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systematic and random error for individual and population were calculated.
Results: The data showed that the system was able to correct shifts with an accuracy of 3 mm. The population systematic errors were 0.7 mm in L – R direction, 0.6 mm in S – I direction for anterior field and 0.9 mm in A-P direction 0.5mm in S – I direction for lateral field. The population random errors were 1.4 mm in L – R direction, 1.1 mm in S – I direction for anterior field and 0.9 mm in A -P direction 1.0 mm in S – I direction for lateral field.The displacement more than 3 mm (negative orpositive) was 4.17 % in S-I direction, 5.88 % in L-R direction, 6.41% in A-P direction.
Conclusions: The current set up for irradiation head & neck cancer patients using IMRT in our department is accurate. The mean set-up error is less than 3 mm . EPIs can promptly detect interfactional set – up errors in patients during radiotherapy and help radiation therapist to improve set up accuracy. It is a useful device for radiation therapy quality assurance (QA) and quality control (QC).

EP-1330
Evaluation of the dose distribution in the CTV through image guided in prostate cancer patients
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Purpose/Objective: In recent years new radiation therapy (RT) techniques have emerged, that have changed the way treatments are done in the RT service, emphasizing the importance of accuracy in all the stages of treatment.Whatever, the technique of RT positioning of the patient is crucial for the successful treatment, as their verification frequency, along the various fractions, established with suitable protocols. As a control tool for positioning the patient, the various techniques of Image Guided Radiation Therapy (IGRT) allow us to assess the position, and the location of the target volume and organs at risk (OARs) before treatment.The aim of this study was the validation of CTV – PTV margins, in prostate cancer patients. The dose distribution was compared in GTV and CTV volumes, calculated in CBCT images, acquired for treatment verification, with CT planning images. The dose calculation was also validated on CBCT images.
Materials and Methods: Images from Computed Tomography (CT) scans were acquired out of 19 patients with prostate carcinoma, delineated target volumes and OARs, and carried out the plan in dosimetric planning system (TPS).Subsequently, the CBCTs were acquired in the treatment machine and performed co-registration with CT planning before treatment. In the TPS we reproduced the conditions of the treatment in the CBCTs, with and without the corrections madein the daily treatment (on-line), and calculated the dosimetric plans of the CTin the 166 CBCTs acquired, for comparison of the $V_{95\%}$ $D_{98\%}$and $D_{100\%}$.
Results: The obtained $V_{95\%}$ of CBCTs with correction was 100% in almost all patients, except one who was 98.8%. In CBCTs with corrections the $D_{98\%}$ and $D_{100\%}$ were above 95% for all patients.
Conclusions: The coverage of the target volume with the prescribed dose has been achieved in all patients and it was possible to reproduce the dosimetric plan of the CT in CBCTs.

EP-1331
The reliability of quantitative thresholding methods for PET aided delineation of GTVs in head and neck tumours.
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Purpose/Objective: PET-CT scans are commonly used for the purpose of gross tumour volume (GTV) delineation in head and neck cancers. Qualitative visual methods (QVM) are currently employed in most radiotherapy departments but these are subject to inter- and intra-observer variability. The aim of this evaluation was to assess the reliability of quantitative thresholding methods to aid GTV delineation.
Materials and Methods: Quantitative thresholding methods which appear in the published literature are evaluated with respect to their reliability for delineation of GTVs in head and neck cancers.
Results: Image segmentation involves the application of a distinct value to all pixels or voxels in an image dataset. This is a complex process affected by numerous variables. Some of the following segmentation thresholds may be applied to automatically delineate specified regions. Standardised uptake value (SUV) is commonly used to apply a threshold for GTV delineation, however this leads to inappropriately large GTVs in head and neck tumours. A further common quantitative threshold is based on the maximum signal on the PET image relative to the background uptake, known as signal to background ratio (SBR). This method generates GTVs that correlate well with surgically removed tumour volumes. Applying a fixed threshold of a percentage of the maximal intensity uptake is also documented in the literature but was found to be unsuitable for the purpose of head and neck GTV contouring. Systems generating volumes based on the physical features of the PET-CT images are also discussed and are found to produce very promising results.
Conclusions: A number of quantitative techniques are evaluated and currently the most suitable is found to be SBR, however even this method was not found to be entirely reliable.
More promising techniques need further evaluation before they could be implemented clinically and a Radiation Oncologist or Nuclear Medicine Radiologist must still validate all GTVs produced by quantitative methods.

