scan finding!

CASE STUDY OF A SECONDARY MENINGIOMA IN A PREVIOUSLY IRRADIATED FIELD [85]

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INTRODUCTION: Secondary malignancies following the treatment of childhood cancers is a rare but recognized complication. In the case of retinoblastoma secondary osteosarcoma is more commonly noted, however irrespective of the primary, radiation is a recognized risk factor for the development of malignant and benign meningioma.

CASE PRESENTATION: We present a case study of a 43- year man who was treated curatively for retinoblastoma as an infant with multiple surgeries; radiation and chemotherapy. As an adult he developed an aggressive large meningioma in the treated area in the orbital socket and a second primary alongside the contralateral optic nerve. The approach to management of this is described and discussed as well as possible clinical scenarios associated with this occurrence.

CONCLUSION: The development of this condition decades after his initial therapy presented unique challenges; despite that surgery and radiation therapy was possible.

THE ADVANTAGES OF USING DAILY CBCT FOR PROSTATE AND HEAD AND NECK CANCER PATIENTS [86]

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Advancement in radiotherapy techniques, like Volumetric Arc Therapy (VMAT), accurately shape radiation dose to the tumour. This allows the delivery of higher radiation doses to targets while minimising the dose to organs at risks (OAR).

These higher doses used in VMAT radiotherapy treatment delivery emphasize the need for treatment planning accuracy, reduced target delineation uncertainty and accurate patient set-up. Volumetric imaging techniques, such as cone beam computed tomography (CBCT), has greatly improved the overall quality of VMAT treatment delivery by moving away from 2D verification of bony landmarks to the 3D positioning of the planning target volume (PTV) and organs at risk.

OBJECTIVES: To measure the effect of daily CBCT verification imaging on treatment setup accuracy for prostate and Head & Neck (H/N) cancer patients treated with VMAT.

DESIGN & METHOD: The imaging study was done on 30 patients with prostate cancer and 30 patients with H/N cancer receiving 72 Gy and 60-66 Gy respectively. Prostate patient receiving external beam radiotherapy post-brachytherapy were prescribed an additional 45 Gy. Treatment preparations for VMAT prostate patients included a full bladder and empty rectum protocol and H/N cancer were all treated using a radiotherapy immobilization mask.

The daily verification process involved the acquisition of a CBCT image set followed by registration of the images with the planning CT performed during CT simulation at the beginning of the treatment course. Evaluation then included the determination of shifts in the longitudinal (Z-axis), vertical (Y-axis) and lateral (X-axis) directions aiming to position the patient in exactly the same position as originally planned. Corrections in X, Y and Z-axis were made if necessary. The overall frequency of set-up shifts was evaluated and the mean variations were calculated.

RESULTS: Prostate mean variation 1.6 ± 1.0 mm along the X axis, 2.0 ± 1.0 mm along the Y axis, and 1.8 ± 1.0 mm along the Z axis respectively. Head and neck mean variations is 1.5 ± 0.5 mm along the X axis, 1.5 ± 0.5 mm along the Y axis, and 1.2 ± 0.5 mm along the Z axis respectively.

CONCLUSION: CBCT has revolutionized and greatly improved the accuracy of pre-treatment localization information available to use for image guidance. This enables the treatment team to visualize the PTV and OAR prior to treatment delivery and allowing the evaluation of set-up accuracy and possible errors. This improves confidence that the dose distribution of the treatment plan is a fair representation of the actual PTV coverage delivered on the linear accelerator.

MEASURED ANISOTROPY AND RADIAL DOSE FUNCTIONS OF THE ONCOSEED 6711 I-125 SEED [87]

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INTRODUCTION: The anisotropy function of a brachytherapy seed accounts for the anisotropic dose distribution around the source. This function gives the angular variation of the dose rate about the source at each distance due to self-absorption, oblique filtration of photons through the seed capsule and scattering and absorption of photons in the medium. The radial dose function takes into account the effects of scatter and absorption in the medium along the transverse axis of the source, but it excludes any inverse square type correction.

METHODS: The anisotropy and radial dose functions were measured with thermoluminescent dosimeters (TLDs) and gafchromic film in a specially designed solid water phantom. The anisotropy was measured to a distance of 5 cm. The greyscale of the red colour channel of the gafchromic was converted to dose and a 1 mm x 1 mm region of interest was drawn at each measurement point. Analysis was done using ImageJ. The anisotropy was measured with TLDs at distances of 2 cm, 3 cm and 5 cm. Doses were measured at 0°, ± 30°, ± 60° and 90° at distances of 2 cm and 3 cm, and every 10 degrees at a distance of 5 cm. The TLD chip size was 3 mm x 3 mm x 0.9 mm. The radial dose function was measured to a distance of 5 cm with film and with TLDs to a distance of 7 cm.

RESULTS: The anisotropy function and radial dose function measured with TLDs and film agreed with published data within measurement uncertainties.

CONCLUSION: The OncoSeed 6711 I-125 seed has been widely described in literature. Measured data agrees well with published data, but TLD data was closer to the published values than gafchromic film data.