EP-1332
An audit of tumour-bed clip matching data for set-up in breast patients at University College London Hospital (UCLH)
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Purpose/Objective: In our institution the tumour bed is localised via the implantation of surgical titanium clips at the point of surgery [1] and verified on the treatment unit with kV imaging and a daily online 'shift to zero' policy. As this is a relatively new process within the department, and in the light of the recent national IGRT guidance document [2], we have decided to audit an initial cohort of patients for adherence to, and robustness of, our departmental imaging protocol.
References available on request.
Materials and Methods: A retrospective review was carried out to assess the set-up variation of an initial cohort of patients. Daily kV online match values based on 'Centre of Mass' of the clips were extracted from the ARIA database (Varian Medical Systems). The data was analysed for the entire cohort and separately for those patients that had had a simultaneous integrated boost or sequential boost in the light of a 7mm departmental imaging tolerance.
Results: The first thirty breast patients who had completed their course of radiotherapy teir ath were included in the review with a total of 415 image matches. 21 patients had a simultaneous integrated boost (daily kV imaging) and the remaining nine patients a sequential boost (daily kV imaging on boost only).
The mean shifts applied for the entire cohort were:
VRT: **0.29**cm (SD ± **0.22**; Range **0-1.0** cm); LNG: **0.25**cm (SD ± **0.20**; Range **0-0.9**cm); LAT: **0.24**cm (SD ± **0.30**; Range **0-0.7**cm)
The systematic difference between CT and treatment for this cohort was:
VRT: **-0.14**cm (SD ±**0.33**); LNG: **0.03**cm (SD ±**0.32**); LAT: **-0.06**cm (SD ±**0.29**)
This suggests that there maybe a systematic difference in the 'centre of mass' in the vertical direction, possibly due to the patients relaxing during treatment compared with CT or posterior movement of the clips. There was no difference in match data between the simultaneous integrated boost cohort and the sequential boost cohort.
Conclusions: This audit shows that the 7mm imaging protocol used by our institution for the clip matching of breast patients is adequate. Further work needs to be carried out to evaluate whether a non-daily protocol would be sufficient for target verification hence reducing imaging dose. The variation in set-up is multi-factorial and includes, patient position, respiratory motion, tumour bed volume changes and clip position changes. This data, however, cannot describe the individual contribution from these factors. Inclusion of more patients into the audit may assist in the development of a non-daily protocol and examining individual clip position may provide information on tumour bed motion and volume changes.

ELECTRONIC POSTER: RTT TRACK: PATIENT CARE AND PATIENT INFORMATION

EP-1333

Control system development for Coline 6 linear accelerator
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Purpose/Objective: The purpose of this study was to verify safety interlocks consistent with international standards IEC 60601-2-1 using a linear accelerator Coline 6 control system developed through the European Accelerators & Detectors AiD Project (AiD project: Development of dedicated systems based on accelerators and detectors of ionizing radiation for medical therapy and indetection of hazardous materials and toxic wastes) in The Polish National Centre for Nuclear Research.
Materials and Methods: The pre-prototype of the control system works with the registration and verification software developed in the National Centre for Nuclear Research and Treatment Planning System PHJ Prague.The system analysis was performed to assess the security operation responsible for the dose off including verifications of error messages of measurement doses related to dosimetry measurement devices, mechanical failure of accelerator elements and use by an unauthorized user. Before starting the irradiations various cases ofoperator errors, omissions in remote data retrieval therapy and manual dialing parameters were tested. During the irradiations different schedules of dose measurements device and accelerator mechanical device errors were tested.
Results: Safety of the patient during the irradiation is dependent on the manufacturer of the treatment devices. The accelerator control system was designed to meet all treatment parameters obtained from the Treatment Planning System and terminated irradiation if the parameters were inconsistent with the plan. The pre-prototype of the control system met all requirements.
Conclusions: The analysis of the cases used in this study showed that the control system created as a pre-prototype can be the first step to create clinically acceptable software.

ELECTRONIC POSTER: BRACHYTHERAPY TRACK: GYNAECOLOGY

EP-1334
Undetected uterine perforation in cervical cancer Brachytherapy may result in harmful over dose of OARs
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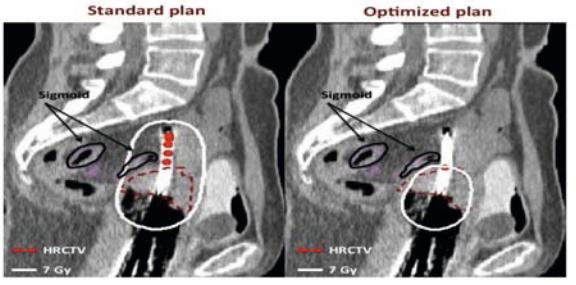
Purpose/Objective: The importance in local control and toxicity of optimal applicator placement in cervical cancer brachytherapy (BT) is well established. Nevertheless uterine perforation remains a frequent complication, generally undetected by classic QA measures of 2D BT to assess the adequacy of implant placement. 3D BT based on CT imaging allows optimal visualization of applicator's position in respect to the OARs thus enabling the possibility of dose optimization. Aim of this work is to define the dosimetric impact on OARs of undetected uterine perforation when a standard point A optimized dose distribution is applied and the eventual dosimetric gain achievable with 3D CT-based dose optimization.
Materials and Methods: 23 CT-based tandem/ovoids BT applications complicated by uterine perforation were selected. All patients had a FIGO IIB cervical cancer and were planned to receive radio-chemotherapy (1.8 Gy per fraction up to 45 Gy with concomitant weekly cisplatin) and BT (4 fractions of 7 Gy) with a plan optimized to HRCTV drawn according clinical findings at the time of BT. The planning aim for dose optimization was to keep the D2cc value for rectum, bladder and sigmoid below 4.6 Gy, 6.5 Gy and 4.6 Gy respectively. Moreover a standard point A plan was calculated and respective DVH parameters for HRCTVs and OARs compared. Wilcoxon test was applied for statistical data analysis and calculated with Matlab 7.11 software (Mathworks Inc).
Results: Median HRCTV width was 46 mm (37-64 range). Median HRCTV D90 and OAR D2cc values achieved with standard or the optimized plan are listed in table 1. When the standard plan was applied the intended dosimetric constraint for rectum, bladder and sigmoid were not achieved in 15 (60%), 10 (43,5%) and 19 (82%) applications respectively while they were always met in the 3D optimized plans. In 8 out of the 19 standard plans where the dosimetric constraint was exceeded the sigmoid D2cc was higher than 8Gy. In 3 cases out of 19 it was higher than10Gy.

*p-value < 0,001	Standard plan	Optimized plan
HRCTV D90 (Gy) *	7,5 (range 6 – 10,1)	6,4 (range 4,8 – 9,6)
Rectum D2cc (Gy) *	5,2 (range 2,33 - 6,73)	4,5 (range 2,68 – 4,71)
Bladder D2cc (Gy)	6,3 (range 3,8 - 17,6)	6,1 (range 4,34 – 6,4)
Sigmoid D2cc (Gy)*	6,8 (range 1,78 – 16,75)	2,9 (range 0,8 – 4,65)



Conclusions: The occurrence of uterine perforation should be kept as low as possible by the routine use of US during GYN BT implantation. When uterine perforation occurs it is easily detected on CT images but rarely on the orthogonal films. In case of uterine perforation 2D planning may thus results in potentially dangerous over dosage of OARs. 3D optimization allows keeping OAR dose within tolerance constraints just minimally compromising HRCTV D90 coverage.

EP-1335
Clinical experience with hyaluronic acid to prevent radiation cystitis in gynecological cancer: literature review
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Purpose/Objective: To evaluate if glycosaminoglycan's (GAG) administration as hyaluronicacid (HA) intravesical instillations reduces the rate of acute and lateradio induced bladder toxicity as a complication of radiation treatment in gynecological cancer. A review of the literature was done to analyse which treatments were used in this field and the HA role among them.
Materials and Methods: Retrospective study of 70 patients diagnosed with cervical and endometrial cancer treated between May 2010 and June 2012 with high-dose rate brachytherapy (HDR-BT) with or without external beam radiotherapy (EBRT). 50/70 received an EBRT total dose of 45-50.4 Gy delivered in 25-28 fractions followed by brachytherapy (HDR-BT) 11Gy in 2 fractions. The remaining 20 patients received HDR-BT alone, 21 Gy in 3 fractions. All of them received intravesical instillations of hyaluronic acid (HA) immediately after each HDR-BT fraction according to recommendations of medical prospectus. 5/50 (10%) presented G1-2 toxicity before brachytherapy. RTOG/EORTC scale was used to evaluate acute and late toxicity rates at 3, 6, 12 and 18 months after HDR-BT. A review of the literature was made using Medline research with the following criteria: HA prevention and gynecological cancer and radioinduced cystitis.
Results: Regarding our study, no upgrading toxicity was observed in patients treated with combined HDR-BT and EBRT (50/70) during the follow-up period. None of the patients (20/70) treated with exclusive HDR-BT had bladder toxicity neither acute nor chronic. No adverse events related to HA were observed. After reviewing literature, we observed that HA instillations have demonstrated effectiveness in relieving symptoms associated with interstitial cystitis, considering a similar biological pattern to radioinduced cystitis. 2 studies with these characteristics and written by the same authors were found: P. Samper et al. The first one is an abstract presented at ASCO 2003 with 90 patients and the other a retrospective study with 95 patients; both of them demonstrate that HA instillations are effective in radioinduced cystitis prevention.
Conclusions: Intravesical instillations of hyaluronic acid are effective in preventing radiation cystitis. It is safe and well tolerated. Given the scarcity reports on this subject, it is difficult to draw any firm conclusions about standard recommendations. However, based on our experience, intravesical HA can be used as routine before each brachytherapy fraction in gynecological cancer. A prospective randomized control study with a large number of patients and long term follow-up is recommended.

EP-1336
Vaginal brachytherapy for endometrial cancer: pulsed dose rate versus low dose rate, a single institution analysis.